MINISTRY OF ECONOMY

THE THIRD NATIONAL ENERGY EFFICIENCY ACTION PLAN FOR THE 2014 - 2016 PERIOD

July, 2014

Contents:

List of abbreviations

APN	Agency for Transactions and Mediation in Immovable Properties
BAU	*business-as-usual*
GDP	Gross Domestic Product
BU	bottom-up
CEI	Centre for Monitoring Business Activities in the Energy Sector and Investments
DHS	district heating systems
CVH	Vehicle Centre of Croatia
DIRH	State Inspectorate of the Republic of Croatia
DOOR	Society for Sustainable Development Design
DZM	State Office for Metrology
EBRD	European Bank for Reconstruction and Development
EE	energy efficiency (efficacy)
EED	Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency
EIHP	Energy Institute Hrvoje Požar
EC	European Commission
EKONERG	Energy and Environmental Protection Institute
EMEEES	project *'Evaluation and Monitoring for the EU Directive on En End-Use Efficiency and En Services'*
EnE	energy efficiency
EPBD	Directive 2002/91/EC on the energy performance of buildings *(Energy Performance of Buildings Directive)*
EPBD II	Directive 2010/31/EU on the energy performance of buildings *(Energy Performance of Buildings Directive - RECAST)*
ESCO	Energy Service Company
ESD	Directive 2006/32/EC on energy end-use efficiency and energy services *(Energy Service Directive)*
ETS	EU emissions trading system
EU	European Union
FER	Faculty of Electrical Engineering and Computing
FSB	Faculty of Mechanical Engineering and Naval Architecture
EPEEF	Environmental Protection and Energy Efficiency Fund
HAK	Croatian Auto Club
HBOR	Croatian Bank for Reconstruction and Development
HERA	Croatian Energy Regulatory Agency
HGK	Croatian Chamber of Economy
HOK	Croatian Chamber of Trades and Crafts
HOPS	Croatian Transmission System Operator Ltd.
HROTE	Croatian Energy Market Operator
HRPSOR	Croatian Business Council for Sustainable Development
HUB	Croatian Banking Association
HUP	Croatian Employers' Association
INA	Oil Industry
IMO	Institute for International Relations
IPMVP	International Performance Measurement and Verification Protocol

JANAF	Adriatic Oil Pipeline
LRSGU	Local and regional self-government unit
MF	Ministry of Finance
ME	Ministry of Economy
MT	Ministry of Tourism
MMATI	Ministry of Maritime Affairs, Transport and Infrastructure
MRDEUF	Ministry of Regional Development and EU Funds
MCPP	Ministry of Construction and Physical Planning
SME	Small and medium-sized enterprises
MENP	Ministry of Environmental and Nature Protection
MSES	Ministry of Science, Education and Sports
NEEAP	National Energy Efficiency Action Plan
N/A	not available
RES	renewable energy sources
PBZ	Privredna banka Zagreb
UNDP	United Nations Development Programme
ZABA	Zagrebačka banka

SUMMARY

The National Energy Efficiency Programme for the 2008–2016 Period has been drawn up and adopted in accordance with the European Directive 2006/32/EC on energy end-use efficiency and energy services (ESD). It lays down the energy savings objectives and forms a basis for drawing up triennial national plans on energy efficiency for three triennial periods up to 2016. Each action plan analyses the effects and, if necessary, revises current measures and establishes new sectoral measures in order to ensure that the objectives are met in 2016. This document meets the requirement referred to in Article 24 of the EED and partially meets the requirements on reporting referred to in Directive 2010/31/EU on the energy performance of buildings (EPBD II). As such, this 3rd NEEAP presents a comprehensive strategy for improving energy efficiency in Croatia.

The Third National Energy Efficiency Action Plan for the 2014- 2016 Period has been drawn up in accordance with the template laid down by the European Commission, with which all EU Member States must comply. This document includes the report on the status evaluation of energy efficiency policy implementation (Appendix A), specifies the achieved energy savings in the previous triennial period (Chapter 2), and offers guidelines for the following period with a detailed description of the planned measures (Chapter 3). The comparison of measures from the 2nd and the 3rd NEEAP can be found in Table 2–13. The action plan shall be forwarded to the European Commission which examines the action plans of all Member States, including Croatia, and analyses the achievement of objectives at EU level.

The adoption of this action plan is the furtherance of the continuous performance of the activities and measures laid down in the National Energy Efficiency Programme for the Period 2008–2016 and, in compliance with evaluations, in the event of an increase in the risk concerning the achievement of the planned objectives, the current measures shall be revised and new sectoral measures shall be laid down in order to ensure the objectives are met in 2016. The most important change in the 3rd NEEAP is the introduction of energy efficiency obligations in accordance with the requirements of Article 7 of the EED. Croatia has chosen to apply a combined approach which includes alternative policy measures and obligatory savings. The obligation schemes will be defined in rules based on the new Energy Efficiency Act which has not been adopted at the time of writing of this document. The national target for energy savings pursuant to Article 7 of the EED for the period from 1 January 2014 to 31 December 2020 is 1.938 PJ per year, or **54.250 PJ** in total, **32.094 PJ** of which is planned to be achieved through 9 alternative policy measures. Compliance with the obligations referred to in Article 7 is explained in Chapter 3.1.1.

The 1st NEEAP set the national indicative savings target for 2016 to 19.77 PJ. The first intermediate target was set for 2010 and it amounted to 6.59 PJ. The analysis conducted during the 2nd NEEAP established that the target was nearly reached because the 2010 savings amounted to 6.43 PJ. Energy savings targets are defined in accordance with the methodology laid down in Directive 2006/32/EC on energy end-use efficiency and energy services (ESD), and they correspond to the absolute amount of 9 %, or 10 % of final energy consumption, defined as average energy consumption in the period 2001 - 2005. Pursuant to the ESD, the achievement of objectives is monitored with calculations of achieved savings in comparison to 2007. On the other hand, the 3rd NEEAP, pursuant to the requirements of Directive 2012/27/EU on energy efficiency (EED), also presents the objective expressed as the absolute amount of final energy consumption in 2020. The aforementioned objective pertains to the revised projections for final energy consumption which take 2010 values as baseline. In view of the energy consumption realised in 2012, and the trend which will quite probably continue in 2013, it will be necessary to draw up new projections for final energy consumption and redefine the objectives expressed as the absolute amount of energy consumption in 2020.

Although the national indicative savings target of 19.77 PJ was set in the 2nd NEEAP and was not changed in the 3rd NEEAP, the target must be amended by the submission date of the following NEEAP report, i.e. by April 2015. By applying the top-down method, the achieved savings in 2012 are at 61 % of the 2016 target, and the target can be expected to be achieved in 2016. In comparison to 2010, savings have increased in every sector, of which industry and

transport have had the highest increase. However, the analysis of the implementation of each individual measure defined in the 1st and 2nd NEEAP shows that many positive results were achieved due to unforeseen activities, or accidental/one-time positive results, and not due to a systematic implementation of measures. This demonstrates the need for substantial improvements in communication and in the systematic implementation of measures.

For that purpose, the 3rd NEEAP features a system for monitoring, measuring and verifying savings which will not only contribute to the comprehensive and exact monitoring of achieved savings (Measure H.9), but also encourage all stakeholders to implement measures. In addition to making this system operational, the further continuous monitoring of measure implementation definitely needs work, and the work on achieving objectives should be considered as a continuous task of the competent institutions, and not just a disposable piece of writing to be adopted every three years.

Croatia has planned measures with which it is steadily advancing towards reaching the set objectives. However, better cooperation among the competent institutions and systematic monitoring and revisions of the energy efficiency policy are necessary.

What follows is an overview of all the measures of the 3rd NEEAP:

No.	Title of the measure	Executive body	Monitoring bodies	Sector	Financing EPEEF	Financing OTHERS	Total expected financing by the end of 2016	Expected energy savings in 2016 (TJ)	Expected energy savings in 2020 (TJ)
H.1	Energy audits and energy management in large companies	ME	CEI	Service	1 200 000.00		1 200 000.00		
H.2	Introduction of the individual metering system of heat energy consumption 'I know how much I consume'	Distributors, suppliers, building managers	ME	Household, service		225 000 000.00	225 000 000.00	1220	1220
H.5	Informative billing (Energy diagnosis)	Distributors, suppliers	ME, HERA	Household, service, industry					
H.6	Info campaigns	CEI	ME and EPEEF	All sectors	30 000.00	15 000.00	45 000.00		
H.7	Energy efficiency education and training	MCPP and MSES	MSES	All sectors		100 000.00	100 000.00		
H.8	Promotion of energy services	CEI	APN, ME, MCPP	Household, service, industry	600 000.00	380 000.00	980 000.00		
H.9	Establishing an integrated information system for monitoring energy efficiency implementation	CEI	ME	All sectors	6 900 000.00	2 100 000.00	9 000 000.00		
B.1	Building regulations and implementation	MCPP	CEI	Household, service, industry				505	505
B.2	Increasing the number of nearly zero energy buildings	MCPP	CEI	Household, service, industry					
B.3	Fostering integral renovation of multifamily housing	MCPP, building managers, distributors and suppliers of thermal energy	MCPP, MENP and CEI	Household	664 500 000.00		664 500 000.00	730	2190

No.	Title of the measure	Executive body	Monitoring bodies	Sector	Financing EPEEF	Financing OTHERS	Total expected financing by the end of 2016	Expected energy savings in 2016 (TJ)	Expected energy savings in 2020 (TJ)
B.4	Programme of energy renovation of commercial non-residential buildings 2014–2020	EPEEF implementation, MCPP programme	MCPP, MENP, ME and MT	Service		1 784 000 000.00	1 784 000 000.00	985	2298
B.5	Energy labelling of household appliances and energy standards	ME and EPEEF (EIHP)	CEI	Household	4 000 000.00		6 000 000.00	2	2
B.6	Programme of energy renovation of family homes 2014 - 2020 PERIOD	EPEEF	MCPP, MENP and CEI	Household	213 000 000.00	409 500 000.00	622 500 000.00	605.4	1412.6
P.1	Programme of energy renovation of public sector buildings 20142015	MCPP, APN, EPEEF	MCPP, MENP and CEI	Service	165 500 000.00	234 500 000.00	400 000 000.00	226.8	226.8
P.2	Programme of energy renovation of public sector buildings 20162020	MCPP, APN, EPEEF	MCPP, MENP and CEI	Service	2 000 000.00	725 000 000.00	727 000 000.00	143.64	718.2
P.3	Connecting ISGE with the metering and charging systems of energy commodity and water suppliers	APN, CEI	MCPP	Service		1 550 000.00	1 550 000.00	400	0
P.4	'Energy Efficient Public Lighting' Programme	ME, MENP and EPEEF	CEI	Service	60 000 000.00	240 000 000.00	300 000 000.00	360	540
P.5	'Green' public procurement	MENP, ME, Central Procurement Office	CEI, MENP	Service					
I.1	Industrial Energy Efficiency Network (IEEN)	EPEEF (EIHP), HGK, CEI	ME	Industry					
I.2	High-efficiency cogeneration in industry	ME	ME	Industry				165	525
I.3	Introduction of efficient electric motor drives	EPEEF	ME	Industry				630	760
I.4	Energy audits of small and medium-sized enterprises	EPEEF	HGK, MA	Industry	6 000 000.00	260 000.00	6 260 000.00		

No.	Title of the measure	Executive body	Monitoring bodies	Sector	Financing EPEEF	Financing OTHERS	Total expected financing by the end of 2016	Expected energy savings in 2016 (TJ)	Expected energy savings in 2020 (TJ)
T.1	Eco-driving training	EPEEF, HAK	CEI, MENP	Transport	8 192 500.00	8 192 500.00	16 385 166.00	59	0
T.2	Intermodal freight transport	MMATI	CEI	Transport					
T.3	Establishing a new payment system for the special environmental charge for motor vehicles	MENP, EPEEF	CEI, MENP	Transport					
T.4	Promotion of integrated transport	MMATI, LRSGU	CEI, MMATI, MENP	Transport				50	220
T.5	Speed limits	MI, DZM	MI, MMATI	Transport	10 000 000.00	400 000.00	10 400 000.00	697	1327
T.6	Financial incentives for energy efficient vehicles	MMATI, MF	CEI, MMATI, MENP	Transport	27 000 000.00		27 000 000.00	170	397
T.7	Developing an alternative fuel infrastructure	ME, MENP, MMATI, HERA, LRSGU	MMATI, MENP, ME, EPEEF	Transport					
T.8	Intelligent transport management	LRSGU	CEI, MMATI, MENP	Transport				156	1082
T.9	Introduction of a special motor vehicle tax based on CO2 emissions	MENP, CVH	ME, MF, MMATI, MI	Transport				132	310
HC.1	Programme for cooling energy accumulation in building construction	APN, FSB	CEI, MCPP, ME, MENP	Service	14 500 000.00	385 000.00	14 885 000.00	180	180
HC.2	Energy audits of heating and air-conditioning systems	MCPP, ME	MCPP	Service, industry					
E.1	Improving efficiency by reducing the energy consumption of hydroelectric power plants (HPP), thermal power plants (TPP), and combined heat and power plants (CHPP) within the HEP Group	HEP-Proizvodnja d.o.o. Hydroelectric and thermal power plant sectors		Industry		146 569 887.00	146 569 887.00	111	111

No.	Title of the measure	Executive body	Monitoring bodies	Sector	Financing EPEEF	Financing OTHERS	Total expected financing by the end of 2016	Expected energy savings in 2016 (TJ)	Expected energy savings in 2020 (TJ)
E.2	Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group	HEP-Proizvodnja d.o.o. Hydroelectric power plant sector	HEP d.d. and CEI	Industry		1 276 070 000.00	1 276 070 000.00	590	590
E.3	Improving energy efficiency in oil research and production	INA d.d.	CEI, ME	Industry				380	380
E.4	Improving energy efficiency in oil refining	INA d.d.	CEI, ME	Industry				1500	1500
E.5	Replacements and reconstructions of the hot water and steam network	HEP-toplinarstvo d.o.o.	CEI	Industry		89 671 000.00	89 671 000.00	61	78
E.6	Replacement of submarine cable sections and replacement of energy transformers	HOPS	CEI, HERA	Industry		120 000 000.00	120 000 000.00	17.64	25.56
E.7	Reducing losses in the electric power distribution grid	HEP ODS	CEI, ME, HERA	Industry		200 000.00	200 000.00	78.9	64.8
	Total				**1 179 326 413.00**	**5 259 797 138.00**	**6 449 316 053.00**	**10.16**	**16.66**

1 INTRODUCTION

The NEEAP is a comprehensive implementing document of the energy efficiency policy for the triennial period it covers (2014–2016), and it also contains a report with a detailed overview of activities implemented in the previous triennial period (implementation period of the 2nd NEEAP) with the evaluation of the achieved energy savings in comparison to the objectives set in the Second National Energy Efficiency Action Plan of the Republic of Croatia until the end of 2013.

The content of this document complies with the EC Guidance for National Energy Efficiency Action Plans of 22 May 2013 and is therefore somewhat different than the Second National Energy Efficiency Action Plan. For easier navigation, Table 2.13 in Chapter 3 presents an overview of all measures and references to measures of the 2nd NEEAP. This document contains everything that is prescribed by the ESD (2006/32/EC), EPBD recast (2010/31/EU) and EED (2012/27/EU) directives.

The second chapter of the document presents the data on the national targets and achieved savings since the 2nd NEEAP. The national target for 2020 has remained the same, but the target projections have been revised, which has consequently changed the savings expressed in PJ.

The third chapter lists all the final and primary consumption measures with which a portion of the set target is to be achieved, and it also presents and describes all the alternative measures with which the obligations referred to in Article 7 of the EED will be met, as well as the calculation in accordance with Article 7. The other measures and sub-chapters within Chapter 3 contain calculations in accordance with Article 3. Although the EC Guidance provides for a separate chapter on financing and savings for each sub-group of measures referred to in Chapter 3, in this document each individual measure has a detailed description of the financing sources and the savings projections, and such pieces of information are only summarised and specified in general terms in the dedicated chapters entitled 'Financing of Measures' and 'Savings Resulting from Measures'.

Appendix A is the annual report for 2014 which covers the activities implemented in the previous triennial period, in accordance with the requirements of the EE Directive. Although the report is required to contain an overview of the measures implemented and savings achieved in 2013, it summarises the activities carried out and savings achieved during the previous three years, i.e. 2011, 2012 and 2013.

The methodology used to calculate the savings and the savings projections is based on the Rules on the methodology for monitoring, measuring and verifying energy savings in final consumption, adopted by the Minister of Economy in July 2012 pursuant to Article 7(3) of the Act on Efficient Energy Use in Final Consumption (Narodne novine (NN; Official Gazette of the Republic of Croatia) Nos 152/08 and 55/12). The methodology was developed in accordance with the international EMEEES guidelines and the international IPMVP protocol. The annual report 'Energy in Croatia' published by the Ministry of Economy was used for statistical data, and the energy balance for 2012 was made in accordance with the EUROSTAT method.

The instructions referred to in Annexes IV and XIV to the EE Directive were used for the calculations referred to in Article 7 of the EE Directive. Both the bottom-up and top-down calculations were used, but only the top-down calculation was taken into account for the official data because the bottom-up calculation covers only a smaller portion of the savings. **One of the key measures of the 3rd NEEAP is 'Establishing an integrated information system for monitoring energy efficiency implementation' which will ensure clear, independent and detailed monitoring of the implementation of all measures and achieved results specified in the 3rd NEEAP, and which is described in Chapter 3.1.7.** This system is crucial for establishing, in a timely manner, whether the designed plans are really being implemented, and what precisely must be improved in order to achieve the planned energy efficiency objectives by 2020.

A new methodology is being designed, based on the Rules currently in force, but it will be improved in accordance with EED requirements and EC recommendations and will differentiate the savings calculation pursuant to the requirements of Article 7 from the savings calculations of all the other measures. The calculations of specific measures were made in accordance with this methodology, but much attention was paid to meet EED requirements, especially those referred to in Annexes V and XIV of the EED. The table of heating

values — taken from the annual report 'Energy in Croatia 2012' published by the Ministry of Economy — as well as the description of eligible measures and other requirements in accordance with which savings were calculated are shown in Appendix D.

Statistical Indicators

The last year for which, at the time of writing of this document, there are national data is 2012. According to the annual energy audit[1], it is evident that the total energy consumption in Croatia in 2012 was 4.7 % lower than the previous year, which is a continuation of the trend of reducing primary energy consumption. Overall energy consumption was reduced by 12.6 % in comparison to 2007. Simultaneously, the gross domestic product dropped 2 % compared to the previous year, which resulted in the reduction of energy intensity of overall energy consumption by 2.8 %. In comparison to the average energy intensity in the European Union (EU 27), the energy intensity in Croatia was 6.9 % higher.

The total primary energy production in 2012 was 5.6 % lower compared to the previous year. Natural gas production was reduced by 18.6 %, crude oil by 9.7 %, and the production of other forms of primary energy increased. The hydrologic conditions in 2012 were favourable, so the energy produced from utilised water potential was increased by 6.7 %, the production of heat energy from heat pumps by 2.1 %, and the production of wood fuel and other solid biomass by 9.1 %. The highest increase in production was achieved for other renewable sources (wind power, solar power, biogas, liquid biofuels and geothermal energy) and it amounted to 90.7 %. In 2012, energy self-supply amounted to 48.3 %, which is 0.6 % lower than the previous year and 1.5 % higher than in 2007.

In the structure of total energy consumption, the energy conversion losses increased by 3.1 %, while all other energy needs decreased. The energy consumption of power plants was reduced by 17.1 % and the energy transport and distribution losses by 1.4 %.

In 2012, final energy consumption was reduced by 4.5 % compared to 2011, and 8.5 % compared to 2007. In 2012, non-energy consumption was reduced by 10.5 % compared to the previous year. A reduction of energy consumption was achieved in all final consumption sectors. Compared to the energy consumption in 2011, industrial energy consumption in 2012 was substantially reduced – by 11.5 %. Energy consumption was also reduced in transport (by 1.6 %) and in general consumption sectors (by 3.8 %). The share of renewable sources in overall energy consumption in 2012 was 12.5 %, if the EUROSTAT method is applied for the calculations.

The efficiency of energy consumption in Croatia continued to improve in 2012 in comparison to the previous period. Energy efficiency, expressed with the energy efficiency progress index, increased by 0.3 index points for all end-use energy consumers monitored as a whole. The aforementioned index increased by 0.1 index points in transport, while the positive trend of its decrease continued with an 1.2 index point decrease in industry, and 0.4 index point decrease in households. The analysis of achieved energy savings due to improved energy efficiency presented in this Action Plan has shown that Croatia is making progress in achieving its objectives by 2016, in comparison to 2007. The 3rd NEEAP presents further measures to ensure that such progress continues and that the 2016 and 2020 objectives are achieved.

[1] Ministry of Economy, Energy in Croatia 2012

More than 180 different institutions, companies or public bodies were contacted in the process of drawing up this document:

- All counties: **21**
- Almost all cities: **116** (of 127 cities in total)
- Ministry of Economy
- Ministry of Construction and Physical Planning
- Ministry of Environmental and Nature Protection
- Ministry of Maritime Affairs, Transport and Infrastructure
- Ministry of Tourism
- Ministry of the Interior
- Ministry of Entrepreneurship and Crafts
- Ministry of Finance
- Ministry of Foreign and European Affairs
- EPEEF – Environmental Protection and Energy Efficiency Fund
- HERA – Croatian Energy Regulatory Agency
- APN – Agency for Transactions and Mediation in Immovable Properties
- Central Procurement Office of the Government of the Republic of Croatia
- EIHP – Energy Institute Hrvoje Požar
- EKONERG – Energy and Environmental Protection Institute
- ENERGO d.o.o. Rijeka – limited liability company for the production and distribution of heat energy and gas
- FER – Faculty of Electrical Engineering and Computing, University of Zagreb
- FSB – Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb
- Faculty of Architecture, University of Zagreb
- UNDP Croatia
- Smart Grids Association
- DOOR – Society for Sustainable Development Design
- Union of Autonomous Trade Unions of Croatia
- IMO – Institute for International Relations
- HRPSOR – Croatian Business Council for Sustainable Development
- HEP-Proizvodnja d.o.o. – limited liability company for the production of electricity and heat energy
- HOPS – Croatian Transmission System Operator Ltd.
- HEP Operator distribucijskog sustava d.o.o. – Distribution System Operator Ltd.
- HEP Toplinarstvo – limited liability company for heat energy
- HEP ESCO – Energy Service Company
- INA – Industrija nafte (Oil Industry)
- JANAF – Jadranski naftovod (Adriatic Oil Pipeline)
- PLINACRO
- Regional energy agencies: IRENA, MENEA, REA Kvarner, REA North, REGEA
- HUB – Croatian Banking Association
- ZABA – Zagrebačka banka
- PBZ – Privredna banka Zagreb
- HBOR – Croatian Bank for Reconstruction and Development
- HGK – Croatian Chamber of Economy
- EBRD – European Bank for Reconstruction and Development
- HUP – Croatian Employers' Association
- HOK – Croatian Chamber of Trades and Crafts

2 Overview of National Objectives and Achieved Savings

2.1 Overview of the National Energy Efficiency Objectives by 2020

National Indicative Energy Savings Targets

The national objective of increasing energy efficiency, as defined in the Energy Strategy, will result in a 19.77 PJ reduction of final energy consumption in 2016 and a 22.76 PJ reduction in 2020. The aforementioned national indicative energy savings targets have been set in accordance with the requirements of Directive 2006/32/EC on energy end-use efficiency and energy services (ESD), and they correspond to the absolute amount of 9 %, or 10 % of final energy consumption, defined as average energy consumption in the period 2001 - 2005.

Projection of Final Energy Consumption

The Energy Strategy presents projections of final and gross final energy consumption by 2020, with a 2030 outlook, for the basic scenario and the additional energy efficiency scenario (sustainable scenario). The aforementioned Strategy is based on the presumption of stable economic growth of the gross domestic product of 5 % per year, as a logical segue of the trend at the time (2006, 2007 and 2008).

In the additional energy efficiency scenario, energy efficiency measures are defined in accordance with the ESD in order to achieve the energy savings objective. Table 2–1 shows the projections of final energy consumption for the basic and the sustainable scenario, derived from the projections of the Energy Strategy of the Republic of Croatia.

Table 2–1: Increase of final energy consumption

PJ	***Final energy consumption***			
	2006	2010	2015	2020
Basic scenario	267.89	306.53	362.76	409.60
Sustainable scenario	267.89	299.84	345.17	386.85

Due to the economic and financial crisis, there was a drop of the gross domestic product (GDP). Instead of the projected GDP rise of 21.5 % in the 2009–2012 period, a negative rate of -9.0 % was achieved, which is a 30.5 % difference. The decrease of industrial production and the overall standard of living also reduced the need for energy. The scenarios featured in the Energy Strategy therefore had to be corrected and adjusted to the resulting situation and plans.

The projections of the Economic Programme of the Government of the Republic of Croatia (April 2013) estimate GDP growth rates of: 0.7 % for 2013, 2.4 % for 2014, and 3.5 % for the 2015–2016 period. There are no official projections for the 2017–2020 period. The annual rate postulated in this document is 4 %. If we presume the elasticity of the increase of final energy consumption and the GDP amounting to 0.61 for the 2010–2015 period and 0.46 for the 2016–2020 period, we can arrive at an 1.8 % increase rate of final energy consumption.

Table 2–2 shows the projections of final energy consumption for the basic and the sustainable scenario, derived from the projections of the Energy Strategy of the Republic of Croatia, and their corrections due to the effects of the economic and financial crisis, as well as GDP growth projections.

Table 2–2: Amended final energy consumption projections

PJ	*Final energy consumption*			
	2006	2010	2015	2020
Basic scenario	267.89	265.78	281.21	308.75
Sustainable scenario	267.89	265.85	268.11	293.04

A comparison of final energy consumption projections and the Energy Strategy (basic projection from 2006) and the amended projections (basic projection from 2010) is shown in Figure 2–1.

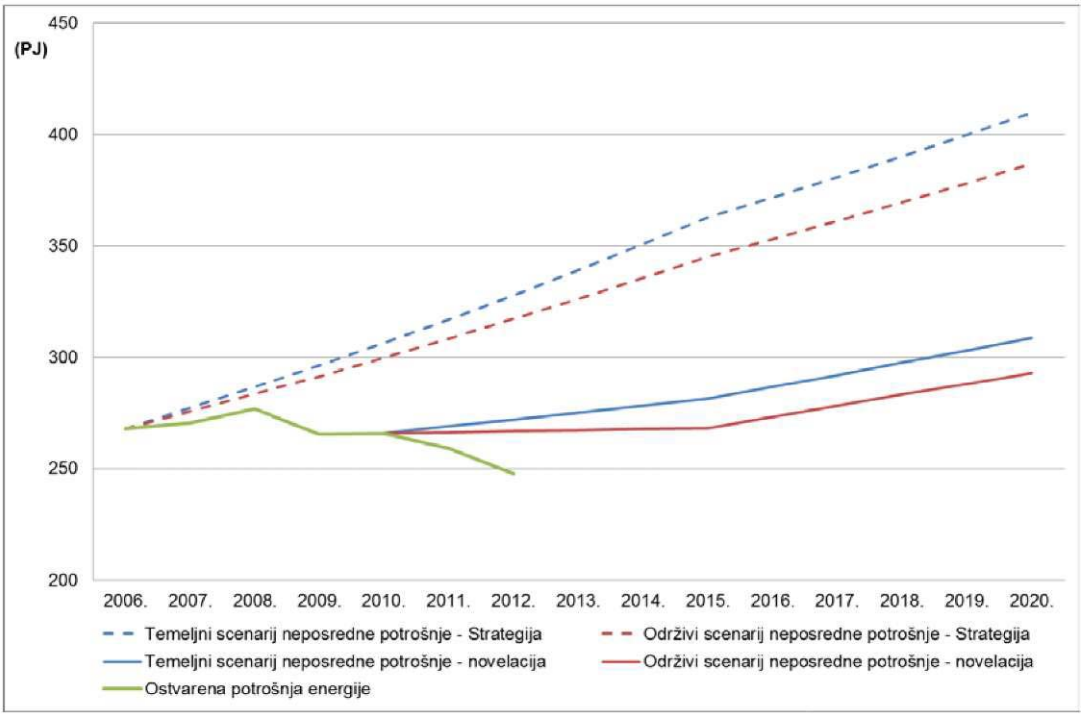


Figure 2–1: Final energy consumption

Figure text:
Temeljni scenarij neposredne potrošnje = Basic scenario of final consumption
Održivi scenarij neposredne potrošnje = Sustainable scenario of final consumption
Strategija = Strategy
novelacija = amendment
Ostvarena potrošnja energije = Achieved energy consumption

Indicative national target for increasing energy efficiency pursuant to Article 3 of Directive 2012/27/EU

Indicative national targets for increasing energy efficiency have been defined in accordance with the amended final energy consumption projections.

The indicative national energy efficiency target expressed as the absolute amount of final energy consumption in 2020 is **293.04 PJ (7.00 Mtoe).**

The corresponding target expressed as the absolute amount of primary energy in 2020 is **466.69 PJ (11.15 Mtoe).**

The estimate of primary energy consumption and energy consumption per final consumption sectors in 2020 is shown in Table 2–3.

Table 2–3: Estimate of energy consumption and production in 2020

Estimate of energy consumption in 2020		***Unit***
Total primary energy consumption	466.69	PJ
Fuel consumption in condensing power plants	62.96	PJ
Electricity production in condensing power plants	31.14	PJ
Fuel consumption in cogeneration	9.91	PJ
Electricity and heat production from cogeneration	6.18	PJ
Transmission and distribution losses	6.88	PJ
Total final energy consumption	293.04	PJ
Final energy consumption – Industry	53.63	PJ
Final energy consumption – Transport	99.46	PJ
Final energy consumption – Households	80.44	PJ
Final energy consumption – Services	38.51	PJ
Final energy consumption – Construction	10.49	PJ
Final energy consumption – Agriculture	10.51	PJ

2.2 Additional Energy Efficiency Objectives

Following the proposal of the Republic of Croatia, the European Commission extended the submission deadline for these data for the Republic of Croatia by July 2014.

The 'Plan for Increasing the Number of Nearly Zero Energy Single-Family Homes by 2020' has been drawn up at the time of writing and it is contained in Appendix C. The documents for other types of buildings are being drawn up and will be submitted at a later date.

2.3 Overview of Primary Energy Savings

Overview of Primary Energy Savings

No methodology has been prescribed for estimating savings in primary energy consumption that result from the application of energy efficiency measures. The description of the methodology used in this NEEAP and the detailed calculation of energy savings that result from the application of measures for increasing energy efficiency in energy transformation, transmission and distribution is shown in Annex A.4.

Savings were studied in comparison to 2007. Estimated primary energy savings in 2016 and 2020 that result from the application of measures for increasing the efficiency of energy transformation, transmission and distribution are shown in Chapter 3.7. Table 24 shows an overview of the achieved and expected primary energy savings.

Table 2–4. Achieved and estimated primary energy savings

PJ/year	2010 - achieved	2012 - achieved	2016 - estimate	2020 - estimate
Savings due to measures for increasing the efficiency of energy transformation, transmission and distribution in comparison to 2007	2.14	6.48	8.46	9.34
Savings in primary energy consumption due to higher efficiency in final consumption	7.80	15.92	33.91	49.29
Total primary energy savings in comparison to 2007	9.94	22.40	42.37	58.63

In comparison to 2007, primary energy consumption in Croatia in 2012 decreased from 418.20 PJ/year to 365.54 PJ/year[2], which is a decrease of 52.66 PJ/year. Based on the calculation of savings due to the application of energy efficiency measures, it is evident that 42.5 % (22.4 PJ/year) of the decrease in consumption results from an increase of energy efficiency, while 57.46 % (30.26 PJ) results from other factors, which are mostly consequences of the reduced economic activity caused by the economic and financial crisis.

Expected Savings by 2020

Table 2–5a. Overview of savings estimates in primary energy and final consumption energy

	Primary energy savings (PJ/year)	Energy savings in final consumption TD (PJ/year)	Energy savings in final consumption BU (PJ/year)
2010 - Achieved savings	9.94	6.43	3.53
2012 - Achieved savings	22.96	14.02	4.50
2016 - Projection	54.11	28.03	12.32
2020 - Projection	76.04	41.45	23.65

Savings specified in Table 2–5. For TD they are expressed as a cumulative sum of the impact of measures in comparison to 2007. The savings calculated using the BU method are expressed as a sum of savings in an individual year.

[2] Energy in Croatia 2012, Ministry of Economy

Table 2–5b. Overview of energy savings estimates in final consumption per individual measures

Overview of estimated savings per individual measure			Annual savings	Measure duration	Expected energy savings in 2016 (TJ)	Expected impact on energy savings for 2020 (TJ)
List of measures in the 3rd NEEAP		Chapter				
				TOTAL (PJ):	**10.16**	**16.66**
H.1	Energy audits and energy management in large companies	3.1.2.	/		/	/
H.2	Introduction of the individual metering system of heat energy consumption 'I know how much I consume'	3.1.3.	406.7	2	1220	1220
H.5	Informative billing (Energy diagnosis)	3.1.4.	/		/	/
H.6	Info campaigns	3.1.4.	/		/	/
H.7	Energy efficiency education and training	3.1.5.	/		/	/
H.8	Promotion of energy services	3.1.6.	/		/	/
H.9	Establishing an integrated information system for monitoring energy efficiency implementation	3.1.7.	/		/	/
B.1	Building regulations and implementation	3.2.1.	?		505	505
B.2	Increasing the number of nearly zero energy buildings	3.2.1.	/		/	/
B.3	Fostering integral renovation of multifamily housing	3.2.2.	365		730	2190
B.4	Programme of energy renovation of commercial non-residential buildings 2014–2020	3.2.2.	296		985	2298
B.5	Energy labelling of household appliances and energy standards	3.2.3.	/		2	2
B.6	Programme of energy renovation of family homes 2014 - 2020 PERIOD	3.2.3.	201.8		605.4	1412.6
P.1	Programme of energy renovation of public sector buildings 2014–2015	3.3.1.	113.4	25	226.8	226.8
P.2	Programme of energy renovation of public sector buildings 2016–2020	3.3.1.	143.64	25	143.64	718.2
P.3	Connecting ISGE with the metering and charging systems of energy commodity and water suppliers	3.3.1.	400	5	400	0
P.4	'Energy Efficient Public Lighting' Programme	3.3.2.		15	360	540
P.5	'Green' public procurement	3.3.3.	/		/	/
I.1	Industrial Energy Efficiency Network (IEEN)	3.4.1.	/		/	/

I.2	High-efficiency cogeneration in industry	3.4.1.			165	525
I.3	Introduction of efficient electric motor drives	3.4.1.			630	760
I.4	Energy audits of small and medium-sized enterprises	3.4.1.		5		
T.1	Eco-driving training	3.5.1.		2	59	0
T.2	Intermodal freight transport	3.5.1.	/		/	/
T.3	Establishing a new payment system for the special environmental charge for motor vehicles	3.5.1.			/	/
T.4	Promotion of integrated transport	3.5.1.			50	220
T.5	Speed limits	3.5.1.			697	1327
T.6	Financial incentives for energy efficient vehicles	3.5.1.	/		170	397
T.7	Developing an alternative fuel infrastructure	3.5.1.	/		/	/
T.8	Intelligent transport management	3.5.1.			156	1082
T.9	Introduction of a special motor vehicle tax based on CO2 emissions	3.5.1.		8	132	310
HC.1	Programme for cooling energy accumulation in building construction	3.6			180	180
HC.2	Energy audits of heating and air-conditioning systems	3.6.1.	/		/	/
E.1	Improving efficiency by reducing the energy consumption of hydroelectric power plants (HPP), thermal power plants (TPP), and combined heat and power plants (CHPP) within the HEP Group	3.7			111	111
E.2	Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group	3.7			590	590
E.3	Improving energy efficiency in oil research and production	3.7			380	380
E.4	Improving energy efficiency in oil refining	3.7			1500	1500
E.5	Replacements and reconstructions of the hot water and steam network	3.7.3.			61	78
E.6	Replacement of submarine cable sections and replacement of energy transformers	3.7.3.			17.64	25.56
E.7	Reducing losses in the electric power distribution grid	3.7.3.			78.9	64.8

2.4 Overview of Savings in Final Consumption

Targets and achieved energy savings in final consumption

The national target by 2016

With the Energy Strategy, the National Energy Efficiency Programme, and the First National Energy Efficiency Action Plan, the Republic of Croatia set the target of reducing final energy consumption in 2016 by 19.77 PJ, in accordance with the requirements of Directive 2006/32/EC on energy end-use efficiency and energy services (ESD). The sectoral distribution of the target was revised in the 3rd NEEAP in accordance with the amended projections for final energy consumption and the savings potentials per sector. The target and the sectoral distribution are shown in Table 2–5.

Table 2–6. National energy savings target in final consumption for 2016

Sectoral distribution of targets	2016	
	Sectoral targets (PJ)	Share in overall target (%)
Household	6.70	34 %
Services	3.64	18 %
Industry (non-ETS)	3.40	17 %
Transport	6.03	31 %
TOTAL	19.77	100 %

The achieved savings in 2010 and 2012 were calculated by applying top-down (TD) indicators in line with the European Commission (EC) recommendations. The total achieved savings and the sectoral distribution in 2010 and 2012 are shown in Table 2–7. The degree of target achievement for 2016 is also shown.

Table 2–7. Progress overview for target achievement, estimated by using the TD method

Sectoral distribution of targets	2010		2012		2016	
	Achieved savings* (PJ)	Share (%)	Achieved savings** (PJ)	Share (%)	Sectoral targets (PJ)	Share in overall target (%)
Household	4.43	69 %	4.45	31 %	6.70	34 %
Services	0.33	5 %	1.35	9 %	3.64	19 %
Industry (non-ETS)	1.21	19 %	2.02	31 %	3.40	17 %
Transport	0.46	7 %	4.14	29 %	6.03	30 %
TOTAL	6.43	100 %	11.96	100 %	19.77	100 %
Degree of target achievement for 2016 (%)	33 %		61 %		100 %	

* specified in the 2nd NEEAP

** specified in the 3rd NEEAP

It is evident that, by applying the TD method, the achieved savings in 2012 were at 61 % of the 2016 target, and the target can be expected to be achieved. In comparison to 2010, savings have increased in every sector, of which industry and transport have had the highest increase.

However, it should be pointed out that, when calculating savings in accordance with the Rules on the methodology for monitoring, measuring and verifying energy savings in final consumption (NN 77/12), only those activities in which savings have been achieved are taken into account. The activities in which the efficiency was lower than in the baseline year, i.e. where there was an increase in energy consumption per output product unit, do not diminish the achieved energy savings. Furthermore, a portion of the achieved reductions resulted from the reduced industrial and economic activity in the observed period.

Based on the aforementioned, it can be concluded that the calculated achieved savings are partially a result of the calculation method based on the prescribed methodology, and partially a result of reduced economic activity, and not exclusively a result of the energy efficiency policy.

Table 2–8 shows achieved savings estimated by using the bottom-up (BU) method. The BU method determines estimates directly from the implemented measures. Although the calculation that results from this approach does not cover all the savings due to a lack of detailed information on implemented activities and measures, this type of calculation indicates savings achieved through the fostered energy efficiency policy. The total achieved savings and the sectoral distribution in 2010 and 2012 are shown in Table 2–7. The degree of target achievement for 2016, measured by applying the BU method, is also shown.

Table 2–8. Progress overview for target achievement, estimated by using the BU method in accordance with ESD

Sectoral distribution of targets	2010		2012		2016	
	Achieved savings* (PJ)	Share (%)	Achieved savings** (PJ)	Share (%)	Sectoral targets (PJ)	Share in overall target (%)
Household	1.53	43 %	1.64	36 %	6.70	34 %
Services	1.32	37 %	2.21	49 %	3.64	19 %
Industry (non-ETS)	0.60	17 %	0.58	13 %	3.40	17 %
Transport	0.08	2 %	0.08	2 %	6.03	30 %
TOTAL	3.53	100 %	4.51	100 %	19.77	100 %
Degree of target achievement for 2016 (%)	18 %		23 %		100 %	

* specified in the 2nd NEEAP

** specified in the 3rd NEEAP

The BU method estimate shows that the achievement of target savings in 2010 was at 18 % of the 2016 target, while the estimate for 2012 was at 23 % of the said target.

The indicative target by 2020 as laid down in the Energy Strategy

The Energy Strategy (NN No 130/09) sets the indicative target for the decrease of energy consumption as a saving of more than 10 % in final energy consumption in relation to the average energy consumption in final consumption in the 2001–2005 period. Such a savings target amounts to 22.76 PJ in 2020. Achievement is monitored by applying the TD methodology until 2020 in the same way as target achievement by 2016.

In regard to the achievement of savings of 22.76 PJ/year by 2020 in relation to the average energy consumption in final consumption in the 2001–2005 period, in 2012 the Republic of Croatia achieved savings of 14.02 PJ/year in comparison to 2007, calculated in accordance with the Ordinance on the methodology for monitoring, measuring and verifying energy savings in final consumption (NN 77/2012), calculated with the TD method, which amounts to 61.6 % of the 2020 target.

Methodology for Calculating and Estimating Energy Savings

In order to calculate the energy savings achieved in 2012, TD indicators were used in accordance with the Rules on the methodology for monitoring, measuring and verifying energy savings in final consumption (NN No 77/12). The methodology laid down in the Rules is in accordance with the Directive 2006/32/EC on energy end-use efficiency and energy services (ESD). The data obtained from the Croatian Bureau of Statistics, the Meteorological and Hydrological Service, the data from the energy balance of the Republic of Croatia (ME), the Ministry of the Interior, the Vehicle Centre of Croatia, as well as data obtained through modelling (EIHP, EKOENERG) were used as data sources.

In accordance with the recommended methodology, 2007 was used as the baseline (reference) year, and the last year with a compiled energy balance was 2012. The calculation of savings and indicators in all consumption sectors was made by using minimal (M) and preferred (P) indicators, except for the service sector in which, due to a lack of data, the calculation of the preferred indicators was not possible. The energy savings determined through P indicator calculations are deemed relevant, except in the service sector. The overview of the used TD indicators is shown in Table 2–9.

Table 2–9. Overview of TD indicators used for calculating and reporting achieved energy savings in 2010

TD indicator	Sector	Possibility of calculation	Reporting on achieved savings
P1	Households	+	P1, P2, P3, P4, P5
P2		+	
P3		+	
P4		+	
P5		+	
M1		+	-
M2		+	
P6	Services	+	-
P7		+	
M3		+	M3, M4
M4		+	
P8	Transport	+	P8, P9, P10, P11, P12, P13
A1 for P8		+	
P9		+	
A2 for P9		+	
P10		+	
P11		+	
P12		+	
P13		+	
M5		+	-
M6		+	
M7		+	
P14	Industry	+	P14
M8		+	-

Overview of achieved savings

Table 2–10. Summary overview of targets and achieved savings per sector in final consumption

	Achieved energy savings (PJ/year) 2010		Estimated energy savings (PJ/year) 2012		Estimated energy savings (PJ/year) 2016	Estimated energy savings (PJ/year) 2020
	TOTAL (TD)	From measures (BU)	TOTAL (TD)	From measures (BU)	TOTAL (TD)	TOTAL (TD)
Household	4.43	1.53	4.45	1.64	9.16	12.48
Services	0.33	1.32	1.35	2.21	3.96	5.08
Industry (non-ETS)	1.21	0.60	2.02	0.58	4.12	5.14
Transport	0.46	0.08	4.14	0.08	10.78	18.76
TOTAL	6.43	3.53	11.96	4.50	28.03	41.45

Table 2–11. Achieved savings per sector

Reference to measure from the 2nd NEEAP	Achieved energy savings from measures in 2013 [PJ] *(evaluation performed using BU methods)*			
	Households	Services	Industry	Transport
B.1	1.52	0.64		
B.2				
B.3		0.112		
B.4				
R.1				
R.2				
R.3	0.00724	0.005	0.002	
R.4	**0.001**			
R.5				
P.1		0.51		
P.2				
P.3				
P.4		0.0826		
P.5		0.159		
C.1		**0.001**		
C.2				
C.3				
C.4				
C.5		0.005		
I.1				
I.2				
I.3			0.005	

Table 2–12. Achieved savings per source of financing

Reference to measure from the 2nd NEEAP	Achieved energy savings from measures in 2013 [PJ] (evaluation performed using BU methods)	
	EPEEF (period of the 1st and 2nd NEEAP)	Other
B.1		2.16
B.2		
B.3	0.002	0.11
B.4		
R.1		
R.2		
R.3	0.014	
R.4	**0.001**	
R.5		
P.1	0.51	
P.2		
P.3		
P.4	0.08	0.0026
P.5	0.0372	0.122
C.1	**0.001**	
C.2		
C.3		
C.4		
C.5	0.005	
I.1		
I.2		
I.3	0.005	

I.4				
I.5			0.57	
I.6				
E.1	0.114			
E.2				
T.1				0.011
T.2				
T.3				
T.4				
T.5				
T.6				0.07
T.7				
T.8				
T.9				
T.10				
T.11				
T.12				
H.1				
H.2				
H.3				
H.4		0.69		
H.5				
H.6				
H.7				
SUM OF TOTAL SAVINGS (BU indicators)	1.642	2.205	0.577	0.081
TOTAL BU	4.50			
SUM OF TOTAL SAVINGS (TD indicators)	4.45	1.35	2.02	4.14
TOTAL TD	11.96			

I.4		
I.5		0.57
I.6		
E.1	0.114	
E.2		
T.1	0.011	
T.2		
T.3		
T.4		
T.5		
T.6	0.07	
T.7		
T.8		
T.9		
T.10		
T.11		
T.12		
H.1		
H.2		
H.3		
H.4	0.69	
H.5		
H.6		
H.7		
SUM OF SAVINGS FROM MEASURES	1.54	2.96
TOTAL	4.50	

3 MEASURES FOR THE IMPLEMENTATION OF THE ENERGY EFFICIENCY DIRECTIVE (2012/27/EU)

This chapter provides an overview of all energy efficiency measures, in accordance with the guidelines of the Guidance for National Energy Efficiency Action Plans, and the contents have been adjusted to facilitate compliance with the obligations laid down in the guidelines.

A table providing a summary overview of all of the measures of the 3rd Action Plan was featured in previous chapters. The said table also provided references to the measures of the 2nd National Energy Efficiency Action Plan. The chapters of the 3rd NEEAP were entitled pursuant to the first letter of the English word proposed by the EC Guidance for National Plans. What follows is a list of chapters and designations used for the measures in each chapter:

1. Horizontal measures H
2. Buildings B
3. Public sector P

4. Industry I
5. Transport T
6. Heating & cooling HC
7. Energy transformation, distribution, transmission and demand response E

Table 2–13 shows all measures, including the measures from obligation schemes. The only difference is that the savings calculations for measures in accordance with Article 7 are done differently than in the remainder of the text. Table 3.8 shows calculations pursuant to the obligations laid down in Article 7, and the following chapter provides a detailed description of the compliance with the obligations laid down in Article 7.

Table 2–13. Overview and status of the measures of the 3rd NEEAP

Overview and status of the measures of the 3rd NEEAP				
List of measures		Ref. to index measures of 2nd NEEAP	Measure status	Chapter
H.1	Energy audits and energy management in large companies	I.3	New measure	3.1.2.
H.2	Introduction of the individual metering system of heat energy consumption 'I know how much I consume'	E.1	Retained, updated, but without the section on informative billing which has become part of the new measure 'Informative billing'	3.1.3.
H.3	Financial instruments for EnE and RES projects	H.2	Description only	3.1.4.
H.4	CO_2 emissions fee for large polluters, except polluters involved in the Emissions Trading System	I.2, I.5	Description only	3.4.1.
H.5	Informative billing (Energy diagnosis)	E.1	Retained, updated, but without the 'Individual metering' section	3.1.4.
H.6	Info campaigns	R.1	Retained, updated	3.1.4.
H.7	Energy efficiency education and training	H.5	Retained, updated	3.1.5.
H.8	Promotion of energy services		New measure	3.1.6.
H.9	Establishing an integrated information system for monitoring energy efficiency implementation	H.7	Retained, updated	3.1.7.
B.1	Building regulations and implementation	B.1	Retained, updated	3.2.1.
B.2	Increasing the number of nearly zero energy buildings	B.4	Retained	3.2.1.
B.3	Fostering energy renovation of multifamily housing	R.5	Retained, renamed, updated	3.2.2.
B.4	Programme of energy renovation of commercial non-residential buildings 2014–2020	C.5	C.5 measure retained, adapted to the MCPP programme	3.2.2.

B.5	Energy labelling of household appliances and energy standards	R.2	R.2 measure retained	3.2.3.
B.6	Programme of energy renovation of family homes 2014 - 2020 PERIOD	R.3	Derived from measure R.3, proposed in obligation schemes and the CENEP project	3.2.3.
P.1	Programme of energy renovation of public sector buildings 2014–2015	P.5	Retained, updated	3.3.1.
P.2	Programme of energy renovation of public sector buildings 2016–2020	P.5	Retained, updated	3.3.1.
P.3	Connecting ISGE with the metering and charging systems of energy commodity and water suppliers	P.1	New measure	3.3.1.
P.4	'Energy Efficient Public Lighting' Programme	P.4	Retained, updated	3.3.2.
P.5	'Green' public procurement	P.3	Retained, updated	3.3.3.
I.1	Industrial Energy Efficiency Network (IEEN)	I.1	Retained, updated	3.4.1.
I.2	High-efficiency cogeneration in industry	I.4	Retained, updated	3.4.1.
I.3	Introduction of efficient electric motor drives	I.6	Retained, updated	3.4.1.
I.4	Energy audits of small and medium-sized enterprises	I.3	Retained, updated	3.4.1.
T.1	Eco-driving training	T.1	Retained, updated	3.5.1.
T.2	Intermodal freight transport	T.2	Retained, updated	3.5.1.
T.3	Establishing a new payment system for the special environmental charge for motor vehicles	T.3	Retained, updated	3.5.1.
T.4	Promotion of integrated transport	T.4, T.7, T.10	Retained, updated, integrates previous measures T.4, T. 7 and T. 10	3.5.1.
T.5	Speed limits	T.5	Retained, updated	3.5.1.
T.6	Financial incentives for energy efficient vehicles	T.6	Retained, updated	3.5.1.
T.7	Developing an alternative fuel infrastructure	T.8	Retained, updated	3.5.1.
T.8	Intelligent transport management	T.11	Retained, updated	3.5.1.
T.9	Introduction of a special motor vehicle tax based on CO_2 emissions		New measure	3.5.1.
HC.1	Programme for cooling energy accumulation in building construction		New measure	3.6
HC.2	Energy audits of heating and air-conditioning systems	B.2	Retained, updated	3.6.1.
E.1	Improving efficiency by reducing the energy consumption of hydroelectric power plants (HPP), thermal power plants (TPP), and combined heat and power plants (CHPP) within the HEP Group		New measure	3.7
E.2	Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group		New measure	3.7
E.3	Improving energy efficiency in oil research and production		New measure	3.7

E.4	Improving energy efficiency in oil refining		New measure	3.7
E.5	Replacements and reconstructions of the hot water and steam network		New measure	3.7.3.
E.6	Replacement of submarine cable sections and replacement of energy transformers		New measure	3.7.3.
E.7	Reducing losses in the electric power distribution grid		New measure	3.7.3.

3.1 Horizontal Measures

3.1.1 Energy Efficiency Obligation Schemes and Alternative Measures (EED Article 7)

By becoming a full member of the European Union on 1 July 2013, the Republic of Croatia has, together with other Member States and pursuant to Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, assumed the obligation of increasing energy efficiency in the EU in order to achieve the objective of saving 20 per cent of primary energy consumption at EU level by 2020 compared to projections (in relation to the *business-as-usual* or basic energy consumption scenario).

Article 7 of Directive 2012/27/EU lays down the establishment of the energy efficiency obligation scheme which ensures that energy distributors and/or retail energy sales companies that are designated as obligated parties and operate in the national territory of an individual Member State achieve a cumulative end-use energy savings target by 31 December 2020.

Article 7(9) enables Member States to opt for an 'alternative approach' to the energy efficiency obligation scheme, which is based on energy efficiency policy measures in final energy consumption whereby the annual amount of energy savings must be equivalent to the amount of energy savings which would be achieved through the application of the energy efficiency obligation scheme.

However, certain steps must be taken:

1. Set the total amount of energy savings to be achieved and its distribution throughout the duration of the obligation period;
2. Decide whether energy efficiency obligation schemes or alternative policy measures will be used, or whether both will be used;
3. Set target sectors and individual measures in order to achieve the required amount of energy savings;
4. Determine how energy savings from individual measures will be calculated;
4. Ensure supervision, verification, monitoring and transparency of the system or alternative policy measures;
5. Report on the results and publish them.

Calculation Methodology for Energy Savings Targets

The Directive lays down that the cumulative end-use energy savings target must be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1.5 % of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged

over the most recent three-year period prior to 1 January 2013. The sales of energy used in transport may be partially or fully excluded from this calculation.

In view of the aforementioned, the annual volume of energy sales to final customers of all energy distributors or all retail energy sales companies (final energy consumption) averaged over the most recent three-year period prior to 1 January 2013 (i.e. for 2010, 2011 and 2012) should be the first item of data to be determined for calculating the total amounts of prescribed savings.

The energy balances of the Republic of Croatia for 2010, 2011 and 2012 are used to determine the average total final energy consumption in accordance with the IEA methodology (Table 3–1).

Table 3–1. Final energy consumption (excerpt from the energy balance of the Republic of Croatia)

PJ	2010	2011	2012
FINAL ENERGY CONSUMPTION	**265.839**	**259.186**	**247.527**
INDUSTRY	**50.298**	**46.964**	**41.560**
Iron and steel	2.668	2.561	1.646
Non-ferrous metals	0.472	0.585	0.625
Glass and non-metallic minerals	2.422	2.384	2.146
Chemical	8.551	7.918	5.345
Construction materials	15.089	13.111	12.151
Pulp and paper	3.037	2.769	2.682
Food production	9.947	9.674	9.108
Other	8.112	7.962	7.857
TRANSPORT	**86.892**	**84.974**	**84.018**
Rail	1.844	1.746	1.651
Road	77.126	75.173	74.299
Air	4.650	4.918	5.072
- international	2.317	2.352	2.893
- domestic	2.333	2.567	2.180
Sea and river	1.650	1.654	1.577
Public city	1.447	1.408	1.349
Other	0.177	0.075	0.069
GENERAL CONSUMPTION	**128.649**	**127.248**	**121.949**
Households	80.809	80.061	77.109
Services	31.720	31.340	30.095
Agriculture	10.268	10.270	9.610
Construction	5.852	5.578	5.134

The amount of sold energy used in the transport sector is excluded from this calculation (Table 3–2).

Table 3–2. Determining the average final energy consumption

PJ	2010	2011	2012	**Average 2010 - 2012 period**
TOTAL FINAL ENERGY CONSUMPTION	265.839	259.186	247.527	
TRANSPORT	86.892	84.974	84.018	
TOTAL FINAL ENERGY CONSUMPTION - TRANSPORT	178.947	174.212	163.508	**172.222**

Pursuant to Article 7(1) of the Directive, the next step is the multiplication of the average final energy consumption (excluding transport) determined for 2010, 2011 and 2012 by 1.5 % in order to calculate the annual savings target. The total amount to be achieved during the entire period is the sum of the following cumulative percentages: 2014 - 1.5 %; 2015 - 3 %; 2016 - 4.5 %; 2017 - 6 %; 2018 - 7.5 %; 2019 - 9 %; 2020 - 10.5 % (Table 3–3).

Article 7(2) and (3) of the Directive specify that it is possible to take into account certain national circumstances which can lead to lower end-use energy savings that must be achieved during a seven-year period. The aforementioned options include:

a) a calculation based on a lower annual savings rate;
b) total or partial exclusion of the energy used in an industry participating in the EU-ETS;
c) energy savings achieved in the energy transformation, distribution and transmission sectors;
d) achieved savings resulting from early measures after 2008 that continue to generate savings in 2020.

There are no restrictions regarding the selection or combination of these four options other than, in accordance with Article 7(3) of the Directive, the cumulative amount resulting from all the chosen options cannot exceed 25 % of the savings laid down in Article 7(1).

The first two options, Article 7(2)(a) and (b), refer to the total amount of energy savings to be achieved (Tables 3–4 and 3–5).

In order to apply the options of Article 7(2)(b), the data on the energy used in an industry participating in the EU-ETS were obtained from the verified annual emissions reports of the operators who are obligated parties to the EU-ETS for 2010, 2011 and 2012.

Table 3–3. Setting a target by taking Article 7(1) of the Directive into account

Article 7(1)								
SAVINGS PER YEAR (PJ)	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	TOTAL
2014	2.583							2.583
2015	2.583	2.583						5.167
2016	2.583	2.583	2.583					7.750
2017	2.583	2.583	2.583	2.583				10.333
2018	2.583	2.583	2.583	2.583	2.583			12.917
2019	2.583	2.583	2.583	2.583	2.583	2.583		15.500
2020	2.583	2.583	2.583	2.583	2.583	2.583	2.583	18.083
CUMULATIVE								**72.333**
ANNUAL								**2.583**

Table 3–4. Setting a target by taking Article 7(2)(a) of the Directive into account

Article 7(2)(a)								
SAVINGS PER YEAR (PJ)	1.0 %	1.0 %	1.25 %	1.25 %	1.5 %	1.5 %	1.5 %	TOTAL
2014	1.722							1.722
2015	1.722	1.722						3.444
2016	1.722	1.722	2.153					5.597
2017	1.722	1.722	2.153	2.153				7.750
2018	1.722	1.722	2.153	2.153	2.583			10.333
2019	1.722	1.722	2.153	2.153	2.583	2.583		12.917
2020	1.722	1.722	2.153	2.153	2.583	2.583	2.583	15.500
CUMULATIVE								**57.264**
ANNUAL								**1.722**

	SAVINGS (PJ)	Decrease compared to Article 7(1)
Cumulative with 1.5 % target	72.333	
Cumulative with growing target (Article 7(2)(a))	57.264	21 %

Table 3–5. Setting a target by taking Article 7(2)(a) and 7(2)(b) of the Directive into account

PJ	2010	2011	2012	Average 2010 - 2012 PERIOD
TOTAL FINAL ENERGY CONSUMPTION	265.839	259.186	247.527	
TRANSPORT	86.892	84.974	84.018	
TOTAL FINAL ENERGY CONSUMPTION - TRANSPORT	178.947	174.212	163.508	172.222
ETS plants	28.651	25.886	20.942	
TOTAL FINAL ENERGY CONSUMPTION - TRANSPORT - EU ETS	150.295	148.326	142.567	147.063

Article 7(2)(a) + (b)								
SAVINGS PER YEAR (PJ)	1.0 %	1.0 %	1.25 %	1.25 %	1.5 %	1.5 %	1.5 %	TOTAL
2014	1.471							1.471
2015	1.471	1.471						2.941
2016	1.471	1.471	1.838					4.780
2017	1.471	1.471	1.838	1.838				6.618
2018	1.471	1.471	1.838	1.838	2.206			8.824
2019	1.471	1.471	1.838	1.838	2.206	2.206		11.030
2020	1.471	1.471	1.838	1.838	2.206	2.206	2.206	13.236
CUMULATIVE								48.898
ANNUAL								1.471

Exceeds max. reduction of 25 %

	SAVINGS (PJ)	Decrease compared to Article 7(1)
Cumulative with 1.5 % target	72.333	
Cumulative with growing target (Article 7(2)(a))	57.264	21
Cumulative with growing target (Article 7(2)(a)), excluding EU ETS plants (Article 7(2)(b))	48.898	32
Maximum permitted reduction	18.083	25
TARGET	**54.250**	**25**

National Energy Savings Target for the 2014–2020 Period

In accordance with the calculation methodology for energy savings targets described in the previous chapter, the national energy savings target for the period from 1 January 2014 to 31 December 2020 is **1.938 PJ** per year or, cumulatively, **54.250 PJ** (Table 3–6 and 3–7).

Table 3–6. Application of the reduction factor

	Annual savings (PJ)	Cumulative savings (PJ)	Reduction of cumulative savings
Energy savings pursuant to Article 7(1) of the Directive	2.583	72.333	-
Application of Article 7(2)(a)	1.722	57.264	21 %
Application of Article 7(2)(a) and (b)	1.471	48.898	32 %
TARGET	**1.938**	**54.250**	**25 %**

In order to achieve the specified target, the Republic of Croatia has opted for a combination of the two approaches (energy efficiency obligation scheme and the application of alternative measures).

Table 3–7. National energy savings target for the 2014–2020 period

TARGET								
SAVINGS PER YEAR (PJ)	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	1.5 %	TOTAL
2014	1.938							1.938
2015	1.938	1.938						3.875
2016	1.938	1.938	1.938					5.813
2017	1.938	1.938	1.938	1.938				7.750
2018	1.938	1.938	1.938	1.938	1.938			9.688
2019	1.938	1.938	1.938	1.938	1.938	1.938		11.625
2020	1.938	1.938	1.938	1.938	1.938	1.938	1.938	13.563
CUMULATIVE								**54.250**
ANNUAL								**1.938**

Alternative Policy Measures and Energy Savings Responsibilities per Sector

This chapter presents the alternative policy measures through the implementation of which a portion of the energy savings target in final consumption will be achieved by 2020. The policy measures include the following final consumption sectors: the housing sector (households), the service sector, the industrial sector, transport.

Table 3–8 shows the measures in final consumption sectors with the estimated annual savings and cumulative energy savings amounts which take into account the life cycle of the savings.

Table 3–8. Policy measures in final energy consumption sectors

Title of the measure	Annual savings (PJ)							TOTAL
	2014	2015	2016	2017	2018	2019	2020	PJ
RESIDENTIAL BUILDINGS								
Programme of energy renovation of family homes 2014 - 2016 PERIOD	0.153	0.306	0.460	0.613	0.766	0.919	1.072	4.290
Programme of energy renovation of multifamily housing	0.000	0.365	0.730	1.095	1.460	1.825	2.190	7.665
Introduction of the individual metering system of heat energy consumption	0.407	0.813	1.220	0.000	0.000	0.000	0.000	2.440
PUBLIC SECTOR BUILDINGS								
Programme of energy renovation of public sector buildings (2014 -2015)	0.095	0.191	0.191	0.191	0.191	0.191	0.191	1.241
Programme of energy renovation of public sector buildings (2016 -2020)	0.000	0.000	0.121	0.242	0.363	0.484	0.604	1.813
COMMERCIAL NON-RESIDENTIAL BUILDINGS								
Programme of energy renovation of commercial non-residential buildings	0.328	0.657	0.985	1.313	1.642	1.970	2.298	9.193
PUBLIC LIGHTING								
'Energy Efficient Public Lighting' Programme	0.099	0.198	0.297	0.343	0.390	0.437	0.483	2.247
TRANSPORT								
Financial incentives for energy efficient vehicles	0.057	0.113	0.170	0.227	0.283	0.340	0.397	1.586
Promoting eco-driving	0.029	0.059	0.059	0.059	0.059	0.059	0.059	0.383
Introduction of a special motor vehicle tax based on CO2 emissions	0.043	0.087	0.132	0.177	0.221	0.266	0.310	1.236
TOTAL	1.260	2.887	4.510	4.454	5.618	6.781	7.945	**32.094**

As shown in Table 3–8, the total savings achieved through alternative policy measures amount to 32.094 PJ.

The description of the measures, which includes time frame, target sector, information on measure implementation, information on monitoring savings, assumptions made and expected cumulative savings, is presented in this chapter. The same measures are also described in the relevant following chapters, but the savings calculations presented here are in accordance with Article 7, and the calculations in Chapter 3 are in accordance with Article 3 of the EED.

The description of the methodology for calculating energy savings can be found in Appendix E.

The effectiveness of all the measures calculated using the BU methodology will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.

Description of 9 alternative policy measures, with savings in accordance with Article 7 of the EED

Title of the measure		**Programme of energy renovation of family homes 2014–2020**
Measure index		**B.6**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016
		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	This measure is aimed at the renovation of existing family homes by 2020. It focuses primarily on family homes of up to 400 m^2 constructed before 1987, and on their renovation in compliance with low-energy standards. The measure includes: 1. Fostering renovation of the building envelope: - Increasing the thermal protection of the building envelope - Replacement of windows 2. Fostering the replacement of heating systems: - Replacement of existing heating systems which use electricity or fossil fuels with new systems with gas powered condensing boilers.
	Target sector	Household sector
Implementation	Implementing authority	EPEEF – establish a co-financing scheme (including obtaining funding from EU structural funds) LRSGU – programme implementation and co-financing intermediary
	Authorities supervising the implementation	MCPP and MENP – operative monitoring of programme implementation CEI – monitoring achieved savings
Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. The description of the method can be found in Appendix E.
	Life cycle of the measure	20 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	It is assumed that 100 family homes per county, or approximately 2 000 houses throughout the territory of Croatia, will participate in the programme at an annual level. Thermal wall insulation saves on average 84.3 kWh/m^2 of wall area. It is also assumed that, on average, 35 m^2 of windows will be replaced per house. That would achieve unit savings of 195.2 kWh/m^2 of window area. In estimating achieved savings, it is assumed that both measures will not be implemented simultaneously on every house. It is therefore assumed that half of the houses will have new

		insulation installed, and half of the houses will have new windows installed. It is assumed that 100 000 m^2 of the outer structure (wall) area will be thermally insulated per year, or 35 000m^2 of windows per year. The replacement of existent gas powered condensing boilers with new ones typically reduces energy consumption by 97.5 kWh/m^2 of building area. The programme is expected to be implemented with the same intensity until the end of 2020.
	Expected cumulative savings 2014–2016	Fostering renovation of the building envelope: 0.329 PJ Fostering the replacement of heating systems: 0.590 PJ
	Expected cumulative savings 2014–2020	Fostering renovation of the building envelope: 1.537 PJ Fostering the replacement of heating systems: 2.752 PJ

Title of the measure		**Programme of energy renovation of multifamily housing**
Measure index		**B.3**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016
		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	This measure provides for the introduction of a systematic programme for the renovation of multifamily housing. The Plan primarily focuses on multifamily housing constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The precondition for participation in the co-financing programme is the existence of project documentation required in accordance with the construction legislation. As a minimum, building renovation includes thermal insulation of the building envelope and, in line with the energy audit recommendations, other measures which reduce heat energy consumption in the building. The measure includes: 1 Fostering integral renovation of multifamily housing: - Increasing the thermal protection of the building envelope; - Replacement of windows; - Improvement or replacement of heating systems.
	Target sector	Household sector
Implementation	Implementing authority	MCPP – controls the activities of authorised design engineers EPEEF – ensures financing Building manager or co-owners – select contractors and stipulate the performance of works
	Authorities supervising the implementation	MCPP – supervises the activities of authorised persons CEI in cooperation with ME and MENP – monitor achieved savings

Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Input data must be set for each individual building, and reference values should be used only in special cases. The description of the method can be found in Appendix E.
	Life cycle of the measure	20 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	A total of 149.38 million m^2 of usable floor area of residential buildings were registered in the Republic of Croatia in 2010, according to the data of the Croatian Bureau of Statistics, the 2001 Census, and data on the total number of issued building permits and constructed buildings in the 2001–2010 period. According to available statistical data, it is assumed that 1/3 of the housing stock in Croatia is in multifamily housing, which means that this measure pertains to approximately 50 million m^2. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987. Energy savings are calculated with the assumption that 1 %, or approximately 500 000 m^2, of multifamily housing area is renovated each year, and that integral renovation of buildings is conducted, which will reduce energy consumption by 202.30 kWh/m^2.
	Expected cumulative savings 2014–2016	1.095 PJ
	Expected cumulative savings 2014–2020	7.665 PJ

Title of the measure		**Introduction of the individual metering system of heat energy consumption**
Measure index		**H.2**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2016
		1st intermediate period: 1 January 2014 - 31 December 2016

	Objective / outline	The current practice of calculating and billing energy consumption in buildings connected to district heating systems does not foster energy efficient behaviour of heat energy consumers, nor does it encourage them to self-implement energy efficiency measures in their homes because the effects of such measures would ultimately not be evident on their energy bills. The introduction of individual metering of energy consumption is therefore a precondition for all future energy efficiency activities in such buildings. Moreover, the Heat Energy Market Act (NN Nos 80/13, 14/14) deems the obligation of installing an individual metering system to be an obligation of the co-owners, which poses a financial burden for them. Financial support will be an incentive for the implementation of this legal obligation.
	Target sector	Household sector
Implementation	Implementing authority	EPEEF – co-financing, with various funds
	Authorities supervising the implementation	CEI, in coordination with ME
Energy savings monitoring	Method for calculating energy savings	Planned savings / estimated savings
	Calculation methodology for energy savings	The effects of this measure are monitored by analysing distributor data on achieved end-user energy consumption before and after the implementation of the measure, with normalisation by climate conditions (heating degree day). The distributors/suppliers are obliged to submit these data to the SMIV. Moreover, the effect of this measure can also be monitored through TD indicators. The description of the method can be found in Appendix E.
	Life cycle of the measure	2 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	Estimates are based on the objective to install individual metering systems to all the existent heat energy consumers by the end of 2016, wherever possible. There were 154 480 heat energy consumers in Croatia in 2010, and a conservative assumption is that individual metering can be installed for least half of them, or for approximately 75 000 consumers. That would mean that individual metering could be installed into 25 000 households per year by 2016.
	Expected cumulative savings 2014–2016	2.440 PJ
	Expected cumulative	2.440 PJ

	savings 2014–2020	

Title of the measure		**Programme of energy renovation of public sector buildings 2014–2015**
Measure index		**P.1**
Description	Category	Regulations, Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2015
		1st intermediate period: 1 January 2014 - 31 December 2015
	Objective / outline	The programme fosters the implementation of energy renovation of public sector buildings and the implementation of measures for improving energy efficiency in public sector buildings, by fostering integral renovation of buildings which includes measures regarding the building envelope, thermal-technical systems, electrical systems, and water supply system works. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation.
	Target sector	Service sector
Implementation	Implementing authority	MCPP – draws up the programme and supervises its implementation APN – implements EPEEF – ensures funding
	Authorities supervising the implementation	CEI, in coordination with MCPP and MENP
Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Input data must be set for each individual building, and reference values should be used only in special cases. The description of the method can be found in Appendix E.
	Life cycle of the measure	25 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.

Energy savings estimate	Assumptions for estimating savings	A total of 13.8 million square meters of usable floor area of public sector buildings were registered in the Republic of Croatia in 2010, according to the data from the National Energy Management Information System. Of the aforementioned area, 43.9 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m^2. This programme provides for the achievement of the following objectives by the end of 2015: - contract and perform integral renovation of 200 public sector buildings, with a usable floor area of approximately 420 000.00 m^2, – of which 33 267 m^2 annually are heated areas of central government buildings (which is 3 % of the total heated areas of public sector buildings); - reduce energy consumption in renovated buildings by 40–60 %, or by approximately 150 kWh/m^2 per year.
	Expected cumulative savings 2014–2015	0.286 PJ
	Expected cumulative savings 2014–2020	1.241 PJ

Title of the measure		**Programme of energy renovation of public sector buildings 2016–2020**
Measure index		**P.2**
Description	Category	Regulations, Financial instruments
	Time frame	Duration of the measure: 1 January 2016 - 31 December 2020
		1st intermediate period: 1 January 2016 - 31 December 2020
	Objective / outline	The measure provides for the design of the Programme of energy renovation of public sector buildings by 2020 and for the implementation of the said Programme. The Programme will primarily focus on public sector buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The Programme will provide for the options for the energy renovation of buildings not deemed financially viable under the Programme of energy renovation of public sector buildings 2014 -2015, and pertaining to the renovation of buildings under the
		protection regime for cultural heritage, large hospital and military complexes requiring large initial investments, and similar. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation.
	Target sector	Service sector
Implementation	Implementing authority	MCPP – draws up the programme and supervises its implementation APN – implements and promotes the programme EPEEF – ensures required funding
	Authorities supervising the implementation	CEI, in coordination with MCPP and MENP

Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Input data must be set for each individual building, and reference values should be used only in special cases. The description of the method can be found in Appendix E.
	Life cycle of the measure	25 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	A total of 13.8 million square meters of usable floor area of public sector buildings were registered in the Republic of Croatia in 2010, according to the data from the National Energy Management Information System. Of the aforementioned area, 43.9 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m^2. This programme provides for the achievement of the following objectives by the end of 2020: - annually contract and perform integral renovation of public sector buildings, with a usable floor area of approximately 210 000.00 m^2, - of which 33 267 m^2 annually are heated areas of central government buildings (which is 3 % of the total heated areas of public sector buildings); - reduce energy consumption in renovated buildings to 50 kWh/m^2 per year, or by 190 kWh/m^2.
	Expected cumulative savings 2014–2016	0.121 PJ
	Expected cumulative savings 2014–2020	1.813 PJ

Title of the measure		**Programme of energy renovation of commercial non-residential buildings**
Measure index		**B.4**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016
		2nd intermediate period: 1 January 2017 - 31 December 2020

	Objective / outline	The energy renovation of existent commercial non-residential buildings focuses on buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation.
	Target sector	Service sector
Implementation	Implementing authority	EPEEF – programme implementation and co-financing MCPP – drawing up the programme
	Authorities supervising the implementation	MCPP, MT, MENP, ME
Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Input data must be set for each individual building, and reference values should be used only in special cases. The description of the method can be found in Appendix E.
	Life cycle of the measure	25 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	A total of 36.5 million square meters of usable floor area of commercial non-residential buildings were registered in the Republic of Croatia in 2010, according to the data of the Croatian Bureau of Statistics, the 2001 Census, and data on the total number of issued building permits and constructed buildings in the 2001–2010 period. Of the aforementioned area, 43.90 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m^2. It is assumed that 3 % of heated usable floor area of commercial non-residential buildings is renovated every year, or approximately 480 000 m^2, and that the specific annual heat energy consumption for heating is reduced from the average 220–250 kWh/m2 to 45 kWh/m2.
	Expected cumulative savings 2014–2016	*1.970 PJ*
	Expected cumulative savings 2014–2020	*9.193 PJ*

Title of the measure		**'Energy Efficient Public Lighting' Programme**
Measure index		**P.4**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016

		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	This measure fosters energy efficiency in public lighting systems through various financial mechanisms: co-financing measures through EPEEF and local self-government units, and energy services of ESCO companies.
	Target sector	Transport sector, road vehicles
Implementation	Implementing authority	ME and MENP – regulations and instructions for LRSGUs LRSGU and ESCO companies – implementation EPEEF – co-financing
	Authorities supervising the implementation	CEI, in coordination with ME
Energy savings monitoring	Method for calculating energy savings	Estimated/measured savings
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Such savings result from the replacement of old or establishment of new, more efficient public lighting systems, and the method is based on the difference in consumption from the old/reference system. The description of the method can be found in Appendix E.
	Measure duration	15 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	In 2009, electricity consumption for public lighting amounted to approximately 450 GWh. Savings amounting to approximately 0.0618 PJ (sum of the effect of measures applied from 2010 to 2013) were achieved in 2013 through measure co-financing. Savings from 25 % to 80 % are achieved in public lighting systems with the use of new technologies in comparison to obsolete technologies. It is assumed that 50 % of public lighting systems will be included in the scheme by 2016, and 75 % by 2020, with a 2 % annual increase in consumption in the scenario without measures. Average savings of 30 % per system and an average simulation factor of 1.1 are assumed.
	Expected cumulative savings 20142016	0.593 PJ
	Expected cumulative savings 20142020	2.247 PJ

Title of the measure		**Financial incentives for energy efficient vehicles**
Measure index		**T.6**
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016

		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	As part of its activities, EPEEF co-finances cleaner transport schemes. Co-financing lines for the purchase of electric and hybrid vehicles, as well as co-financing lines for the modification/purchase of liquefied petroleum gas (LPG) and compressed natural gas (CNG) powered vehicles are an integral part of such schemes.
	Target sector	Transport sector, road vehicles
Implementation	Implementing authority	MMATI and EPEEF, MF – designing a model for tax benefit eligibility
	Authorities supervising the implementation	CEI, in coordination with MMATI and MENP
Energy savings monitoring	Method for calculating energy savings	Estimated savings
	Methodology for calculating energy savings	A national BU method for monitoring savings has been developed. Such savings result from the replacement of old or purchase of new, more efficient vehicles, and the method is based on the difference in consumption between the old/reference vehicle and the new one, as well as on their mileage. The description of the method can be found in Appendix E.
	Life cycle of the measure	8 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	Co-financing the procurement of 15 000 electric and 6 000 hybrid vehicles by 2020 is assumed. A mileage of 12 000 km/year per automobile is assumed, with a final energy consumption of 15 kWh/100 km for electric cars, 44 kWh/100 km for hybrid cars, and 67 kWh/100 km for conventional vehicles. Savings achieved through fostering modification/purchase of liquefied petroleum gas (LPG) and compressed natural gas (CNG) powered vehicles will also be calculated under this measure.
	Expected cumulative savings 2014–2016	0.340 PJ
	Expected cumulative savings 2014–2020	1.587 PJ

Title of the measure		**Eco-driving training and promotion**
Measure index		**T.1**
Description	Category	Education and training

	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016
		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	This measure wishes to achieve a maximum level of awareness of all the citizens and drivers in the Republic of Croatia about the advantages of eco-driving, through active implementation of eco-driving training and promotional activities among drivers who obtained their licences before the adoption of the Rules on training learner drivers (NN Nos 13/09). Special elements of the national campaign should be dedicated to eco-driving education for: drivers of passenger cars, buses and freight vehicles > 3.5 tonnes. This measure is primarily targeted at drivers who traverse an above average number of kilometres per year.
	Target sector	Transport sector, road vehicles
Implementation	Implementing authority	EPEEF, in coordination with HAK
	Authorities supervising the implementation	CEI, in coordination with MENP
Energy savings monitoring	Method for calculating energy savings	Savings established on the basis of research
	Calculation methodology for energy savings	The method for monitoring savings is based on the difference in fuel consumption before and after education/training, and on the mileage covered. The description of the method can be found in Appendix E.
	Life cycle of the measure	2 years
	Monitoring and verification protocols	The effects of the measure will be monitored through the Measuring and Verification System (SMIV) which is explained in detail under measure H.9 – Establishing an integrated information system for monitoring the implementation of the energy efficiency policy.
	Revision protocols	The National Coordinating Body for Energy Efficiency is competent for the revision of the savings calculations.
Energy savings estimate	Assumptions for estimating savings	A total of 12 750 short training/education courses for drivers of passenger cars, 688 for drivers of freight vehicles, and 650 for bus drivers are assumed per year. It is assumed that 50 % of drivers will change their habits after taking the course, and they will achieve average fuel savings of 7.5 %. It is assumed that the average annual mileage for drivers of passenger cars is 12 000 km, for drivers of freight vehicles 38 000 km, and for bus drivers 54 700 km. It is assumed that the average fuel consumption of passenger cars is 7 l/100 km (with a 50 % share of diesel cars and a 50 % share of petrol cars), the average diesel consumption of freight vehicles is 32.3 l/100 km, and the diesel consumption of buses is 37.2 l/100 km.
	Expected cumulative savings 2014–2016	0.147 PJ
	Expected cumulative savings 2014-2020	0.383 PJ

Title of the measure		Special motor vehicle tax based on CO2 emissions
Measure index		**T.9**
Description	Category	Tax instrument
	Time frame	Duration of the measure: 1 January 2014 - 31 December 2020
		1st intermediate period: 1 January 2014 - 31 December 2016
		2nd intermediate period: 1 January 2017 - 31 December 2020
	Objective / outline	A special motor vehicle tax (NN Nos 15/13, 108/13) was introduced with the aim of reducing emissions from transport. Based on the 'polluter pays' principle, the model is calculated on the basis of CO2 emissions from motor vehicles. The special tax is determined on the basis of the sales price or market value of a motor vehicle, carbon dioxide (CO2) emissions expressed in grams per kilometre, engine volume in cubic centimetres and greenhouse gas emission levels. The motor vehicles which are powered exclusively by electricity are not subject to this tax, and the special tax amount for 'plug-in' hybrid electric vehicles is reduced by the percentage which corresponds to the vehicle's driving range in full electric mode. This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions.
	Target sector; taxpayer segment	Transport sector, road vehicles Vehicle buyers
Implementation	Implementing authority	MENP and CVH
	Authorities supervising the implementation	MMATI, MI, ME, MF
Energy savings monitoring	Method for calculating energy savings	Savings established on the basis of research
	Calculation methodology for energy savings	A national BU method for monitoring savings has been developed. Such savings result from the replacement of old or purchase of new, more efficient vehicles, and the method is based on the difference in consumption between the old/reference vehicle and the new one, as well as on their mileage. The description of the method can be found in Appendix E.
	Life cycle of the measure	8 years
Energy savings estimate	Assumptions for estimating savings	The introduction of the tax encourages the purchase of more energy efficient vehicles and vehicles with lower greenhouse gas emissions. The following assumptions were used: purchase of 40 000 passenger cars and 2 500 motorcycles per year, with an annual increase of 5 %; an average mileage of 12 000 km/year per passenger car, 5 000 km/year per motorcycle; it is assumed that 50 % of the purchased passenger cars that are subject to this Act will be diesel fuelled, and 50 % will be petrol fuelled. It is assumed that 20 % of buyers will choose vehicles with emissions that are 10 gCO2/km lower than those they would have chosen if the special tax had not been introduced, and 20 % of buyers

		will choose vehicles with emissions that are 20 gCO2/km lower.
	Expected cumulative savings 2014-2016	0.262 PJ
	Expected cumulative savings 2014-2020	1.236 PJ

Energy Efficiency Obligation Scheme

The cumulative national energy savings target for the 2014–2020 period is 54.250 PJ. Savings amounting to 32.094 PJ are planned to be achieved through the application of alternative policy measures, and the target difference of 22.156 PJ is planned to be achieved through the energy efficiency obligation scheme.

The Republic of Croatia plans to define a cost-effective and institutionally implementable energy efficiency obligation scheme by the end of 2014, and provide information about it in the next annual report. The obligated parties (energy distributor or retail energy sales company) will be determined pursuant to objective and non-discriminatory criteria. The method of establishing the energy efficiency obligation scheme will also be defined.

The introduction of the energy efficiency obligation scheme is planned for 2015.

3.1.2 Energy Audits and Consumption Management Systems (EED Article 8)

Energy audits have been regulated in Croatia since 2013 and they are regularly conducted. What follows are descriptions of control systems for certificates and energy audit reports, as well as descriptions of measures undertaken to maintain the quality of energy audits. The legal basis and its amendments are summarised under measure B.1.

There are currently 144 large companies in Croatia in accordance with the criteria specified in the EED, and those companies employ a total of 206 144 persons. The measure of introducing energy audits and energy management (H.1), specified below, is planned for large companies.

Control System for Energy Performance Certificates and Reports

Pursuant to the Rules on the control of energy performance certificates of buildings and energy audit reports (NN Nos 81/12, 79/13):

(1) The Ministry (MCPP) performs the control of energy performance certificates and/or reports on regular audits of heating and cooling or air-conditioning systems in buildings.

(2) The energy performance certificates and reports on regular audits of heating and cooling or air-conditioning systems in buildings are selected for control using one of the following methods:

- by random selection from the total number of issued energy performance certificates, certificates of a certain energy class, and certificates for a certain type and intended use of buildings;
- by random selection from the total number of reports on regular audits of heating and cooling or air-conditioning systems in buildings;
- following a complaint.

(3) The Ministry performs the control of at least one energy performance certificate and/or report on a regular audit of heating and cooling or air-conditioning systems in a building for every authorised person, by random selection, at least once in five years.

The energy audit and the energy certification of a building are conducted by a person who is authorised by the Ministry of Construction and Physical Planning pursuant to the Rules on the conditions and criteria for persons conducting energy audits and energy certification of buildings (NN Nos 81/12, 64/13). In the last three years, 10 educational institutions were granted authorisation to conduct training for energy certifiers:

1. College of Slavonski Brod, Slavonski Brod, Dr. Mile Budaka 1
2. Faculty of Civil Engineering at the University of Zagreb, Zagreb, Fra Andrije Kačića-Miošića 26
3. Faculty of Engineering at the University of Rijeka, Rijeka, Vukovarska 58
4. Energy Institute Hrvoje Požar, Zagreb, Savska cesta 163
5. Faculty of Mechanical Engineering and Naval Architecture at the University of Zagreb, Zagreb, Ivana Lučića 5
6. Brodarski institut d.o.o., Zagreb, Zagreb, Avenija Većeslava Holjevca 20
7. Society of Civil Engineers Zagreb, Zagreb, Berislavićeva 6
8. Croatian Chamber of Mechanical Engineers, Zagreb, Ulica grada Vukovara 271
9. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture at the University of Split, Split, R. Boškovića 32
10. Faculty of Civil Engineering Osijek at the Josip Juraj Strossmayer University of Osijek, Osijek, Drinska 16a

As of 31 December 2013, a total of 883 certifiers (natural and legal persons) have been registered in the register of persons authorised to conduct energy certification, and a total of 17 400 certificates have been submitted thus far.

Subject of Control

An authorised person controls the validity and completeness of input data as follows:

- the soundness and accuracy of the energy performance certificate, calculations and proposed measures for the improvement of the energy performance of a building;
- the soundness and accuracy of the report on a regular audit of heating and cooling or air-conditioning systems in a building, calculations and proposed measures for the improvement of energy efficiency.

Actions Following a Negative Report

An authorised person whose energy performance certificate and/or report on a regular audit of heating and cooling or air-conditioning systems in a building was evaluated negatively may be ordered to repeat the energy performance certification or regular audit of heating and cooling or air-conditioning systems in a building free of charge.

Title of the measure		**Energy audits and energy management in large companies**
Measure index		H.1
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: New measure, derived from measure 'Energy audit scheme for industry' – measure I.3 in the 2nd NEEAP
	Objective / outline	This measure should ensure support for estimating the energy savings potential in large companies by co-financing energy audit implementation. The ISO 50001 standard and similar guidelines for comprehensive energy management in companies will be taken into account when drafting the Rules on energy audits in large companies.
	Target final consumption	Consumption of all energy sources and water in large companies
	Target group	Large companies
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: 1. The amendments to the regulations will pertain to the obligations of conducting energy audits of large companies. This obligation will be laid down in the new Act which will define the area of energy efficiency. This measure endeavours to aid such companies in fulfilling the aforementioned obligation by granting them a portion of the subsidies for conducting energy audits. 2. The measure will be laid down in further detail by the ME, after the adoption of the regulation which will define the said obligation, and the ME will issue instructions for EPEEF. 3. EPEEF stipulated the drafting of the Energy Audit Scheme for Industry with EIHP in the 2nd NEEAP, and the scheme will be drawn up by the end of 2014.

		The objective of drafting the Energy Audit Scheme for Industry: 1. Establish and promote a scheme for large consumers (implementation of cost-effective measures should be a condition for energy audits, which is in line with the legal obligation, and monitoring the fulfilment of the said obligation should be ensured); 2. Establish and promote a scheme for other industrial consumers, in particular for SMEs and separately for individual branches of industry. The beneficiaries of subsidised energy audits must commit themselves to establishing an energy management system. In addition to energy audits, they should be provided with a possibility to obtain subsidies for devices for supervision, monitoring and analysis of energy consumption.
	Funds and financing sources	Planned funds by the end of 2016: • EPEEF: co-financing energy audits and/or the introduction of systematic energy management in compliance with international standards (such as ISO 500001) – HRK 400 000.00 per year
	Executive body	ME – drawing up instructions for EPEEF EPEEF and EIHP – drawing up the energy audit scheme for industry EPEEF – co-financing
	Monitoring (supervision) bodies	CEI, ME, MCPP, MENP
Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored using the BU method ex-ante. The life cycle will be defined with the new Rules on monitoring, measuring and verification which is currently being drafted, and it will be possible to calculate the specific expected savings once the Rules are adopted.
	Energy savings expected in 2016	Not estimated
	Expected impact on energy savings for 2020	Not estimated
	Assumptions	Energy savings resulting from the energy audit itself are determined on the basis of evaluated potentials given in the final report of the energy audit. It is assumed that at least 5 % of those potentials will be achieved. Certain European recommendations[33] contain significantly higher assumptions (20 % for electricity and 15 % for other forms of energy), but they will not be used because they take into account only the effect of raised awareness of users which would result in better maintenance and management procedures ('soft measures') by means of which energy savings are achieved. Due to a lack of data on total energy consumption by large companies, at the start of implementation of this measure it is not possible to estimate expected energy consumption reductions resulting only from this measure neither by 2016 nor by 2020. Accurate monitoring and measuring of implemented savings will be ensured by the development of the SMIV (measure H.9).
	Overlapping, multiplication effect, synergy	/

[3] Source: EMEEES project, Method 18 – Energy audits:
http://www.evaluate-energy-savings.eu/emeees/en/evaluation_tools/bottom-up.php

3.1.3 Metering and Billing (EED Articles 9–11)

Title of the measure		**Introduction of the individual metering system of heat energy consumption**
Measure index		H.2
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	The current practice of calculating and billing energy consumption in buildings connected to district heating systems does not foster energy efficient behaviour of heat energy consumers, nor does it encourage them to self-implement energy efficiency measures in their homes because the effects of such measures would ultimately not be evident on their energy bills. The introduction of individual metering of energy consumption is therefore a precondition for all future energy efficiency activities in such buildings. Moreover, pursuant to the Heat Energy Market Act (NN Nos 80/13, 14/14), the obligation of installing an individual metering system has become an obligation of the co-owners, which will definitely pose a financial burden for them. Financial support will be an incentive for the implementation of this legal obligation.
	Target final consumption	Consumption of heat energy from district heating systems in households.
	Target group	Co-owners of residential buildings (citizens) connected to district heating systems; companies that manage multifamily housing (building managers), LRSGU.
	Regional application	National
Information on implementation	List and description of activities for measure implementation	- ME invites all heat energy suppliers to draw up their programmes for the installation of individual metering for their customers, in cooperation with building managers. - EPEEF establishes a co-financing programme for the introduction of individual metering systems into buildings connected to the DHS, amounting to up to 40 % of total investment costs. Funds are awarded through LRSGUs. - Co-financing is awarded to building managers, and the difference is covered by the co-owners through the mandatory maintenance fee mechanism. - The suppliers are obliged to enter the data on measure implementation into the SMIV. The input method and obligations will be laid down in the new Rules on the methodology for monitoring, measuring and verifying energy savings.
	Executive body	Heat energy distributors and suppliers / building managers EPEEF – co-financing, with various funds
	Financing	HRK 75 million per year are required for the introduction of the individual metering system of heat energy consumption
	Monitoring bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored using the BU method ex-post or using estimates. The life cycle will be defined with the new Rules on monitoring, measuring and verification which is currently being drafted. The life cycle of this measure is 2 years.
	Energy savings expected in 2016	1220 TJ

	Expected impact on energy savings for 2020	1220 TJ
	Assumptions	The scope of current activities related to the introduction of the individual metering system of heat energy consumption from the DHS differs from supplier to supplier; • some have achieved individual metering coverage of 100 %, while others vary from 25 % to 75 %. The potential for new individual metering installations exists, and is specified in the suppliers' plans. Future estimates are based on the objective of installing individual meters for all existing heat energy consumers, where possible, by the end of 2020. There were 154 480 heat energy consumers in Croatia in 2010, and a conservative assumption is that individual metering can be installed for least half of them, or for approximately 75 000 consumers. That would mean that individual metering could be installed into 25 000 households per year by 2020. That would achieve annual savings of 406.7 TJ, and the duration of the measure is 2 years. The implementation cost of this measure is assumed to be HRK 3 000 per household.
	Overlapping, multiplication effect, synergy	The measure is a precondition for the implementation of other energy efficiency measures in buildings connected to the DHS because it is the only method through which the effects of reduced energy consumption can impact energy bills. It is therefore assumed that, after the implementation of this measure, other energy efficiency measures (e.g. window replacement) could start to be implemented on a larger scale in buildings connected to the DHS. Moreover, the measure overlaps with the measure 'multifamily housing renovation programme' which, within the scope of integral renovation, also plans for the introduction of individual metering systems. The savings from integral renovation will be calculated under the programme, and only the savings achieved from individual metering installation services will be calculated under this measure.

The measure 'Reducing losses in the electric power grid' (shown in Chapter 3.7.3), a part of which pertains to the reduction of non-technical losses through the introduction of individual metering, belongs in this category. However, in order to avoid the measures being referenced twice, these two measures have been consolidated into one. See Chapter 3.7.3 measure: 'Reducing losses in the electric power grid'.
The reduction of non-technical losses in the electric power grid will be evident in the following:

- further installation and introduction of the largest possible number of advanced meters in the remote supervision and meter reading system;
- further comprehensive implementation of connection and meter point controls (CMPC), with an emphasis on detecting unauthorised electric power consumption;
- continued improvement of indirect and semi-direct meter points and periodic control of such meter points;
- continued reconstruction of existing connections and meter points installed on the premises of the customers.

3.1.4 Consumer information and training programmes (EED Articles 12, 17)

H3 – Financial instruments for EnE and RES projects

A lot has been done in the information sector in Croatia during the last triennial period. Since information is a precondition for a successful implementation of measures, and co-financing is a necessity for achieving certain established energy efficiency targets, this chapter outlines the results achieved in this area.

Most measures are co-financed by EPEEF but, in addition to certain ministries and EPEEF, there are also other financial models, fees and financial institutions which participated in the co-financing of measures of the 2nd NEEAP and their further involvement in the measures of the 3rd NEEAP is expected. The most prominent of the aforementioned are:

- HBOR
- Commercial banks
- Public-private partnership
- CO_2 fee
- Financing by way of CO_2 and other emission fees

HBOR

Since its establishment, the Croatian Bank for Reconstruction and Development, in its role as the national development bank, directed its efforts towards financing sustainable projects which protect the environment and improve energy efficiency, as well as projects involving renewable energy sources.

In the 2007–2013 period, HBOR approved approximately HRK 1 213 million of loan funding intended for investments in environmental protection, renewable energy sources and energy efficiency projects. Of the aforementioned amount, HBOR approved approximately HRK 98.4 million of loan funding for energy efficiency projects in the 2011–2013 period. The aforementioned HBOR loan funding was approved through business banks operating in the Republic of Croatia, directly through HBOR, and through the risk distribution model in cooperation with business banks.

Moreover, based on the multi-annual successful cooperation with the EIB, HBOR currently also has European Commission funds at its disposal for financing projects on energy efficiency and renewable energy sources, and such funds can be used when approving HBOR loans from EIB funds. For further details about this issue, please see the report in Annex A4.4.

Commercial banks

The lines of credit at Zagrebačka banka and Privredna banka Zagreb can serve as examples of how commercial banks embraced EnE measure financing in a broader scope. These are only examples of good business practice, by no means the only ones implemented in the Republic of Croatia. Many commercial banks offer similar lines and models, or are actively working on their development.

Privredna banka Zagreb d.d.

In cooperation with EIB, PBZ developed a programme for financing energy efficiency projects implemented by small and medium-sized enterprises and LRSGUs. The programme ensures incentives (EU grants) for the clients, as well as technical assistance in the form of consultants who assist the clients in choosing measures which generate energy and financial savings, and such assistance is offered free of charge. In order to be granted the incentives, the clients must implement their projects in accordance with the presented project idea which was approved by the EU/an international development bank.

PBZ also has a financing programme for projects on energy efficiency and renewable energy sources, concluded with the GGF, which can be utilised by all types of clients. There is a line of credit for citizens with which they can finance energy renovation projects or energy efficiency improvement projects for residential real estate. Citizens can use this PBZ Energo line of credit to finance the purchase of a higher energy class (A, A+, and B) real estate, the purchase of real estate with energy efficiency improvements, the purchase of building land for the construction of low-energy and passive houses, or they can finance the construction, extension, addition, and completion of low-energy and passive houses, as well as improve the energy efficiency of an existing home.

A total of 19 projects on energy efficiency and renewable energy sources have thus far been financed from the aforementioned programmes, with a total value of approximately HRK 30 million. Generally speaking, a higher demand for this type of loans was registered in late 2012, and it additionally intensified in 2013.

In view of the increased involvement of LRSGUs in programmes fostering the use of renewable energy sources or energy efficiency projects for households, the Bank plans to consider and, depending on an individual programme, offer special lines of credit.

Zagrebačka banka d.d.

For some time ZABA has been offering green loans in Croatian kunas with a fixed interest rate, ensuring a fixed monthly obligation throughout the loan repayment period. Such loans are particularly convenient for those who wish to improve an existing real estate to be energy efficient, in order to both improve the comfort of living and achieve substantial energy savings. A green housing loan is approved for energy efficiency improvements of real estate, with a fixed interest rate of 6 % and a repayment period of up to six years. Loan amounts vary from HRK 15 000 to 300 000, and the loan application processing fee is calculated as 0.5 % of the loaned amount.

An additional facility is the option of linking this loan with Design Savings, which involves regular monthly payments and enables early repayment of the loan without additional fees after five years or less.

Mortgages are not required for loans of up to HRK 200 000 and no other credit insurance instrument is required with a one-off payment into Design Savings amounting to 15 % of the loan.

Webseff II Programme

A cooperation programme between Zagrebačka banka and the European Bank for Reconstruction and Development was established in December 2013 with the aim of facilitating investments in energy efficiency and projects related to renewable energy sources for companies and local self-government units. In addition to favourable conditions and free technical assistance, this line of credit at Zagrebačka banka enables the loan beneficiaries to access incentive EU grants, and is a result of the EBRD project entitled Western Balkans Sustainable Energy Financing Facility II (WeBSEFF II) carried out in cooperation with the EU. This line of credit is open to both the public and the private sector if they wish to improve efficient energy use and/or invest in plants for the production of energy from renewable sources. The grant amounts for projects which meet energy savings and/or CO2 reduction criteria will be from 5 % to 10 % of the loan amount for business operators, or from 10 % to 15 % of the loan amount for LRSGUs. Furthermore, this line also offers free technical assistance by consultants who will be able to give preliminary estimates of savings in the initial stages of a project, as well as evaluate whether a project will meet the required eligibility criteria for grants.

Public-private partnership

The first public-private partnership agreements in the Republic of Croatia were concluded in 2006 and 2007. It was a contractual type of public-private partnership, the private finance initiative model (PFI model), mostly in the domain of school construction. In addition to the PFI model, the concession model was predominantly used in public-private partnership projects, and the institutional type of PPP was featured in addition to the contractual type.

Public-private partnership projects are long-term cooperation projects between the public and the private sector which aim to deliver a service traditionally provided by the public sector, and within the framework of which the private sector assumes the risks of construction and financing as well as supply or demand. A decision on choosing a PPP model over the traditional (budgetary) one is based on the calculation of savings which result from the selected PPP model. In the handover of a public building under the PPP model, in addition to the construction costs, the overall costs of living are also taken into account and the latter also include maintenance and replacement costs as well as financing costs and revenues from possible commercial activities. The PPP model results are compared with

the traditional model in order to establish whether the PPP model is more acceptable, i.e. whether the PPP model can achieve the value for money.

The Agency for Public-Private Partnership has registered 13 implemented PPP projects in Croatia thus far. The projects have predominantly been carried out on the construction of school facilities (9), one bus terminal, county building and sports hall. The total value of these projects is HRK 614 250 000.00.

PPP projects are also implemented by the Centre for Monitoring Business Activities in the Energy Sector and Investments, in the name and on behalf of the state bodies of the Republic of Croatia. One of the initial steps in the preparatory stage of PPP project implementation is to request the PPP project applicant to submit the project documentation for the proposed projects. In order to meet the requirements of the upcoming EU laws and rules on energy efficiency, the status of project documentation for the proposed projects is recorded with regard to the requirements set by the Ministry of Construction and Physical Planning. These guidelines are stricter than the maximum permitted values laid down by the law which is currently in force, whereby PPP projects result in an increase of energy efficiency. The prescribed stricter requirements include the maximum permitted heat transfer coefficient (U), the maximum permitted annually required heat energy for heating (Qh, nd), and mandatory insolation protection.

In order to increase the improved energy efficiency and overall energy soundness of a project, CEI usually recommends that, when submitting a project involving addition, the existing buildings be included in the scope of the works. That would achieve energy efficiency of the entire future building, if the buildings subject to the addition works are older and if no substantial investment works on the maintenance and replacement of worn-out elements and materials have been performed on such existing buildings.

The strengthening of the market for 'Energy services' offered by private companies and higher absorption of funding from structural funds for energy efficiency projects is expected in the following period. Experience in implementing energy efficiency projects has shown there was a need for establishing guarantee mechanisms. Although in some cases ESCO companies may have the credit ability to finance projects providing energy services, without a guarantee mechanism or other financial instruments the overall market potential is reduced and fewer projects can be financed. The risk to reward ratio in energy efficiency projects, although the financial flow is positive, does not justify investments in full renovation of buildings, which greatly reduces the savings potential and the investment levels of ESCO companies. Borrowing from banks is also problematic, conditioned by two main reasons:

1. As a rule, an energy efficiency improvement project entails an investment by an entrepreneur on someone else's property, which does not provide a guarantee in form of a mortgage to the financial institutions.
2. Revenues are based on technically conditioned obligations, and the banks do not possess sufficient specialist knowledge to conduct an acceptable risk analysis.

In order to overcome these issues, in addition to the aforementioned lines of credit, the development of three new mechanisms for the utilisation of financial instruments is planned:

1. Guarantee programmes which will cover specific risks related to the implementation of energy efficiency programmes. The objective of guarantee instruments is to assume some of the risk incurred by the financial institutions which finance ESCO companies, with the payment of a fee which would not amount so high as to jeopardise the financing of the project.

2. Equity instruments which will ensure co-investments through the financial instrument, whereby the public co-investor would have limitations in generating profit, i.e. excess profit would be transferred to the private partner. The use of this instrument will increase the attractiveness of investments in projects with lower profitability rates/return on investment period.

3. Mezzanine financing – by combining the aforementioned instruments, we intend to form programmes and institutions with private investors, and such institutions would assume risks through specialised mezzanine financing (subordinated borrowing) for energy efficiency projects.

There is a possibility of establishing forfeiting products as a financing method, if acceptable discount rates are achieved, especially since there is no *del credere* liability for ESCO companies. For that reason, forfeiting is not planned to be used for integral project financing, but only as a support product for planned financial instrument mechanisms.

H.4 – Financing by way of CO_2 and other emission fees

A special measure of a financial nature involves funds collected by way of CO_2 and other emissions, previously specified under measure I.5. The full title of the measure is: **Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units, the CO_2 emission fee for polluters, and the fee for plants excluded from the emission unit trade.** What follows is the description of the measure:

Plants in Croatia have been included in the EU Emissions Trading System from 1 January 2013. The ETS system participants from Croatia can buy emission units at auction, and access to auctions is open for all market participants regardless of their state of origin. The funds obtained from the auction sale of emission units that originate from the quotas set for plants in Croatia are paid into a special account of the Environmental Protection and Energy Efficiency Fund. Pursuant to the Air Protection Act (NN Nos 130/11, 47/14), 95 % of the available funds (85 % in 2014 and 2015) will be put to the following use:

- reducing greenhouse gas emissions;
- adaptation to climate change;
- financing measures on climate change mitigation and adaptation in third countries;
- financing renewable energy sources with the objective of meeting the obligation of using 20 % of renewable energy sources by 2020;
- improving forest resources and reporting from the forestry sector;
- reducing emissions from transport;
- financing research targeted towards climate change mitigation and adaptation, including the field of aeronautics and air transport;
- ecologically safe carbon dioxide capture and geologic storage, especially from fossil fuel power plants and certain industrial sectors and sub-sectors, including those in third countries;
- fostering the transition to low emission transport and types of public transport;
- financing research and development in the field of energy efficiency and clean technologies;
- financing research and development in the field of reporting on greenhouse gas emissions;
- measures aimed at increasing energy efficiency and insulation, or ensuring financial support for resolving the social aspects in low and mid-income households.

The funding for the implementation of this measure is ensured in two ways:

1. Pursuant to the Decree on unit fees, corrective coefficients and detailed criteria and measures for determining the carbon dioxide emissions fee (NN No 73/07), the plants which emit more than 30 t/year of CO_2 pay an annual fee to the Environmental Protection and Energy Efficiency Fund. The Decree prescribes that the CO_2 emissions fee tributaries may have their fee reduced by a corrective factor which depends on the existence and implementation of the Programme for the reduction of CO_2 emissions.
2. Pursuant to the Air Protection Act, since 1 January 2013 the Republic of Croatia has been generating certain funds obtained from the auction sale of greenhouse gas emission units. Since 1 January 2013, in accordance with the Decree, 73 plants involved in the Emissions Trading System are exempt from CO_2 fee payments. This provision pertains to: thermal power facilities exceeding 20 MW; refineries; coking plants; the metal, cement, paper, ceramics, glass industry; ammonia, nitric acid production, etc. Fossil fuel powered electric

power plants covered by the Emissions Trading System are obliged to purchase all emission units (one emission unit is a licence for the emission of one tonne of $CO2_{eq}$) at auction from 1 January 2013. In early 2014, the price of an emission unit on the EU market was approximately EUR 5. The plants whose emissions do not exceed 25 000 $tCO_{2\,eq}$ per year and whose nominal input thermal power is below 35 MW can be excluded from the trading system, in which case they will pay a single special annual fee. This fee is calculated as the difference of the verified emissions from the plant in the previous year and the emissions equivalent to the quantity of emission units which would have been allocated for free to the plant operator, multiplied with the average emission unit price at auction in the previous year. Of the aforementioned 73 plants, 13 have requested exclusion from the trading system. 95 % (or 85 % in 2014 and 2015) of the funds that the state will receive from auctions will be paid into a special account of the Environmental Protection and Energy Efficiency Fund. In accordance with the Plan for the Utilisation of Funds Received from the Auction Sale of Emission Units for the 2014–2016 period, which will be adopted by the Government of the Republic of Croatia in the 3rd quarter of 2014, the funds will be used to foster the use of renewable energy sources, energy efficiency and other measures for reducing greenhouse gas emissions, as well as adaptation to climate change.

The allocation of funds will be determined on the basis of the Plan, and the Plan will be used to set, calculate and allocate the funds received from the auction sale of emission units per area, for the 2014–2016 period. A plan for the allocation of funds per area and measure will be designed. The amount of funding required for implementation will be evaluated for each measure, as will the stakeholders/executors of the measure and the dynamic of implementation. In the course of designing this Plan, the need to harmonise it with the 3rd National Energy Efficiency Action Plan will be taken into account.

This measure will be executed by EPEEF, with the supervision and monitoring by MENP, and EPEEF will direct a portion of the funds received from CO_2 fees and auctions into co-financing energy efficiency projects in industry. EPEEF should continue evaluating investments and emission reduction programmes for CO_2 fee tributaries. In accordance with the aforementioned Decree and Act, EPEEF supervises the implementation of CO_2 emission reduction programmes and draws up a report on the utilisation of funds received from auctions.

This measure is a combination of a voluntary approach based on the reduction of CO_2 fee payments, the utilisation of funds collected from the fee for co-financing industry projects, and the utilisation of funds received from auctions for financing measures on increasing energy efficiency in building construction. In view of past experiences and great savings potentials, a total of 1 PJ of energy savings is set as a target to be achieved by 2016. In view of the characteristics of industry measures and their relatively long life cycle, it is assumed that all the savings will still be producing results in 2016 and 2020. Special attention will be paid to building construction which, according to estimates, accounts for 43 % of final energy consumption. When selecting energy efficiency measures, maximising the reduction of CO_2 emissions will be taken into account, i.e. priority will be given to measures with the lowest marginal costs per tonne of avoided CO_2 emissions.

The Feasibility Study for the Introduction of a System of Voluntary Industry Agreements will also be drawn up. The study will be drawn up by EIHP for EPEEF and it will be completed by the end of 2014.

Title of the measure		**Informative billing (Energy diagnosis)**
Measure index		H.5
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: updated measure
	Objective / outline	Clear and comprehensible energy bills (electricity, heat energy and natural gas). This will raise the consumers' awareness of the way in which they consume energy. The bills should contain graphic comparisons of consumption in the billing period of the current year and the

		corresponding period in the previous year. The bills should be based on the actual achieved consumption. The bills should also contain information on where to obtain advice on efficient energy consumption, and a toll-free phone number is recommended.
	Target final consumption	Consumption of electricity, heat energy, natural gas and water in households, industry, service and public sector
	Target group	Distributors and suppliers of electricity, heat energy and natural gas; building managers
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: The new Act, which will define the energy efficiency policy, will stipulate the obligation of operators/suppliers to, at least once a year, deliver their customers a bill specifying the following: • Consumption in comparison to the same period in the previous year – graphic and table overview • Proposal of measures that can be undertaken by the customer in order to reduce monitoring • Info points, including the main website where the customers can find further information – see measure: Info campaigns ME should draw up an instruction on the basis of the future Energy Efficiency Act and submit it to all operators/suppliers
	Funds and financing sources	/
	Executive body	Distributors, suppliers
	Monitoring bodies	ME and HERA
Energy savings	Method of monitoring/measuring energy savings	The effect of this measure can be covered by TD indicators in accordance with the European Commission recommendations (indicators P1 and P3).
	Energy savings expected in 2016	/
	Expected impact on energy savings for 2020	/
	Assumptions	The effects of this measure cannot be estimated.
	Overlapping, multiplication effect, synergy	This measure can produce effects primarily in the household sector, and the effects in the sense of energy savings will be shown for that sector. The bills should contain information on where to obtain advice on efficient energy consumption, which is also a link to the next measure: Info campaigns, or a link to the main EE website.

Title of the measure		**Info campaigns**
Measure index		H.6
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2016

		Planned major modifications, amendments, improvements: The co-financing and implementation of some activities which were started in 2007 will continue, and the measure will be amended with the addition of the National Central EnE Information Point in accordance with the EED and EPBD (especially the requirements of Article 20 of the EPBD).
	Objective / outline	The info campaigns have tried to raise the awareness of target groups about the benefits and possibilities of energy efficiency improvements. If comprehensive, financially demanding measures are being implemented, integral renovation has proven to be the most efficient and the most cost-effective. However, if the measures in question are 'small measures', the most efficient campaigns are those conducted in a limited time period and targeted towards specific activities, for example thermal insulation of buildings, more efficient lighting, etc. Targeted info campaigns should cover all the participants involved in reaching the energy efficiency improvement target. In addition to targeted activities, a single site containing all the information for all the stakeholders, from citizens to industry, is also required. A website will be developed as an upgrade of the UNDP EE campaign, linking to the EPEEF, ME and MCPP websites as well as to the ISGE, but it will contain a broader range of information. This should be the main website for all the activities, projects, measures and programmes, in other words, it should feature everything regarding energy efficiency in the Republic of Croatia. Among other things, the website should encourage small and medium-sized enterprises to conduct energy audits and introduce systematic energy management. This is an EED and EPBD requirement and it will include all the obligations towards these directives.
	Target final consumption	All sectors and all consumption, from citizens to public bodies and industry
	Target group	This measure is a supplement to most of the other measures of this Action Plan and, as such, affects all the end users of those measures.
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: The implementation of the general national media campaign has stopped. Targeted activities aimed at individual groups of users and/or individual types of final energy consumption will be implemented instead. Such activities must be accompanied by a financial support. Each co-financing programme introduced by the EPEEF under the measures defined in the 3rd NEEAP must be accompanied by strong promotional activities. EPEEF should finance such activities and coordinate with CEI. CEI is responsible for the maintenance of the website. Targeted activities aimed at individual groups of users and/or individual types of final energy consumption will be implemented under the Programme of energy renovation of public buildings, Programme of energy renovation of family homes, Programme of energy renovation of multifamily housing, and the Programme of energy renovation of commercial buildings 2014–2020. Such programmes must be accompanied by a financial support. Each co-financing programme introduced by the EPEEF under the measures defined in the 3rd NEEAP must be supported by strong promotional activities.
	Funds and	Planned funds by the end of 2016: • EPEEF: ensure necessary funds for the promotion of measures specified in

	financing sources	1. ME and EPEEF: HRK 30 000 for website design 2. CEI: HRK 15 000 for server procurement and website maintenance
	Executive body	CEI – website design and coordination of activities EPEEF – ensure co-financing for website design and for the promotion of measures defined in the 3rd NEEAP is expected.
	Monitoring bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	This measure can be monitored using a research-based method, but, based on practice, it was decided that energy savings will not be quantified. This measure is a precondition for informing all the stakeholders and achieving other energy efficiency measures.
	Energy savings expected in 2016	Cannot be determined
	Expected impact on energy savings for 2020	Cannot be determined
	Assumptions	Practice has shown that it is impossible to isolate the effects of this measure and that it is best to monitor the measure by using TD indicators. The estimates of the effects of this measure are therefore no longer provided.
	Overlapping, multiplication effect, synergy	This measure overlaps with and is an extension of all the measures financed/co-financed by EPEEF or implemented/coordinated by CEI. EPEEF should financially monitor the implementation of promotional, educational and informational activities aimed at the general public regarding all the measures financed/co-financed by EPEEF or implemented/coordinated by CEI. The measure is a precondition for providing information to all sectors and fostering easier implementation of other measures.

3.1.5 Availability of Qualification, Accreditation and Certification Schemes (EED, Article 16)

The energy audit and the energy certification of a building are conducted by a legal or natural person who is authorised by the Ministry of Construction and Physical Planning pursuant to the Rules on the conditions and criteria for persons conducting energy audits and energy certification of buildings (NN Nos 81/12, 64/13).

The rules based on the Construction Act (NN No 135/13) and the Act on Efficient Energy Use in Final Consumption (AEEU) (NN Nos 152/08, 55/12, 101/13, 14/14) lay down the following:

- the method and conditions for conducting energy audits of buildings and regular audits of heating and cooling or air-conditioning systems in buildings;
- the contents of reports on such audits, the energy certification method;
- the contents and appearance of the energy performance certificate;
- low energy buildings;
- the method and conditions for conducting independent controls of energy performance certificates and reports on regular audits of heating and cooling or air-conditioning systems in buildings;
- the contents and implementation method of Module 1 and Module 2 vocational training programmes;
- vocational training and mandatory advanced training tests for authorised persons;

- contents of the register and other issues related to conducting energy audits, energy certification of buildings;
- independent controls of energy audit reports and energy performance certificates.

The soundness of an energy performance certificate is achieved through independent control, as laid down in Article 39 of the Construction Act pursuant to which every energy performance certificate is subject to independent control. There are legal entities authorised to conduct such control in Croatia, and the control is conducted at the direction of MCPP. If the independent control negatively evaluates an energy performance certificate, MCPP will declare such a certificate invalid, and the authorised person whose certificates have been declared invalid will have their authorisation revoked.

In order to ensure the implementation of mandatory building certification, the Construction Act lays down penal provisions for legal or natural persons who, as owners of a building or a part thereof, fail to obtain an energy performance certificate.

The register of legal and natural persons authorised to perform energy audits and energy certification of buildings, as well as other information for citizens, has been published at the MCPP website which is regularly updated with new replies to the citizens' queries.

Title of the measure		**Energy efficiency education and training**
Measure index		H.7
Description	Category	Educational measures
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: Amended and updated measure.
	Objective / outline	The importance of formal and informal education on energy, energy efficiency, renewable energy sources and sustainable development is emphasised in a series of strategy documents of the Republic of Croatia. This measure defines the activities for achieving those objectives and the steps for their implementation. Activities: 1. Introducing additional lessons into elementary and high-school education; 2. Introducing the options for additional training/retraining of existing workers; 3. Improving the existing knowledge and skills of construction workers and construction sector workers.
	Target final consumption	All energy consumption segments
	Target group	Construction workers and construction sector workers, pupils, students, existing workers seeking retraining and further training
	Regional application	National

Information on implementation	List and description of activities for measure implementation	Implemented activities: A system for the energy certification of buildings has already been established in the Republic of Croatia, and certificates are issued by legal or natural persons authorised by the MCPP. There are two education modules, including testing which certifiers must pass, depending on the complexity of the facilities for which they are undertaking the training. In order to establish systematic and continuous education on energy efficient construction for construction workers, craftsmen and entrepreneurs, the Faculty of Civil Engineering in Zagreb introduced the CROskills project, following the recommendation of the Ministry of Construction and Physical Planning. Energy advisers for almost all major public sector buildings (central state administration, LRSGUs) have undergone training through the education programmes implemented by ME and UNDP under the EE Project. Further details on the activities implemented in the previous period can be found in the report, A4.2. Measure H.5. Future activities: • Based on the experience acquired from the CROSKILLS project, determine and quantify the requirements and possibilities of the construction sector in Croatia in order to help achieve the ambitious national energy efficiency objectives and facilitate the transformation of the construction sector with new technologies and requirements. • APN will continue to provide public sector beneficiaries with education and training for energy advisers for all major buildings (central state administration, LRSGUs), in accordance with the Agreement on assuming EE project activities. • Develop national guidelines for establishing a continuous education system on energy efficiency for (current and future) construction workers, and a system for the market evaluation of a qualified labour force. The implementation of these systems should lead to increased application of energy efficiency and renewable energy sources in everyday construction practice, all through the improvement of the practical know-how of on-site workers specialised in all the construction stages of a building as well as its maintenance procedures. • Set up an education and training plan and programme, and establish systematic and continuous education and training for construction workers. The implementation of the project should increase the number of vocationally trained workers, or train craftsmen and entrepreneurs who possess the sufficient know-how or are specialised in the construction of low energy, passive or nearly zero energy buildings, in order to ensure quality construction of buildings. • ME and MSES should design a programme for the inclusion of energy issues in curricula at all education levels.
	Funds and financing sources	Planned funds by the end of 2016: • MCPP – through the CROskills project • APN – educating energy advisers for public sector beneficiaries – HRK 100 000 per year • MSES – implementation into existing science and education

		systems
	Executive body	MCPP in cooperation with: • MSES • Faculty of Civil Engineering in Zagreb
	Monitoring bodies	CEI
Energy savings	Method of monitoring/measuring energy savings	This measure can be monitored using a research-based method, but, based on practice, it was decided that energy savings will not be quantified. This measure is a precondition for informing all the stakeholders and achieving other energy efficiency measures.
	Energy savings expected in 2016	Cannot be determined
	Expected impact on energy savings for 2020	Cannot be determined
	Assumptions	/
	Overlapping, multiplication effect, synergy	This measure complements the measure 'Promotion of energy services' which will also be used to educate the general public on energy services, energy service providers, and other. It also overlaps with the previous measure 'Info campaigns' which will consolidate all the information about raising awareness of energy efficiency at a single location.

3.1.6 Energy Services (EED Article 18)

The development of the energy services market was conducted through the adoption of the amendments to the Act on Efficient Energy Use in Final Consumption (NN Nos 152/08, 55/12, 101/13, 14/14, *hereinafter AEEU*), specifically by the adoption of the Decree on the contracting method and the implementation of energy performance contracts in the public sector (NN No 69/12), and through the implementation of the Programme of energy renovation of public sector buildings. The amendments to the AEEU established clear provisions on energy performance contracts, as well as basic terms required for the implementation of such contracts – energy service customer, energy service provider, energy service, reference consumption. The amendments to the Act awarded CEI the authorisation to stipulate energy performance contracts in the name and on behalf of the state. After the pilot project was implemented, the amendments to the Act awarded the authorisation to APN, which continued to implement the programme under the same conditions. The Decree on contracting and the implementation of energy services in the public sector further regulates the sections of energy performance contracts, as well as the method of treating the costs of payments under an energy performance contract in budgetary accounting. The Decree laid down that an energy service be treated as an operative cost, for which preconditions in accordance with ESA 95, Chapter IV.4. (classification per risk-benefit ratio) have been met, whereby the evaluation that the majority of the risks and benefits be borne by the private investor prevails, which means that an energy performance contract, in the sense of its treatment in national accounting, be treated as a ratio similar to operative leasing; in other words, financing renovations is not considered to be a debt of the state but of the ESCO company.

PROGRAMME OF ENERGY RENOVATION OF PUBLIC SECTOR BUILDINGS

At the session held on 31 October 2013, the Government of the Republic of Croatia adopted the Programme of Energy Renovation of Public Sector Buildings 2014–2015 which plans for approximately 200 buildings intended for public use to be renovated in 2014 and 2015, which would encourage investments in an estimated value of approximately HRK 400 million. One of its objectives is to meet the requirements in accordance with Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, pursuant to which the Member States are required, as of 1 January 2014, to annually renovate 3 % of the total floor area of heated and/or cooled buildings owned and used by the central government.

Under this Programme, the Fund will procure loans for co-financing the Programme in the section pertaining to energy renovation on the basis of energy performance contracts, amounting to 40 % of eligible costs for which HRK 160 000 000 must be ensured in 2014 and 2015, and in the section pertaining to drawing up energy audits, energy performance certificates and, when necessary, terms of reference, amounting to 100 % of eligible costs for which HRK 5 500 000 must be ensured in 2014 and 2015. On the basis of this Decision, the Fund concluded co-financing contracts for the implementation of parts of the Programme with the Agency for Transactions and Mediation in Immovable Properties (APN). APN is responsible for the implementation of the entire Programme, and the Fund will pay the earmarked funds to the APN who will be obliged to allocate them to energy service providers and persons contracted to draw up energy audits, energy performance certificates and terms of reference.

The objective of the Programme is to utilise the potential of investments in public sector buildings in those cases in which the cost of the investment is lower than the benefits to be achieved through savings on energy commodities in the future period. The renovation of buildings owned by the public sector, with a reduction of overall costs of energy commodities, has been contracted under the Programme, the share of renewable energy sources has been increased, the energy management information system has been established, and the conditions for the development of the energy services market have been created.

The Programme fosters integral energy renovation with the objective of achieving maximum savings effects, whereby improvements are made to the building envelope and the energy supply and production system in the building is optimised in those cases in which it is technically feasible. The results achieved show that the average permanent reduction of energy costs exceeds 60 % and, without additional costs to the state, the lifetime of the buildings is extended and their utilisation standard is improved.

In its initial stage, the Programme was implemented by the Centre for Monitoring Business Activities in the Energy Sector and Investments (CEI), and since 3 August 2013 it has been implemented by the Agency for Transactions and Mediation in Immovable Properties (APN). A model of tender documents was designed for the requirements of the Programme, in accordance with the Public Procurement Act (NN Nos 110/07 and 125/08 – model energy performance contract and guarantee scheme).

Tender Documents

For the purpose of programme implementation, CEI created tender documents for energy services. The process of drawing up the documents was particularly difficult because there were no examples of energy service contracting in accordance with the regulations currently in force, since the documents were drawn up within the framework of the Public Procurement Act and, specifically, for the open public procurement procedure. Such practice achieved a substantial reduction of contracting costs (EUR 1 000–3 000 per contract), increased contracting speed (ca. 180 days), and achieved full transparency of the implementation of the contracting procedure. Public procurement procedures were implemented on template documentation, and the bidders made no objections to the most recent version. The success is reinforced by the fact that the template was also used by other customers implementing similar procedures, not within the scope of the Programme of energy renovation of public sector buildings.

Energy Performance Contract

A model energy performance contract which corresponds to the programme framework and the Decree on contracting and the implementation of energy services is used in programme implementation.

An energy performance contract is based on the following assumptions:

- Investments in energy renovation are made by private companies which assume the business risk
- A contract is based on an implemented public procurement procedure
- Public institutions pay a fee for achieved energy savings
- Achieved energy savings exceed the payments under the energy performance contract
- Payments are based on achieved savings
- Savings are proven by a project, verified by physics auditors and an expert commission
- The duration of a contract may be up to 14 years and, in this period, the company providing the energy service is responsible for maintaining the condition of the building in conformity with the project
- A contract is based on assumed prices of energy commodities, valid on the day the procurement procedure starts
- The minimum scope of renovations is determined before the start of the procedure
- After the renovation is complete, the contractual parties and the centre assume obligations related to consumption monitoring and establishing the energy efficiency of the building

Guarantee Scheme

The aim of establishing the Guarantee Consortium is to improve the market conditions for private sector investments within the framework of the Programme of energy renovation of public sector buildings 2014–2015 *(hereinafter: the Programme)* in such a way as to allow, via the Guarantee Consortium, the Programme participants (the companies providing energy services) to be provided with guarantees for earmarked loans for eligible costs related to the provision of energy services. The bidding companies (ESCO companies) have limited possibility to submit a most favourable bid due to, among other things, the uncertainty of obtaining loans. Because of the long period for the return on investment (up to 14 years), the cost of interest for the funds with which ESCO companies are financed has a substantial impact on the potential bid, which is why HBOR, as a development bank, has been involved in the development of the Programme since its inception. Only a very small number of projects could be viable with the current customary interest rates under commercial conditions.

In view of the specific properties of the model, as well as the state of the economy, loans cannot be based on the bidder's previous business activities but on the project financing for newly established companies specialising in this type of activities. In order to facilitate loans for ESCO companies, risks which occur on the creditor's side must be eliminated, especially because an ESCO company does not acquire assets which could be used as collateral and, since the client is the public sector, issuing guarantee funds for the client would require new loans for the state.

A guarantee scheme was prepared in order to remove the aforementioned market obstacles. For an appropriate fee, the scheme will provide ESCO companies with guarantees for loans with which they finance eligible costs related to the provision of energy services – renovation of public sector buildings. The guarantee scheme for the Programme is implemented by HAMAG BICRO.

In regard to market development, the Programme has resulted in the emergence of approximately 15 companies and/or consortia of companies that provide energy services. An increase of the number of companies, their activities and references is expected with further Programme implementation.

The public is regularly informed about programme implementation through presentations, educational workshops and at the APN website www.apn.hr.

A special measure was developed with the aim of developing the energy services market:

Title of the measure		**Promotion of energy services**
Measure index		H.8
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2016 New measure, obligation under the Energy Efficiency Directive (2012/27/EU) Article 18
	Objective / outline	This measure is aimed at raising the awareness of building users and transforming the market towards more efficient buildings. Conduct an informational campaign to raise the awareness of target groups about the benefits and possibilities of implementing energy efficiency measures through energy services. Inform and educate the general public about ESCO companies, models, and the principle of providing energy services. Lay down regulations on the qualifications for energy services providers. Prepare and keep records on energy services providers.
	Target final consumption	All types and systems of energy consumption in building construction and industry
	Target group	Owners of housing units (citizens), LRSGUs, public sector, citizens, companies – energy services providers, energy service customers, banks and other institutions which should monitor companies in financing energy services
	Regional application	National

Information on implementation	List and description of activities for measure implementation	Future activities: • ME will prepare a set of rules developing the regulation on the qualifications/requirements to be met by energy services providers. • APN will continue developing the established register of legal and natural persons performing energy management in the public sector through the ISGE. • CEI will compile and keep records of legal persons, energy services providers. It will train energy services providers on the single reporting method for achieved savings through the Energy Savings Measuring and Verification System – SMIV. • CEI will design a central location (info contact point) at which end-users will be able to obtain information on energy services and the providers thereof. The aforementioned will be achieved, among others, through the design of a web portal on energy services. The design of a web portal on energy services will allow citizens to access information on: - energy services principles and models; - good practice examples; - energy services providers and their qualifications; - examples of energy service contracts (energy performance contract, energy supply contract, etc.); - general promotion of achieving savings by using energy services models. Further education/training activities should be established for target groups (aimed at designers, planners and other operators who participate in achieving the objective of increasing energy efficiency). Education and training on the application of high-efficiency alternative energy supply systems should be provided for designers. This should be coordinated with the measure 'Energy efficiency education and training'.
	Funds and financing sources	Planned funds 2014: • EPEEF: HRK 360 000.00 • ME: HRK 50 000.00 • CEI: HRK 100 000.00 • APN: HRK 30 000.00 – adaptive maintenance of the ISGE Planned funds 2015: • EPEEF: HRK 120 000.00 • CEI: HRK 110 000 • APN: HRK 30 000.00 – adaptive maintenance of the ISGE Planned funds 2016: • EPEEF: HRK 120 000.00 • CEI: HRK 90 000 • APN: HRK 30 000.00 – adaptive maintenance of the ISGE
	Executive body	CEI – prepare and elaborate regulations, establish a records system, design a web portal proposal, train energy services providers
	Monitoring bodies	ME, MCPP, APN (experience in implementing the first energy efficiency contracts)
Energy savings	Method of monitoring/measuring energy savings	This measure does not result in savings. It is a precondition to successfully monitoring the savings achieved through the application of energy services.
	Energy savings expected in 2016	Cannot be determined

	Expected impact on energy savings for 2020	Cannot be determined
	Assumptions	This is a new measure, with which the Republic of Croatia meets the requirements under EED Article 18 The effects of this measure cannot be quantified.
	Overlapping, multiplication effect, synergy	This measure overlaps with and is an extension of all the measures that are being implemented or that can be implemented through the model of providing energy services. Moreover, this measure is used to plan the education and training of energy services providers about the use of the Energy Savings Measuring and Verification System (elaborated in further detail under measure 'Establishing an integrated information system for monitoring energy efficiency implementation').

3.1.7 Other Energy Efficiency Measures and Horizontal Measures (EED Articles 19 and 20)

A regulatory obstacle to the implementation of energy renovation of multifamily housing are the provisions of the Act on Ownership which regulate that the consent of all residents (100 % consent) is required for the renovation of a building. Such a regulation hinders the implementation of energy efficiency measures, especially for large buildings which have the largest potential. The regulatory framework for the achievement of the aforementioned measures is planned to be improved through the development of legal provisions on energy services and amendments to the Act on Ownership.

The Environmental Protection and Energy Efficiency Fund (*hereinafter: EPEEF)* was established by the Act on the Environmental Protection and Energy Efficiency Fund (NN Nos 107/03, 144/12) in 2003 as a non-budgetary fund with the status of a legal person with public authority, with the objective of raising earmarked funds for financing the preparation, implementation and development of programmes, projects and similar activities in the field of environmental preservation, sustainable use of the environment, environmental protection and amelioration; the participation in financing national energy programmes aimed at improving energy efficiency, the use of renewable energy sources, as well as organising and implementing a management system for special categories of waste.

EPEEF is a national Fund, whose establishment was proposed in Article 20 of the EED, and it is competent for financing the implementation of the energy policy of the Government of the Republic of Croatia in regard to energy efficiency improvements and increasing the use of renewable energy sources. The Fund co-finances energy efficiency programmes and projects in accordance with the Energy Strategy of the Republic of Croatia (NN No 130/09), the National Energy Efficiency Programme for the 2008–2016 period, national energy efficiency action plans, as well as other programmes derived from the aforementioned strategy documents adopted by the ministries competent for energy, construction, environmental protection and transport. In addition to the Act on the Environmental Protection and Energy Efficiency Fund, the Fund's activities regarding energy efficiency are also regulated by the Act on Efficient Energy Use in Final Consumption (AEEU; NN Nos 152/08, 55/12, 101/13 and 14/14) which, in Article 16, provides that the Fund shall ensure financing for the implementation of energy efficiency improvement measures laid down in the NEEAP currently in force.

EPEEF is primarily financed with funds obtained from the auction sale of emission units derived from the quotas allocated to plants in Croatia, in accordance with the Air Protection Act (NN Nos 130/11, 47/14).

Title of the measure		Establishing an integrated information system for monitoring the implementation of the energy efficiency policy
Measure index		H.9
Description	Category	Mechanisms for achieving and monitoring energy savings
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: This is a new measure which will establish an integrated system for monitoring, analysing, measuring and verifying energy savings, as well as reporting, informing and preparing mechanisms and plans for the implementation of the energy efficiency policy.
	Objective / outline	The integrated information system (SMIV) is based on the National Energy Savings Measuring and Verification System and on the future legal obligation (the law is being drafted and it will define energy efficiency obligations). The integrated system will be a basis for the implementation of the measures laid down in national action plans in the sense of: monitoring the implementation of all measures, methodological calculations of savings, drawing up regulations on energy efficiency, facilitating the implementation of measures, the integration of all participants and end users. This measure will meet the requirements of the provisions of two EED articles: • Article 7, which lays down the obligation of establishing a monitoring system for energy efficiency measures, whereby all the alternative measures used to achieve mandatory savings will be measured in accordance with the criteria laid down in Article 7 • Measuring savings from implemented measures which are used to achieve the target referred to in Article 3
	Target consumption	Primary and final consumption; this measure would monitor the implementation of energy efficiency measures, programmes, plans and projects in all final and primary consumption sectors.
	Target group	All obligated parties in measure implementation (executive bodies) defined by this action plan; obligated parties in planning (defined by the Act governing the energy efficiency policy); transmission and distribution system operators and suppliers of electricity, heat energy and natural gas; LRSGUs; EPEEF; companies that provide energy services (ESCO)
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: 1. ME and EPEEF plan this activity in their budget for 2014, 2015 and 2016. 2. The project of developing an integrated information system was started by CEI in the first quarter of 2014. 3. System development is conducted in stages, and additional development depends on future EC requirements and the obligations of the Republic of Croatia towards the EU. 4. By the end of 2014, CEI will build the basic system which will support the activities of ME, the implementation reports for the Government of the Republic of Croatia and the European Commission. The integrated information system should enable: 1. Regular reporting to ME, the Government of the Republic of Croatia and the European Commission on the implementation of energy efficiency measures, programmes and plans; 2. Analysis of the implementation of measures, programmes and plans, as well as recommendations for the future

		period and revisions of plans, measures and programmes; 3. Easier identification of obstacles in the implementation of measures, plans and programmes; 4. Support for the coordination of energy efficiency policy implementation; 5. Support for drawing up national energy efficiency regulations and support for drawing up national planning documents; 6. Contribute to the entire system of energy efficiency policy implementation.
	Funds and financing sources	Planned funds by the end of 2016: • ME: HRK 3 x 700 000 (in three fiscal years, within the existing budgetary activities) • EPEEF: HRK 3 x 2 300 000 (in three fiscal years)
	Executive body	CEI – system development and management
	Monitoring bodies	ME
Energy savings	Method of monitoring/measuring energy savings	On a national level, this measure applies the calculation of implemented energy efficiency measures, programmes and plans in accordance with the BU and TD method, as well as the amendments to the Rules on the methodology for monitoring, measuring and verifying energy savings. The measure is a precondition for quantifying the results of all implemented measures.
	Energy savings expected in 2016	Not applicable
	Expected impact on energy savings for 2020	Not applicable
	Assumptions	/
	Overlapping, multiplication effect, synergy	This measure is compatible with all the measures specified in the action plans, as well as with other obligated parties in the enforcement of the law regulating the energy efficiency policy. This measure also affects future periods of preparing energy efficiency measures (after 2016) because systematic integrated monitoring of measure implementation and the development of a general energy efficiency policy will provide information and aid in high-quality planning for future periods.

3.1.8 Savings That Result from Horizontal Measures

Described above, individually for each measure.

3.1.9 Financing Horizontal Measures

Described above, individually for each measure.

3.2 Energy Efficiency Measures in Building Construction

3.2.1 Meeting the Requirements of the EPB Directive (2010/31/EU)

Title of the measure	**Building regulations and implementation**
Measure index	B.1

Description	Category	Regulations
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: The measure was revised with actual achieved savings and in accordance with the planned future activities regarding compliance with EPBD II requirements.
	Objective / outline	Building regulations and their implementation is an efficient measure ensuring compliance with the best energy efficiency standards for buildings. The development of the regulations on the energy efficiency of buildings is closely connected to meeting the requirements of the EPBD. The activities to be performed in the following period will therefore be based on the requirements of EPBD II. The implementation mechanisms include inspection, control of mandatory certification of new buildings prior to use, and control of the soundness of energy performance certificates.
	Target final consumption	New and existing buildings (for major reconstructions)
	Target group	Construction participants, owners of the buildings undergoing reconstruction
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Acts, decrees and rules currently in force: 1. Adoption of the Construction Act (NN No 153/13). With the adoption of the Construction Act, the definition of the energy performance of a building was included in the Act, whereby the energy performance of a building is regulated by the provisions of Articles 20 to 47 of the Act, while the penal provisions of the Act lay down the penalties for violations committed by the investor, designer, contractor, building owner, and persons authorised to conduct energy certification. The Act primarily includes the transposition of all the EPBD II requirements pertaining to: energy efficiency requirements, the study on alternative energy supply systems, the regular audit of heating and cooling or air-conditioning systems in a building, the energy performance certificate of a building, the energy audit of a building, authorisations for conducting energy certification, the energy audit of a building and the regular audit of heating and cooling or air-conditioning systems in a building, the possibility of performing energy audit and energy certification activities for persons from Contracting States to the Agreement on the European Economic Area in the Republic of Croatia, the certificate on acquiring the right to provide the services of energy certification and energy audits of buildings for Croatian citizens and legal persons in the Contracting States to the aforementioned Agreement, the implementation of education and training programmes, independent control of energy performance certificates and reports on regular audits of heating and cooling or air-conditioning systems in buildings, revoking authorisations and control authorisations, the register, and

		rules regulating this field. 2. Rules on the energy audit of a building and energy certification (NN No 48/14) 3. Rules on the conditions and methods for issuing certificates to Croatian citizens and legal persons for acquiring the right to provide services in the regulated profession of energy certification and energy audits of buildings in the Contracting States to the Agreement on the European Economic Area (NN No 47/14) 4. Amendments to the Act on Efficient Energy Use in Final Consumption (NN Nos 152/08, 55/12, 101/13, 14/14) 5. Decree on contracting and the implementation of energy services in the public sector (NN No 69/12) 6. Rules on conditions and criteria for persons who perform energy audits and energy certification of buildings (NN No 81/12, 64/13) 7. Rules on the control of energy performance certificates of buildings and energy audit reports (NN Nos 81/12, 79/13) 8. Rules on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – photovoltaic systems (NN Nos 79/13, 85/13) 9. Technical regulation on the rational use of energy and thermal protection in buildings (NN Nos 110/08, 89/09, 79/13, 90/13). This regulation is continuously updated and is currently being notified by the European Commission. 10. Rules on energy audits and energy certification of buildings (NN Nos 81/12, 29/13, 78/13).
		<u>Other acts currently in force:</u> • Methodology for conducting energy audits of buildings with algorithms for calculating the energy performance of buildings: o Algorithm for calculating the energy required for heating and cooling the areas of a building, compliant with HRN EN ISO 13790 o Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (Heating and domestic hot water preparation systems) o Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (cogeneration systems, remote heating systems, photovoltaic systems) o Algorithm for determining the energy efficiency of lighting systems in buildings (energy requirements for lighting) o Algorithm for calculating the energy required for the application of ventilation and air-conditioning systems for heating and cooling the areas of a building • Decision on the maximum cost prices of conducting energy audits and issuing energy performance certificates of buildings • Decision on the delivery method for reports on conducted energy audits of buildings or issued energy performance certificates of buildings

		<u>New regulations in the process of being adopted:</u> • Rules on persons authorised to conduct energy certification of buildings, energy audits of buildings and regular audits of heating and cooling or air-conditioning systems in buildings • Rules on the control of energy performance certificates and reports on regular audits of heating and cooling or air-conditioning systems in buildings • Rules on the conditions and method of issuing a certificate to persons from Contracting States to the Agreement on the European Economic Area for providing the services of energy certification and energy audits of buildings in the Republic of Croatia, and the recognition of foreign professional qualifications for providing the services of energy certification and energy audits of buildings <u>Currently being drafted:</u> 1. Drafting and adoption of the Feasibility study of alternative energy production systems in buildings with usable floor area of over 1 000 m^2, and the Feasibility study of alternative energy production systems in buildings with usable floor area up to 1 000 m2; 2. Defining reference buildings and nearly zero energy buildings CURRENTLY BEING DRAFTED; 3. Amendments of technical regulations will pertain to harmonisation with EPBD II; 4. The National plan for increasing the number of nearly zero energy buildings will be drafted, and it will include the measures and instruments for the implementation of the plan.
	Funds and financing sources	MCPP: planned under the Ministry's budget
	Executive body	MCPP (preparatory activities and drafting amendments to regulations); MCPP (improving the methodology for conducting energy audits of heating and air-conditioning systems of buildings)
	Monitoring bodies	MCPP, in coordination with CEI
Energy savings	Method of monitoring/measuring energy savings	The measure will be additionally monitored for public sector beneficiaries and the effects will be analysed through the Remote Metering Module and the Energy Renovation Module via the ISGE.
	Energy savings expected in 2016	• households: 156 TJ • services (public and commercial): 349 TJ The savings result from stricter requirements laid down by new regulations adopted in 2013. The effects resulting from the 2006 regulations are no longer being analysed.
	Expected impact on energy savings for 2020	• households: 156 TJ • services (public and commercial): 349 TJ The savings result from stricter requirements laid down by new regulations adopted in 2013. The effects resulting from the 2006 regulations are no longer being analysed. Pertains only to buildings constructed during the 3rd NEEAP is expected.

	Assumptions	In order to calculate savings in the consumption of heat energy for heating, 2013 is taken as a reference year since it is the year when the new Technical regulation entered into force, setting the maximum allowed specific consumption of heat energy for heating at 40.5 to 75 kWh/m2 per year for residential buildings, or 10.13 to 18.75 kWh/m3 per year for non-residential buildings, depending on the shape factor of the building. Since 2006, or the former Technical regulation, the average consumption of heat energy for heating was 85 kWh/m2 for residential buildings or 25 kWh/m3 for non-residential buildings (107.5 kWh/m2), and pursuant to the new Technical regulation (NN No 90/13) it is 60 kWh/m2 for residential buildings or 15 kWh/m3 for non-residential buildings (60 kWh/m2). A total of 999 924 m2 were constructed in residential buildings in 2013, and 730 438 m2 were constructed in new non-residential buildings in the service sector. Since 2010, the growth of residential building construction has been continuously declining by 25 % per year, and the growth trend of non-residential buildings has been declining by 20 % per year. On those assumptions, it is planned that a total of 1 734 243 m2 of residential and 1 425 875 m2 of non-residential area will be constructed from 2014 until the end of 2016. On those assumptions, the planned total savings for 2014–2016 are 43 356 080 kWh (156 TJ) for residential and 96 978 991 kWh (349 TJ) for non-residential buildings.
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Increasing the number of nearly zero energy buildings**
Measure index		B.2
Description	Category	Regulations; Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	The sector of buildings intended for public use must assume the leading role in the field of improving energy efficiency in buildings and set ambitious targets for buildings intended for public use. The public sector should be stimulated towards energy renovation compliant with the standard for nearly zero energy buildings.
	Target final consumption	New buildings and existing buildings undergoing reconstruction
	Target group	Construction participants and owners of the buildings undergoing reconstruction
	Regional application	National
Information on implementation	List and description of activities for measure implementation	A national plan for increasing the number of nearly zero energy buildings is currently being drafted, following which a system will be designed to encourage construction participants to construct new buildings whose energy characteristics will exceed those required by the regulations, i.e. buildings that will be constructed in compliance with nearly zero energy standard.
	Funds and financing sources	MCPP – planned under the budget
	Executive body	MCPP – drawing up the plan for increasing the number of nearly zero energy buildings
	Monitoring bodies	CEI, in coordination with APN

Energy savings	Method of monitoring/measuring energy savings	This is a regulatory measure and as such it does not result in savings. However, all the implemented activities, i.e. all constructed nearly zero energy buildings, if co-financed by EPEEF or the state, will be monitored through the SMIV.
	Energy savings expected in 2016	Cannot be determined. They will be known once the programme is drawn up.
	Energy savings expected in 2020	Cannot be determined. They will be known once the programme is drawn up.
	Assumptions	In view of the obligation of achieving the objective for new nearly zero energy buildings by 2020 (2018 for buildings intended for public use), it is assumed that by 2016 or by 2020 new regulations will be continuously adopted with increasingly stricter requirements regarding the energy performance of buildings until the nearly zero energy standard is achieved for construction in 2018, or 2020. The savings target was made based on the assumption that there would be 10 % of new buildings with heat energy consumption for heating under 15 kWh/m2 from 2014.
	Overlapping, multiplication effect, synergy	This measure is complemented by the measure 'Energy audits and energy certification of buildings' which provides information on energy consumption to the potential end-user, thereby directing their choice towards buildings with lower energy consumption and associated costs. It is additionally complemented by measures on the energy renovation of buildings, although there are no overlaps. In order to achieve the multiplication effect and attract the interest of investors for the construction of nearly zero energy buildings, the public should be regularly presented with completed projects and the benefits they have brought to their owners. The financial mechanisms for fostering such construction should also be developed.

3.2.2 Strategy of the Energy Renovation of Buildings (EED Article 4)

Title	Fostering integral renovation of multifamily housing	
Index	B.3	
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	This measure provides for the design and introduction of a systematic programme for the renovation of multifamily housing. The Plan primarily focuses on multifamily housing constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The precondition for participation in the co-financing programme is the existence of project documentation required in accordance with the construction legislation.
	Target final consumption	All types and systems of energy consumption in multifamily housing. Consumption of heat energy in existing multifamily housing constructed before 1987. As a minimum, building renovation includes thermal insulation of the building envelope and, in line with the energy audit recommendations, other measures which reduce heat energy consumption in the building. Measures which reduce the consumption of energy for non-thermal needs can also be a component of an integral renovation project, in accordance with the energy audit recommendations.
	Target group	Co-owners of residential buildings (citizens); companies that manage multifamily housing (building managers).
Information on Implementation	Regional application	National
	List and description of activities for measure implementation	The implementation of the Programme of energy renovation of multifamily housing 2014–2020 with a detailed plan for the 2014–2016 period includes the following: • EPEEF and MCPP invite building managers to develop renovation plans for the buildings they manage, based on the results of conducted energy audits and project documentation. • EPEEF establishes a subsidy scheme of up to 50 % of the total investment or up to a maximum of HRK 500/m2. The fund allocation criteria will be jointly laid down by MCPP and EPEEF and, as a minimum, they should be based on the level of achievable savings, the comprehensiveness of measures and the initial condition of the building.

	Required funds and financing sources	The overall investments required for this programme amount to HRK 527.5 million per year: • HRK 10 million per year for energy audits and energy performance certificates of buildings • HRK 17.5 million per year for drawing up project documentation for the renovation of buildings • HRK 500 million per year for integral renovation of multifamily housing EPEEF – should ensure 40 % (60 % or 80 %) of the costs of energy audits and energy certification of buildings, as well as 100 % of the costs of drawing up project documentation for the renovation of buildings, and at least 40 % of the costs of the integral renovation of multifamily housing and the introduction of an individual metering system of heat energy consumption EU Structural Funds – (EPEEF does not have such funds at its disposal on an annual level for energy efficiency projects, it will not be possible to implement the measure without the participation of EU Structural Funds.) LRSGU – ensure additional funding in proportion to their own available funds for the introduction of the individual metering system of heat energy consumption (recommendation is 10 %)
	Executive body	MCPP – controls the activities of authorised design engineers EPEEF – ensures financing Building manager or co-owners – select contractors and stipulate the performance of works
	Monitoring bodies	MCPP – supervises the activities of authorised persons CEI in cooperation with ME and MENP – monitor achieved savings
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored using the estimation method. The life cycle is 25 years. Input data must be set for each individual building, and reference values should be used only in special cases.
	Expected annual energy savings	365 TJ
	Energy savings expected in 2016	730 TJ
	Energy savings expected in 2020	2190 TJ

		It is assumed that energy audits will be conducted, and energy performance certificates issued, for 500 buildings per year. It is assumed that project documentation will be drawn up for 500 buildings per year. A total of 149.38 million m2 of usable floor area of residential buildings were registered in the Republic of Croatia in 2010, according to the data of the Croatian Bureau of Statistics, the 2001 Census, and data on the total number of issued building permits and constructed buildings in the 2001–2010 period. According to available statistical data, it is assumed that 1/3 of the housing stock in Croatia is in multifamily housing, which means that this measure pertains to approximately 50 million m2. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987. Energy savings are calculated with the assumption that 1 %, or approximately 500 000 m2, of multifamily housing area is renovated each year, and that integral renovation of buildings is conducted, which will reduce energy consumption by 202.30 kWh/m2. According to the Rules on monitoring, measuring and verifying energy savings in final consumption, annually that should save 101 kWh or 365 PJ, and the life cycle of this measure is 20 years. The assumed cost of renovation is HRK 1 000 / m2.
	Overlapping, multiplication effect, synergy	In order to achieve the multiplication effect and attract the interest of owners for the renovation of their buildings, the public should be regularly presented with completed projects and the benefits they have brought to the occupants of such buildings. It is necessary to raise the awareness of co-owners on the condition of their building and the possibilities for improving its energy performance, and encourage them to invest in energy renovation measures proposed in the energy audit. It is assumed that, having observed the reduced energy consumption on their energy bills, the co-owners will also start to implement other energy efficiency measures. The central info point (see measure H.6) will have a key role in informing all participants and raising their awareness.

Title of the measure		**Programme of energy renovation of commercial non-residential buildings**
Measure index		B.4
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	The energy renovation of existent commercial non-residential buildings focuses on buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class.
	Target final consumption	Existing non-residential buildings intended for commercial use (privately owned)

	Target group	Owners of non-residential buildings intended for commercial use A commercial non-residential building within the meaning of this Programme of energy renovation of commercial buildings shall be any building which is predominantly privately owned, in which more than 50 % of the gross usable floor area is intended for business and/or service activities, and which includes one of the following intended uses: 1. Offices (financial institutions, office buildings, business facilities for general use, and other facilities which are predominantly privately owned); 2. Hotels, restaurants and hospitality facilities (hotels, hostels, halls, pools, restaurants, cafés and other hospitality facilities which are predominantly privately owned); 3. Retail and wholesale facilities (shops, retail and wholesale shopping centres which are predominantly privately owned); 4. Industrial facilities (halls, industrial plants, storage facilities, warehouses and other similar facilities which are predominantly privately owned); 5. Other (greenhouses, farms, nurseries, fairgrounds, garages, hangars and other enclosed or semi-enclosed unheated spaces).
	Scope of application	National
Information on implementation	List and description of activities for measure implementation	The Programme of energy renovation of commercial non-residential buildings for the 2014–2020 period, with a detailed plan of energy renovation of commercial non-residential buildings for the 2014–2020 period, includes the energy renovation of buildings intended for commercial use, especially those constructed before 1987, which offer the greatest potential for energy savings. Renovation includes measures for the reconstruction of the building envelope of the heated area of the building, with the objective of complying with the Technical regulation proposal and achieving a B, A or A+ energy class. The implementation of the plan should be monitored on annual level in regard to expended funds, achieved energy and financial savings, and reduced CO_2 emissions. The production of energy performance certificates for buildings intended for public use, before and after renovation, is planned. Continuously promote MCPP, MT, ME programmes. Encourage commercial banks to open lines of credit.
	Funds by 2016, and sources of financing	HRK 1 784 360 000.00 by 2016 <u>Currently available sources of financing:</u> HBOR, Commercial banks EPEEF HAMAG BICRO EIB EBRD CroPSSF WeBSEFF II

		<u>Possible sources of financing:</u> EU Structural Instruments ELENA revolving funds Horizon 2020 JASPERS EEE-F
	Executive body	EPEEF – programme implementation and co-financing MCPP – drawing up the programme
	Monitoring (supervision) bodies	MCPP MT MENP ME
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored using the estimation method. The life cycle is 25 years. Input data must be set for each individual building, and reference values should be used only in special cases.
	Energy savings expected in 2016	985 TJ
	Energy savings expected in 2020	2 298 TJ
	Assumptions	A total of 36.5 million square meters of usable floor area of commercial non-residential buildings were registered in the Republic of Croatia in 2012, according to the data of the Croatian Bureau of Statistics, the 2001 Census, and data on the total number of issued building permits and constructed buildings in the 2001–2012 period. Of the aforementioned area, 43.90 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m^2. Assumption: that 3 % of heated usable floor area of commercial non-residential buildings is renovated every year, or approximately 480 000 m^2, and that the specific annual heat energy consumption for heating is reduced from the average 220–250 kWh/m^2 to 45 kWh/m^2.
	Overlapping, multiplication effect, synergy	In order to achieve the multiplication effect and attract the interest of the owners of commercial buildings for the renovation of their buildings, the public should be regularly presented with completed projects and the benefits they have brought to their owners. The measure also provides for energy audits and energy certification of buildings.

3.2.3 Other Energy Efficiency Measures in the Building Construction Sector

Title of the measure		**Energy labelling of household appliances and energy standards**
Measure index		B.5
Description	Category	Information and mandatory information measures; Financial instruments
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: The measure was introduced in the 1st NEEAP, but it was revised in accordance with the planned future activities regarding harmonisation with EPBD II requirements.
	Objective / outline	Energy labels provide customers with information on the energy consumption of an appliance and direct their choice towards more efficient ones. Furthermore, the ecodesign requirements for energy-related products should be promptly adopted in order to ensure that only the products compliant with EU regulations can be placed on the Croatian market.
	Target final consumption	Household appliances
	Target group	Citizens
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: The regulatory framework for the energy labelling of energy-related products is regularly amended and harmonised with Directive 2010/30/EU and its delegated acts in accordance with the development of EU regulations: 1. EIHP will draw up the Programme for EPEEF by the end of 2014. 2. Continued monitoring and active participation of the representatives of the competent ministry in the activities of the Regulatory Committee established under Directive 2009/125/EC (representatives of all Member States participate in the committee), which is working on the preparation of implementing measures for future product groups. 3. Amendments to the Act on Efficient Energy Use in Final Consumption should be adopted, containing penal provisions which currently do not exist, in order to enable economic inspectors to properly monitor and issue penalties for incorrectly labelled products found on the market (in accordance with Directive 2009/125/EC or the Rules on the requirements for the ecodesign of energy-related products). 4. The system of monitoring the market status, i.e. the quantity of individual products in regard to energy efficiency class, will be improved. 5. EPEEF should establish a co-financing programme for the procurement of the most efficient appliances available on the market as replacements for old appliances which are being removed from use: • EPEEF should design a model of incentives for citizens – for the procurement of individual groups of appliances (refrigerators, freezers and air-conditioning units with the highest energy efficiency class [min. class A+ and A++]);

		• Financial support could be claimed on the basis of an invoice for the purchased appliance, the energy efficiency designation of the appliance or the material safety data sheet specifying the energy efficiency class, and on the basis of a certificate on the disposal of the old appliance as electronic waste; • EPEEF, in cooperation with CEI and ME, is obliged to elaborate these models in detail and to start implementing them in 2014.
	Funds and financing sources	Planned funds by the end of 2016: • ME (regulations): within the scope of regular activities (activities 1) • co-financing citizens for purchasing appliances EPEEF (co-financing the purchase of high-efficiency appliances: HRK 2 000 000)
	Executive body	ME – improve the regulatory framework; EPEEF – establish a co-financing scheme for the purchase of high-efficiency products; EIHP – draw up the Programme.
	Monitoring (supervision) bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	The effects of this measure are monitored by using the European Commission's recommended TD indicators for the household sector (P4). The European Commission's BU method as well as national reference values should be used for programmes introduced by EPEEF.
	Energy savings expected in 2016	2 TJ
	Expected impact on energy savings for 2020	2 TJ
	Assumptions	The BU method will be used to monitor the successfulness of the co-financing scheme for the purchase of new appliances. A detailed description of the method based on EC recommendations can be found in the separate document 'Measuring and Verification of Energy Savings Using the Bottom-Up Method'. TD indicators will be used to monitor the overall effect of the energy efficiency labelling scheme for appliances. EPEEF subsidies are estimated based on the target of 4 000 replaced appliances in the following year and an average subsidy of approximately HRK 500 per appliance. It is estimated that 4 000 replaced appliances would save 1 TJ per year.
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Programme of energy renovation of family homes 2014–2020**
Measure index		B.6
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020

	Objective / outline	This measure is aimed at the renovation of existing family homes by 2020. It focuses primarily on family homes of up to 400 m^2 constructed before 1987, and on their renovation in compliance with low-energy standards by encouraging the renovation of the building envelope, the replacement of the heating system and the use of RES. The most important expected effects of the implementation of this measure are: encouraging investments, achieving annual energy savings in final consumption, reducing the citizens' payments for energy, reducing CO_2 emissions, increasing the share of renewable energy sources, providing employment, increasing power supply security, improving the condition and increasing the market value of real estate, developing the production industry, reducing the 'grey economy', reducing energy poverty, and an overall improvement of living conditions.
	Target final consumption	Reducing the energy requirements of buildings, reducing energy consumption for heating and hot water preparation in family homes.
	Target group	Owners of family homes (citizens)
	Scope of application	National, in cooperation with counties, LRSGUs and regional energy agencies
Information on implementation	List and description of activities for measure implementation	The Programme of energy renovation of family homes 2014–2020 with a detailed plan for the 2014–2020 period encourages investments in the energy renovation of family homes amounting to HRK 207.5 million per year through financial support to natural persons for investing in improvements of the energy performance of family homes by encouraging the renovation of the building envelope (increasing the thermal protection of the building envelope, window replacement), encouraging the replacement of heating systems (replacing existing electrical or fossil fuel powered heating systems with new systems with gas powered condensing boilers), encouraging the use of RES (installation of solar thermal collectors; installation of heat pumps; installation of small, biomass powered boilers). Programme implementation: • MCPP, MENP and EPEEF are conducting a promotional campaign among LRSGUs and a general campaign for citizens in order to encourage them to implement energy renovation measures. • EPEEF publishes calls for tender for LRSGUs. • EPEEF generally ensures subsidies amounting to up to 40 % of the overall investment and, when possible, more than 40 % (islands, hilly and mountainous areas, areas of special state concern). • LRSGUs publish calls for tender for citizens. • The LRSGU pays out the subsidy to the contractor on the basis of a contract/voucher, and the citizen only pays the contractor the remaining amount of the total project value. • Comprehensive monitoring of achieved energy savings.

	Funds and financing sources	Planned funds by the end of 2016: • EPEEF – HRK 71 000 000.00 per year Other HRK 136 500 000.00 per year: • Funding from the EU Structural Funds • Financing the preparation and implementation of energy efficiency and energy renovation projects for residential buildings in the Republic of Croatia is planned within the scope of the thematic objective 4 'Support for the transition towards an economy based on low level CO_2 emissions in all sectors'. The programme documentation is still being drafted and it must be harmonised with this Programme. • Sources of financing for citizens (citizens' funds from home savings accounts etc.) • Citizens' loans • LRSGU budgets
	Executive body	EPEEF – establish a co-financing scheme (including the absorption of funding from EU structural funds) LRSGU – programme implementation and co-financing intermediary
	Monitoring bodies	MCPP and MENP – operative monitoring of programme implementation CEI – monitoring achieved savings
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored using the estimation method. The life cycle is 25 years. Input data must be set for each individual building, and reference values should be used only in special cases.
	Expected annual energy savings	201.8 TJ (expected annual CO_2 reduction is 14 460 t)
	Energy savings expected in 2016	605.4 TJ (168 GWh)
	Energy savings expected in 2020	1 412.6 TJ (392 GWh)

	Assumptions	It is assumed that 100 family homes per county, or approximately 2 000 houses throughout the territory of Croatia, will participate in the programme at an annual level. Thermal wall insulation saves on average 84.3 kWh/m2 of wall area. It is also assumed that, on average, 35 m2 of windows will be replaced per house. That would achieve unit savings of 195.2 kWh/m2 of window area. In estimating achieved savings, it is assumed that both measures will not be implemented simultaneously on every house. It is therefore assumed that half of the houses will have new insulation installed, and half of the houses will have new windows installed. It is assumed that 100 000 m^2 of the outer structure (wall) area will be thermally insulated per year, or 35 000 m^2 of windows will be installed per year. The replacement of existent gas powered condensing boilers with new ones typically reduces energy consumption by 97.5 kWh/m2 of building area. It is assumed that this programme will be most successful in encouraging the installation of solar thermal collectors for the preparation of domestic hot water. The installation of a solar thermal system for heating domestic hot water can annually reduce energy consumption by 675 kWh/m2 of collector surface. The programme is expected to be implemented with the same intensity until the end of 2020.
	Overlapping, multiplication effect, synergy	It is assumed that the multiplication effect will be achieved through the promotion of the programme and its results, and that a certain number of people will opt to implement these measures even without incentives.

The previous national action plan provided for a separate measure for co-financing the use of liquefied petroleum gas (LPG) and solar power on the islands. However, this plan features no separate measure for renewable sources. They are mentioned as part of the activities under the measure 'Programme of energy renovation of family homes'. A separate measure no longer exists for tourism facilities because such facilities are covered within the scope of the renovation programme.

3.2.4 Savings Resulting from Measures for Increasing Energy Efficiency in Building Construction

Described above, individually for each measure.

3.2.5 Financing Measures for Increasing Energy Efficiency in Building Construction

Described above, individually for each measure.

3.3 Energy Efficiency in the Public Sector (EED Articles 5 and 6)

3.3.1 Central Government Buildings (EED Article 5)

The implementation of the energy renovation of public sector buildings and the implementation of energy efficiency improvement measures for public sector buildings owned and used by the central government will include measures on the building envelope, the thermal-technical systems, electrical systems, and water supply system works, in accordance with the requirement pursuant to which the Member States must, as of 1 January 2014, annually renovate 3 % of the total floor area of heated and/or cooled buildings owned and used by the central government. A total of 13.8 million square meters of usable floor area of public sector buildings were registered in the Republic of Croatia in 2010, according to the data from the National Energy Management Information System. Of the aforementioned area, 43.9 % is heated usable floor area.

A total of 0.991 PJ of savings must be achieved in all public buildings by 2020, or the intermediate target of 0.53 PJ in 2016. The public buildings referred to in the 2nd NEEAP are all public buildings whose total usable floor area for 2011 was estimated at 9.577 million square meters. However, according to the list of public buildings owned and used by the central government, a total of 1.325 million square meters of usable floor area were registered, which amounts to 13.8 % of the total fund of public buildings referred to in the 2nd NEEAP is expected.

The proportional share of savings which need to be achieved in central government's public buildings is 13.8 % of 0.533 PJ, or 0.0736 PJ by 2016 and 0.1368 PJ by 2020. The total measured final energy consumption by the central government's public buildings for all uses is 1.6345 PJ per year. Of which, 0.28673 PJ are consumed for non-thermal uses and 1.34777 PJ are consumed for thermal uses for heating, cooling, domestic hot water (DHW) preparation and cooking.

The energy renovation of existing public buildings for which it is determined that renovation is viable will be performed under two programmes of energy renovation of public sector buildings, one for the 2014–2015 period and the other for the 2016–2020 period. Those measures are presented below. The energy renovation of buildings which includes the renovation of 3 % of public buildings from the current energy consumption level to the level required by the regulations currently in force will achieve annual energy savings of 0.005523 PJ. However, such savings will not be presented separately, but will be calculated under the Programme of energy renovation of public sector buildings.

Title of the measure		**Programme of energy renovation of public sector buildings 2014–2015**
Measure index		P.1
Description	Category	Regulations; Financial instruments
	Time frame	Start: 2014 End: 2015
	Objective / outline	The programme fosters the implementation of energy renovation of public sector buildings and the implementation of measures for improving energy efficiency in public sector buildings, by fostering integral renovation of buildings which includes measures regarding the building envelope, thermal-technical systems, electrical systems, and water supply system works. This programme provides for the achievement of the following special objectives by the end of 2015: • contract and perform integral renovation of 200 public sector buildings, with a usable floor area of approximately 420 000.00 m2;

		• reduce energy consumption in renovated buildings by 40–60 %, or by approximately • 150 kWh/m2 per year; • reduce CO_2 emissions by approximately 20 500 t per year; • attract investments amounting to approximately HRK 400 000 000.00; • open the energy services market. Improve the standard of use of public buildings by creating a more pleasant and healthier environment for the citizens and the users of public spaces.
	Target final consumption	Public sector buildings
	Target group	• central government buildings: ministries and state administration bodies; • LRSGUs, public companies, various beneficiaries (kindergartens, schools, centres, hospitals, etc.)
	Regional application	National
Information on implementation	List and description of activities for measure implementation	• The programme provides for the energy renovation of existing buildings for which it is determined that renovation is viable in accordance with the model laid down in this Programme, or for buildings which can be renovated provided that an energy services provider can offer energy savings which can be proven by designing an energy renovation project. An energy audit, energy performance certificate and/or terms of reference must be drawn up before implementing a contracting procedure. • The public procurement procedure is implemented by APN. • The Programme is implemented through energy performance contracts. • The Programme should be presented publicly and ESCO companies, as well as other private companies, should be encouraged to participate in the implementation of activities. • Programme implementation should be monitored on annual level in regard to expended funds, achieved energy savings and reduced CO_2 emissions. • EPEEF is obliged to plan for all the required co-financing funds until the end of 2016. • Promotional and educational activities should be continuously implemented.

	Funds and financing sources	The planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 400 million. • Implementation annually: HRK 200 000 000.00 • Commercial banks, HBOR, EIB (ELENA funds for covering project documentation costs) 99.43 % • EPEEF total: HRK 165 500 000.00 – financing energy audits, terms of reference and/or energy performance certificates for buildings, co-financing renovation • EU co-financing funds • ESCO companies – the ESCO market should be included in programme implementation
	Executive body	MCPP – draws up the Programme and supervises its implementation APN – implements and promotes the Programme EPEEF – ensures funding required for Programme implementation and monitors the utilisation of funds
Energy savings	Monitoring bodies	CEI, in coordination with MCPP and MENP
	Method of monitoring/measuring energy savings	The measure will be monitored through the Energy Savings Measuring and Verification System, using the BU estimation method. The effects of the measure will also be visible from the input of actual achieved consumption into the ISGE.
	Expected annual energy savings	113.4 TJ
	Energy savings expected in 2016	226.8 TJ
	Energy savings expected in 2020	226.8 TJ
	Assumptions	A total of 13.8 million square meters of usable floor area of public sector buildings were registered in the Republic of Croatia in 2010, according to the data from the National Energy Management Information System. Of the aforementioned area, 43.9 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m2. It includes the assumption that specific annual heat energy consumption for heating in renovated buildings will be reduced by 40–60 % from the average 220–250 kWh/m2, or by approximately 150 kWh/m2 per year. The Programme plans for the renovation of approximately 210 000 m2 of usable floor area per year, and overall savings of 31.5 GWh or 113.4 TJ per year. The life cycle of this measure is 25 years.

Title of the measure		**Energy renovation of public sector buildings 2016–2020**
Measure index		P.2
Description	Category	Regulations; Financial instruments

Time frame	Start: 2016 End: 2020
Objective / outline	The measure provides for the design of a detailed action plan for the renovation of existing public sector buildings by 2016, the Programme of energy renovation of public sector buildings by 2020 and for the implementation of the said Programme. Public sector buildings, within the meaning of the 3rd NEEAP, are buildings owned by the LRSGUs (cities, municipalities, counties), buildings owned by the central government – budget beneficiaries (ministries, bureaus, institutes, academies, offices) and non-budgetary funds, as well as buildings owned by public companies. The plan will primarily focus on public sector buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. In view of the requirements of the EPBD II directive that all buildings intended for public use should be renovated and constructed in compliance with the nearly zero energy standard from 2018, the criteria for the renovation of buildings intended for public use must be stricter than the legal minimum prescribed by 2020. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation. The programme fosters the implementation of energy renovation of public sector buildings and the implementation of measures for improving energy efficiency in public sector buildings, by fostering integral renovation of buildings which includes measures regarding the building envelope, thermal-technical systems, electrical systems, and water supply system works. The establishment and market growth of new companies specialising in providing energy services (ESCO) should be ensured. Provisions should be made for the options of energy renovation of buildings not deemed financially viable under the Programme of energy renovation of public sector buildings 2014–2015, and pertaining to the renovation of buildings under the protection regime for cultural heritage, buildings, large hospital and military complexes requiring large initial investments, and similar.
Target final consumption	Public sector buildings
Target group	• Buildings owned by LRSGUs (cities, municipalities, counties) • Buildings owned by the central government o Budget beneficiaries (ministries, bureaus, institutes, academies, offices) o Non-budgetary beneficiaries • Buildings owned by public companies
Regional application	National

Information on implementation	List and description of activities for measure implementation	Future activities: 1. Drawing up the Programme of energy renovation of public sector buildings by 2020, with a detailed plan by 2016 • MCPP must draw up the Programme by the end of 2014. The Programme must include all the findings from the ISGE and the findings acquired from the implementation of the Programme of energy renovation of public sector buildings 2014–2016. • The Programme should be presented publicly and ESCO companies, as well as other private companies, should be encouraged to participate in the implementation of activities. • The programme should take into account the specifics of energy efficiency programmes and plans submitted to the MCPP by the public sector parties obligated to implement energy management. • EPEEF is obliged to plan for all the required funds for partial co-financing of the Programme until the end of 2020. The Programme should lay down the financial models for co-financing and financing the implementation of activities, taking into account the utilisation of funding from the Structural Funds (establishing national funds to foster energy efficiency). 2 Plan application • The application of the Programme should start in the second half of 2015, at the latest, and continue until 2020. • Programme implementation should be monitored on annual level in regard to expended funds, achieved energy savings and reduced CO_2 emissions. • Promotional and educational activities should be continuously implemented.
	Funds and financing sources	The planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 1 500.00 per m2 and amount to HRK 0.72 billion. • MCPP: HRK 150 000 – for drawing up the Programme • Implementation annually: HRK 724 100 000 • Commercial banks, HBOR, EIB (ELENA funds for covering project documentation costs) 99.43 % • EPEEF: HRK 2 000 000 – financing energy performance certificates for buildings 0.27 % • EU co-financing funds, Operative Programme, TO 4.3 • ESCO companies – the ESCO market should be included in programme implementation • The detailed requirements and sources of financing will be laid down in the Programme.
	Executive body	MCPP – draws up the Programme and supervises its implementation APN – implements and promotes the Programme EPEEF – ensures funding required for Programme implementation
	Monitoring bodies	CEI, in coordination with MCPP and MENP
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored through the Energy Savings Measuring and Verification System, using the BU estimation method. The ex-post effects of the measure will also be visible from the input of actual achieved consumption into the ISGE.

	Expected annual energy savings	143.64 TJ
	Energy savings expected in 2016	143.64 TJ
	Energy savings expected in 2020	718.2 TJ
	Assumptions	A total of 13.8 million square meters of usable floor area of public sector buildings were registered in the Republic of Croatia in 2010, according to the data from the National Energy Management Information System. Of the aforementioned area, 43.9 % is heated usable floor area. It is assumed that the energy renovation of buildings will primarily be based on buildings constructed before 1987, with an average heat energy consumption for heating of 220–250 kWh/m2. This programme provides for the achievement of the following objectives by the end of 2020: - annually contract and perform integral renovation of public sector buildings, with a usable floor area of approximately 210 000.00 m^2, - reduce energy consumption in renovated buildings to 50 kWh/m^2 per year, or by 190 kWh/m^2. The life cycle of this measure is 25 years.
	Overlapping, multiplication effect, synergy	The Programme of energy renovation of public sector buildings emphasises the leading role of the state in fostering the development of the energy efficiency market, which will result in transferring the effects from public sector buildings into the area of energy service contracting between private operators.

Title of the measure		**Connecting ISGE with the metering and charging systems of energy commodity and water suppliers**
Measure index		P.3
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2016
	Objective / outline	After achieving savings by monitoring consumption, a further direction for the development and intensification of ISGE application is its system integration with external application systems and services in order to download and exchange data which will then be used and processed, as well as correlated and analysed with other data contained in individual ISGE modules. Further integration is expected to be achieved with business information systems of suppliers of energy commodities and water, in order to enable direct data transfer from their billing systems in accordance with the B2B (business-to-business) concept. The possibility of connection with the SMIV will also be considered, in order to increase the quantity of relevant pieces of information and prevent double data entry. The entry of bills and meter readings is defined as a basic function and a legal obligation of ISGE users, and it is the basis for establishing basic and advanced analyses and projections for further EE measures which ultimately lead to financial and energy savings from local to national level. Up to 10 000 bills are currently being entered into the ISGE database per week, while the database contains more than 1 200 000 bills in total, all of

		them entered manually by users. Connecting the ISGE database with external databases of the distributors of energy commodities and water would definitely lead to higher quality, more precise and more regular data (directly enabling real-time consumption planning) which would not depend on the users' manual input (and error). The establishment of such inter-system communication would enable users to focus on the strategy analyses of consumption and help them improve consumption management at their facilities. A higher-quality management of facilities would enable the national bottom-up approach to consumption, whose ultimate objective is to provide the most accurate depiction of national energy and water consumption.
	Target final consumption	Existing buildings owned by LRSGUs Existing buildings owned and used by the Government of the Republic of Croatia
	Target group	Public sector employees
	Regional application	National
Information on implementation	List and description of activities for measure implementation	From the application aspect of the ISGE, the existing system fields are ready to be paired with the fields of individual distributors. Individual 'pairings' of certain fields will need to be made for each individual distributor due to the specifics of the fields of each individual distributor. Initially, priority will be given to larger distributors (HEP, ViO, etc.) with well-maintained databases which are better suited for database connection with the ISGE system. It is believed that, once a high-quality data exchange between databases is established, an increasing number of suppliers will join the measure, with the ultimate objective being to incorporate the measure into the legislative framework of the Republic of Croatia.
	Funds and financing sources	Planned funds by the end of 2016: HRK 1 550 000 • APN: HRK 1 550 000
	Executive body	APN – finances and implements Suppliers of energy commodities and water, distribution systems operators CEI – in regard to ISGE and SMIV interconnection
	Monitoring bodies	APN, in coordination with MCPP
Energy savings	Method of monitoring/measuring energy savings	Until now, achieved energy savings could be monitored via the ISGE system through basic and advanced database analyses. Achieved savings are based on the metering data for the consumption of all types of energy, and the input of such data is voluntary. Verified data can be obtained through database synchronisation, and real-time data which enable strategic planning and measure implementation can be obtained through connections with metering systems.
	Energy savings expected in 2016	400 TJ
	Expected impact on energy savings for 2020	/

	Assumptions	More than 400 distributors of energy commodities and water are currently in the ISGE system. If we take into account that HEP Distribution (and accompanying Supply) covers nearly all the facilities in the system, almost the entire electricity consumption of the public sector on the entire territory of the Republic of Croatia would be covered by connecting only their database. Once a quality protocol for the entry of their bills into the system was established, it is assumed that the other large suppliers would also join the implementation of this measure. The calculations of actual achieved consumption entered into the ISGE provided the information on energy savings in 2011 and 2012. Those savings resulted from the introduction of 'small measures', the implementation of which started on most facilities in 2011. The life cycle of those measures is 5 years. The average annual savings amount to 400 TJ.
	Overlapping, multiplication effect, synergy	Individual metering and informative billing Promotion of energy services Programme of energy renovation of commercial non-residential buildings Programme of energy renovation of public buildings

3.3.2 Buildings of Other Public Bodies (EED Article 5)

Many cities have voluntarily joined the 'Covenant of Mayors', an initiative which encourages European cities to combat climate change by developing Sustainable Energy Action Plans (SEAPs) which are a basis for future implementation of specific projects on energy efficiency and use of renewable energy sources. Thus far, 39 Croatian cities have drawn up SEAPs (48 with municipalities), 11 of which have already been adopted by the project council.

The cities and municipalities which have drawn up SEAPs are: Vinkovci, Brtonigla, Varaždin, Zadar, Ludbreg, Lastovo, Korčula, Mljet, Pirovac, Vela Luka, Donji Miholjac, Beli Manastir, Belišće, Osijek, Poreč, Labin, Brdovec, Samobor, Ozalj, Velika Gorica, Bjelovar, Rovinj, Buzet, Krk, Otočac, Umag, Kastav, Barban, Buje, Grožnjan, Dugo Selo, Oprtalj, Križevci, Ogulin, Gospić, Karlovac, Opatija, Pregrada, Slunj, Sveta Nedelja, Duga Resa, Jastrebarsko, Sisak, Koprivnica, Zaprešić, Klanjec, Rijeka, Ivanić Grad, Zagreb.

While cities voluntarily joined the Covenant of Mayors, counties were obliged to adopt annual plans and triennial energy efficiency programmes in accordance with the Act on Efficient Energy Use in Final Consumption (NN No 152/08) currently in force. In the application period of the 2nd NEEAP, 17 counties and 2 cities drew up and adopted annual energy efficiency plans for final consumption. A total of 11 counties and 1 city drew up triennial energy efficiency programmes for final consumption.

Title of the measure		**'Energy Efficient Public Lighting' Programme**
Measure index		P.4
Description	Category	Financial instruments, energy services for energy savings
	Time frame	Start: 2014 End: 2020 Planned major modifications, amendments, improvements: This measure is a continuation of and amendment to the measure from the 2nd NEEAP, but with revised objectives. It was designed on the basis of the best practical experiences of the company HEP-ESCO d.o.o., as well as on EPEEF experiences in co-financing public lighting reconstruction projects. The measure aims to stimulate the ESCO market in Croatia.

	Objective / outline	Public lighting in Croatia consumes 446.33 GWh of electricity, which is approximately 3 % of total final electricity consumption (2009 data). Energy efficiency improvement projects for public lighting are profitable, the savings are immediately visible, easily provable and verifiable. These projects, therefore, have an excellent use in stimulating the energy services market. This measure covers and develops innovative models of various financial mechanisms and project implementations (not only the ESCO model), on the basis of the Programme of energy renovation of public lighting, which will be drawn up.
	Target final consumption	Electricity consumption for public lighting
	Target group	Responsible persons at LRSGUs, companies - energy services providers
	Regional application	National
Information on implementation	List and description of activities for measure implementation	<u>Future activities:</u> 1. Pursuant to the Act on Efficient Energy Use in Final Consumption (NN No 152/08 and 55/12), the public sector is obliged to conduct energy management and implement energy efficiency measures in its buildings and in public lighting (LSGU obligation on periodic energy audits). Pursuant to the new Energy Efficiency Act which is being drafted (ME), the Act on the Protection from Light Pollution (NN No 114/2011) and the associated implementing regulations of the MENP (LSGUs will be obliged to draw up action plans for the compliance of public lighting with appropriate standards, to annually report on implemented activities, etc.), LSGUs will be stimulated to utilise their energy savings potentials by using energy services, without imposing budgetary burdens. 2. A detailed Programme for the energy renovation of public lighting should be drawn up by ME and MENP by the end of 2014. The application of the Programme should start in 2015. The Programme should, *inter alia*, include and develop innovative components for various financial mechanisms: improving LSGU co-financing by the Fund under the current model, utilising funds within the EU programming framework (Structural Funds) through the Fund (project consolidation), a guarantee fund for ESCO public lighting projects, and other appropriate innovative financing mechanisms. 3. The objective of this programme is to achieve demonstrable savings in the public lighting system amounting to 60 GWh (approximately 13 % of current consumption) by 2016. This amount includes additional savings to those already achieved.
	Funds and financing sources	Estimated funds in the 2014–2016 period: HRK 300 million • drawing up the Programme of energy renovation of public lighting under the ME and/or MENP budget, or with EPEEF funds • EPEEF, ESCO model and other financial mechanisms: co-financing in accordance with the financial plan based on the Programme of energy renovation of public lighting • PPP model
	Executive body	ME and MENP – regulations and instructions for LRSGUs LRSGU and ESCO companies – implementation EPEEF – co-financing
	Monitoring bodies	CEI, in coordination with ME and MENP

	Method of monitoring/measuring energy savings	This measure will be monitored using the BU evaluation method or ex-post evaluation. The actual effects of the measure will also be visible through ISGE's Remote Metering Module and Public Lighting Module.
	Energy savings expected in 2016	360 TJ (100 GWh)
	Expected impact on energy savings for 2020	540 TJ (150 GWh)
	Assumptions	The savings from all the implemented measures, taking into account the life cycle of the equipment installed in public lighting systems, will still be producing results in 2016 and 2020. It is expected that the savings in 2020 will exceed the planned targets due to a more developed energy services market. The target for 2016 was set on the basis of the following facts: in 2009, electricity consumption for public lighting was approximately 450 GWh; public lighting systems can achieve savings of around 25 %, and even as high as 80 %; the programme plans to cover 1/2 of the overall electricity consumption for public lighting. 3/4 of the overall electricity consumption for public lighting will be covered by 2020. A 2 % annual increase of areas covered by public lighting was assumed. A vigorous continuation of the application of energy efficiency measures in public lighting is expected. Energy savings of up to 80 % can be achieved with the development of new technologies, especially LED lighting, in comparison to obsolete technologies. In view of the aforementioned, the achievement of the set objectives is expected. Average savings of 30 % per system are assumed.
	Overlapping, multiplication effect, synergy	CEI monitors all projects from a single location via the National Measuring and Verification System, and ensures there are no overlaps or that projects are not double-counted. Data are obtained from EPEEF and financial institutions (for co-financed projects) and from LRSGUs and ESCO companies.

3.3.3 Procurement by Public Bodies (EED Article 6)

Title of the measure		'Green' public procurement
Measure index		P.5
Description	Category	Voluntary agreements and cooperation instruments
	Time frame	Start: 2014 End: 2016
	Objective / outline	It is necessary to intensify the activities which can provide the public procurement officers with the legal and technical know-how for including and evaluating energy efficiency requirements in public procurement procedures by applying the criterion of the economically most favourable bid. The aim of this measure is to increase the inclusion of energy efficiency criteria in public procurement procedures in accordance with the Public Procurement Act (NN Nos 90/11, 83/13, 134/13), the ME Guidelines (2013) and the Act on the Promotion of Clean and Energy-efficient Road Transport Vehicles (NN No 127/13). The objective of the measure is to improve the general knowledge of all public procurement stakeholders in order to increase the inclusion of green public procurement elements in public procurement procedures at both national and local level. In order to achieve that, there is further work to be done on producing appropriate educational materials (reference books, guides) and distributing the existing educational and promotional materials (including EC materials available in Croatian) electronically and through workshops. The design of the national Action Plan for Green Public Procurement is planned, and the plan will identify the key stakeholders and measures that should be undertaken on national and local level in order to achieve better integration of the green public procurement criteria into the public procurement procedure. The use of green public procurement criteria laid down by the European Commission, which also include the energy efficiency indicator, will be encouraged. There are plans to create a guide, i.e. instructions, which will enable the practical application of the Public Procurement Act through the energy efficiency criterion because the general knowledge of energy efficiency is insufficient. The guide will describe how energy efficiency criteria must be taken into account during public procurement procedures, and it will define the criteria for typical product groups that can be easily integrated into tender documentation. The guide will aid the persons competent for public procurement. Since the public sector is a large purchaser of goods and services, energy efficient public procurement can be very effective in transforming the market towards more efficient solutions, reducing the prices of new technologies and broadening their use.
	Target final consumption	All types of energy consumption in the public sector, including liquid fuel consumption for vehicles used by the public sector.
	Target group	Persons competent for public procurement at national and LRSGU level.
	Regional application	National
Information on implementation	List and description of activities for measure implementation	<u>Future activities:</u> 1. MENP, in cooperation with ME and other relevant bodies, should create a guide (instructions) for the integration of energy efficiency requirements into public procurement procedures which would also include detailed elaboration of technical criteria for the green procurement of certain products. By Government instruction, this guide (instructions) should be sent to all state institutions and LRSGUs. 2. MENP will coordinate the design of the national Action Plan for Green Public

		Procurement, which will identify the key stakeholders and measures that should be undertaken on national and local level in order to achieve better integration of the green public procurement criteria into the public procurement procedure. 3. Once the guide is drawn up, courses and other educational activities should be designed and implemented for the employees of state and local public administration who will be conducting procurement, and a monitoring system for the use of green criteria should be established. 4. The Central Procurement Office of the Government of the Republic of Croatia will apply energy efficiency and environmental protection criteria in its operations: technical specifications will be drawn up, for computer and office equipment, among others; and fuel consumption, the use of tyres and other equipment as well as CO_2 emissions will be evaluated for the procurement of motor vehicles. 5. In regard to the procurement of computer equipment for the 2014–2015 period, in addition to the application of the criterion of the economically most favourable bid, as related to the warranty period, technical specifications are defined in such a manner that the tendered computer equipment must comply with the following requirements: a. Energy Star 5.0 is the basic requirement for personal computers, laptops and monitors, pursuant to EU GPP criteria. A certificate or a possibility of verifying the compliance with the energy standards laid down by Energy Star 5.0 is a precondition for compliance with the EU GPP criteria for this product group. b. The WEEE symbol, i.e. the marking that designates the sorted collection of electrical and electronic waste regulated by Directive 2012/19/EU on waste electrical and electronic equipment, i.e. the Act on Sustainable Waste Management (NN No 94/13) into which the Directive was transposed and laid down in detail in the Rules on the management of waste electrical and electronic appliances and equipment (NN Nos 74/07, 133/08, 31/09, 156/09, 143/12, 86/13). c. RoHS is a designation certifying that a product was manufactured in compliance with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment, i.e. the Rules on the restriction of the use of certain hazardous substances in electrical and electronic equipment (NN No 131/2013) with which the Directive was transposed, and in accordance with Article 4(1) of the Act on Technical Requirements for Products and on Conformity Assessment (NN No 80/2013). In this way, EU Member States ensure that the electrical and electronic equipment placed on the market does not contain hazardous substances. 6. In the public procurement procedure for the purchase of motor vehicles, the Central Procurement Office of the Government of the Republic of Croatia will apply the provisions of the new Rules on the criteria used in public procurement procedures for road transport vehicles (NN No 11/2014).
	Funds and financing sources	Cannot be estimated. MENP, ME
	Executive body	MENP, in cooperation with ME and other relevant bodies – draw up the guide and the Action Plan for Green Public Procurement. Central Procurement Office of the Government of the Republic of Croatia and LRSGUs – application of energy efficiency measures
	Monitoring bodies	CEI, in coordination with MENP

Energy savings	Method of monitoring/measuring energy savings	In the future, the monitoring of achieved energy savings will be implemented by applying the BU method for each individual group of procured devices, taking into account the energy efficiency criteria. It is expected that most of the procurement will be related to computer and office equipment and motor vehicles. A national method was developed for vehicles, based on the difference in fuel consumption of a standard automobile with an internal combustion engine and a new vehicle with advanced technology (hybrid or electric), and the average annual mileage of a vehicle. The Central Procurement Office of the Government of the Republic of Croatia monitors the data on the quantities and types of procured computer equipment and vehicles, and enters the implemented measures into the SMIV.
	Energy savings expected in 2016	Cannot be estimated
	Expected impact on energy savings for 2020	Cannot be estimated
	Assumptions	In view of the lack of activity (public procurement) to which energy savings could be allocated in the previous period, it is not possible to allocate achieved savings for 2010 to this measure. Furthermore, due to a current lack of plans by institutions competent for public procurement, in the sense of procurement quantities for computer and office equipment and vehicles, the effects of this measure cannot be estimated neither by 2016 nor by 2020. However, as the implementation of this measure starts, a system for monitoring the effects through the BU method will be established, and it is therefore expected that it will be possible to calculate energy savings for this measure in the next period.
	Overlapping, multiplication effect, synergy	/

3.3.4 Savings Resulting from Public Sector Measures

Described above, individually for each measure.

3.3.5 Financing Measures in the Public Sector

Described above, individually for each measure.

3.4 Energy Efficiency Measures in Industry

3.4.1 Principal Measures for Increasing Energy Efficiency in Industry

Title of the measure		Industrial Energy Efficiency Network (IEEN)
Measure index		I.1
Description	Category	Voluntary agreements and cooperation instruments
	Time frame	Start: 2008 End: 2016 Planned major modifications, amendments, improvements: The measure was revised and amended with target activities.
	Objective / outline	A series of activities will be implemented through IEEN, aimed at promoting energy efficiency in industry. The basic objective is to increase the awareness and knowledge of the management and employees of industrial companies in order to fully utilise the potential of achievable energy savings measures. Energy consumption management structures should be established at company level and at industrial group level, monitoring and analyses of energy consumption should be introduced and targets should be set. By employing this method, a comprehensive database on energy consumption in industry will be created and indicators will be developed, to be used for benchmarking against companies in the same sector in both Croatia and the EU. An activities plan for key industrial sectors should be drawn up under the measure, and the implementation of target energy efficiency measures should be co-financed.
	Target final consumption	Consumption of all types of energy in industrial processes
	Target group	Industrial plants
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Implemented activities and achieved results: Since 1998 – development of IEEN as one of the national energy programmes (NEPs): development of network structure; involvement of state bodies, experts and individual industrial companies; involvement of the public sector and the service sector as consumer groups in addition to industry; implemented sectoral analyses; cooperation with foreign partners (IFE - Norway) and transfer of experience from analogue network projects; establishing initial consumer groups as groups under IEEN – wood and food industry, hotels within the service sector and hospitals within the public sector; implementation of initial pilot projects – analysis, publication of the book 'IEEN – Past Results and Future Activities'. The key elements of IEEN are: establishing permanent structures for SEM, M&T (supervision and analysis of energy consumption; setting objectives); energy audits; demo projects (implementing best practice projects and disseminating information on such projects); education and training. Future activities: 1. Drawing up the Network's work programme by 2016 • By the end of 2014, EPEEF will draw up the Work Programme of the Industrial Energy Efficiency Network which will include the selection of the key branches of industry for the implementation of activities, a detailed proposal of energy efficiency measures for each branch, and an implementation plan for those measures. The programme will also set the amounts required for the implementation of measures and co-financing mechanisms.

		• Activities: o Institutional coordination: Cooperation between state and professional bodies involved in IEEN development. o Recording consumption: Status overview of energy consumption and use by branches of industry. o Development of tools: SEM, M&T, energy audits, benchmarking, demo projects. o Selection of key branches of industry and target companies for demo projects, in accordance with set criteria. o Establishment of energy management: o Proposal of appropriate energy efficiency measures for each industrial branch and implementation plans. o Managing finances: Developing financing aspects, considering possible 'pipeline' projects, developing possible application of ESCO principles. o Monitoring programme implementation and results 2. Programme implementation • The application of the plan should start in the second half of 2014, at the latest, and continue until 2016, with optional extension until 2020. Plan implementation should be monitored on annual level in regard to expended funds, achieved energy savings and reduced CO_2 emissions.
	Funds and financing sources	Source of financing: EPEEF Potential source of co-financing: EU funds The required funds will be set in the detailed work programme of the Network.
	Executive body	EPEEF – drawing up the programme (EIHP) and programme co-financing HGK – programme implementation, in cooperation with ME and CEI
	Monitoring bodies	ME and CEI
Energy savings	Method of monitoring/measuring energy savings	A methodology must be established for future activities (the BU method can be established for every standardised measure, or a savings evaluation can be required). CEI will develop the methodology on the basis of the Programme and it will monitor the effects through the Energy Savings Measuring and Verification System.

Title of the measure		**High-efficiency cogeneration**
Measure index		I.2
Description	Category	Financial instrument; regulations
	Time frame	Start: 2007 End: 2016
	Objective / outline	In addition to the system of incentives for the production of electricity from high-efficiency cogeneration, this measure also provides for the adoption of the appropriate regulations for stimulating the production of heat energy from cogeneration (defining the status of eligible heat energy producer).
	Target final consumption	Production of heat energy and electricity in industrial plants
	Target group	Industrial plants
	Regional application	National

Information on implementation	List and description of activities for measure implementation	<u>Implemented activities and achieved results under the 2nd NEEAP:</u> By the end of 2013, three cogeneration plants, with a total installed electric power of 10.493 MW, were in the system of incentives and were delivering energy into the grid. One additional cogeneration plant, with 1 MW of power, was granted the eligible producer status, but was still not connected to the grid. The regulations on stimulating heat energy production were adopted through the Heat Energy Market Act (NN No 80/2013) and the Rules on acquiring the status of eligible producer (NN No 132/2013). <u>Future activities:</u> In accordance with the Heat Energy Market Act, with the aim of achieving greater utilisation of the national thermal potential for heating and cooling, the Government of the Republic of Croatia will adopt a programme on the utilisation of potential for heating and cooling efficiency. The Programme on the utilisation of potential for heating and cooling efficiency will, *inter alia,* lay down the public support measures for the production of thermal energy for heating and cooling. The Programme will be adopted by 1 July 2015 for the 2016–2030 period.
	Funds and financing sources	Planned funds by the end of 2016: • HROTE: depending on the quantity of produced electricity and on the basis of unit • incentive prices defined in the tariff systems (NN No 63/2012, 121/12, 144/12 and 133/13).
	Executive body	HROTE, ME, HERA – regulations and the system of incentives for the production of electricity from renewable energy sources and cogeneration.
	Monitoring bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored using the BU method for estimated savings. The results of the implemented measures will be entered into the SMIV.
	Energy savings expected in 2016	165 TJ (46 GWh)
	Expected impact on energy savings for 2020	525 TJ (146 GWh)
	Assumptions	Electricity production in cogeneration plants which are in the system of incentives amounted to 2185.5 MWh in 2012. Taking into account the required primary energy savings of 10 % with regard to separate production of electricity and thermal energy (reference power plant and reference boiler room), it may be calculated that the annual consumption of primary energy from fuels amounts to approximately 28.4 TJ and the achieved savings amount to 2.84 TJ. Energy savings for 2016 and 2020 have been set based on the expected construction of high-efficiency cogeneration plants in accordance with the amended projections for final consumption (2013).
	Overlapping,	/

Title of the measure		Introduction of efficient electric motor drives
Measure index		I.3
Description	Category	Financial instrument; regulations
	Time frame	Start: 2011 End: 2016 Planned major modifications, amendments, improvements: Continuation of an existent measure
	Objective / outline	Electric motor drives account for the largest share of electricity consumption in industry – up to 90 %. This area has a great potential for savings, but systematic measures or programmes have not been implemented. The introduction of efficient electric motor drives pertains to the installation of high-efficiency electric motors and the introduction of variable-speed drive (VSD) management by frequency and/or amplitude, where appropriate, for example in processes where the flow of the working substance is continuously changing. Depending on the power category of the motor, this measure can achieve technical savings of electricity exceeding 16 % and economic savings exceeding 10 %. Furthermore, this measure provides for achieving energy savings from the proper use of individual elements of an existent electric motor drive, as well as an electric motor drive as a whole. A reduction of the installed power would have a positive effect on the operating stability of the electric power system, and on reducing labour costs for users and electricity distributors.
	Target final consumption	Electricity consumption in industrial plants
	Target group	Industrial plants using any type of electric motor drive
	Regional application	National
Information on implementation	List and description of activities for measure implementation	<u>Future activities:</u> 1. Development of standardised energy audits of rational energy consumption of electric motor drives in industrial plants with evaluation of cost-effectiveness of improvements, with a simple methodology applicable to practically all industrial plants 2. Establishment of favourable financing models with the development of guarantee mechanisms acceptable to banks
	Funds and financing sources	Source of financing: EPEEF and commercial banks The required funds will be set in the detailed work programme of the Network.
	Executive body	EIHP, HEP, ESCO companies – measure implementation EPEEF – co-financing energy audits and certification
	Monitoring bodies	CEI, in coordination with ME, MENP
Energy savings	Method of monitoring/measuring energy savings	The measure will be monitored using the BU method for estimated savings. The results of the implemented measures will be entered into the SMIV.
	Energy savings expected in 2016	630 TJ (174 GWh)
	Expected impact on energy savings for 2020	760 TJ (210 GWh)
	Assumptions	It is assumed that up to 90 % of electricity consumption in the industry sector pertains to pumps, ventilators, conveyors and other electric motor drives to which the aforementioned measures may be applied. Economic savings are lower than the technical ones, but nevertheless high enough for

		this measure to be economically feasible. Companies should be encouraged to implement integral programmes of replacing and improving their electric motor drives, and not to resort to emergency solutions for individual cases. Developed standardised energy audits provide an evaluation of the purposefulness and potential for the application of this measure, which later facilitates financing, provided there are developed financial models.
	Overlapping, multiplication effect, synergy	A substantial number of older electric motors which are currently used are oversized – by implementing this measure the installed electrical power would be reduced, as well as the related costs, and sudden grid overloads would be avoided.

Title of the measure		**Energy audits of small and medium-sized enterprises**
Measure index		I.4
Description	Category	Financial instruments, information
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: This measure is a combination of measures C1 and I3 from the 2nd NEEAP and its objective is to meet the requirements of Article 8 (2) and Article 18 of the EED.
	Objective / outline	The objective of this measure is to provide financial support to small and medium-sized enterprises (SMEs) in order for them to introduce and implement activities for improving energy efficiency, and primarily for conducting high-quality energy audits and continuous energy management (introduction of international standards such as ISO50001), as well as for promoting energy efficiency and promotional-educational activities for employees. According to the Directive, small and medium-sized enterprises present a huge energy savings potential in the EU, and Member States should establish a favourable framework for providing technical assistance and target information to SMEs in order to assist them in adopting measures for improving energy efficiency. The Directive defines small enterprises as: the category of micro, small and medium-sized enterprises is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.
	Target final consumption	Buildings of small and medium-sized enterprises (privately owned)
	Target group	Owners and occupants of SME buildings
	Regional application	National

Information on implementation	List and description of activities for measure implementation	Future activities: There will be two types of support for SMEs that wish to improve the energy efficiency of their companies: • Financial support – EPEEF will publish a call for tender for financing energy audits of SME buildings at least once per year. • Educational support – MA will design a method for informing SMEs by the end of 2014. In accordance with the existent criteria, EPEEF will publish a call for tender for an educational activities provider. It is the role of ME to specify which criteria the education must satisfy. Educational activities should cover the following topics: • Introduction of an energy management system • Energy audit • Energy efficiency improvement projects
	Funds and financing sources	Planned funds by the end of 2016: • MA – HRK 260 000 for drawing up the study • EPEEF – HRK 6 000 000 over 3 years, HRK 2 000 000 per year
	Executive body	EPEEF – financing and publishing calls for tender
	Monitoring bodies	HGK and MA, in coordination with CEI
Energy savings	Method of monitoring/ measuring energy savings	The effects of this measure are monitored by using the European Commission's recommended BU method as well as national reference values. Furthermore, where applicable in regard to available data, the principle of 'measured' savings is used on the basis of the difference in energy consumption before and after the implementation of the energy efficiency measure.
	Energy savings expected in 2016	Cannot be estimated. Will be known after the study is finalised.
	Expected impact on energy savings for 2020	Cannot be estimated. Will be known after the study is finalised.
	Assumptions	The savings achieved thus far in relation to this measure are very low. The reasons lie either in the lack of interest from the commercial sector or in the search for other (co-)financing sources. Co-financing was previously available separately for commercial facilities and separately for industry. Now, emphasis is separately being given to small and medium sized enterprises on one hand, and large companies on the other. It will be possible to calculate savings once the programme is designed and the scope of EPEEF financing is set.
	Overlapping, multiplication effect, synergy	This measure overlaps with the horizontal measure 'Energy Audits'. However, when evaluating the effects, individual sectors are analysed separately and achieved savings are listed under only one of the measures in order to avoid the savings being double-counted. The measure is supplemented by the aforementioned promotional activities due to which the final savings will surely be higher, but it will not be possible to quantifiably monitor the effects of that measure. It is assumed that education will be a preliminary step towards improving the implementation of this measure and ultimately achieving savings on the basis of energy audit measures.

3.4.2 Savings Resulting from Energy Efficiency Measures in Industry

Described above, individually for each measure.

3.4.3 Financing Energy Efficiency Measures in Industry

Described above, individually for each measure.

3.5 Energy Efficiency Measures in Transport

3.5.1 Principal Measures for Increasing Energy Efficiency in Transport

Title of the measure		**Eco-driving training**
Measure index		T.1
Description	Category	Information and mandatory information measures
	Time frame	Start: 2011 End: 2016 Planned major modifications, amendments, improvements: New measure
	Objective / outline	Eco-driving has been recognised as one of the most efficient measures for promoting energy efficiency at EU level. Launching the **National Eco-driving Campaign** could achieve the maximum level of awareness of all citizens and drivers in the Republic of Croatia on the advantages of this modern, intelligent and environmentally friendly style of driving, through active implementation of eco-driving training among **licensed (existing) drivers**. Special elements of the national campaign should be dedicated to eco-driving education for: • drivers of passenger cars; • bus drivers; • drivers of freight vehicles > 3.5 tonnes. Education on eco-driving elements could be implemented through **short trainings** (in the duration of up to 60 minutes per learner) among the drivers who **obtained their driving licence prior to the entry into force** of the Rules on training learner drivers (NN No 13/09), which introduced the obligation for all driving schools and instructors to provide education on eco-driving elements in the course of standard training for learner drivers. It should be pointed out that the proposed measure **does not pertain** to new drivers, who are trained in eco-driving in accordance with the legal obligations laid down in the aforementioned Rules. In view of the fact that 45 000 learners per year undergo training for new drivers in the Republic of Croatia, approximately 100 000 drivers of passenger cars have thus far been trained in eco-driving techniques under the training programme for learner drivers. The total number of active drivers in the Republic of Croatia is estimated at 2 000 000. The current difference of 1 900 000 are drivers who in the past, prior to 2009, acquired few eco-driving skills or none at all. These drivers are the target group of this measure.
	Target final consumption	Passenger cars, freight vehicles, and buses.
	Target group	All drivers of passenger cars who obtained their driving licence **prior to the entry into force** of the Rules on training learner drivers (NN No 13/09); bus drivers in public transport; drivers of public and commercial freight vehicles of maximum authorised mass > 3.5 tonnes.
	Regional application	National
Information on implementation	List and description of activities for measure implementation	1 Training examiners and instructors • Before launching the eco-driving campaign, it will be necessary to conduct training for examiners and instructors who will be certified and authorised to conduct eco-driving training for the categories of licensed drivers of passenger cars, bus drivers, and freight vehicle drivers, in conformity with EU standards. A single European eco-driving certificate has been defined and

		adopted within the framework of the European ECOWILL[4] project. In order to transpose it into Croatian practice, the Energy Institute Hrvoje Požar, as the national ECOWILL project coordinator for Croatia, in cooperation with the Croatian Auto Club (HAK), has already conducted training of 14 initial instructors/examiners (coaches)[5] who will present the basis for further education and training of coaches for the implementation of authorised eco-driving training. It should be pointed out that this training goes a step further than the legal obligation laid down by the aforementioned Rules, because authorised coaches will adopt a single practice of conducting eco-driving training, which has thus far not been harmonised at the level of all driving schools and which is applied in the territory of other EU Member States. • In the Republic of Croatia, training of learner drivers is currently conducted by 1250 driving instructors who are employed by 383 driving schools. HAK is the authorised expert organisation through which 85 authorised examiners conduct driving exams in the Republic of Croatia. The measure provides for the training of at least 100 driving instructors and all 85 examiners by the end of 2013. 2. Training drivers licensed prior to 2009 • In order to achieve the objectives of the 3rd NEEAP, the training of a minimum of 51 000 licensed passenger car drivers by 2016 is proposed. It is expected that undergoing eco-driving training will enable all participants to reduce fuel consumption by up to 10 %, on average, provided that they apply eco-driving principles in practice. • Training of a minimum of 2750 freight vehicle drivers by 2016 is proposed. With the implementation of this measure, minimum savings of 7580 tonnes of fuel are expected by 2016. Upon completing the training, every driver will be issued the single certificate on completed eco-driving training. • There are currently 15 public transport operators in the Republic of Croatia with approximately 1700 buses used for public transport. The largest one is ZET, with 550 buses. In regard to the implementation of eco-driving training for bus drivers, the training of a minimum of 2600 bus drivers by 2016 is proposed. With the implementation of this measure, minimum savings of 10 573 tonnes of fuel are expected by 2016. Upon completing the training, every bus driver will be issued the single certificate on completed eco-driving training. In order for this activity to be implemented, it will require hiring trained instructors and examiners outside the scope of their usual activities related strictly to new drivers. For the purpose of promoting the programme, and with the objective of including the desired number of drivers, the domain www.ekovoznja.hr[2] has been reserved and will be used to provide information to the participants in the National Eco-driving Campaign implementation plan. Inclusion of LRSGUs is especially important for successful programme implementation.
	Funds and financing sources	Total required funds HRK 5 545 000.00 per year: • IEE: HRK 83 333.33 ensured (activity 1) • EPEEF: HRK 2 730 834.00 (activity 2) • MMATI: HRK 1 365 417.00 (activity 2) • LRSGU: HRK 1 365 417.00 (activity 2)
	Executive body	EPEEF, in cooperation with HAK

www.ecodrive.org

http://www.eihp.hr/hrvatski/detaliniie.php?Tip=viiest&id=2547

	Monitoring bodies	CEI, in coordination with MENP
Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored using the research method. In order to systematically monitor savings, it will first of all be necessary to compile a national inventory of all eco-driving training participants. Records of participants could be kept via such an inventory and, by way of periodic questionnaires, information on the savings achieved after the completion of training could be collected.
	Energy savings expected in 2016	59 TJ
	Expected impact on energy savings for 2020	/
	Assumptions	A total of 12 750 short training courses for drivers of passenger cars, 688 for drivers of freight vehicles, and 650 for bus drivers are assumed per year. It is assumed that 50 % of drivers will change their habits after taking the course, and they will achieve average fuel savings of 7.5 %. It is assumed that the average mileage for drivers of passenger cars is 12 000 km, for drivers of freight vehicles 38 000 km, and for bus drivers 54 700 km. It is assumed that the average fuel consumption of passenger cars is 7 l/100 km (with a 50 % share of diesel cars and a 50 % share of petrol cars), the average consumption of freight vehicles is 32.3 l/100 km, and of buses 37.2 l/100 km. The duration of the measure is 2 years.
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Intermodal freight transport**
Measure index		T.2
Description	Category	Regulations
	Time frame	Start: 1st quarter of 2014 End: 3rd quarter of 2014 Planned major modifications, amendments, improvements: New measure
	Objective / outline	Intermodal transport includes several methods of transportation in freight transport. This measure focuses only on freight transport and the potential it offers for unburdening road routes and reducing fuel consumption by using railway infrastructure and inland waterways. In order for this measure to be implemented, it is necessary to provide an appropriate regulatory framework as well as an appropriate infrastructure for unloading/loading containers. The Act on Combined Transport came into force in 2009, regulating: distances in combined transport, the exemption from paying the annual fee for the use of public roads, the exemption from licences and quotas, the exemption from road transport limitations for combined transport participants, and the documents that a freight vehicle driver in combined transport is obliged to hold. On the basis of the Act, the Rules on combined transport terminals and transshipment terminals were adopted in 2010, regulating: combined transport terminals, transshipment terminals, as well as road routes to or from the nearest combined transport or transshipment terminal along which the exemptions from quotas and licences apply.

		Amendments to the Act on Combined Transport are currently being drafted with the aim of stimulating road transport carriers to utilise the more environmentally friendly and economically viable type of transport.
	Target final consumption	Road freight transport
	Target group	Transport companies in road, rail, and maritime transport, and inland navigation
	Regional application	National
Information on implementation	List and description of activities for measure implementation	The new amendments to the Act on Combined Transport provide for the exemption from 50 % of the road fee during road vehicle registration for carriers who use combined transport which allows for substantial energy savings measures.
	Funds and financing sources	It is necessary to plan for funds to compensate losses of companies who are beneficiaries of the fee at vehicle registration. At this stage of drafting the Act, it is still not possible to precisely determine the financing sources.
	Executive body	MMATI
	Monitoring bodies	CEI, in coordination with MMATI
Energy savings	Method of monitoring/measuring energy savings	Inspections, financial supervision of allocated funds for stimulating combined transport.
	Energy savings expected in 2016	N/A
	Expected impact on energy savings for 2020 (if applicable)	N/A
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Establishing a new payment system for the special environmental charge for motor vehicles**
Measure index		T.3
Description	Category	Regulations
	Time frame	Start: 2013 End: 2016 Planned major modifications, amendments, improvements: New measure
	Objective / outline	The aim of the European and Croatian development policy for sustainable transport is the establishment of a transport system which will satisfy the social and economic requirements for mobility while simultaneously complying with increasingly stricter environmental criteria. In order to stimulate the procurement and use of vehicles with lower CO_2 emissions per kilometre and contribute to the reduction of emissions from the transport sector, in 2013 the Government amended the regulation on special tax charges ('excise duty') for motor vehicles by introducing an environmental criterion for determining the special tax amount which now depends on average CO_2 emissions per kilometre

		and the type of fuel used by the vehicle. In order to reduce emissions from transport, one of the measures for achieving the objective is the establishment of a new payment system for the special environmental charge for motor vehicles. Based on the 'polluter pays' principle, the current model would be upgraded and calculated on the basis of emissions of CO_2 and other pollutants from motor vehicles for passenger cars, or M1 road vehicles. The 'Model for charging fees for CO_2 emissions from road vehicle engines' was drawn up in December 2013. The objective was to design a model calculation for CO_2 emission fees which would pertain to all passenger cars, or the M1 category of road vehicles. There are no official data on CO_2 emissions for the majority of such vehicles, and the EU Member States that have already introduced the fees are encountering the same problem. Official data have been compiled on new vehicles sold on the Croatian market from 2000 to 2012, with the objective of establishing a system for charging CO_2 emission fees. The ideal model, which would be based on actual CO_2 emissions, is nearly impossible to achieve. Therefore, a model which would include the factors affecting CO_2 emissions was designed by taking into account available data. A classification model for the fee calculation was proposed on the basis of analysed vehicle data for those vehicles for which there are no official CO_2 emission data. A division into classes based on the factors affecting CO_2 emissions was proposed, and corrective factors and their values were defined for the division. The proposal of the Decree on unit fees, corrective coefficients and detailed criteria and measures for determining the special environmental charge for motor vehicles from 2013 aims to establish a more equitable method for collecting the fee by respecting the 'pollute more - pay more' principle and, on the other hand, the aim is to base the fee calculation on both CO_2 emissions and the emission level of a vehicle. Furthermore, the calculation method for the unit fee, as well as the initial fee values and the corrective coefficient which depends on the annual mileage, have also been laid down. The ultimate fee amount to be paid by the tributary will not change substantially, but it will be more equitably distributed. The objective of this measure is also to direct customer demand towards more environmentally friendly and economical vehicles. The new calculation pertains only to M1 category vehicles (passenger cars) because other vehicles are generally classified as vehicles intended for business use and, in accordance with EU practice, it is preferred not to impose additional costs on them when calculating the fee. With the adoption of the Decree, the Rules on the method and terms for calculation and payment of the special environmental charge for motor vehicles will need to be amended.
	Target final consumption	Road vehicles – passenger cars (M1 category vehicles)
	Target group	Vehicle owners
	Regional application	National

Information on implementation	List and description of activities for measure implementation	With the objective of achieving valid application of the new EU acquis communautaire in the transport sector, under this measure MENP (in cooperation with expert institutions) will draw up a proposal of the Decree on unit fees, corrective coefficients and detailed criteria and measures for determining the special environmental charge for motor vehicles. In addition to drawing up the Decree, MENP will draw up the required amendments to the Ordinance on the method and terms for calculation and payment of the special environmental charge for motor vehicles. The full application of the new payment system is expected in 2015.
	Funds and financing sources	MENP – improving regulations under the budget
	Executive body	MENP, EPEEF
	Monitoring bodies	CEI, in coordination with MENP
Energy savings	Method of monitoring/measuring energy savings	Measure implementation will be monitored by analysing indicators for vehicles included in this measure.
	Energy savings expected in 2016	Cannot be estimated.
	Expected impact on energy savings for 2020 (if applicable)	Cannot be estimated.
	Assumptions	The collection of funds will enable the implementation of other measures. Raising the awareness of producers and end users on the need to protect the environment, which includes an active role in environmental protection and nature preservation. Fostering the development of new technologies, production and consumption of products which are less harmful to the environment, reducing pollution, and a more rational management of raw materials and energy.
	Overlapping, multiplication effect, synergy	The collected funds will enable the implementation of other measures. The purchase of vehicles with lower emissions results in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions. Stimulating the purchase of eco-vehicles results in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions.

Title of the measure		**Promotion of integrated transport**
Measure index		T.4
Description	Category	Information and organisation measure
	Time frame	Start: 2014 End: 2020 The measure is a consolidation of previous measures T.4, T.7 and T.10
	Objective / outline	Traffic congestion is becoming a growing problem in cities and it has a great impact on the unnecessarily increased fuel consumption. Sustainable development of urban transport systems should therefore be promoted through the following: - optimising city logistics of freight transport; - intelligent management of public parking spaces; - providing support for developing the infrastructure of public city bikes;

		- introducing car-sharing schemes in cities.
	Target final consumption	Road vehicles
	Target group	Drivers
	Regional application	Urban/ National
Information on implementation	List and description of activities for measure implementation	MMATI will start drawing up guidelines in 2014 in cooperation with CEI, and it will launch educational activities and measure application in 2015 in cooperation with LRSGUs. MMATI should hire a technical consultant for drawing up the guidelines for the optimal solutions regarding integrated transport. EPEEF should then publish calls for tender for LRSGUs, stimulating the cities to introduce those schemes which were defined as optimal by the finalised study. Co-financing should start in 2015. The guidelines will, among other things, include the following: - Optimising city logistics of freight transport; Optimising the city logistics of freight transport poses a special challenge due to the specific features of urban terrain configuration, local market requirements and suppliers' habits. In order to actively contribute to energy efficiency improvement in the process of urban logistics of freight transport, the measure will primarily define guidelines for increasing the efficiency of freight transport on the basis of which trainings for operators of delivery fleet vehicles will be implemented. - Intelligent management of public parking spaces A problem of today's philosophy of public parking space management lies in the fact that no city has thus far introduced a variable tariff on the basis of which parking would be charged depending on the type of the vehicle's drive system or fuel. In order to facilitate a gradual transfer towards the use of sustainable technologies in transport in urban areas, it will be necessary to introduce a differentiated access to public parking spaces, thereby giving an opportunity to more energy efficient and environmentally friendly solutions to get established on the market. For the implementation requirements of this measure, it will be necessary to define guidelines on the basis of which decisions could be passed on exemptions or discounts for the use of public parking services for environmentally friendly vehicles. - Providing support for developing the infrastructure of public city bikes Inhabitants of urban areas will be offered an alternative mobility solution which will have a direct positive impact on the direct avoidance of fossil fuel consumption, the reduction of environmental load, and an overall improvement of the citizens' quality of life through increased physical activity. It is proposed to introduce 9500 public city bikes by 2020 on the territories of the largest Croatian cities. Assuming that the average daily mileage of a public city bike is 5.5 km, it is to be expected that their integration into urban mobility, as one of the solutions, could help to avoid approximately 2 million km on the average, which inhabitants would probably cover in their cars. By transferring the aforementioned 2 million km to bikes, urban areas could cumulatively avoid almost 661 tonnes of fuel by 2016 and 1 148 tonnes of fuel by 2020. - Introducing a car-sharing scheme Based on the experiences of European countries and cities, practice has shown that one vehicle in a car sharing scheme substitutes 4–8 regular vehicles. In order to implement a car sharing scheme, as one of the measures of increasing energy efficiency in transport, successive introduction of a minimum of 100 cars per year into the scheme in the largest cities is proposed by 2020. It is estimated that a difference of 2 l/100 km in comparison to existing vehicles could be achieved if the most efficient

		vehicles were introduced into the scheme.
		On the other hand, the average annual mileage per vehicle in the car sharing scheme is estimated at 30 000 km.
	Funds and financing sources	LRSGU budgets and EPEEF (a detailed estimate of the required co-financing will be made through the implementation guidelines), EU funds
	Executive body	MMATI LRSGU
	Monitoring bodies	CEI, in coordination with MMATI and MENP
Energy savings	Method of monitoring/measuring energy savings	The effects of this measure will be recorded using TD indicators in accordance with the EC recommendations for road transport (indicators P.8 and P.9).
	Energy savings expected in 2016	50 TJ
	Expected impact on energy savings for 2020 (if applicable)	220 TJ
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Speed limits**
Measure index		T.5
Description	Category	Regulations
	Time frame	Start: 2014 End: 2016
	Objective / outline	Experiences of such European countries as Denmark, Estonia, Finland, France, Hungary, Ireland, Luxembourg, Malta, etc. indicate that limiting speeds to levels below standard, especially on motorways, is a strong contribution towards the systematic reduction of fuel consumption in road transport. However, a more stringent enforcement of the existing speed limits, with lower tolerance for exceeding the limits, could yield very good results by itself. Therefore, under the 2nd NEEAP, this measure was focused on lowering the tolerance threshold for exceeding the regulated speed limits.
	Target final consumption	Road vehicles
	Target group	Vehicles circulating on motorways
	Regional application	National
Information on implementation	List and description of activities for measure implementation	It is estimated that, of the total annual mileage covered by vehicles in the Republic of Croatia, an average 10 % of traffic occurs on motorways. By introducing more stringent enforcement of maximum speed limits on motorways, it is expected that fuel consumption could be reduced by a minimum of 2 %. It bears mentioning that the implementation of the speed limit measure is one of the cheapest measures. The following has been planned within the scope of this measure: • The State Office for Metrology (DZM) will amend the Rules on metering requirements for speed meters for vehicles in road transport (NN No

		38/01, 43/01 and 19/02) and reduce the allowed safety difference in measuring all speeds to 5 %. • Develop, estimate the effect of and implement the 'Project of Speed Control on Roads (Motorways) ': o Develop a single traffic control system: procurement and installation of ca. 100 devices – digital cameras, with the option of measuring vehicle speed. Connecting the said cameras into a single system and transmitting data to the single data processing centre. o Develop a single data processing centre (checks on traffic violation perpetrators – vehicle owners, as well as printing and delivering prescribed fines throughout the territory of the Republic of Croatia). o Develop an automated system for checks on vehicle owners – traffic violation perpetrators (speed) with permanent residence throughout the territory of the EU, in accordance with Directive 2011/82/EU, as well as printing and delivering information on fines – connection to the EU EUCARIS infrastructure.
	Funds and financing sources	The planned required funds for the implementation of the entire measure amount to HRK 10 000 000.00. However, implementation will be preceded by a detailed study which will define the precise scope of the measure and the required funds. The study will be drawn up by a technical consultant, it will be commissioned by MI, and financed by MI and EPEEF. Required funds for the study: HRK 400 000
	Executive body	MI DZM – amendments to the Rules EPEEF – co-financing of the study
	Monitoring bodies	MI and MMATI
Energy savings	Method of monitoring/measuring energy savings	The savings can be estimated using the method described above, and the results will be covered using TD indicators in accordance with the EC recommendations for road transport (indicators P.8 and P.9).
	Energy savings expected in 2016	697 TJ
	Expected impact on energy savings for 2020 (if applicable)	1 327 TJ
	Assumptions	An increase of the total number of registered vehicles in the Republic of Croatia by approximately 500 000 is expected in the 2012–2020 period (which will mean that approximately 2.5 million vehicles will be registered in Croatia). A lower tolerance for exceeding the maximum speed limit on motorways will therefore result in reducing fuel consumption by 4 300 tonnes by 2016, or 4 809 tonnes by 2020.
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Financial incentives for energy efficient vehicles**
Measure index		T.6
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020 Planned major modifications, amendments, improvements: New measure

	Objective / outline	As part of its activities, EPEEF co-finances cleaner transport schemes. This programme should be improved by developing special co-financing lines for specific purposes, such as: • modification/purchase of compressed natural gas (CNG) powered vehicles.
	Target final consumption	Road vehicles
	Target group	Natural and legal persons
	Regional application	National
Information on implementation	List and description of activities for measure implementation	- Modification of petrol powered vehicles / purchase of compressed natural gas (CNG) powered passenger cars. - Stimulating the installation of gas powered drives into motor vehicles will result in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions, as well as savings for the end user. It is necessary that EPEEF opens a special co-financing line, modelled after the EURO 5 programme which was implemented in the previous period, for CNG powered passenger cars. Installation/Purchase of motor vehicles with installed CNG powered drives. Currently there are ca. 60 000 registered vehicles with installed gas powered drives in the Republic of Croatia, which is relatively little compared to the total number of petrol powered passenger cars (ca. 800 000), which offers great potential for using gas as an alternative fuel for petrol powered vehicles. Device prices on the market range from HRK 7 000.00 to HRK 10 000.00 and such devices enable the use of fuels that are ca. 50 % cheaper than petrol, and they allow vehicles to retain the same exhaust gas percentages or even improve them in regard to the engine in question. It is important to note that the percentage of carbon dioxide (CO_2) can be reduced by 2–5 % with the installation of a gas powered drive, which is not negligible. Since the majority of passenger cars are used in urban areas, reducing the percentage of CO_2 in the atmosphere would significantly improve the pollution statistics of cities and surrounding areas. Financial incentives amounting to HRK 3 000.00 for the installation of devices into a minimum of 3 000 vehicles per year are proposed for the implementation of this measure, with a time horizon by 2020. It is proposed that a model be designed in cooperation with MF, by way of which gas device installers would be granted tax benefit eligibility at the end of the year, whereby an installer could reduce the invoiced amount to the customer by approximately HRK 3 000 and that would, at the end of the year, constitute the amount that the state would write off the installer's taxes due. Co-financing the procurement of 15 000 electric and 6 000 hybrid vehicles by 2020 is also assumed. It is expected that the prices of electric vehicles, as well as the required incentives for the procurement of such vehicles, will decrease by 2020. The implementation of measures will depend on the cost-effectiveness of subsidies for the reduction of greenhouse gas emissions. A mileage of 12 000 km/year per automobile is assumed, with a final energy consumption of 15 kWh/100 km for electric cars, 44 kWh/100 km for hybrid cars, and 67 kWh/100 km for conventional vehicles.
	Funds and financing sources	The amount required from EPEEF is HRK 9 000 000 per year. However, this amount would no longer be necessary once a tax benefit eligibility model is designed, and these funds could then be expended for other measures that foster clean transport.

	Executive body	MMATI EPEEF – co-financing and publishing calls for tender MF – designing a model for tax benefit eligibility
	Monitoring bodies	CEI, in coordination with MMATI and MENP
Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored using the estimation method.
	Energy savings expected in 2016	170 TJ
	Expected impact on energy savings for 2020 (if applicable)	397 TJ
	Assumptions	Specified under the description of activities
	Overlapping, multiplication effect, synergy	Stimulating the installation of gas powered drives into motor vehicles will result in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions, as well as savings for the end user.

Title of the measure		**Developing an alternative fuel infrastructure**
Measure index		T.7
Description	Category	Infrastructure, strategic planning, regulations, organisation, information and mandatory measures
	Time frame	Start: 2014 End: 2030 Planned major modifications, amendments, improvements: New measure, regulatory measure
	Objective / outline	The objective of this measure is to facilitate the acceptance of alternative fuels by users/consumers by strengthening the alternative fuel distribution infrastructure and implementing common technical specifications for such infrastructure. The adoption of the legislative and national political framework for the development of alternative fuel infrastructure is planned by mid-2016, whereby strategic documents will be adopted, laying down plans for financial, technical, informative-educational and other measures which will enable market development of alternative fuels (electricity, compressed natural gas (CNG), liquefied petroleum gas (LPG), and hydrogen) and the construction of the accompanying infrastructure. The adoption of this document also fulfils one of the obligations imposed on the EU Member States by the Directive of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, which is currently in the final stage of adoption and which will lay down the minimum requirements for the development of alternative fuels infrastructure on the territory of the European Union. The Directive also lays down the necessity of harmonising the national programming frameworks among neighbouring Member States. One of the preparatory activities for the preparation of the Croatian National Programming Framework is the participation of the Republic of Croatia in an initiative of ten EU Member States for cooperation in drafting national programming frameworks.

		The national plan for the development of alternative fuels infrastructure will define actions, resource requirements, and deadlines. Programme implementation will be ensured through instruments, and directed by way of development objectives. The successfulness of the programme will be verified using indicators which show how the programme is progressing and where it should be amended. The promotional campaign, as well as financial incentives, must be accompanied by the development of CNG fuelling stations, which means that pilot projects must be implemented within the scope of promotion. This infrastructural measure will not have a direct impact on the reduction of fuel consumption in transport, but the development of infrastructure is definitely a necessary precondition for the development of a market for CNG powered vehicles in Croatia. The measures for reducing emissions from transport are regulatory, infrastructural and financial, all with the aim of developing a fuelling infrastructure for compressed natural gas (CNG) powered vehicles.
	Target final consumption	Road vehicles, vessels for inland navigation, maritime vessels
	Target group	
	Regional application	National
Information on implementation	List and description of activities for measure implementation	In February 2014, MMATI formed a working group for drawing up the National Policy Framework (NPF), the document which will analyse the current status of the infrastructure and market of alternative fuels in the Republic of Croatia, set objectives and design methods for achieving the objectives regarding infrastructure for vehicles powered by electricity, compressed natural gas, liquefied petroleum gas, and hydrogen, as well as promote the use of these types of fuel on the market of the Republic of Croatia. NPF will lay down plans for legislative, financial, technical, informative-educational and other measures for achieving these objectives. The working group for drawing up the NPF already includes ME, MENP, MFEA, CEI, industry representatives and representatives of infrastructure managers, and there are plans to include HERA, the scientific community and representatives of the local and regional self-government. The NPF is planned to be finalised by mid-2016. In parallel with the internal national consultations on all levels during the drafting of this document, the participation of Croatian representatives in the international 'Clean Power' project is also planned. The project was launched by the Republic of Austria and it currently includes 10 EU Member States, European cities through the Polis network, industry, as well as numerous European organisations involved in research on sustainable transport. The result of the project should be established guidelines for drawing up the national policy frameworks of the participating Member States. Project financing is planned by way of the European funds from Horizon 2020. Croatia is represented in the project by MMATI and the Croatian Association for Energetics. Full implementation of the measures featured in the NPF is planned by 2030, in accordance with the deadlines set by the Directive on the deployment of alternative fuels infrastructure. However, a more detailed development of measures resulting from the NPF is not possible before the NPF is adopted.

	Funds and financing sources	Funds and financing sources: EPEEF, LRSGUs (detailed funds will be estimated during the development of the campaign and the development programme), EU funds, possible co-financing by suppliers through changes to gas distribution tariff systems (HERA)
	Executive body	ME, MENP, MMATI, HERA, LRSGU
	Monitoring bodies	MMATI, MENP, ME, EPEEF
Energy savings	Method of monitoring/ measuring energy savings	To be determined.
	Energy savings expected in 2016	Cannot be estimated
	Expected impact on energy savings for 2020 (if applicable)	Cannot be estimated
	Assumptions	The development of infrastructure encourages the purchase of more energy efficient vehicles and vehicles with lower greenhouse gas emissions.
	Overlapping, multiplication effect, synergy	This measure has an impact on many industrial branches/sectors; to be defined

Title of the measure	**Intelligent transport management**	
Measure index	T.8	
Description	Category	Infrastructure
	Time frame	Start: 2011 End: 2020
	Objective / outline	Smart traffic lights, equipped with an autonomous power supply system from renewable sources (sun, wind) will contribute to the reduction of primary energy consumption, as well as the reduction of carbon dioxide and other harmful gas emissions. On the other hand, installing a visual indicator for the duration of the red light phase will contribute to raising the drivers' awareness of the possibility of deciding whether to turn off the engine while waiting in traffic at an intersection. Supporting the integration of such traffic lights into busy intersections will contribute to a systematic reduction of fuel consumption in transport by providing appropriate and timely information to drivers about the flow of an intersection, based on which a driver can decide on whether to switch the engine into start-stop mode.
	Target final consumption	Road vehicles
	Target group	LRSGUs – Cities Road vehicle drivers
	Regional application	National
Information on implementation	List and description of activities for measure implementation	The total daily fuel consumption of all vehicles in Croatia for waiting at traffic lights is estimated at 160 000 litres. There are currently about 1000 intersections with traffic lights in the Republic of Croatia. On average, approximately 160 litres of fuel are consumed every day per intersection due to unnecessary idling at traffic lights. The measure proposes a successive replacement of the existing traffic lights installed at 200 intersections by 2020. In such circumstances, the measure could reduce fuel consumption at busy intersections by up to 1 580 tonnes by 2016, or 9 320 tonnes by 2020.

	Executive body	LRSGUs and EPEEF (co-financing) – replacing traffic lights with smart, remote-controlled traffic lights
	Monitoring bodies	CEI, in coordination with MMATI and MENP
Energy savings	Method of monitoring/measuring energy savings	In order to evaluate the successfulness of measure implementation, the number of replaced traffic lights should be monitored. The effects, in the sense of energy savings, are covered by TD indicators for road transport in accordance with EC recommendations.
	Energy savings expected in 2016	156 TJ
	Energy savings expected in 2020	1 082 TJ
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

Title of the measure		**Introduction of a special motor vehicle tax based on CO_2 emissions**
Measure index		T.9
Description	Category	Financial instruments
	Time frame	Start: 2014
		End: 2020
		Planned major modifications, amendments, improvements: New measure
	Objective / outline	The introduction of special motor vehicle tax is a measure aimed at achieving the objective of reducing emissions from transport. Based on the 'polluter pays' principle, the model is calculated on the basis of CO_2 emissions from motor vehicles.
		The special tax is determined on the basis of the sales price or market value of a motor vehicle, CO_2 emissions expressed in grams per kilometre, engine volume in cubic centimetres and greenhouse gas emission levels.
		The motor vehicles which are powered exclusively by electricity are not subject to this tax, and the special tax amount for 'plug-in' hybrid electric vehicles is reduced by the percentage which corresponds to the vehicle's driving range in full electric mode.
Information on implementation		This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions.
	Target final consumption	Motor vehicles
	Target group	Vehicle buyers
	Regional application	National
	List and description of activities for measure implementation	The application and implementation of the measure is ensured by the adoption of the Act on Special Motor Vehicle Tax (NN No 15/13, 108/13)
	Funds and financing sources	Vehicle buyers
	Executive body	MENP and CVH
	Monitoring bodies	ME, Ministry of Finance, Ministry of Maritime Affairs, Transport and Infrastructure, MI in coordination with CEI

Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored by using the research method; Questionnaires distributed to vehicle buyers
	Energy savings expected in 2016	132 TJ
	Energy savings expected in 2020	310 TJ
	Assumptions	The introduction of the tax encourages the purchase of more energy efficient vehicles and vehicles with lower greenhouse gas emissions. The following assumptions were used: purchase of 40 000 passenger cars and 2 500 motorcycles per year, with an annual increase of 5 %; an average mileage of 12 000 km/year per passenger car, 5 000 km/year per motorcycle; it is assumed that 50 % of the purchased passenger cars that are subject to this Act will be diesel fuelled, and 50 % will be petrol fuelled. It is assumed that 20 % of buyers will choose vehicles with emissions that are 10 gCO_2/km lower than those they would have chosen if the special tax had not been introduced, and 20 % of buyers will choose vehicles with emissions that are 20 gCO_2/km lower. The duration of the measure is 8 years.
	Overlapping, multiplication effect, synergy	Stimulating the purchase of eco-vehicles results in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions. This measure is connected to the measure promoting the procurement of energy efficient vehicles, which additionally promotes the procurement of electric and hybrid vehicles.

3.5.2 Savings Resulting from Energy Efficiency Measures in Transport

Described above, individually for each measure.

3.5.3 Financing Energy Efficiency Measures in Transport

Described above, individually for each measure.

3.6 Promotion of Efficient Heating and Cooling (EED Article 14)

10–20 % of the total electricity consumed is used for cooling and air-conditioning purposes. The operation of cooling and air-conditioning systems in industry and building construction is one of the basic reasons behind the occurrences of peak loads in the electric power system, especially during the summer months. It is estimated that the cooling and air-conditioning market will quadruple in the next 5 years. The consumption of energy for cooling in European countries is estimated at 500 TWhc, with electricity consumption of 200 TWh. In Croatia, the consumption of energy for cooling is estimated at 5 TWhc and electricity consumption at 1.8 TWh.
The increase in energy consumption is followed by an increase in required electricity. An increase from 20 % (EU) to 50 % (Croatia) has been recorded in the last 10 years, which has been known to cause outages in the electric power system in Dalmatia in summer.

The measure introducing 'ice bank' is presented below as one of the solutions for the aforementioned problem. After the measure, Table 3–9 shows a calculation of savings to be achieved through the measure.

The operative principle of an 'ice bank' is based on the preparation and storage of cooling energy (ice) over night (in hydroelectric power plants) and its usage during the day. That achieves the following results:

1. Smaller devices, which impose lower loads on the electric power system, are used to generate cooling energy.
2. The existent systems that use cooling agents which damage the ozone layer are replaced with environmentally friendly ones.
3. In order to operate, the system uses only 30 % of electricity from classic fossil fuel power plants (0.376 $kgCO_2$/kWh) and 70 % from renewable energy sources or hydroelectric power plants (0 $kgCO_2$/kWh).

Title of the measure		**National programme for cooling energy accumulation in building construction**
Measure index		HC.1
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	The objective of this measure is to ensure financial support for legal and natural persons to invest in the reconstruction of existent cooling devices or installation of new ones, in tandem with cooling energy accumulation systems (cold water tanks, ice banks) in the field of building construction for littoral Croatia and in the industrial field throughout the territory of Croatia, with the objective of: • reducing peak loads in the electric power system; • favourably affecting the balance of electricity consumption for cooling and air-conditioning equipment; • reducing the size (capacity) of cooling devices; • reducing the cost of leasing operating energy capacity and the cost of operating energy; • achieving a higher cooling factor of a cooling device; • applying natural operative substances (NH3, CO_2, propane); • reducing the refill quantity of operative substances and consequently their leakage into and pollution of the environment.
	Target final consumption	Electricity consumption and reduction of power leases (reducing loads in the electric power system) in the cooling and air-conditioning sector.

	Target group	Consumers of cooling energy (cooling and air-conditioning sector): buildings intended for public use, hotels, commercial buildings, residential buildings, facilities for occasional stay (sports halls, concert halls, congress centres, etc.), food industry (dairy etc.), processing and petrochemical industry.
	Regional application	National (primarily littoral Croatia)
Information on implementation	List and description of activities for measure implementation	The minimum criteria for being awarded incentives are the installation of new cooling systems, or the replacement/reconstruction of existing electric-powered cooling systems or water coolers for the preparation of cold water for air-conditioning with new cooling energy storage systems. The tender procedure for awarding funds must prioritise those cooling devices that operate using natural operative substances (NH3, CO_2, propane and others) which do not cause ozone layer depletion and which are not categorised in the greenhouse gas group, i.e. which either do not have, or have very low, global warming potential (GWP). The tender procedure for awarding funds must prioritise those buildings that have already installed thermal insulation to their building envelope, and that have taken a systematic and comprehensive approach to the renovation or construction project (synergy of construction, mechanical engineering and electrical engineering measures). Furthermore, priority should be given to those entities who own old cooling systems and water cooler systems for cold water preparation which are at the end of their life cycle.
	Funds and financing sources	Planned funds by the end of 2016: • APN (drawing up the study and the Programme): HRK 350 000 • MCPP (programme co-financing) HRK 35 000 • EPEEF (co-financing the procurement of high-efficiency devices) HRK 14 500 000
	Executive body	APN – participates in the implementation and finances the drafting of the Programme and the study MCPP – conducts the drafting process of the Programme FSB (Department of Thermodynamics, Thermal and Process Engineering) – draws up the study and the Programme
	Monitoring bodies	CEI, in coordination with ME, MCPP and MENP
Energy savings	Method of monitoring/measuring energy savings	This measure will be monitored using the BU evaluation method. Project designers and/or contractors must clearly specify the data on the area and properties of the installed thermal insulation to the funding beneficiary, and the beneficiaries must then submit those data to the LRSGUs. LRSGUs are obliged to enter the summary data into the SMIV. The actual effects of the measure will be additionally monitored by way of the input of achieved consumption into the ISGE.
	Annual energy savings expected in 2016	180 TJ
	Annual energy savings expected in 2020	180 TJ

	Assumptions	It is assumed that 50 public and residential buildings, 10 facilities for occasional stay in littoral Croatia, and up to 5 food production and/or processing plants throughout the territory of Croatia will annually participate in the programme. It is assumed that this programme will be most successful in stimulating the installation of energy storage systems in facilities for occasional stay, followed by public sector buildings, facilities in the food production and processing industry, and finally in commercial and residential buildings. Peak loads in the electric power system grid occur in Croatia in the summer months when, due to the need for air-conditioning, the available cooling devices are put into operation nearly simultaneously. In order to cover those peak loads, thermal power plants characterised by high specific carbon dioxide (CO_2) emissions are put into operation. In view of the predicted growing trend of cooling energy requirements and, correspondingly, electricity requirements, the Republic of Croatia will be forced to build new power plants in the future. Instead of building new electric power capacities in order to meet the short-term peak requirements of cooling devices (several hours per day, from 13:00 to 16:00), the application of cooling energy storage systems is proposed in order to avoid the impact of cooling devices on the electric power grid. More than 40 % of installed electricity production capacities in Croatia are currently comprised of mazut or natural gas fired thermal power plants. In accordance with the Kyoto Protocol, the Republic of Croatia must reduce greenhouse gas emissions by 5 % in the next 4-year period. The application of cooling energy storage systems is expected to reduce CO_2 emissions in two ways: by reducing emissions in electric power production in electric power plants by transferring the consumption of cooling systems into night time, when renewable energy sources are used in hydroelectric power plants; and by reducing emissions by using natural operative substances in cooling devices instead of the fluorinated greenhouse gases (F-gases) which are being used today. The programme is expected to be implemented with the same intensity until the end of 2020.
	Overlapping, multiplication effect, synergy	This measure has some commonalities with the measure 'Connecting ISGE to the metering and charging systems of energy commodity and water suppliers' and 'Energy audits of heating and air-conditioning systems'.

Table 3–9. Calculation of savings achievable with the introduction of ice banks

Consumer	Number of facilities	Average cooling energy requirement	Annual cooling energy requirement [kWh]	Electricity consumption of existing systems [kWh]	CO_2 emissions of existing systems [kg]	Electricity consumption of ice bank systems [kWh]	CO_2 emissions of ice bank systems* [kg]
Residential and commercial buildings	50	60–80	40 000 000	11 428 571	4 297 143	9 714 286	1 084 114
Facilities for occasional stay	10	500–5000	15 000 000	4 285 714	1 611 429	3 642 857	406 543
Processing industry	5	1000–10 000	36 500 000	10 428 571	3 921 143	8 864 286	989 254
TOTAL			**91 500 000**	**26 142 857**	**9 829 714**	**22 221 429**	**2 479 911**
ANNUAL ENERGY SAVINGS	**3 921 428.57 kWh or 0.014 PJ**						
ANNUAL REDUCTION OF CO_2 EMISSIONS	**7 349 802.86 kg**						
ENERGY SAVINGS BY 2020	**84.7 TJ**						
REDUCTION OF CO_2 EMISSIONS BY 2020	**44 098 817.14 kg**						

* It is assumed that only 30 % of electricity is obtained from classic fossil fuel power plants (0.376 kg CO_2/kWh) and 70 % from renewable energy sources or hydroelectric power plants with specific CO_2 emissions of 0 kg CO_2/kWh.

3.6.1 Comprehensive Evaluation

In accordance with the Heat Energy Market Act (NN No 80/13), with the aim of achieving greater utilisation of the national thermal potential for heating and cooling, the Government of the Republic of Croatia will adopt the Programme on the utilisation of potential for heating and cooling efficiency for the 2016–2030 period. The Programme will be adopted by 1 July 2015.

The evaluation of the national heating and cooling potential should contain:

1. a description of development possibilities of thermal energy systems for heating and cooling by way of increasing energy consumption and/or renovating existing infrastructure;
2. estimates of how the specified consumption will change in the next 10 years, especially taking into account the growth of demand in buildings and various industrial sectors;
3. a map of the Republic of Croatia with areas denoting the following, while preserving commercially sensitive information:
    - locations of thermal energy consumption for heating and cooling, including municipalities and cities with a degree of development of at least 0.3 and industrial zones where total annual thermal energy consumption for heating and cooling exceeds 20 GWh;
    - the existing and planned infrastructure for district heating and cooling;
    - possible thermal energy supply locations for heating and cooling, including electric power plants whose total annual electricity production exceeds 20 GWh, waste incineration plants and existing and planned cogeneration plants which use technologies laid down by the regulations governing energy efficiency and plants for closed and district thermal systems;
4. determine the demand for thermal energy for heating and cooling which can be met through high-efficiency cogeneration, including micro-cogeneration in the housing sector, in closed and district thermal systems;
5. determine the potential for additional high-efficiency cogeneration by way of converting existent or building new production and industrial plants or other plants that produce waste heat;
6. determine the potential for increasing energy efficiency of the infrastructure for closed and district thermal systems;
7. strategies, policies and measures that can be adopted by 2020 and 2030 in order to realise the potential for additional high-efficiency cogeneration by way of converting existent and building new production and industrial plants or other plants that produce waste heat, in order to meet the demand for thermal energy for heating and cooling which can be met through high-efficiency cogeneration, including proposals for the following:
    - increasing the share of cogeneration in thermal energy consumption for heating and cooling and in electricity production. That may include proposals endorsing the grouping of a certain number of individual plants at the same location in order to ensure optimum harmonisation of supply and demand for thermal energy for heating and cooling;
    - developing the infrastructure for efficient closed and district thermal systems in order to enable the development of high-efficiency cogeneration and the use of thermal energy for heating and cooling obtained from waste heat and renewable energy sources;
    - encouraging the installation of new thermal power plants and industrial plants that generate waste heat at such locations at which the maximum quantity of available waste heat could be used to satisfy the existent or planned demand for heating and cooling;
    - encouraging the establishment of new residential zones or new industrial plants which use thermal energy in their production processes at such locations at which available waste heat, as established

by comprehensive evaluation, may contribute to meeting their demand for heating and cooling. That may include proposals endorsing the grouping of a certain number of individual plants at the same location in order to ensure optimum harmonisation of supply and demand for thermal energy for heating and cooling;

- encouraging the connection of thermal power plants, industrial plants that generate waste heat, waste incineration plants and other plants for the production of energy from waste to closed and district thermal systems;
- encouraging the connection of residential zones and industrial plants that use thermal energy in their production processes to closed and district thermal systems;

8. the share of high-efficiency cogeneration and the determined potential, as well as the progress made in accordance with the regulations governing energy efficiency;

9. an estimate of the expected savings of energy commodities;

10. an estimate of public support measures for heating and cooling, if they were adopted, with an annual budget, and determining possible support elements. This would not call into question a separate notification on public support programmes for evaluating support.

The comprehensive evaluation may be comprised of a group of regional or local plans and strategies, under the appropriate measure.

The measures for reducing the energy consumption of combined heat and power plants owned by HEP d.d. are presented in chapter 3.7.1.

Title of the measure		**Energy audits of heating and air-conditioning systems**
Measure index		HC.2
Description	Category	Regulations
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: The measure was not systematically implemented in the previous period, other than within the scope of mandatory implementation of energy audits for the purpose of energy certification of buildings, and within the scope of EPEEF financing of energy audit implementation. The relevant regulations were adopted only in early 2011, so a more substantial implementation and results are expected in the forthcoming period.
	Objective / outline	A large percentage of heating and air-conditioning systems is old, malfunctioning, and therefore wasting great amounts of energy. In line with the EPBD II requirements, regulations were adopted laying down the obligation of regular audits of heating and air-conditioning systems, by way of which users will be issued clear recommendations for improving the energy efficiency of such systems.

	Target final consumption	Heating and air-conditioning systems in existent buildings
	Target group	Building occupants
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: 1. In order to reduce the costs of energy certification and audits of heating and air-conditioning systems, there are plans to harmonise the methodology for conducting audits of heating and air-conditioning systems and the methodology for conducting energy audits performed for the purpose of energy certification of buildings. In the following period it is therefore required that, once the methodology for conducting energy audits of heating and air-conditioning systems of buildings is harmonised, the training programme and requirements for the persons conducting regular audits of heating and air-conditioning systems be harmonised with the programme and requirements laid down by the Rules on conditions and criteria for persons who perform energy audits and energy certification of buildings. The harmonisation will include the amendments to the Rules on authorisations for energy audits of structures and the Act on Efficient Energy Use in Final Consumption. 2. The implementation of the aforementioned obligation should be enforced in the following period by way of increased inspections. 3. An issue regarding implementation is the lack of data on the number of systems that are subject to this obligation. It is therefore necessary to start implementing this obligation in those buildings which are subject to the obligation of energy certification and energy management (primarily in the public sector), and it is necessary to create a database of such systems. To that end, when allocating financial support (especially via EPEEF), it is required to provide data on the heating and air-conditioning systems of the buildings which are beneficiaries of such support.
	Funds and financing sources	Planned funds by the end of 2016: • ME and MCPP: within the scope of regular activities • EPEEF (co-financing energy audits)
	Executive body	MCPP and ME – harmonising regulations EPEEF – ensure co-financing
	Monitoring bodies	MCPP (administrative supervision of the enforcement of the provisions of relevant rules, keeping a database of systems that are subject to the obligation)
Energy savings	Method of monitoring/ measuring energy savings	A national BU methodology for monitoring the effects of energy audits has been developed as a measure for providing information on energy savings potentials. The details are specified in the document 'Measuring and Verification of Energy Savings Using the Bottom-Up Method'. Since inspections will generally be an integral part of energy audits, their results will be included with the overall results of energy audits.
	Energy savings expected in 2016	Not estimated
	Expected impact on energy savings for 2020	Not estimated
	Assumptions	Energy savings resulting from the energy audit itself are determined

		on the basis of evaluated potentials presented in the final report of the energy audit. It is assumed that at least 5 % of those potentials will be achieved. Certain European recommendations[6] contain significantly higher assumptions (20 % for electricity and 15 % for other forms of energy), but they will not be used because they take into account only the effect of raised awareness of users which would result in better maintenance and management procedures ('soft measures') by means of which energy savings are achieved. The effects of implemented energy efficiency investment projects are not taken into account when evaluating this measure.
	Overlapping, multiplication effect, synergy	This measure could overlap with a series of measures that provide for energy audit implementation. If an inspection was conducted within the scope of building certification, its effects will be shown within the scope of that measure. If an inspection was conducted as an integral part of an energy audit aimed at energy management, its effects will be shown within the scope of relevant measures. Only in those cases when a system inspection is conducted separately, without a general energy audit of a building, will the effect be assigned to this measure.

3.6.2 Individual Installations

Pursuant to the Heat Energy Market Act (NN No 80/13), a cost-benefit analysis will be made in accordance with the provisions of the regulations governing energy efficiency in the following cases:

1. when planning a new combined heat and power plant with total thermal power exceeding 20 MW, in order to evaluate the costs and benefits of ensuring that the plant operates as a high-efficiency cogeneration plant;

2. when undertaking a substantial reconstruction of an existing combined heat and power plant with total thermal power exceeding 20 MW, in order to evaluate the costs and benefits of converting it into a high-efficiency cogeneration plant;

3. when planning or undertaking a substantial reconstruction of an industrial plant which generates waste heat at a useful temperature level, with total thermal power exceeding 20 MW, in order to evaluate the costs and benefits of utilising waste heat in order to meet economically viable demand, including by way of cogeneration and connection of such a plant to closed and district heating systems;

4. when planning new closed and district heating systems, or if a new energy production plant with total thermal power exceeding 20 MW is planned within the existent closed and district heating systems, or if such an existing plant is undergoing substantial reconstruction, in order to evaluate the costs and benefits of utilising waste heat from neighbouring industrial plants.

The cost-benefit analysis is based on climate conditions, economic feasibility, and technical suitability in the sense of sources and costs and most efficient solutions for meeting the demand for heating and cooling.

3.7 Energy Transformation, Transmission, Distribution, and Demand Response

Title of the measure		**Improving efficiency by reducing the energy consumption of hydroelectric power plants (HPP), thermal power plants (TPP), and combined heat and power plants (CHPP) within the HEP Group**
Measure index		E.1
Description	Category	Production of electricity and/or heat energy – in HPP, TPP and CHPP of the HEP Group
	Time frame	Start: 2014 End: 2016 Reduction of own consumption by way of replacements and reconstructions in HEP Group power plants
	Objective / outline	A reduction of own and general consumption directly contributes to increasing efficiency. It is based on undertaking measures and activities in the process of planning and managing electricity and heat energy production, and implementing a plan on replacing and reconstructing production plants, primary and secondary equipment in power plants and associated subsystems. A reduction of own consumption entails a contribution to the reduction of primary energy and fuel consumption in certain production units and associated subsystems, and it pertains to measurability and comparison of new and previous energy and fuel consumption indicators after measures and activities have been undertaken in direct production of electricity and/or heat energy. Reduction of general consumption in power plants also entails energy and fuel savings, and the said savings do not pertain to an individual production unit (generator in HPP, block or boiler in TPP and CHPP) but to the power plant as a whole. The greatest contribution to reducing own and general consumption, or to improving efficiency from the aspect of energy and fuel consumption, is achieved through replacements and reconstructions of primary and secondary equipment in HPP, TPP and CHPP plants, even though the primary aim of replacements and reconstructions of production plants is to improve the supply security of electricity and heat energy while optimising, reducing operating costs and maintenance costs. A reduction of operating costs also includes a reduction of energy and fuel costs, i.e. own consumption, while a reduction of general consumption contributes to the reduction of production unit availability costs. The installation of new equipment increases the degree of efficiency of blocks and boilers, with possible improvements of technical properties of production units (regulation, start-up time). Increasing the degree of efficiency of blocks and boilers is based on the benefits of using modern technology in designing, producing and installing back-up equipment into TPPs and CHPPs, and on the further improvement of the process of optimising and managing the operation of blocks and boilers in TPPs and CHPPs. Due to the inevitable process of rapid ageing of primary equipment and accompanying plants in HPPs, and blocks or boilers with accompanying plants and subsystems in TPPs and CHPPs, it is necessary to perform timely and high-quality replacements and reconstructions of plants and equipment at the end of their life cycle or start of reduced efficiency, in order to extend the remaining life cycle and increase the efficiency of production units and accompanying technological systems. In addition to improving availability and energy efficiency, replacements and reconstructions of TPP and CHPP equipment also comply with environmental protection obligations. Since the effects of reducing the plants' own consumption by way of replacements and reconstructions in process systems greatly exceed the contributions to efficiency improvements in business systems (lighting reconstruction, optimising heating and cooling systems, insulation of commercial buildings), this document will prioritise the analyses of savings in production

		plants' own consumption.
	Target contribution to improving efficiency by reducing own consumption in production activities	The basic objectives of production activities are electricity supply security and ensuring appropriate reserves of power and energy for managing the Croatian EPS, as well as the heating energy supply security of district heating systems in Zagreb, Osijek and Sisak, while minimising fixed and variable production costs in HPPs, TPPs and CHPPs within the HEP Group. Production efficiency improvements in HPPs, TPPs and CHPPs can also be achieved by reducing a power plant's own consumption, which directly reduces the operating costs of consumption of electricity or heat energy produced or taken from the grid, as well as fuel procurement costs, costs of purchasing emission units and other variable costs of HPPs, TPPs and CHPPs. This document contains a detailed description of the purpose, implementation plan, costs of planned replacements and reconstructions, and expected effects regarding the improvement of energy efficiency by reducing own consumption in individual power plants by applying certain measures and activities pursuant to the adopted Investment Plan for HEP-Proizvodnja d.o.o. for 2014, which is based on 5-year plans for HEP-Proizvodnja, i.e. the Work Programme for HEP-Proizvodnja d.o.o. for the 2012–2016 Period.
	Target group	HEP Group HPPs, TPPs and CHPPs (HPP generators, TPP and CHPP blocks and boilers)
	Regional application	National
Information on implementation	List and description of activities for implementing planned measures and activities	**<u>Future activities:</u>** 1. **Refurbishment of the back-up generator stator with replacement in HPP Čakovec (2013–2015)** The construction and replacement of the generator stator for generator B in HPP Čakovec has been contracted. The subject of the contract is as follows: drawing up a construction design for the refurbishment of the generator stator in HPP Čakovec, repairs of the existent stator frame, construction of a new stator pack, construction of new stator bars, keying bars into slots by applying a new keying method detailed in the refurbishment project, evaluate the condition of the entire generator B and repair and replace worn out and damaged generator parts which will be demounted, and finally mounting the refurbished generator. After the mounting works are completed, operative testing of the refurbished generator B is planned, with test operation in the spring of 2015. 2. **Reconstruction of pumped-storage HPP Fužine (2013–2016)** The second stage of reconstruction of PSHPP Fužine includes: designing the reconstruction of the entire PSHPP Fužine (2014); publishing a public call for tender for the replacement of the motor generator in PSHPP Fužine with all the accompanying control, measuring, protection and signalling parameters (2015), including the construction of an adjustable intake device for the pump and construction work on the lower water intake (2015). In 2016, it is planned to replace the motor-generator, the intake hydraulic section, and all the shafts of the pump-turbine generator in PSHPP Fužine. The start of test operation of the reconstructed PSHPP Fužine is expected in the autumn of 2016.

		3. **Reconstruction of own consumption of block C in CHPP Zagreb (2013–2015)** The further steps in the reconstruction of RP 6.3 kV block C are: demounting a section of the installed RP 6.3 kV equipment, delivery and installation of back-up primary and secondary RP 6.3 kV equipment, functionality testing and test operation of the 6.3 kV plant in accordance with the turnkey scheme. Test operation of the reconstructed RP 6.3 kV plant of block C is planned for late 2015 or early 2016. 4. **Reconstruction of transformer TR3 110/30 kV 60 MVA (2013–2014)** Construction works on the repairs of transformer box TR3 and its cable ducts, as well as the factory reconstruction of TR3, are currently in course, to be followed by transport from the factory to CHPP Zagreb, installation of TR3 with accompanying secondary equipment and fire protection, drawing up of the as-built state design, final testing and test operation, and TR3 handover. 5. **Reconstruction of hot water boilers VK-3 and VK-4 in CHPP Zagreb (20142015)** Tender documentation for procurement procedure requirements for the reconstruction has been prepared. Contracting the reconstruction of VK-3 and VK-4 and the start of preparatory works has been planned for 2014, and the reconstruction and test operation is planned for 2015. 6. **Reconstruction of own electricity consumption in CHPP Osijek (2013–2015)** The following activities have been planned for conducting the reconstruction project of CHPP Osijek's own consumption: expansion of the 110 kV plant, installation of 110/6.3 kV transformation and 35/6.3 kV transformation, construction of the main 6.3 kV distributor at power plant level, construction of a 6.3 kV plant for hot water station requirements. The deadline for the reconstruction is autumn 2015.
	Funds and financing sources	1. **Refurbishment of the back-up generator stator with replacement in HPP Čakovec (2013–2015)** • HEP: HRK 463 280 by 31 December 2013 • HEP: HRK 6 100 000 in 2014 • HEP: HRK 5 981 720 in 2015 **Total: Refurbishment of the back-up generator stator with replacement in HPP Čakovec: HRK 12 545 000 (EUR 1 635 200)** 2. **Reconstruction of pumped-storage HPP Fužine (2013–2016)** • HEP: HRK 1 616 887 by 31 December 2013 • HEP: HRK 1 370 000 in 2014 • HEP: HRK 20 350 000 in 2015 **Total: Reconstruction of PSHPP Fužine: HRK 23 336 887** **3. Planned funds for the reconstruction of own consumption of block C in CHPP Zagreb** • HEP: HRK 5 000 000 by 31 December 2013 • HEP: HRK 10 000 000 in 2014 • HEP: HRK 10 000 000 in 2015

		Total: Reconstruction of own consumption of block C: HRK 25 000 000 (EUR 3 257 900) 4. **Planned funds for the reconstruction of TR3 110/30 kV 60 MVA (2013-2014)** (design, TR3 reconstruction, equipment procurement and installation, testing, test operation) - HEP: HRK 10 000 000 by 31 December 2013 - HEP: HRK 4 762 000 in 2014 **Total: Reconstruction of TR3 60 MVA in CHPP Zagreb: HRK 14 762 000 (EUR 1 942 500)** **5. Planned funds for the reconstruction of VK-3 and VK-4 in CHPP Zagreb (20142015)** (design, equipment procurement and installation, supervision of installation, test operation) - HEP: HRK 2 000 000 in 2014 - HEP: HRK 38 000 000 in 2015 **Total: Reconstruction of VK-3 and VK-4 in CHPP Zagreb: HRK 40 000 000** **6. Planned funds for the reconstruction of own consumption in CHPP Osijek (2013–2015)** (design, equipment procurement and installation, supervision of installation, testing, test operation) - HEP: HRK 171 000 by 31 December 2013 - HEP: HRK 10 755 000 in 2014 - HEP: HRK 20 000 000 in 2015 **Total: : Reconstruction of own consumption in CHPP Osijek: HRK 30 926 000**
	Executive body	**HEP-Proizvodnja d.o.o., Hydroelectric power plant sector (1–2), Thermal power plant sector (3–6)**
	Monitoring bodies	CEI, in coordination with HEP d.d.
Energy savings	Method of monitoring/measuring energy savings	1. Comparison of achieved availability before and after replacing the generator stator on generator B, or comparison of electricity produced in comparable hydrological circumstances with this generator and with back-up generator B at HPP Čakovec. 2. Comparison of turbine and pump operating modes at PSHPP Fužine under hydrologically similar conditions, i.e. contribution to peak and regulation operation of HPP Vinodol before and after the reconstruction of PSHPP Fužine. In current conditions, PSHPP Fužine annually pumps approximately 8.3 million m^3 into the Lokve storage reservoir, or saves the said volume of water from overflowing, i.e. if we reduce the direct contribution of the pump and turbine operating modes at PSHPP Fužine to the potential production of HPP Vinodol, it would amount to approximately 13 GWh. It is assumed that the efficiency of the reconstructed PSHPP Fužine will increase by 5 %, i.e. reduced to HPP Vinodol, a production of 13.65 GWh will be ensured. 3. Comparison of transformation losses in general and own consumption before and after reconstruction of the 6.3 kV plant of block C in CHPP Zagreb, as well as data on the statistics of operating events in order to compare the unavailability of RP 6.3 kV. 4. By comparing TR3's own consumption before and after reconstruction, as well as evaluating the reduction of electricity consumption for transformer cooling, guideline indicators of savings

		in TR3's own consumption can be determined. Transformer test sheets certified by the manufacturer and the registered loads of TR3 are the basis for estimating savings in TR3's own consumption, or for estimating the extent to which the reconstruction contributed to improving efficiency. 5. Analysis of increased availability and efficiency of VK-3 and VK-4 in CHPP Zagreb before and after the reconstruction of peak boilers. 6. Analysis of the calculation of electricity consumption and auto-consumption in CHPP Osijek before and after the reconstruction of RP 6.3 kV and its transformers.
	Expected savings from reducing primary energy consumption in electricity and heat energy production in 2016	1. **The refurbishment of the back-up generator stator with replacement in HPP Čakovec will contribute to increasing the operating availability of generator B for an estimated 100 hours of operation per year which, in view of average annual production, will contribute to the reduction of required energy for own and general consumption in the amount of ≈ (100/(2 x7 500) x 318) ≈ 2.1 GWh/year.** 2. **A direct contribution of the pump and turbine operating modes at PSHPP Fužine is expected after the reconstruction which, when reduced to HPP Vinodol, will amount to an increase of 0.65 GWh/year. The start of test operation of PSHPP Fužine is planned for 1 October 2016, and therefore the estimated savings for 2014 amount to 0.4 x 0.65 ≈ 0.26 GWh.** 3. **The estimated savings from the reconstruction of RP 6.3 kV block C at CHPP Zagreb amount to 0.2 GWh/year, and the indirect contribution is the increased availability of the 6.3 kV plant, i.e. the operating safety of block C. The start of operations of the reconstructed RP 6.3 kV is planned for late 2015 or early 2016, at the latest.** 4. **The estimated savings of electricity consumption from the reconstruction of TR 3 110/30 kV 60 MVA at CHPP Zagreb are 1 GWh/year.** 5. **The estimated savings from the reconstruction of VK-3 and VK-4 at CHPP Zagreb are based on the increased number of operating hours of boiler plants (Δ≈ 500 operating hours per boiler, i.e. the savings for both boilers ≈ 3 000 m^3/h, which is an equivalent of primary energy savings from natural gas of 3 million m^3 of natural gas for both boilers or 27.78 GWh in natural gas).** 6. **The reconstruction of the RP 6.3 kV plant and the installation of appropriate transformers will reduce the losses in own and general consumption in CHPP Osijek. The expected reduction is estimated at 5 % of the electricity consumed at CHPP Osijek. Since the estimated own and general consumption at CHPP Osijek amounts to approximately ≈ 2.2 GWh/year, the estimated reduction of own and general consumption for 2016 is 0.1 GWh/year.** **Conclusion:** **Reduction of own consumption at HPPs, TPPs and CHPPs** by way of previously planned measures and activities, i.e. reconstructions at HPPs, TPPs and CHPPs is estimated at:

		Savings in natural gas consumption 27.78 GWh/year→ **≈ 27.8 GWh/year.** Direct and indirect savings in electricity consumption: 3.66 → **≈ 3.7 GWh/year.**
	Expected impact on energy savings for 2020	1. **The refurbishment of the back-up generator stator with replacement in HPP Čakovec will contribute to the cumulative reduction of the need for own and general consumption in the amount of 8.4 GWh for the 2017–2020 period.** 2. **The planned cumulative savings from the reconstruction of PSHPP Fužine amount to approximately 2.6 TWh for the 2017–2020 period.** 3. **The reconstruction of RP 6.3 kV block C at CHPP Zagreb will enable cumulative savings of electricity consumption amounting to 0.8 GWh for the 20172020 period.** 4. **The estimated savings from the reconstruction of TR3 110/30 kV 60 MVA at CHPP Zagreb will enable cumulative savings of electricity amounting to ≈ 4 GWh for the 20172020 period.** 5. **The reconstruction of hot water boilers VK-3 and VK-4 will enable them to remain operational after 2018 ('environmental permit' conditions), and the estimated cumulative savings of natural gas consumption are ≈ 12 million m^3 or 111 GWh in natural gas for the 2017–2020 period.** 6. **The reconstruction of the RP 6.3 kV plant and the installation of appropriate transformers will reduce the losses in own and general consumption in CHPP Osijek. The estimated cumulative savings in own and general electricity consumption for the 2017–2020 period are 0.4 GWh.** **Conclusion:** **The cumulative reduction of own primary energy consumption at HEP Group HPPs, TPPs and CHPPs for the 2017–2020 period** is estimated as follows: Cumulative savings in natural gas consumption: 27.78 GWh/year→ **≈ 111.1 GWh** Cumulative savings in electricity consumption: 3.66 GWh/year → **≈ 16.2 GWh.**
	Assumptions	Ensuring sufficient funds through the Annual Investment Plan for HEP-Proizvodnja, and the performance of activities by contractors in accordance with the planned/contracted scope of equipment procurement and installation, and performance of other necessary works within the legally binding deadlines.
	Overlapping, multiplication effect, synergy	No significant factors which can impact the planned performance of the aforementioned activities aimed at improving energy efficiency are expected during the reconstruction of HEP Group HPP, TPP and CHPP plants. There is no overlapping with other measures.

Title of the measure	**Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group**

Measure index		E.2
Description	Category	Electricity production – hydroelectric power plants
	Time frame	Start: 2014 End: 2016 Multi-annual stages of revitalising existent HPPs and SHPPs
	Objective / outline	The revitalisation of older HPPs entails replacement of primary and secondary equipment in order to increase the operational readiness of power plants and the availability of generators, while increasing installed power and future production. In other words, revitalisation directly contributes to increasing energy efficiency. Revitalisation increases the degree of efficiency of generators and of a power plant as a whole, with possible increases of daytime and peak production which is significant from the energy production viewpoint. By increasing power, some of the night-time production can be shifted to daytime production. Due to the inevitable diminishment of the remaining life cycle of the existent, generally older small hydroelectric power plants (SHPPs), HEP-Proizvodnja is planning to revitalise, i.e. replace production units and reconstruct small hydroelectric power plants in order to retain operational readiness and increase energy efficiency. Increasing the overall degree of power plant efficiency is based on the contribution of new technologies in the design, production and installation of primary equipment, and in optimising power plant operation management. Although revitalisation increases the power and future production of HPPs and SHPPs, an increase of their environmental impact is not expected, i.e. the current environmental protection requirements are taken into account.
	Target contribution to more efficient electricity production	Increasing electricity production from the available hydro-potential in order to improve operating safety of HPPs and SHPPs, increase the share of RES in electricity production, and continue improving the energy efficiency of existent hydro-power structures.
	Target group	Constructed HPPs and SHPPs
	Regional application	National
Information on implementation	List and description of activities for measure implementation	**Future activities:** 1. **Dispatch Centre for Production in Dalmatia** Equipment of hydrological stations and entry of hydrological measurements for RHPP Velebit and HPP Dubrovnik into the remote management system of the Dispatch Centre for Production in Dalmatia (CSRCE), upgrading process-communication nodes when required. 2. **Stage revitalisation of HPP Zakučac (2012–2016)** Continue the revitalisation of HPP Zakučac, replace generator C in 2014 and generator D in 2015. Other activities (process systems and auxiliary plants), as-built state documentation, and obtaining the remaining building inspection certificates are planned by the end of 2016. 3. **Stage revitalisation of HPP Dubrovnik (2012–2015)** Continue the revitalisation of HPP Dubrovnik, start replacement works on generator A in June 2014, to be finalised in early 2015. Test operation of generator A is planned for spring 2015. In 2014 and 2015 it is planned to continue the replacement of secondary equipment and auxiliary plants, as well as the reconstruction of MV and LV distribution at HPP Dubrovnik. 4. **Installation of back-up generator at SHPP with low head hydro power (LHHP) HPP Varaždin (2013–2015)**

		The installation of the back-up generator at SHPP LHHP HPP Varaždin is planned for 2014, with test operation in early 2015. The increase of back-up generator power from the previous 450 kW to 635 kW (≈ 0.6 MW) is based on the intake structure and the optional increase of production by installing more efficient equipment within the scope of the prescribed environmental impact requirements. The planned production after the installation of the back-up generator is 5 GWh/year. Furthermore, there are plans to acquire the eligible producer status and join the system of incentives.
	Funds and financing sources	**1. Planned funds for the Dispatch Centre for Production in Dalmatia** - HEP: HRK 36 485 000 (EUR 4 800 000) by 31 December 2013 - HEP: HRK 720 000 (EUR 94 000) in 2014 - HEP: HRK 1 350 000 (EUR 175 000) in 2015 **Total: Dispatch Centre for Production in Dalmatia: HRK 38 555 000 (EUR 5 070 000)** **2. Planned funds for the revitalisation of HPP Zakučac (538 MW)** - HEP: HRK 571 205 987 by 31 December 2013 - HEP: HRK 114 080 000 in 2014 - HEP: HRK 170 000 000 in 2015 - HEP: HRK 76 714 013 in 2016 - Total HEP: costs of the revitalisation of HPP Zakučac and investment documentation - Revitalisation of the generator and equipment HRK 932 000 000 - Investment documentation HRK 65 000 000 **Total: Revitalisation of HPP Zakučac with investment documentation: HRK 997 000 000** **3. Planned funds for the revitalisation of HPP Dubrovnik (236 MW)** equipment replacement and refurbishment - HEP: HRK 168 300 685 by 31 December 2013 - HEP: HRK 18 200 000 in 2014 - HEP: HRK 75 517 000 in 2015 - Total HEP: costs of revitalization of HPP Dubrovnik with documentation - Equipment replacement and refurbishment HRK 262 000 000 **Total: Revitalisation of HPP Dubrovnik with investment documentation: HRK 262 000 000** **4. Planned funds for the installation of back-up generator at SHPP LHHP HPP Varaždin (0.6 MW)** (design, equipment installation and procurement, connection, supervision of installation, test operation) - HEP: HRK 800 000 by 31 December 2013 - HEP: HRK 6 500 000 in 2014 - HEP: HRK 4 700 000 in 2015 **Total: Back-up generator at SHPP LHHP HPP Varaždin: HRK 12 000 000**
	Executive body	**HEP-Proizvodnja d.o.o., Hydroelectric power plant sector**
	Monitoring bodies	HEP d.d. and CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	1. Comparison of annual production in similar hydrological circumstances at annual level for periods before and after establishing the Dispatch Centre for Production in Dalmatia. 2. Comparison of increased engaged power and electricity produced before and after the revitalisation of HPP Zakučac, comparison of contributions to secondary regulation before and after revitalisation, comparison of the number of hours of operational readiness and availability of production units, and the reduction of corrective maintenance costs. 3. Comparison of increased engaged power and electricity produced before and after the revitalisation of HPP Dubrovnik, comparison of contributions to automatic secondary regulation – new regulation

		service, comparison of the number of hours of operational readiness of the power plant and the availability of production units, as well as the reduction of corrective maintenance costs before and after the revitalisation of HPP Dubrovnik. 4. Calculated data from the metering of electricity production and consumption at the interface of SHPP LHHP HPP Varaždin and the distribution grid. Comparison with data on the electricity produced by 2010, in the period before the breakdown of the generator.
	Expected savings due to increased electricity production in 2016	1. **Dispatch Centre for Production in Dalmatia,** indirect effect of plant optimisation by **increasing the production at HPPs in Dalmatia by 5 GWh/year.** 2. **The revitalisation of HPP Zakučac is expected to increase production by 58 GWh/year** in average hydrological years; to increase the power of the plant by 52 MW in late 2016; and to increase daytime and peak production by approximately 10 %. 3. **The revitalisation of HPP Dubrovnik is expected to increase production by 96 GWh/year** under average hydrological circumstances; to increase the power of the plant by 20 MW in early 2016; and to increase daytime and peak production by up to 15 %. 4. **With the installation of the back-up generator at SHPP LHHP HPP Varaždin**, it is planned to restart electricity production at the natural minimum flow level of HPP Varaždin amounting to **5 GWh/year**, starting from 2015. Total: 164 GWh/year
	Expected impact on energy savings for 2020	1. Dispatch Centre for Production in Dalmatia **20 GWh** (cumulative for the 2017–2020 period) 2. Revitalisation of HPP Zakučac **232 GWh** (cumulative for the 20172020 period) 3. Revitalisation of HPP Dubrovnik **384 GWh** (estimated cumulative contribution for the 2017–2020 period) 4. Installation of the back-up generator at SHPP LHHP HPP Varaždin **20 GWh** (estimated cumulative contribution for the 2017–2020 period) Total: 656 GWh/year.
	Assumptions	Achieve at least average hydrological circumstances; ensure planned funds to finalise the equipment of the Dispatch Centre for Production in Dalmatia; complete revitalisation stages of specified HPPs and SHPPs; contractors complete activities in accordance with the planned/contracted scope of equipment procurement and installation within the legally binding deadlines.
	Overlapping, multiplication effect, synergy	No significant factors which can impact the planned performance of the aforementioned activities aimed at improving energy efficiency are expected during the revitalisation of existent HPPs and SHPPs. This measure is an extension of the measure 'Improving efficiency by reducing the energy consumption of hydroelectric power plants (HPP), thermal power plants (TPP), and combined heat and power plants (CHPP) within the HEP Group', but it emphasises caution regarding double planning (interventions on the same power plants under both measures).

Title of the measure		**Improving energy efficiency in oil research and production**
Measure index		E.3
Description	Category	Oil research and production
	Time frame	Start: 2014 End: 2016
	Objective / outline	Achieving energy efficiency in oil and gas production
	Target final consumption	Electricity consumption, heat energy consumption, gas consumption
	Target group	Gas processing facilities (GTP) Molve, fractionation plants Ivanić Grad (FPIG) Ivanić Grad
	Regional application	National
Information on implementation	List and description of activities for measure implementation	1. Upgrading the hydraulic turbine for the recovery of fluid flow energy in the gas processing system at GTP Molve with 700KW power. 2. Optimising the heating system at GTP Molve by using low-pressure steam with lower steam losses, savings of ca. 8 t/h. 3. Construction of the system for the optimum regulation of the medium and energy during gas fractionation in Ivanić Grad. 4. Optimising gas compression at FPIG Ivanić Grad with regard to reduced capacities, power reduced by 400 kW. 5. Construction of a hot oil system by using waste heat from the gas turbines at FPIG Ivanić Grad. 6. Optimising the low temperature extraction of heavier hydrocarbon fractions at GTP Molve, power reduced by 50 kW. 7. Optimising heating from oil production at the Žutica fields by replacing boiler rooms, reduced by 150 kW. 8. Self-production of electricity in Ivanić Grad. 9. Utilisation of gas from low-pressure oil separation at Žutica. Expected savings in the period 2014 - 2016: 106.6 GWh
	Funds and financing sources	Planned funds: INA business plans
	Executive body	INA d.d.
	Monitoring bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring energy savings	Implementation of activities; reduced consumption amounts of electricity, energy commodities; as well as reduced emissions from the oil production process and gas production and refining process, as specified in the Energy Balance of the Republic of Croatia per product unit and in the Environmental Pollution Register at the Croatian Environment Agency.
	Energy savings expected in 2016	0.38 PJ (35.5 GWh in 2014, 2015 and 2016)
	Expected impact on energy savings for 2020	0.38 PJ (additional measures for the 2017 - 2020 period have not been determined)
	Assumptions	Successfulness of projects with continuous operation of production fields and, consequently, continuous operation of GTP Molve and FPIG Ivanić Grad.

	Overlapping, multiplication effect, synergy	This measure will primarily affect oil and gas production processes.

Title of the measure		**Improving energy efficiency in oil refining**
Measure index		E.4
Description	Category	Oil refining
	Time frame	Start: 2014 End: 2016
	Objective / outline	INA will continue activities aimed at improving energy efficiency, reducing the environmental impact, and reducing losses in the refineries in Rijeka and Sisak.
	Target final consumption	Electricity consumption, heat energy consumption, liquid fuel consumption, gas consumption
	Target group	Rijeka and Sisak refineries
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Rijeka Oil Refinery: • Improvement of the condensate collection and return system • Recovery of gas from the flare system • Analysis and improvement of existing process furnaces and boilers • Replacement of lighting and installation of LED technology • Analysis and improvement of existent heat exchangers • Integration and improvement of heat recovery • Improvement of energy consumption metering, monitoring and control • Construction of a TS 110/35 kV substation • Analysis and upgrade of existing equipment (e.g. frequency regulator installations) Expected savings in the period 2014 - 2016: 535.1 GWh <u>Sisak Oil Refinery:</u> • Improvement of the condensate collection and return system • Recovery of gas from the flare system • Analysis and improvement of existing process furnaces and boilers • Analysis and improvement of existent heat exchangers • Analysis of existent and installation of remote electric grid management centres • Analysis and improvement of cooling towers Expected savings in the period 2014 - 2016: 294.3 GWh
	Funds and financing sources	Planned funds: INA business plans
	Executive body	INA d.d.
	Monitoring bodies	CEI, in coordination with ME
Energy savings	Method of monitoring/measuring	Implementation of activities; amounts of reduced losses and emissions from refineries, as specified in the Energy Balance of the Republic of Croatia per product unit and in the Environmental Pollution Register at the Croatian Environment Agency.

	energy savings	
	Energy savings expected in 2016	1.5 PJ (207.35 GWh in 2014 and 2015)
	Expected impact on energy savings for 2020	1.5 PJ (additional measures for the 2017 - 2020 period have not been determined)
	Assumptions	The specified savings were given under the assumption of operating at maximum capacity, as a difference from energy consumption per product unit in 2013.
	Overlapping, multiplication effect, synergy	This measure will primarily affect oil refinement processes in refineries.

3.7.1 Energy Efficiency Criteria in Designing Network Tariffs and Regulations (EED Article 15)

In accordance with the Energy Act (NN No 120/12), the Act on the Regulation of Energy Activities (NN No 120/12), the Act on the Electricity Market (NN No 22/13), and the Gas Market Act (NN No 28/13), HERA monitors and analyses the operations and business activities of energy operators. The aforementioned legislative framework is in accordance with Directive 2009/72/EC, and the Interpretative Note on Directive 2009/72/EC concerning common rules for the internal market in electricity and Directive 2009/73/EC concerning common rules for the internal market in natural gas.

Planned or adopted measures – operators

The Act on the Electricity Market (NN No 22/13) laid down the responsibilities and duties of electricity market operators in the context of increasing energy efficiency.

The responsibilities of the transmission system operator are:

- to provide information required for efficient network access and transmission network usage to electric power operators and transmission network users, based on the principles of transparency and non-discrimination;
- to pay due attention to energy efficiency, nature preservation and environmental protection.

The duties of the transmission system operator are:

- to stipulate contracts on providing ancillary services with network users in order for them to obtain system services, and provide system services in an economical and efficient manner;
- to exchange necessary information with operators of other connected systems in order to ensure safe and efficient operation, harmonised development, and the operation of interconnected systems;
- to provide network users with the necessary information for efficient network access and transmission network usage.

The responsibilities of the distribution system operator are:

- to provide information required for efficient network access and distribution network usage to energy operators and distribution network users, based on the principles of transparency and non-discrimination;
- to implement energy efficiency improvement measures.

The duties of the distribution system operator are:

- to manage and maintain, construct and modernise, improve and develop the distribution network with the aim of ensuring safe, reliable and efficient operation of the distribution system and electricity distribution;
- to provide clear and precise information required for efficient network access and distribution network usage to distribution network users, while protecting those items of information and data which are considered confidential in accordance with special regulations;
- to stipulate contracts on providing ancillary services for the distribution network with network users, in order for them to obtain distribution network services, and provide distribution network services in an economical and efficient manner.

The Gas Market Act (NN No 28/13) lays down the duties of gas market operators regarding energy efficiency improvement.

Duties of the transmission system operator:

- to draw up and deliver to the Agency (HERA) by 1 March of the current year the annual report of the transmission system operator for the previous year, and such a report shall contain a report on the reliability, security and efficiency of the transmission system, the quality of gas, the quality of service, the reliability of gas delivery, the technical characteristics of the system, the use of transmission system capacities, the maintenance of the system equipment, and the fulfilment of other duties and exercising the rights pursuant to this Act;
- when adopting the ten-year plan of transmission system development, to define the objectives and the scheduled implementation plan for energy efficiency improvement measures for the gas transmission system, including planning the amounts of annual energy savings. Upon approval, the Agency shall submit the plan to the Ministry of Economy;
- pay due attention to energy efficiency, nature preservation and environmental protection.

Duties of the gas storage system operator:

- to operate, maintain and develop a safe, reliable and efficient gas storage system;
- to draw up and deliver to the Agency by 1 March of the current year the annual report of the gas storage system operator for the previous year, and such a report shall contain a report on the reliability, security and efficiency of the gas storage system, the quality of gas, the quality of service, the reliability of gas delivery, the technical characteristics of the system, the use of gas storage system capacities, the maintenance of the system equipment, and the fulfilment of other duties and exercising the rights pursuant to this Act;
- to pay due attention to energy efficiency, nature preservation and environmental protection.

Duties of the liquefied natural gas (LNG) operator:

- to operate, maintain and develop a safe, reliable and efficient LNG terminal;
- to draw up and deliver to the Agency by 1 March of the current year the annual report of the LNG terminal operator for the previous year, and such a report shall contain a report on the reliability, security and efficiency of the LNG terminal, the quality of gas, the quality of service, the reliability of gas delivery, the technical characteristics of the LNG terminal, the use of LNG terminal capacities, the maintenance of the LNG terminal equipment, and the fulfilment of other duties and exercising the rights pursuant to the provisions of this Act;
- to pay due attention to energy efficiency, nature preservation and environmental protection.

Duties of the distribution system operator:

- to operate, maintain and develop a safe, reliable and efficient distribution system;
- to draw up and deliver to the Agency by 1 March of the current year the annual report of the distribution system operator for the previous year, and such a report shall contain a report on the reliability, security and efficiency of the distribution system, the quality of gas, the quality of service, the reliability of gas delivery, the technical characteristics of the distribution system, the use of distribution system capacities, the maintenance of the system equipment, the fulfilment of other duties and exercising the rights pursuant to this Act;
- to pay due attention to energy efficiency, nature preservation and environmental protection.

Planned or adopted measures – suppliers

Pursuant to the Act on the Electricity Market (NN No 22/13), the obligations of suppliers towards final customers in the context of energy efficiency are:

- to provide accurate information on actual electricity consumption and costs, frequently enough to enable the final customers to manage their electricity consumption – such information shall be provided within a reasonable time frame, taking into account the features of the electricity meter installed at the final customer and the method of electricity consumption, with due attention being paid to the cost-efficiency of such measures and without any additional costs being charged to final customers for such a service;
- to design and publish a programme for fostering energy efficiency;
- to regularly inform the final customers about energy efficiency improvement measures in final energy consumption.

Pursuant to the Gas Market Act (NN No 28/13), the duties of the gas supplier are:

- to perform the gas supply activity in a safe, reliable and efficient manner.

3.7.2 Facilitating and Stimulating Demand Response (EED Article 15)

HOPS and HEP-ODS have been continuously investing in the automation of electric power grids and ICT within the scope of their competence. As one of its strategic objectives, HOPS plans to continue its substantial investments in the latest ICT for the remote management (coordinated supervision, management, protection and metering) of the Croatian electric power system, which entails the modernisation of the National Dispatch Centre (NDC) and four grid management centres (GMC), which also complies with the obligations on parallel operation in the synchronous grid of Continental Europe, with the aim of ensuring continuous balance between electricity consumption and production as the basic condition for supply security.

In the distribution network it is planned to connect all HV/MV and MV/MV plants to the remote management system, to equip all billing meter points with a connection power higher than 30 kW with advanced electronic meters (smart metering units), and to define the priorities and objectives, i.e. the development concept, for an advanced network (multiple operators).

The measures *Introduction of the individual metering system of heat energy consumption* (Chapter 3.1.3) and *Individual metering and informative billing* (Chapter 3.1.4) form an integral part of the infrastructure which is a precondition for the development of dynamic pricing, tariff addressing and stimulating demand response.

3.7.3 Energy Efficiency in Network Design and Regulation (EED Article 15)

Title of the measure		**Replacements and reconstructions of the hot water and steam network**
Measure index		E.5
Description	Category	
	Time frame	Start: 2014 End: 2016
	Objective / outline	Preventive and corrective replacement of main hot water pipelines, hot water pipeline branches and connection points, with the aim of reducing heat losses, reducing operating water losses, reducing flue gas emissions, and increasing heat energy supply security for final customers. Furthermore, the revitalisation of steam lines older than 30 years is also planned in order to reduce heat losses.
	Target final consumption	Heat energy consumption
	Target group	Heat energy distributor – HEP-TOPLINARSTVO d.o.o.
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Future activities: 1. Prepare documentation for replacing worn out hot water and steam distribution systems. 2. Replace hot water pipelines and steam lines whose steel pipeline insulation has worn out with new pre-insulated pipes.
	Funds and financing sources	Planned funds: • 2014 – HRK 28 521 000 (own funds) • 2015 - 2016 PERIOD – HRK 61 150 000 (own funds, commercial banks)
	Executive body	Heat energy distributor – HEP-TOPLINARSTVO d.o.o.
	Monitoring bodies	CEI
Energy savings	Method of monitoring/measuring energy savings	The effects of this measure are monitored on the basis of the data from the heat energy distributor.
	Energy savings expected in 2016	16 963 MWh
	Expected impact on energy savings for 2020	21 732 MWh
	Assumptions	The age and wear of the hot water and steam systems, and the lack of systematic revitalisation are causes of a relatively large number of ruptures in the network. Those ruptures cause interruptions in heat energy supply, which increases losses due to lost energy, i.e. they reduce system efficiency and cause high costs of repairs. Losses can potentially be reduced by undertaking systematic replacement of the oldest sections of the hot water pipelines and steam lines with new, pre-insulated piping technology and a monitoring system for leak detection. In addition to reducing heat losses, that would also increase heat energy supply security and reduce flue gas emissions.
	Overlapping, multiplication effect, synergy	This measure can produce effects primarily in the heat energy distribution sector, and the effects in the sense of energy savings will be shown for that sector.

Title of the measure		**Replacement of submarine cable sections and replacement of energy transformers**
Measure index		E.6
Description	Category	Replacement of submarine cable sections and replacement of energy transformers
	Time frame	Start: 2014 End: 2016 Planned major modifications, amendments, improvements: Replacing older equipment with new one, with reduced losses.
	Objective / outline	The replacement of submarine 110 kV cable sections with new cables with larger cross-sections is planned, as is the replacement of power transformers which are at the end of their life cycle with new ones, with reduced iron losses (fixed loss) and copper losses (variable loss – depending on load). Replacing older equipment with new one, with reduced losses, will also reduce the overall losses at system level.
	Target final consumption	Electricity consumption (losses)
	Target group	Croatian Transmission System Operator
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Implemented activities and achieved results: • The current level of losses amounts to approximately 2 % of transmitted electricity, which is on a par with the other transmission system operators in the ENTSO-E interconnection. • The highest impact on the amount of losses in the Croatian transmission network is exerted by energy flows resulting from the interaction of electricity production undertakings, the distribution of electricity consumption, the switching status of transmission network elements, and transactions on the electricity market in the relevant wider area (not just neighbouring countries). • The replacement of 10 % of the oldest transformers in the network, which are responsible for approximately 20 % of total fixed losses in transformation and approximately 15 % of total variable losses in transformation. • The replacement of existing cable/duct sections with new cables/ducts with a larger cross-section will directly reduce the resistance of conductors, whereby it will have a positive impact on reducing technical losses due to loads (variable losses). Future activities: 3. In the future intermediate period, HOPS plans to replace all old submarine cable sections towards the islands, which will increase the transmission power towards the islands and replace the old oil-filled cables. Increasing the cross-section of the conductors by 20–35 % will directly reduce the technical losses due to heat (the reduction of total technical losses at annual level depends on load amount and duration).
	Funds and financing sources	Planned funds by the end of 2016: • HOPS: HRK 120 000 000 • HBOR, Commercial banks • EU Funds (from 2015)
	Executive body	HOPS
	Monitoring bodies	CEI, in coordination with HERA
Energy savings	Method of monitoring/meas	The effects of this measure are monitored on the basis of data on achieved electric power losses before and after the implementation of

	uring energy savings	the measure, with normalisation by load amount and duration.
	Energy savings expected in 2016	17.64 TJ (4.9 GWh)
	Expected impact on energy savings for 2020	25.56 TJ (7.1 GWh)
	Assumptions	Future estimates are based on indications of electricity consumption growth in the previous 5 years, and on maintaining the existing flows of cross-border electricity exchange in the wider surrounding area.
	Overlapping, multiplication effect, synergy	This measure can produce effects primarily in the electricity production, transmission and distribution sector, and the effects in the sense of energy savings will be shown for that sector.

Title of the measure		Reducing losses in the electric power distribution grid
Measure index		E.7
Description	Category	Information and mandatory information measures; Financial instruments
	Time frame	Start: continuous End: continuous Planned major modifications, amendments, improvements: Electric power losses will be systematically monitored and analysed by the organisational units of HEP- Operator distribucijskog sustava d.o.o., on the basis of which activities will be conducted with the objective of reducing electric power losses. Introduction of smart meters.
	Objective / outline	Electric power losses in the distribution grid can be classified as technical and non-technical losses, and therefore the activities for reducing losses can also be divided into two categories: • activities for reducing non-technical losses; • activities for reducing technical losses, or increasing energy efficiency. A detailed analysis of electric power losses in the distribution grid will determine the causes of increased losses, and set the priorities for implementing activities aimed at reducing losses. Activities for reducing non-technical losses require smaller amounts of funding (except for the installation of smart meters), while the activities for reducing technical losses generally require larger investments in distribution grid elements. The objective of HEP- Operator distribucijskog sustava d.o.o. is to reduce electric power losses (total technical and non-technical) by the end of 2016 to a maximum amount of 8 % (±0.25 %) of the achieved procurement in the distribution grid for that year.
	Target final consumption	Electricity consumption
	Target group	Distribution system operator
	Regional application	National
Information on implementation	List and description of activities for measure implementation	Implemented activities and achieved results: HEP- Operator distribucijskog sustava d.o.o. is continuously conducting activities aimed at reducing electric power losses. In the 2011–2013 period, special emphasis was given to the implementation of the following activities: • control of connection points and billing meter points; • timely calibration of metering devices; • control of potential unauthorised consumption; • installation of electronic meters; • remote reading and supervision of billing meter points; • regulation of two-system metering; • reduction of reactive energy in the grid (installing compensation, installing suitable metering devices, billing inductive and capacitive reactive energy); • providing metering data to the customers so they can optimise their energy consumption. The result of these activities was a reduction of the average amount of losses in the period in question by 2 % in comparison to the achieved electric power losses in 2010.

		<u>Future activities:</u> Continue the systematic implementation of the measure for reducing losses in the electric power distribution grid. A detailed analysis will determine the causes of increased losses in certain sections of the grid, and priorities will be set for implementing activities for reducing technical and non-technical losses. The activities for reducing technical losses will be conducted through the following: • optimising the operating state of the grid; • reconstructions of parts of the grid with small conductor cross-sections and long sections; • installation of equipment with reduced losses (primarily transformers); • reducing own consumption. The activities for reducing non-technical losses will be conducted through the following: • further installation and introduction of the largest possible number of advanced meters in the remote supervision and meter reading system; • further comprehensive implementation of connection and meter point controls (CMPC), with an emphasis on detecting unauthorised electric power consumption; • continued improvement of indirect and semi-direct meter points and periodic control of such meter points; • continued reconstruction of existing connections and meter points installed on the premises of the customers. HERA will perform a cost-efficiency analysis for the introduction of smart (advanced) meters. In 2015, at the latest, ME will design a plan/programme for the introduction of smart meters.
	Funds and financing sources	Planned funds: distribution system operator's own business plans ME: HRK 200 000 (drawing up the programme)
	Executive body	Distribution system operator
	Monitoring bodies	CEI, in coordination with ME and HERA
Energy savings	Method of monitoring/measuring energy savings	HEP- Operator distribucijskog sustava will draw up a balance for the previous year, specifying electric power losses.
	Energy savings expected in 2016	21.9 GWh
	Expected impact on energy savings for 2020	18 GWh
	Assumptions	The specified savings were given under the assumption that the electricity procurement in the electric power distribution grid would be of an approximately equal amount and approximately equal consumption structure per voltage levels for 2010, 2016 and 2020, and data were shown as average amounts for 2016 and 2020.
	Overlapping, multiplication effect, synergy	This measure will primarily affect the electric power distribution grid.

3.7.4 Savings Resulting from Energy Supply Measures

Described above, individually for each measure.

3.7.5 Financing Energy Supply Measures

Described above, individually for each measure.

APPENDIX A ANNUAL REPORT ON THE ENERGY EFFICIENCY DIRECTIVE

This report presents information on the progress towards achieving national energy efficiency targets pursuant to Article 24(1) of Directive 2012/27/EU.

A1 The National Energy Efficiency Target by 2020

National Indicative Energy Savings Targets

The national indicative energy savings targets are defined in the Energy Strategy. The expected reduction of final energy consumption in 2016 is **19.77 PJ** and in 2020 it is **22.76 PJ**. The aforementioned national energy savings targets have been set in accordance with the requirements of Directive 2006/32/EC on energy end-use efficiency and energy services (ESD), and they correspond to the absolute amount of 9 %, or 10 % of final energy consumption, defined as average energy consumption in the period 2001 - 2005.

Indicative national target for increasing energy efficiency pursuant to Article 3 of Directive 2012/27/EU

The national targets for increasing energy efficiency have been defined in accordance with the amended final energy consumption projections. The Energy Strategy is based on the presumption of stable economic growth of the gross domestic product (GDP) of 5 % per year. Due to the economic and financial crisis, there was a drop of the GDP. Instead of the projected GDP rise of 21.5 % in the 2009–2012 period, a negative rate of -9 % was achieved, which is a 30.5 % difference. The decrease of industrial production and the overall standard of living also reduced the need for energy. In view of the aforementioned, the scenarios presented in the Energy Strategy have been corrected and adjusted to the newly arisen situation and plans (amended projections).

The indicative national energy efficiency target expressed as the absolute amount of final energy consumption in 2020 is **293.04 PJ (7.00 Mtoe).**

The corresponding target expressed as the absolute amount of primary energy in 2020 is **466.69 PJ (11.15 Mtoe).**

A2 Key Energy Consumption Indicators

The annual reports referred to in Article 24(1) are a basis for monitoring the progress in achieving the national targets for 2020. To that effect, Table A2-1 presents the estimate of the following indicators for the year before last (2012).

Table A2-1: Estimate of key energy consumption indicators for 2012

Estimate of key energy consumption indicators in 2012	***2012***	***Unit***	***2012/2011 %***
Total primary energy consumption	365.5	PJ	-4.71 %
Total final energy consumption	247.5	PJ	-4.48 %
Final energy consumption – Industry	41.6	PJ	-11.50 %
Final energy consumption – Transport	84.0	PJ	-1.60 %
Final energy consumption – Households	77.1	PJ	-2.97 %
Final energy consumption – Services	30.1	PJ	-3.71 %

Final energy consumption – Construction	5.1	PJ	-8.06 %
Final energy consumption – Agriculture	9.6	PJ	-8.39 %
Gross value added – Industry	NO	million HRK	NO
Gross value added – Services	NO	million HRK	NO
Disposable household income	NO	HRK	NO
Total number of households	1 523.0	k	0.26 %
Gross Domestic Product (GDP)	320 436	million HRK	-0.04 %
Electricity production in thermal power plants	2 513.1	GWh	-12.64 %
Electricity production in combined heat and power plants	2 912.0	GWh	-7.04 %
Heat production in thermal power plants	NO	PJ	NO
Heat production in combined heat and power plants	20.3	PJ	-3.22 %
Fuel consumed in thermal power plants	26.9	PJ	-5.11 %
Fuel consumed in combined heat and power plants	43.1	PJ	-3.45 %
Transmission and distribution losses	10.0	PJ	-1.38 %
Passenger-kilometres	24 000	Mpkm	-4.76 %
Tonne-kilometres	8 649	Mtkm	-3.10 %
Population	4 268	k	-0.28 %
Heat production in DHS heating plants	2.7	PJ	-11.95 %
Fuel consumed in DHS heating plants	3.3	PJ	-12.27 %

A3 Energy Consumption Trend Analysis

The trend (for the 2006–2012 period) of key energy consumption indicators is shown in Table A3-1.

For those sectors in which energy consumption is stable or increasing, the underlying reasons will be analysed and substantiated.

Table A3-1: Key energy consumption indicators for the 2007 -2012 period

Estimate of key energy consumption indicators	*Unit*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2012/ 2007 %*	*2012/ 2011 %*
Total primary energy consumption	PJ	418.2	414.9	408.4	411.7	383.6	365.5	-12.6 %	-4.7 %
Total final energy consumption	PJ	270.5	276.8	265.5	265.8	259.1	247.5	-8.5 %	-4.5 %
Final energy consumption – Industry	PJ	60.8	61.2	51.1	50.3	47.0	41.6	-31.7 %	-11.5 %
Final energy consumption – Transport	PJ	91.1	90.5	89.8	86.8	85.4	84.0	-7.7 %	-1.6 %
Final energy consumption – Households	PJ	73.0	76.2	77.2	80.9	79.5	77.1	5.7 %	-3.0 %
Final energy consumption – Services	PJ	27.9	29.8	30.1	31.7	31.3	30.1	7.9 %	-3.7 %
Final energy consumption – Construction	PJ	769.0	8.6	6.7	5.9	5.6	5.1	-33.3 %	-8.1 %
Final energy consumption – Agriculture	PJ	10.1	10.6	10.5	10.3	10.5	9.6	-4.4 %	-8.4 %
Gross value added – Industry	million HRK	55 415	58 407	61 663	65 453	NO	NO	NO	NO
Gross value added – Services	million HRK	149 387	155 955	162 753	171 026	NO	NO	NO	NO
Disposable household income	HRK	77 442	79 274	86 847	86 975	81 215	NO	NO	NO
Total number of households	k	1 470	1 484	1 500	1 515	1 519	1 523	3.6 %	0.3 %
Gross Domestic Product (GDP)	million HRK	308 887	329 992	317 098	313 949	320 554	320 436	3.7 %	0.0 %
Electricity production in thermal power plants	GWh	5 181.4	4 414.3	3 422.2	2 494.8	2 876.6	2 513.1	-51.5 %	-12.6 %
Electricity production in combined heat and power plants	GWh	2 628.6	2 545.4	2 486.2	3 035.8	3 132.6	2 912.0	10.8 %	-7.0 %
Heat production in thermal power plants	PJ	NO	NO	NO	NO	NO	NO	NO	NO
Heat production in combined heat and power plants	PJ	24.1	24.3	23.5	23.1	20.9	20.3	-15.8 %	-3.2 %

Fuel consumed in thermal power plants	PJ	50.0	42.0	33.5	24.9	28.4	26.9	-46.2 %	-5.1 %
Fuel consumed in combined heat and power plants	PJ	45.6	44.8	43.5	45.8	44.6	43.1	-5.5 %	-3.4 %
Transmission and distribution losses (all fuels)	PJ	10.8	9.4	10.3	10.9	10.1	10.0	-7.3 %	-1.4 %
Passenger-kilometres	Mpkm	26 000	27 000	26 800	25 700	25 200	24 000	-7.7 %	-4.8 %
Tonne-kilometres	Mtkm	10 622	11 042	9 429	8 780	8 926	8 649	-18.6 %	-3.1 %
Population	k	4 436	4 434	4 429	4 418	4 280	4 268	-3.8 %	-0.3 %
Heat production in DHS heating plants	PJ	3.0	3.0	2.9	3.1	3.0	2.7	-10.9 %	-11.9 %
Fuel consumed in DHS heating plants	PJ	3.6	3.6	3.6	4.1	3.8	3.3	-9.4 %	-12.3 %

For nearly all selected indicators, the data show a decreasing trend in 2012 in comparison to 2007. Total primary energy consumption in 2012 was 12.6 % lower than in 2007, and 4.7 % lower than in 2011. The largest drop in final energy consumption occurred in the industry and construction sectors, which is largely due to the economic and financial crisis. An increase in final energy consumption in comparison to 2007 was achieved in the household sector (5.7 %) and the service sector (7.9 %). This increase can be interpreted through the increase of disposable household income and the increase of the number of households in the 2007–2010 period, and with the development of services in the 2007–2010 period which was reflected in the rise of the GDP for services. However, there was a 3.0 % drop in final consumption in the household sector, and a 3.7 % drop in the service sector in comparison to 2011. This decrease was partly caused by the implementation of energy efficiency measures, but it was mostly due to the drop of the GDP and the disposable household income.

Electricity production in thermal power plants in 2012 was 51.5 % lower than in 2007, and 12.6 % lower than in 2011, which was largely due to lower demand and a lower price of electricity at international markets which often makes it more cost-effective to import electricity than produce it in certain thermal power plants. There was a 10.8 % increase in electricity production in combined heat and power plants in comparison to 2007, which is considered favourable from the viewpoint of efficient primary energy use. In comparison to 2011, this type of production decreased by 7 % due to lower demand.

For the remaining items, there was a decrease in 2012 in comparison to 2007 and 2011.

4. Information on Measures Implemented in 2013

A4.1. Primary Energy Savings Measures

Primary energy savings measures are aimed at existing facilities as well as a selection of new energy facilities.

In view of the market orientation of the energy sector and its integration into the single European energy market, it is evident that the decisions of investors on building new energy facilities will be guided by market principles and that they will opt for the most economically viable solutions. Energy efficiency and environmental protection are definitely significant factors in that regard. It should be pointed out that, in Croatia, the construction of energy facilities (oil and natural gas production and processing plants; international and main pipelines for the transport of gas, oil and petroleum products; nuclear power plants and associated plants; electric power plants and power plants whose power exceeds 30 MWe) is subject to conducting a study evaluating the environmental impact of the works in which the aforementioned factors are evaluated and which is a precondition for being granted construction permits for the structure.

According to the plans and reports of energy operators and the Croatian Energy Regulatory Agency (HERA), collected for the purpose of drawing up this report, substantial efforts are being expended to improve efficiency and reduce losses in energy transformation, transmission and distribution. The summary of activities conducted for that purpose by energy operators in the 2011–2013 period is shown in Table A4-1.

Table A4.1 – Overview of activities implemented and planned by energy entities with the aim of improving energy efficiency and reducing losses in the energy sector

No.	Title of energy efficiency improvement measure	Target primary energy consumption / sector	Achieved reduction of primary energy consumption in the 20082010 period (PJ/year)	Achieved reduction of primary energy consumption in the 20112013 period (PJ/year)
1	Improving efficiency of existing thermal power plants within the HEP Group	Electricity production	N/A	0.60
2	Improving efficiency of existing hydroelectric power plants within the HEP Group	Electricity production	N/A	0.53
3	Reducing own consumption in HEP Group power plants	Electricity production	N/A	0.05
4	Reducing losses in the electric power transmission network	Electricity transmission	N/A	N/A
5	Reducing losses in the electric power distribution grid	Electricity distribution	0.34	0.10
6	Revitalisation of heating systems and hot water pipeline networks	Heat energy production and distribution	0.10	0.22
7	Stimulating cogeneration	Electricity and heat energy production	N/A	0.20
8	Improving the exploitation efficiency of domestic oil and natural gas deposits	Crude oil and natural gas production	1.08	1.90
9	Modernisation of oil refineries in Sisak and Rijeka	Production of petroleum products	0.61	0.72

10	Reducing losses in the oil pipeline transport system	Oil pipeline transport	N/A	**0.00**
11	Reducing losses in the natural gas transmission system – replacing boiler rooms; reducing the gas preheating temperature	Natural gas transmission	**0.00**	0.01
12	Reducing losses in the natural gas distribution system – reconstruction of worn out gas pipelines	Natural gas distribution	N/A	N/A
TOTAL NEW SAVINGS IN THE PERIOD (PJ/year)			2.14	4.34
CUMULATIVE SAVINGS IN COMPARISON TO 2007 (PJ/year)			2.14	6.48

A4.2. Primary energy savings resulting from energy savings in final consumption

No methodology has been prescribed for calculating primary energy savings. The 2rd NEEAP, primary energy savings were examined as a consequence of two basic causes:

- primary energy savings resulting from measures aimed at increasing transformation efficiency and reducing transmission and distribution losses;
- primary energy savings resulting from energy savings in final consumption.

The calculations of achieved savings resulting from the application of energy efficiency measures in energy transformation, transmission and distribution processes are presented in Chapter 4.1. of Appendix A, and the estimate of future savings is specified in Chapter 3.7. of the 3rd NEEAP.

The methodology for calculating primary energy savings resulting from savings in final energy consumption is described below.

The consequences on primary energy savings differ depending on the type of energy saved in final consumption. The starting point for estimating savings are the savings calculated using the TD method. The savings estimated using the TD method are classified by type of saved fuel as: electricity, heat energy, liquid fuel, and gas fuel.

Depending on the estimated share of an individual energy type in savings, each type of saved energy is multiplied by an appropriate *calculation factor* in order to calculate the impact on reduced primary energy consumption.

Electricity

If electricity savings were achieved in final consumption, the resulting primary energy savings were calculated depending on the share of domestic electricity production, the share of energy transformation losses, and the loss rate in transmission and distribution.

$$U_{PRIM} = U_{NEP} \times FP$$

whereat it is as follows:

U_{PRIM} - primary energy savings
U_{NEP} - energy savings in final consumption
FP - calculation factor

$$FP = 1 / ((1 - \%_{gPD}) ((1 - \%_{gTR}) (\%_{DOM}) + (1 - \%_{DOM}))),$$

whereat it is as follows:

$\%_{gPD}$ - loss rate in transmission and distribution

$\%_{gTR}$ - loss rate in energy transformation

$\%_{DOM}$ - share of electricity production in total electricity consumption

For example, with a 10 % loss rate in transmission and distribution, a 60 % loss rate in energy transformation, and a 75 % share of domestic electricity production in total consumption, the calculation factor is 2.0. The factor may vary. Pursuant to Directive 2006/32/EC, the reference factor at EU level is 2.5. That could be achieved with a 100 % share of domestic production, average transformation losses of 60 %, and no transmission and distribution losses. A relatively low calculation factor was calculated for Croatia using the aforementioned methodology due to the significant share of electricity imports and electricity production in hydroelectric power plants. Furthermore, in relation to the reference factor, the expected transmission and distribution losses were also calculated.

For the calculation of energy savings in final consumption in 2010 the calculation factor was 2.0, and in 2012 it was 1.7. The calculation factor for estimating savings in 2016 and 2020 was 2.0.

It is important to note that increased heat and electricity production in cogeneration reduces the calculation factor because it reduces energy transformation losses and increases heat energy usability.

Heat energy

When calculating heat energy savings in final consumption into primary energy savings, the calculation factor was set in regard to average losses in heat energy distribution amounting to 5 %.
The calculation factor for calculating heat energy savings in final consumption into primary consumption savings is 1.05. **Liquid fuel**
When calculating liquid fuel savings in final consumption into primary energy savings, the calculation factor was set to 1.01 due to the usual share of losses in refineries of approximately 1 % of total liquid fuel consumption.

Gas fuel

When calculating gas fuel savings in final consumption into savings in primary energy consumption, the calculation factor was set to 1.02 due to the usual losses of approximately 2 % of total natural gas consumption.

Classification of energy savings in final consumption

The TD evaluation of energy savings in final consumption does not explicitly define the savings of an individual type of energy. The savings shares per sector set as follows:

- in the household sector, 20 % of savings pertain to electricity and 80 % to heat energy;
- in the service sector, 100 % of savings pertain to heat energy;
- in the transport sector, 100 % of savings pertain to liquid fuels;
- in the industry sector, 25 % of savings pertain to electricity, and 75 % to an energy mix for which a calculation factor of 1.025 was employed for calculating primary energy savings resulting from savings in final consumption.

Primary energy savings for 2010 and 2012 were calculated on the basis of the method described above.

Table A4-2. Overview of achieved savings

PJ/year	2010 - achieved	2012 - achieved

Savings due to primary energy savings measures in comparison to 2007	2.14	6.48
Savings in primary energy consumption due to higher efficiency in final consumption in comparison to 2007	7.80	15.92
Total primary energy savings in comparison to 2007	9.94	22.40

A4.3. Energy Efficiency Measures in Electricity Production, Transmission and Distribution

Electricity production

Approximately 95 % of installed electricity production capacities in Croatia is owned by HEP d.d., a state-owned electric power company. Therefore, the description of the previously implemented measures, as well as of future activities in electricity production, is focused on the activities of production plants (power plants) owned by HEP d.d.

In the triennial period 2011–2013, HEP Proizvodnja d.o.o. (a HEP Group subsidiary) implemented a series of activities aimed at:

1. improving the efficiency of existing power plants;
2. reducing own energy consumption in power plants.

Table A4-3. overviews projects aimed at improving the efficiency of existing power plants or reducing own energy consumption in power plants, conducted in the 2011–2013 period

Plant	Activity implementation status	Activities / effects / savings
TPP Sisak	The replacement of the management system at BLOCK A was performed in the second half of 2013. The replacement of the mazut plant management system was performed in the second half of 2013.	Block A was not operating long enough to determine savings.
	The new chemical water preparation plant was put into operation in 2011. Construction of the condensate return system.	
TPP Rijeka	Adaptation of the waste water treatment system.	Waste water treatment procedure accelerated; use of chemicals reduced

	Installation of equipment for 'eco measuring'	Improved monitoring of raw material consumption – possibilities for savings
	Procurement of a self-cleaning filter for turbine oil cooling and new equipment for cleaning condenser piping	Energy savings (from the operation of cooling pumps)
	Replacing lighting with a more energy efficient type / energy savings	Savings from consumption: 20 362 kWh (39 %); Reduction of CO_2 emissions per year: 8.18 t
TPP Plomin	Installation of high-efficiency lighting (LED lighting)	Implemented in 2013; actual savings depend on the total number of operating hours; maintenance reduced to minimum
	Installation of a frequency converter on the 6 kV seawater pump engine	Implemented in 2013; actual savings will depend on the total number of operating hours
CTPP Jertovec	Replaced the management and control system for gas turbines PTA A and PTA B	Reduced specific fuel consumption by ca. 1 % (110 kJ/kWh), increased available power by ca. 1 MW
	Refurbished the cooling system of gas turbo generators PTA A and PTA B	Reduced specific fuel consumption by ca. 1 % (110 kJ/kWh)
	General overhaul of steam turbines TA A and TA B (replaced management system)	Reduced specific consumption of superheated steam by ca. 1 %, increased production by ca. 0.5 MWh/h
	General overhaul of generator TA A and TA B	Increased generator efficiency, increased power by ca. 250 kW per generator
	Replaced block transformers of steam turbo generators TA A and TA B	Reduced transformation losses by 100 kWh/h at operating load
	Replaced the shell and sprinkler system of cooling tower A	Increased achieved power and production of steam turbine generators by ca. 1 MWh/h
	Replaced thermal insulation on the plating of the exhaust gas boilers KU A and KU B	Reduced heat losses, increased boiler efficiency by ca. 1 % (0.5 t superheated steam/hour)
	Replaced raw water supply pipeline	Reduced raw water consumption by ca. 20 % (HRK 300 / production day)
	Replaced worn out potable water piping and armature	Reduced potable water consumption by ca. 30 % (HRK 40 / day)
	Recirculation/return of cooling water from feed pumps and circulation pumps	Reduced fees for water use and discharge (HRK 150 / production day, in total), raw water and decarbonised water consumption reduced by 10 %
	Replaced worn out windows and doors	Reduced heat losses – reduced energy consumption for heating
	Replaced the wiring and fixtures for engine room lighting	Reduced electricity consumption by ca. 20 kWh/day
CHPP Zagreb	BLOCK C: Replaced convection steam superheaters 1 and 2 (KPP-1 and KPP-2) BLOCK C: Reconstructed the air preheater of the block C boiler	Boiler production at base load increased from 460 t/h to 505 t/h of superheated steam
	COOLING WATER PUMPING STATION SAVA: Reconstructed the Sava water purification system by installing rough mechanical bar screens, fine mechanical bar screens ('combs') and rotary drum screens at intake; completion of the 3rd project stage	Achieved nominal capacity of cooling water pumping station Sava of 2 x 14 000 m^3/h (which was reduced for years), which consequently improved steam turbine vacuum in condensing mode
	BLOCK K: GAS TURBINES: Replaced the regulation and process management system Mark V and its supporting systems with the regulation and process management system Mark Ve and its supporting systems. (The Mk Ve system implemented all the regulation and management improvements for General Electric gas turbo generators, which achieves additional effects in turbo generator efficiency and availability [increased peak power and reduced fuel	- Programme and equipment for achieving short-term power increase (by increasing combustion temperature) for two PTAs. - The peak power of each gas generator can be increased by **2.87 MW**. In total for **Block K** that is ca. **9 MW**, with improved efficiency, i.e. fuel consumption reduced by **0.64 %**.

	consumption at peak power].)	
	IMPROVING THE EFFICIENCY OF GAS TURBINE PT3 AT BLOCK L	Results of turbine operation with the OpFlex programme (at ambient temperature of 2.7 °C) and base load compared to operation without OpFlex: power increased by **2411 kW**, reduced specific heat consumption by **43 kJ/kWh**, increased flue gas energy by **11.4 GJ/h**, increased exit gas temperature by **12.7 °C**. Results of operation at peak power: power increased by **2.7 MW**.
	RECONSTRUCTION OF LP HEATER AND HP SUPERHEATER OF EXHAUST GAS BOILERS AT BLOCK K	Leaks at the HP superheater and the LP heater elbow which caused frequent shutdowns of Block K were repaired. The piping at the LP heater and the connections of the HP superheater to the collector were replaced, which ensures long-term reliability of exhaust gas boilers at Block K.
	INSTALLATION OF LED LIGHTING AT CHPP PREMISES	Reduced own electricity consumption
	RECONSTRUCTION OF HOT WATER BOILER VK 5	Achieved boiler efficiency of 128 MWt when powered by gas (nominal boiler efficiency is 116 MWt), with hot water outlet parameters of 160 °C and 25 bar pressure. The savings of 1 % of fuel at the boiler amount to 1 000 operating hours x 10 t/h of mazut x EUR 500 / t = EUR 50 000 per year. Measured emission values from gas operation: NOx=98.7 mg/mn3 CO=6.9 % mg/mn3 SO2<13.5 mg/mn3 All reduced to O2 volume share of 3 %.
CHPP Osijek	1 Return of the condensate from boiler blowdown at the 45 MW block into the hot water system; 2 Reconstruction of public lighting and increasing energy efficiency	• Savings of 2 310 GJ/year in primary energy (natural gas or mazut) and 10 000 m^3/year in raw water • Electricity savings of ca. 165 000 kWh/year + reduced maintenance costs
	1 Installed frequency converter for powering the electric motor of the hot water circulation pump	1 Electricity savings per heating season are ca. 770 000 kWh; Primary energy savings – gas are approximately 158 000 Sm^3; Primary energy savings – mazut are approximately 200 000 l.
CHPP Zagreb (Trešnjevka)	Replaced existent exterior and interior lighting systems with new LED lighting	Electricity savings, higher quality lighting of plant roads, access paths and engine room interior. Expected savings amount between HRK 180 000 and HRK 240 000 per year.
	Collection of condensate, hot water pipeline water and boiler water during plant unit start-up and shut-down	Reducing water losses in the circulation process, reducing waste water discharge into the sewage system, increasing the degree of plant efficiency (by 1.5–2.0 %). Reducing water consumption from the public water supply system in 2012/2013 from 27 000 m^3 to 4 700 m^3. Savings: In total, approximately 450 000 m^3 of water, approximately 10 000 MWh of heat energy.
	Replaced the VK3 burner system and the economiser.	Enabled boiler operation and increased fuel efficiency. Increased heat energy production efficiency. Reduced fuel consumption per produced MWh of heat energy.
HPP Gojak	Improved power plant efficiency – intake tunnel repaired	Annual water consumption reduced by ca. 16 000 000 m3, i.e. annual electricity production increased by ca. 4.5 GWh.
	Reduced power plant's own consumption – installed LED lighting, installed aluminium doors and windows, installed thermal insulation	Reduced electricity consumption for heating and cooling of premises by approximately 50 000 kWh

HPP Vinodol	New group management system	The system is more efficient in using water for electricity production (optimum power distribution per generator) – at each operating power point of the plant, the system produces maximum electricity for the minimum quantity of water,
		in regard to the efficiency factor of individual generators in group operating mode. Estimated achieved savings are 700 MWh/year.
	Reduced power plant's own consumption – Operating premises heated with a heat pump	Estimated achieved savings are 150 MWh/year.
	Reduced power plant's own consumption – Replaced incandescent light bulbs with LED light bulbs in the plant premises with permanent lighting	Estimated achieved savings are 68.11 MWh/year.
HPP Senj	Repaired leaks at the compensation reservoir – reduced water losses	Since water losses from the Gusić Polje reservoir directly impact the production at the HPP Senj generators, efforts are expended to keep the said losses at a minimum. In the 20112013 period, losses were reduced from 365 l/s to 344 l/s (2012), or to 295 l/s (2013) which, when calculated into equivalent, amounts to 6 047 MWh (in the 2011–2013 period).
HPP Rijeka	Improved lighting and reduced electricity consumption. The classic fluorescent lighting was replaced by LED lighting in the main hall, access tunnel and control cabinets.	Installed power reduced by 8 554 VA (from 11 774 W to 3 220 W).

Many capital projects were started in 2012 and 2013, and such projects generally have a multi-annual implementation time. Therefore, it will be possible to evaluate the results only in the next reporting period 2014-2016.

Electricity transmission

The transmission network is operated by HEP Operator prijenosnog sustava (HOPS).

The transmission network losses under the competence of HOPS amount to approximately 2 % of transmitted energy, which is in line with the losses incurred by other operators in the EU. HOPS's electric power balance lays down plans for reducing transmission network losses in 2014 by 1.4 % from the estimated losses achieved in 2013. Technical losses in the transmission network greatly depend on hydrology, prices of energy commodities, external events, as well as unwanted flows in the control area and the region. It is therefore not possible to produce an estimate of power and loss flows for such a long period.

The Croatian Transmission System Operator, as a signatory of the 2010 ITC Agreement (Regulation (EC) No 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging), participates in the Inter-TSO compensation mechanism which provides compensation for the costs incurred in electricity transmission through each individual control area. This mechanism also does not have exact data on planned losses. Losses, as well as revenues/expenditures, are based on what is achieved within a month, and estimates are only approximate, in line with what was achieved in previous years by all 42 European transmission system operators who are signatories of the ITC Agreement.

The usual operating measures for reducing losses in the transmission network, regularly implemented by HOPS, include:

- high-quality maintenance activities on all transmission network elements (transformer maintenance, regular thermovisual checks of network elements in order to eliminate high transient resistance);
- managing operations with the most favourable network configuration;
- economic distribution of transformer operations;
- maximum permitted elevated operating voltage level;
- reactive power compensation;
- high-quality electricity metering at transmission network input and output points, etc.

The transmission network development plans under the competence of HOPS (3-year plan and 10-year plan) define measures which can influence transmission network losses (installing chokes and condenser batteries, as well as secondary and tertiary voltage regulation systems). Investments in transmission network refurbishment, upgrades and construction also lead to a reduction of losses, under the precondition of a return on investment for each individual network element. A feasibility study must be drawn up prior to the implementation of any of the aforementioned activities.

Electricity distribution

The Second National Energy Efficiency Action Plan of the Republic of Croatia until the end of 2013 specified the planned measures for reducing electricity losses in the distribution grid in the 2011–2013 period and improving overall business performance of HEP Operator distribucijskog sustava d.o.o.

In the 2011–2013 period, HEP Operator distribucijskog sustava d.o.o. intensively implemented the following activities aimed at reducing electricity losses:

- control of connection points and billing meter points;
- calibration of metering devices;
- control of potential unauthorised consumption;
- installation of electronic meters;
- remote reading and supervision of billing meter points;
- regulation of two-system metering;
- reduction of reactive energy in the grid (installing compensation, installing suitable metering devices, billing inductive and capacitive reactive energy);
- providing metering data to the customers so they can optimise their energy consumption.

The systematic implementation of the aforementioned activities achieved a trend of reducing losses.

Table A4-4. – Losses incurred in the electric power distribution grid in the 2004–2012 period, with projections until 2015

					2004	2005	2006	2007	2008	2009	2010	2011	2012
Losses [GWh]					1 637	1 570	1 365	1 653	1 223	1 508	1 424	1 325	1 402
Losses [%]	10.68	9.85	8.31	9.83	7.21	9.30	8.74		8.19	8.68			

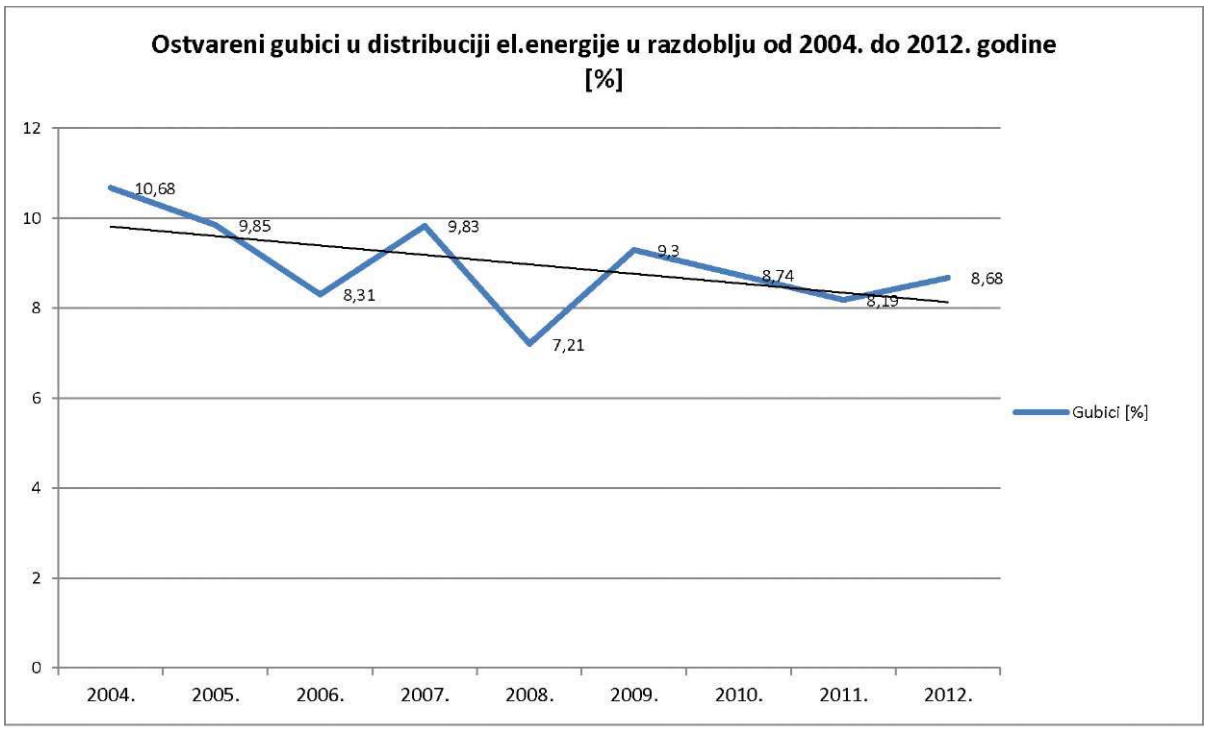


Diagram A4-1 – Losses incurred in the electric power distribution grid in the 2004–2012 period
[Gubici = Losses]

A detailed overview of activities per individual item is presented below.

Control of connection points and billing meter points

In accordance with the Instruction for planning and implementing controls of connection points and billing meter points, from January 2011, controls of connection points and billing meter points in distribution areas are planned for the following year at quarterly level, and a triennial control plan per individual areas, settlements, cities and streets is designed. Quarterly reports are compiled on the controls of connection points and billing meter points.

In the 2011 to 2013 period, a total of approximately 430 000 connection points and billing meter points were controlled at HEP ODS.

A pilot project on the regulation of connection points and billing meter points was conducted at Elektra Zagreb in 2012, and it included a total of 7 740 customers.

Based on the experience of Elektra Zagreb, the planning and implementation process for regulating connection points and billing meter points was expanded to other distribution areas in 2013, in which the regulation of a total of approximately 14 500 connection points and billing meter points was planned.

Calibration of metering devices

In the 2011–2013 period, HEP ODS calibrated electricity meters in the certification periods defined by the Order on certification periods for certain legal measures and the method of their use and the measuring periods for the measuring standards used for the certification of legal measures (NN No 47/2005).

The most extensive activity of regular certification was related to the meters in the category that has the largest number of meter points – households, the vast majority of which (86 %) are in the category of directly connected single-phase and multiphase induction electricity meters for alternating current whose certification period is 16 years.

Meters are generally certified in such a way that all meters whose certification period has expired are disconnected from the grid and are immediately replaced by other certified meters. The disconnected meters are then serviced and certified.

Table A4-5 shows an overview of the number of regular electricity meter certifications conducted in the period in question.

Table A4-5. Number of certified electricity meters

Year	**2011**	**2012**	**2013**
Number of certified meters	126 062	124 842	131 417

Control of unauthorised consumption

The control of potential unauthorised electricity consumption was implemented in the period in question on the basis of:

- citizen reports on the suspicion of unauthorised electricity use;
- planned controls of connection points and billing meter points.

On the basis of citizen reports, a total of 950 cases of unauthorised electricity consumption were discovered in the period in question. On the basis of regular controls of connection points and billing meter points, a total of 2140 cases of unauthorised electricity consumption were discovered.

Installation of electronic meters

The Energy Act (Article 38) lays down the obligation of introducing advanced (smart) meters as an obligation of the grid distributor. In order to reduce electricity losses in the distribution grid, electronic meters with the options of remote reading, disconnection and connection (controlled meters) are continued to be installed to meter points of business category customers whose connection power can be less than 30 kW. These meters are installed to those billing meter points at which the meters are being regularly replaced due to the expiration of their certification period, and such meters are used to register a minimum energy consumption of 10 000 kWh per year.

Table A4-6 shows an overview of the number of installed electronic meters which have replaced the previous induction meters.

Table A4-6. Number of installed electronic meters

Year	**2011**	**2012**	**2013**
Number of replaced meters	18 862	21 043	38 129

Remote reading and supervision of billing meter points

In the 2011–2013 period, systematic work was being done on increasing the number of billing meter points in the remote reading system.

Table A4-7 shows an overview of the number of meters in the remote reading system by year.

Table A4-7. Number of meters in the remote reading system

Year	2011	2012	2013
Number of meters in the remote reading system	31 200	38 500	41 800

Regulation of two-system metering

Due to the special significance of billing meter points with two-system metering, extensive activities for regulating the said meter points in all distribution areas were conducted in 2011. A total of 140 billing meter points with two-system metering were regulated in 2011, which completed the regulation of billing meter points with this type of metering.

Reducing reactive energy in the grid

In the 2011–2013 period, with the aim of reducing the costs of reactive energy in the grid, HEP ODS started the systematic procurement of combination meters for billing meter points of business category customers, and conducted the metering of excessive reactive energy use.

Table A4-8 shows an overview of the number of combination meters and the amounts of billed excessively used reactive energy in HEP ODS.

Table A4-8. Overview of combination meters and billed reactive energy

Year	2011	2012	2013
Number of combination meters	52 367	63 314	72 129
Billed reactive energy (HRK)	70 261 514.00	71 903 921.00	58 046 599.00

Providing metering data to the customers so they can optimise their energy consumption

In order to optimise electricity consumption, business category customers whose connection power exceeds 30 kW are provided access to the metering data of their billing meter point via the web application of HEP - Operater distribucijskog sustava entitled 'Metering Data', at the website: http://mjerenje.hep.hr/.

Energy efficiency measures in heat energy production and distribution in district heating systems

Approximately 74 % of heat energy production for regional heating in Croatia is owned by the HEP Group, company HEP- Toplinarstvo d.o.o. This company also supplies approximately 84 % of all customers connected to district heating systems (DHS) in Croatia. It is therefore particularly important to outline the activities of HEP- Toplinarstvo in the previous period, as well as the activities it plans to implement in the future triennial period.

Most of the projects started in the 2008–2010 period were continued in the 2011–2013 period, and those projects were:

- Modernisation of district heating systems (DTSs) in Zagreb and Osijek, which increased the efficiency of heat energy distribution, i.e. reduced losses in heat energy distribution;
- Technical-economic optimisation of the district heating system of the City of Zagreb. By installing equipment and using software tools, the entire system is managed in real time, which enables the reduction of initial hot water system temperatures and directly reduces losses in heat energy distribution;
- Continued reconstruction of regulation systems which reduces return temperatures in the hot water system, which in turn reduces losses in heat energy distribution;
- Construction of the condensate return system from all main steam heating stations in Sisak;
- Terminating heat energy production in own plants in Sisak, following the construction of the new gas fired cogeneration block at TPP Sisak;
- Replacement of the hot water network with a steam network in the settlement Caprag in Sisak;
- Completed the conversion to gas power (conversion from light and extra light fuel oil to natural gas) and replacement of boilers, burners and pumps with a newer generation of higher efficiency equipment at the boiler room Vidrićeva 1 in Velika Gorica (20 MW);
- Conversion of the 11.8 MW boiler room Slavonska 6 in Samobor to gas power, with the installation of new burners;
- Conversion of the 1.5 MW boiler room Gajeva 6 in Bregana to gas power, and the construction of a connecting hot water pipeline from the boiler room Basaričekova 9 (1.0 MW).

The reconstruction of the hot water boiler at CHPP Zagreb (combined heat and power plant) was completed in 2013. The reconstruction of the firing plant was conducted in accordance with TTR (reducing emissions by using primary methods).
The degree of efficiency of the hot water boiler is 90 % when it is mazut powered and 91 % when gas powered. The emission guarantees will be in accordance with the regulations in force for existent plants whose power exceeds 100 MWt even after 2018.

Table A4-9. Revitalisation of the distribution network – reducing losses in heat energy distribution

Year	**2011**	**2012**	**2013**
Investments in million HRK	30.9	45.6	27.0
Length of revitalised distribution network in km	6.0	8.1	4.6

Table A4-10. Implementing the application for the technical-economic optimisation of the remote heating system – reducing heat energy losses in the district heating system (investments in million HRK)

Year	**2011**	**2012**	**2013**
Technical-economic optimisation of the remote heating system of HEP- Toplinarstvo	7.1	0.3	0.0

Table A4-11. Revitalisation of heating systems (conversion from light and extra light fuel oil to natural gas)

Year	**2011**	**2012**	**2013**
Conversion of boiler room Galženica III in Velika Gorica to gas power	10.9	0.0	0.0
Conversion of boiler room Južno Naselje in Samobor to gas power	0.9	0.0	0.0

By implementing the planned activities in the triennial period 2011–2013, primary energy consumption was reduced by approximately 62 GWh in total. Furthermore, HEP- Toplinarstvo is still achieving annual savings of 39 GWh on the basis of the World Bank project under which 27.2 km of hot water pipelines were replaced.
The other energy operators who perform heat energy production, distribution and supply activities in the Republic of Croatia have also implemented and are planning to implement energy efficiency improvement measures which can be categorised as follows:

- replacement of worn out boiler rooms with the conversion from liquid fuels to natural gas;
- improving regulation in boiler rooms and heating stations;
- use of alternative systems (especially RES);
- reconstruction of hot water/steam pipelines.

Due to the large losses in heat energy production, distribution and supply systems, which range from 13 % to over 30 % (according to HERA data), energy operators will be obliged to implement the aforementioned measures in the following period, in accordance with their business plans. The effects, in the sense of reduced losses and energy savings, should be monitored by HERA in coordination with CEI.

Stimulating electricity and heat energy cogeneration

In accordance with the requirements Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market, Croatia established a regulatory framework for stimulating electricity production from cogeneration. The framework consists of the following regulations:

- Rules on the use of renewable energy sources and cogeneration (NN No 88/12)
- Rules on acquiring the status of eligible electricity producer (NN No 88/12)
- Tariff system for the production of electricity from renewable energy sources and cogeneration (NN No 63/12)
- Decree on the minimum share of electricity produced from renewable energy sources and cogeneration whose production is incentivised (NN Nos 33/07, 08/11)
- Decree on incentive fees for promoting electricity production from renewable energy sources and cogeneration (NN Nos 33/07, 133/07, 155/08, 155/09, 08/11)

Electricity producers who use high-efficiency cogeneration have the right to acquire the status of eligible producer who is guaranteed the incentive purchase price for electricity. Since the adoption of the regulations, the eligible producer status was granted to 4 cogeneration producers. The total installed power of those 4 cogeneration plants is 11.49 MWe. It should be pointed out that these are micro, small, and medium-sized plants in the housing, service and industrial sectors which also contribute to the ESD objective. Six more plants with total installed power of 40.15 MWe are registered in the Register of Renewable Energy Sources and Cogeneration Plants, and their construction and start of operations can be expected in the following triennial period.

Energy efficiency measures in the exploitation of domestic oil and natural gas deposits

In Croatia, crude oil is produced from 34 oil fields, and gas condensate from eight gas-condensate fields. Natural gas is produced from 17 gas fields in the Pannonian Basin and 6 gas fields in the Adriatic. These fields are managed by INA - Industrija nafte d.d. who has undertaken a series of activities in the previous triennial period to reduce its own energy consumption in the exploitation of these deposits.

The objective of the project of optimising domestic inland production activities was to improve and optimise the domestic production of hydrocarbon, reduce costs, and harmonise the safety, health protection and environmental protection activities. The results of the analyses of research and production activity organisation, applied technologies of surface systems, operating procedures and maintenance, as well as measures undertaken with the aim of optimisation, have shown how it is possible to reduce costs, improve the profitability of production fields and extend the exploitation lifespan.

The activities of the undertaken optimisation measures are aimed at the following areas:

- simplifying surface technologies;
- simplified equipment (reduced quantity of operating equipment);
- introducing the operation of unmanned or remote-controlled collection stations by installing an automatic alarm and data transmission system;
- reducing energy costs (e.g. by changing the heating technology from steam system to hot water);
- clearly defining the organisation, work assignments and responsibilities;
- including operative staff in the performance of the majority of maintenance works.

Improving energy efficiency in the oil and gas production process has resulted in internal savings in gas and electricity consumption, as shown in Table A4-12 and Table A4-13.

Table A4-12. Gas consumption in plants

No.	Plants	2011 (in m^3)	2012 (in m^3)	2013 (estimate, in m^3)
1	Žutica	3 623 700	2 560 000	2 649 067
2	Šumečani	1 061 800	995 800	711 860
3	Stružec	2 742 600	2 540 000	2 730 000
4	Etan	32 941 400	23 954 120	8 540 000
5	Beničanci	1 725 000	1 728 120	1 885 800
6	Lipovljani	6 302 580	5 391 300	5 096 800
7	Vinkovci	694 350	662 350	635 230
8	Molve	1 852 000	38○09○000	40 480 060
9	GTP Molve	40 746 200	0	0
10	Šandrovac	7 805 300	7 715 000	8 569 000
11	Koprivnica	475 650	341 690	343 900
	Total plants	**99 970 730**	**83 979 463**	**71 644 449**

Table A4-13. Electricity consumption in plants

No.	Plants	2011 (in kWh)	2012 (in kWh)	2013 (estimate, in kWh)
1	Žutica	22 832 790	23 212 650	20 249 280
2	Šumečani	8 655 372	5 856 100	7 808 100
3	Stružec	2 025 000	2 011 126	2 285 635
4	Etan	90 444	3 024 540	6 350 760
5	Beničanci	3 555 400	3 475 500	3 366 000
6	Lipovljani	5 490 000	5 132 600	4 850 000
7	Vinkovci	1 245 400	1 373 180	964 500
8	Molve	1 367 900	2 044 600	2 621 400
9	Šandrovac	3 221 490	3 011 400	3 143 300
10	Koprivnica	911 200	564 270	518 471
	Total plants	**49 601 080**	**52 505 274**	**52 433 060**

The positive effects of the implemented measures are already evident in regard to reduced costs and improved profitability of the fields.

In order to adapt the technological chain Molve-Etan to the newly arisen situation due to the termination of supply to Dioki, the gas flow was redirected from Posavina to Podravina. The technical-technological changes have also been exact in showing a positive financial effect.

Energy efficiency measures in oil refining and the production of petroleum products in refineries

Crude oil from Croatian own production and from imports is refined in the oil refineries in Rijeka and Sisak. Energy efficiency improvement measures are continuously being undertaken in both refineries. Generally speaking, energy efficiency improvement procedures are conducted in two ways: to a certain extent, energy consumption can be reduced through procedures which do not require investments, such as optimisation and rational management. However, larger investments are required in order to achieve substantial reductions.

In March 2012, a system for full and continuous control of water quality at the steam boiler intake was installed at the Rijeka Oil Refinery. This system enabled the improvement of operating availability and reliability of the steam generator and a reduction of fuel oil/gas consumption. The improved operation of hydrogen piston compressors, in order to enable automatic and non-staged control of compressor capacity, was the result of the project completed in June 2012. Energy consumption at the compressors was minimised and maintenance requirements were substantially reduced. The construction of the natural gas pressure reduction station was completed in July 2011. The use of natural gas as fuel resulted in a 60 % reduction of SOx emissions.

The implementation of an important venture aimed at improving energy efficiency at the Rijeka Oil Refinery started in September 2013. Additional heat exchangers, whose positions were determined with the ‘pinch analysis’, are being installed on old refinery plants. These heat exchangers will utilise previously unused sources of waste heat to increase the temperatures of various process flows. This will increase the overall efficiency and profitability of the

Rijeka Oil Refinery. Furthermore, extensive works are being undertaken and planned with the aim of reducing electricity consumption, including the reconstruction of existent transformer stations and improving the operation of electric motors, as well as improving the lighting system.

The first stage of modernisation of the Rijeka Oil Refinery was concluded in 2011, when the construction of the hydrocracking plant was completed and the plant was put into operation. The hydrocracking plant processes heavy oil fractions and produces medium distillates and lighter hydrocarbon fractions. These products are processed in the hydrodesulphurisation plant and used for the production of EURO V quality diesel and petrol fuels.

Several activities aimed at improving energy efficiency and reducing losses were successfully implemented at the Rijeka Oil Refinery in 2012, including: collecting condensate at plant group 5 (hydrocracking plant) to be reutilised as additional water; control of the condensation operating mode in turbo generators to reduce losses through condensate and achieve electricity savings; optimisation of the cooling water system; replacement of the top of the flare in order to reduce steam consumption, reduce noise levels, achieve smokeless burning and thereby reduce the environmental impact.

Great improvements to the overall energy efficiency, environmental impact, competitiveness and productivity of the Rijeka Oil Refinery will be achieved with the planned construction of the new heavy residue processing plant, the delayed coking unit, as part of the second stage of modernisation. This plant will enable the Rijeka Oil Refinery to increase the production of high-value and high-quality distillates used for diesel fuel production.

Furthermore, the yields of high-quality liquefied petroleum gas and petrol will also increase. The production of the low-value and high-sulphur fuel oil will be terminated and, as an energy source, it will be replaced by refinery gas or natural gas. That will significantly reduce emissions and ensure a bright future for the Rijeka Oil Refinery.

Table A4-14 shows the activities implemented in the 2011–2013 period and the corresponding annual energy savings.

Table A4-14. Activities implemented in 2011–2013 and the corresponding annual energy savings

Project Title	Annual energy savings (MJ/year)	Annual energy savings (MWh/year)
Installation of water analyser at steam boiler intake	66 510 000	18 475
Installation of automatic and non-staged control of compressor capacity	12 816 000	3 560
Reconstruction of transformer stations	12 600 000	3 500
Installation of the first series of exchangers for waste heat return	81 000 000	22 500
Condensate collection at plant group 5	53 316 000	14 810
Control of condensation operating mode of turbo generators	487 692 000	135 470
Cooling water system optimisation	6 300 000	1 750
Replacement of the flare top	2 844 000	790
Total	**723 078 000**	**200 855**

The activities aimed at improving energy efficiency, reducing environmental impact, and reducing losses will continue in the 2014–2016 period. They will include: installation of additional heat exchangers at old plants; improving the efficiency of process furnaces; installation of systems for recovering gas from the flare in order to

reduce refinery gas and natural gas consumption and reduce COx, SOx and other emissions; modernisation of the power plant and the reformer plant; installation of devices for measuring, monitoring and controlling energy sources in order to establish an energy management system; steam condensate collection and reuse. The expected annual energy savings are 535 100 MWh/year (value of expected annual energy savings calculated on the basis of the assumption of Rijeka Oil Refinery operating at maximum capacity).

An efficient online system for the flue gas oxygen analyser was installed at the fluid catalytic cracking plant at the Sisak Oil Refinery in May 2012. This helped reduce the consumption of high-pressure steam and reduce emissions, not just of carbon dioxide and carbon monoxide, but also of nitrous oxides.

The activities aimed at reducing heat losses in order to increase energy efficiency at the Sisak Oil Refinery were implemented in 2012. Heat losses were reduced in the steam distribution system. Steam siphons, process flows and steam-heated tanks were controlled. Steam condensate leakage at the desulphurisation plant was reduced.

Table A4-15 shows the activities implemented in the 2011–2013 period and the corresponding annual energy savings.

Table A4-15. Activities implemented in the 2011–2013 period and the corresponding annual energy savings

Project Title	Annual energy savings (MJ/year)	Annual energy savings (MWh/year)
Installation of oxygen, carbon dioxide and carbon monoxide analyser systems	27 036 000	7 510
Reduction of heat losses	50 436 000	14 010
Total	**77 472 000**	**21 520**

The activities aimed at improving energy efficiency and reducing losses will continue in the 20142016 period. They will include: installation of additional heat exchangers at old plants; improving the efficiency of process furnaces; installation of systems for recovering gas from the flare in order to reduce refinery gas and natural gas consumption and reduce COx, SOx and other emissions; installation of devices for measuring, monitoring and controlling energy sources in order to establish an energy management system; steam condensate collection and reuse.

The expected annual energy savings are 242 300 MWh/year (expected annual energy savings calculated on the basis of the assumption of Sisak Oil Refinery operating at maximum capacity).

Energy efficiency measures in oil pipeline transport

The Adriatic pipeline was constructed in 1979 as an international oil transport system from the oil tanker port and terminal Omišalj to domestic and foreign refineries in Eastern and Central Europe. The designed pipeline capacity is 34 million tonnes of transported oil per year, and the installed capacity is 20 million tonnes. The total capacity of the newly constructed storage tanks is 240 000 m^3, and their construction increased the overall capacity of oil tanks at the Omišalj Terminal to 1 000 000 m^3 (previously, the crude oil capacity was 760 000 m^3). JANAF's total oil storage capacity is 1.54 million m^3, and petroleum product storage capacity is 100 000 m^3.

JANAF's development projects include the activities and measures of process optimisation, improved energy consumption management, and introduction of new technologies aimed at efficient energy use and cost reduction. In the 2011–2013 period, JANAF implemented the following activities which contribute to the energy efficiency policy:

Activities and measures of process optimisation, improved energy consumption management, SCADA

Putting the new remote supervisory control system into operation produced the following effects in regard to energy efficiency:

1. SCADA enables the control and supervision of the power supply distribution grid, a detailed insight into electricity consumption, the monitoring of current consumption values and avoidance of peak consumption;
2. The main energy efficiency indicator can be expressed with a lower electricity consumption per tonne and kilometre in comparison to the status before the reconstruction;
3. SCADA enables transport management in an operating mode which ensures the optimal use of energy resources (transport time, duration, flows, pressures);
4. The number of block station on-site inspections by employees is reduced due to remote supervision.

Replacement of existing plants and regular maintenance

The installation of electric motor drives with frequency regulation and soft starters reduces grid load and overall consumption by ca. 10 %. The installation of lighting regulators optimises the efficiency of light sources by reducing the voltage after they have been switched on, which increases light source durability and reduces losses by approximately 20 % (lighting costs).

A solar collector system was installed at the motorway location Bosiljevo to supply power for the cathodic protection of the Omišalj-Sisak oil pipeline, and the HEP distribution grid is used only as an alternative power supply. Solar collectors only supply power to batteries, and the collected power is used for night-time operation.

The following was installed with the introduction of new 6 kV plants: modern vacuum switches with electric motor drives and withdrawable vacuum breakers, multifunctional numerical protection relays for measuring, controlling, supervising and analysing energy values (current, voltage, frequency, power, energy), as well as other necessary equipment. New reactive energy compensation was also installed within the scope of construction of new 6 kV plants. The new 0.4 kV plant is a withdrawable module, with select technical solutions that currently represent state-of-the-art technology on the global market. This type of design enables secure and reliable supply, control, protection and signalling of the status of low-voltage electrical devices.

The existent 35 kV plants intended for receiving electricity from the HEP grid will be replaced with new 35 kV plants, with full coordination with the electricity provider at the Omišalj Terminal and PS Melnice in 2014, and at the Sisak Terminal in 2015.

The replacement of existing plants with newer and more efficient ones (replacement of rotors on pumps, electric motors) will only be viable when the pumps achieve annual engagement of min. 2 500 h, which is currently not the case because the pumps operate 500–1 000 h per year, on average.

Regular maintenance and testing includes: servicing switching plants, transformers, rectifiers with batteries, electric motors, etc.; testing and measuring earthing resistance; testing protection relays; connection checks (thermovisual recording); security system reliability checks; diagnostics of large rotating machines; high-voltage cable diagnostics, etc.

Optimisation of energy costs

Oil transport along the oil pipeline section Omišalj Terminal – Sisak Terminal is generally conducted only in the night-time, i.e. in the period when the lower electricity tariff applies. That substantially reduces electricity costs and balances the electric power system. An additional benefit of using electricity during the night is that it does not require payments for peak power which is calculated for the day-time tariff and which would amount to approximately 7.7 MW for the Omišalj Terminal and PS Melnice to power two 3.3 MW generators at each locality, required for oil transport along the Omišalj-Melnice-Sisak section, or approximately 15.4 MW in total.

Process optimisation was achieved by replacing reactive energy compensation plants due to their worn-out state and non-compliance with environmental standards at the Omišalj, Sisak and Virje terminals, and at PS Melnice and OS Dobra. JANAF therefore has its own reactive energy source, such energy does not need to be taken from the electric power grid, which yields savings at electric power system level because reactive energy production and transmission are not required.

Energy efficiency measures in natural gas transmission and distribution

Natural gas transmission is a regulated energy activity that is performed as a public service and is the core business activity of Plinacro d.o.o., the owner and operator of the gas transmission system. Plinacro is fully owned by the Republic of Croatia.

The replacement of equipment in gas boiler rooms in gas transmission system facilities (measuring-reduction stations) was continued in 2011. Gas boiler rooms at measuring-reduction stations are used for preheating natural gas before its delivery to customers, and they use natural gas as fuel. Since some of the boiler rooms are more than thirty years old, in 2008 Plinacro d.o.o. started the systematic replacement of boiler room equipment (boilers, burners, boiler room management system). Instead of the previous old, inefficient and unreliable boiler plants, the facilities were installed with new equipment (condensing boilers with modulating burners) which has a 110 degree of efficiency. By replacing the aforementioned equipment, in addition to increasing safety and reliability, Plinacro greatly reduced energy (gas) consumption for preheating natural gas. A total of 20 boiler rooms were modernised in the 2011–2013 period. That achieved 15–20 % savings in gas consumption in comparison to the old boiler rooms. It will be possible to accurately quantify the gas savings only at the end of the gas year (September 2014). It is estimated that the replacement of equipment at those 20 facilities will yield savings of ca. 36 000–50 000 m^3 of natural gas per year, which is equivalent to 406–580 MWh.

In 2014 and 2015 it is planned to replace the equipment in other old, inefficient boiler rooms, a total of 8 facilities, which could achieve additional savings in natural gas consumption of 5 000–20 000 m^3 per year.

In addition to replacing gas boiler room equipment, the preheating temperature for exit gas was reduced from the previous 15 ^oC to 12 ^oC at several facilities in order to reduce natural gas consumption and achieve additional savings. It will be possible to achieve the aforementioned temperature reduction at those facilities at which the reduced temperature of exit gas will not impact gas delivery security and gas consumers. Since this is a complex issue for which every facility must be given individual consideration, especially in wintertime, substantial savings are expected to be achieved in the following years.

In its internal regulations, Plinacro d.o.o. prescribes regular inspections and controls of the gas pipeline system, whereby it takes preventive action in regard to possible losses (leaks). In addition to the aforementioned, the condition of the pipe walls is periodically inspected, and pipeline damages which could cause leaks or ruptures in the future are preventively repaired.

In order to prevent uncontrolled leakage in worn out gas pipeline sections, numerous pipeline repairs were made in 2011, 2012 and 2013, all following regular pipeline status checks during which the condition of pipe walls and anticorrosion insulation was inspected. Most of the repairs were done by strengthening the damaged parts by installing composite clamps (89 locations, 137 clamps installed on gas pipelines). Some of the more severe damages were repaired by installing metal clamps, and pipeline sections were replaced at those locations where there was a higher concentration of damages.

Natural gas distribution

Rational use of gas in the distribution and supply process is most evident in the level of gas losses during gas transmission through the distribution network, in the network manipulations during the interruption and re-establishment of operating pressure, and during gas supply to final customers. These are technical gas losses. They occur due to the natural properties of gas, measuring methods and conditions, and uncontrolled gas leakages from the network in the event of gas pipeline damage or at gas connection points. The majority of the losses result from the natural properties of gas and they cannot be remedied. A smaller share of technical losses results from gas leaks. The measures for reducing such leaks primarily include the reconstruction of worn out steel pipelines, which reduces the share of steel pipelines in overall pipeline length and reduces losses.

The total losses, in addition to technical, also include metering errors, discrepancies due to the consumption reading time, and unauthorised gas consumption. The total losses vary greatly depending on the distribution system operator, and they range from 0.22 % to as much as 26 %, which clearly indicates that there is potential for improvements.

The primary measure for reducing technical losses is the reconstruction of worn out gas pipelines. Energy operators plan gas pipeline reconstructions under their five-year distribution system development plans, which are approved by the minister competent for the energy sector following a positive opinion issued by HERA.

It should be pointed out that a distribution system operator is obligated to draw up, publish, and annually update a five-year distribution system development plan and submit it for approval to the minister, with the ME being obliged to obtain HERA's opinion before issuing an approval.

A4.4. Savings Measures in Final Consumption

This chapter presents a detailed overview of the implementation and effects of all savings measures in final consumption under the 2nd NEEAP. The overview of verified energy savings in 2013 is presented using the BU (bottom-up) method. This section primarily explains the actions undertaken in the previous 3 years (2011–2013), or under the 2nd NEEAP, and the previous chapters present an overview of measures for the future period (20142016).

The measures are divided by sector (in accordance with the 2nd NEEAP) as follows:

1. General measures in buildings (measures B) – these measures are aimed at households, public and commercial services
2. Measures for households (measures with designation R)
3. Measures for the service sector
    a. Measures for the public sector (measures with designation P)
    b. Measures for the commercial services sector (measures with designation C)
4. Measures in industry (measures with designation I)
5. Measures in transport (measures with designation T)
6. Measures for energy companies (measures with designation E)

7. Horizontal measures (measures with designation H)

It should be pointed out that the energy savings presented in this report were calculated using the bottom-up methodology laid down in the Rules on the methodology for monitoring, measuring and verifying energy savings in final consumption (NN No 77/12). Moreover, this includes the savings achieved by way of EPEEF funds, calculated with the same method.

The description of each measure is preceded by a table overview of the measure from the 2nd NEEAP is expected.

General measures in buildings – these measures are aimed at households, public and commercial services
B.1 Building regulations and implementation

Overview of the measure from the 2nd NEEAP		*Building regulations and implementation*
Measure index		*B.1*
Description	Category	*Regulations*
	Time frame	*Start: 2008 End: 2016* *Planned major modifications, amendments, improvements:* *The measure was revised with actual achieved savings and in accordance with the planned future activities regarding compliance with EPBD II requirements.*
	Objective / outline	*Building regulations and their implementation is an efficient measure ensuring compliance with the best energy efficiency standards for buildings. The development of the regulations on the energy efficiency of buildings is closely connected to meeting the requirements of the EPBD. The activities to be performed in the following period will therefore be based on the requirements of EPBD II. The implementation mechanisms include inspection, control of mandatory certification of new buildings prior to use, and control of the soundness of energy performance certificates.*
	Target final consumption	*New and existing buildings (for major reconstructions)*
	Target group	*Construction participants, owners of the buildings undergoing reconstruction*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *MEPPPC: approximately HRK 1 000 000* *Planned funds by the end of 2013:* *MCPP: planned under the Ministry's budget*
	Executive body	*MCPP (preparatory activities and drafting amendments to regulations);* • *MCPP (improving the methodology for conducting energy audits of heating and air-conditioning systems of buildings)*
	Monitoring bodies	*MCPP (supervise the enforcement of regulations)*

Amendments to the building regulations and their implementation are compliant with the requirements of EPBD II. Increasing the requirements related to energy efficiency in building construction is planned as a measure for setting the standards for new buildings, as well as for the reconstruction of existent buildings. Building regulations and their implementation is an efficient measure ensuring compliance with the best energy efficiency standards for buildings.

The following acts were adopted during the implementation of the 2nd NEEAP:

- Act on Efficient Energy Use in Final Consumption (NN Nos 152/08, 55/12, 101/13, 14/14); Associated act:
- Construction Act (NN 153/13, Article 202(2))

The act creates the preconditions for the adoption of implementing regulations. The Technical regulation on the rational use of energy and thermal protection in buildings lays down the minimum requirements for the energy performance of new buildings and existent buildings, when the latter are subject to extensive reconstructions. Other technical regulations laid down the minimum requirements for construction products; the technical systems of a building and the parts of a building's structure to which the said technical systems apply; and the design, construction, usability and maintenance requirements for the aforementioned.

The adopted acts include the transposition of some of the EPBD II (9 July 2012) requirements, and primarily those pertaining to the mechanisms of implementation, penalisation and quality control of the issued energy performance certificates.

Decrees: Decree on contracting and the implementation of energy services in the public sector (NN Nos 69/12). The adopted Decree lays down the conditions for the implementation of some of the EPBD II requirements related to the renovation of public sector buildings.

Rules:

- Rules on energy audits and energy certification of buildings (NN 81/12, 29/13, 78/13)
- Rules on conditions and criteria for persons who perform energy audits and energy certification of buildings (NN Nos 81/12, 64/13)
- Rules on the control of energy performance certificates of buildings and energy audit reports (NN No 81/12, 79/13)
- Rules on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – photovoltaic systems (NN 79/13, 85/13)

The adopted sets of rules lay down the implementation of energy audits; the establishment of a comprehensive system for authorising persons for conducting energy audits and energy certification of buildings; education and training programmes for persons conducting energy audits and energy certification of buildings; the rules establish a system of independent controls of energy performance certificates of buildings, reports on energy audits of buildings, and reports on audits of heating and cooling or air-conditioning systems in buildings; as well as the conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – photovoltaic systems.

Technical regulations:

- Technical regulation on the rational use of energy and thermal protection in buildings (NN Nos 110/08, 89/09, 79/13, 90/13)

The amendments to the Technical regulation on the rational use of energy and thermal protection in buildings primarily pertain to setting the minimum requirements for the energy performance of new and existent buildings, including parts of a building's structure and the technical systems of a building, and to defining reference buildings and nearly zero energy buildings, or to harmonisation with EPBD II. Other acts:

- Methodology for conducting energy audits of buildings (NN No 81/12, 29/13, 78/13)
- Decision on the delivery method for reports on conducted energy audits of buildings or issued energy performance certificates of buildings
- Decision on the costs of issuing a decision on the authorisation for conducting energy audits of buildings and/or energy certification of buildings
- Corrigendum to the Decision on the costs of issuing a decision on the authorisation for conducting energy audits of buildings and/or energy certification of buildings
- Decision on the costs of issuing a decision on the authorisation for the control of energy audit reports and energy performance certificates of buildings
- Corrigendum to the Decision on the costs of issuing a decision on the authorisation for the control of energy audit reports and energy performance certificates of buildings
- Decision on the maximum cost prices of conducting controls of issued energy performance certificates of buildings and reports on regular audits of heating and cooling or air-conditioning systems in buildings

The adopted decisions pertain to determining the methodology and algorithms for calculating the energy performance of buildings related to conducting energy audits of buildings, and they pertain to the decisions governing other implementation issues related to conducting energy audits and energy certification.

A methodology is defined as a group of actions and procedures for conducting energy audits of buildings, which contains an algorithm for calculating the energy performance of a building, and it includes the following elements:

- Methodology for conducting energy audits of buildings
- Template of the report on the energy audit of a building
- Questionnaire for collecting data

Algorithm for calculating the energy performance of a building

- Algorithm for calculating the required energy for heating and cooling the premises and Annex 2 with a calculation of heat transfer coefficients for a residential-commercial building
- Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (heating and domestic hot water preparation systems)
- Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (cogeneration systems, remote heating systems, photovoltaic systems)
- Algorithm for determining the energy efficiency of lighting systems in buildings (energy requirements for lighting)
- Algorithm for calculating the energy required for the application of ventilation and air-conditioning systems for heating and cooling the areas of a building

This measure is complemented by the measure B.3 'Certification of buildings' which provides information on energy consumption to the potential end-user, thereby directing their choice towards buildings with lower energy consumption and associated costs.

B.2 Energy audits of heating and air-conditioning systems

Overview of the measure from the 2nd NEEAP		*Energy audits of heating and air-conditioning systems*
Measure index		*B.2*
Description	Category Time frame	*Regulations* *Start: 2009 (2011) End: 2016* *Planned major modifications, amendments, improvements:* *The measure was not systematically implemented in the previous period, other than within the scope of mandatory implementation of energy audits for the purpose of energy certification of buildings, and within the scope of EPEEF financing of energy audit implementation. The relevant regulations were adopted only in early 2011, so a more substantial implementation and results are expected in the forthcoming period.*
	Objective / outline	*A large percentage of heating and air-conditioning systems is old, malfunctioning, and therefore wasting great amounts of energy. In line with the EPBD II requirements, regulations were adopted laying down the obligation of regular audits of heating and air-conditioning systems, by way of which users will be issued clear recommendations for improving the energy efficiency of such systems.*
	Target final consumption	*Heating and air-conditioning systems in existent buildings*
	Target group	*Building occupants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *MELE: within the scope of regular activities* • *EPEEF: within the scope of tenders for conducting energy audits* *Planned funds by the end of 2013/2016:* • *ME and MCPP: within the scope of regular activities*

		• *DIRH: within the scope of regular activities*
		4 EPEEF (co-financing energy audits)
	Executive body	*MCPP and ME – harmonising regulations* *Centre – conducting tenders for energy audits on behalf of state administration bodies and by request of LRSGUs and public institutions and companies* • *EPEEF – ensuring co-financing*
	Monitoring bodies	*MCPP (administrative supervision of the enforcement of the provisions of relevant rules, keeping a database of systems that are subject to the obligation)*

The adoption of regulations laying down the obligation of energy audits and energy certification of buildings, which provide users with clear recommendations for improving the energy efficiency of these systems, meets the requirements of EPBD II.

Measure B.2 was not implemented as a separate measure in the previous period because the obligations and methods for energy audits of heating and air-conditioning systems were implemented under the system of energy audits and energy certification of buildings. The implementation was covered under measure B.3 with which B.2 will be merged for the following period.

B.3 Energy certification of buildings

Overview of the measure from the 2nd NEEAP		***Energy certification of buildings***
Measure index		*B.3*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2010 End: 2016* *Planned major modifications, amendments, improvements:* *The measure was revised in accordance with the planned future activities on alignment with EPBD II requirements.*
	Objective / outline	*This measure is aimed at raising the awareness of building users and transforming the market towards more efficient buildings. In order to benefit from the full effects of this measure, a programme on informing the citizens about the meaning and importance of certificates should be designed and implemented, and mechanisms for controlling the implementation and quality of the activities of authorised energy certifiers should be planned. An energy performance certificate provides information on the consumption of heat energy for heating, and proposes measures for improving the energy performance of all energy systems. An energy certificate for a new building is issued on the basis of design documents, while an energy audit must be conducted for an existent building. Based on the calculations of specific annual heat energy requirements for heating ($Q_{H,nd,ref}$), buildings are classified in energy consumption classes – from the A+ class with the lowest heat energy consumption for heating ($Q_{H,nd,ref} \leq$ 15 kWh/(m^2a)), to the G class with the highest energy consumption ($Q_{H,nd,ref} >$ 250 kWh/(m^2a)) in two reference climates, continental and littoral Croatia, with a division limit at 2 200 heating degree days. An energy performance certificate is currently expressed in accordance with the specific annual heat energy requirement for heating. Ultimately, the total energy consumption of a building, up to primary energy level, should be entered into an energy performance certificate. Further amendments to the regulations will be developed to that end.*
	Target final consumption	*New and existent buildings*
	Target group	*Building users, construction participants, everyone involved in the implementation of activities for achieving the energy efficiency improvement targets of buildings*
	Regional application	*National*

Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *MEPPPC: specified under B.1* *Planned funds by the end of 2013:* • *MCPP: planned under the Ministry's budget* *4 EPEEF: financing the informational-educational campaign*
	Executive body	*MCPP (amendments to the regulations, starting the informational-educational campaign or programme on energy certification)*
	Monitoring bodies	*MCPP (administrative supervision of enforcing the provisions of relevant rules and the sanctioning mechanism, submitting data on issued authorisations to the central database)* *Institutions (legal persons) authorised to conduct quality control of issued energy performance certificates*

This measure was primarily aimed at raising the awareness of building users and transforming the market towards more efficient buildings. In order to do that, it was primarily necessary to implement a programme on informing the citizens about the meaning and importance of certificates, and design the mechanisms for controlling the implementation and quality of the activities of authorised energy certifiers.

The energy audit and the energy certification of a building are conducted by a person who is authorised by the Ministry of Construction and Physical Planning pursuant to the Rules on the conditions and criteria for persons conducting energy audits and energy certification of buildings (NN Nos 81/12, 64/13). In the last three years, 10 educational institutions were granted authorisation to conduct training for energy certifiers:

1. College of Slavonski Brod, Slavonski Brod, Dr. Mile Budaka 1
2. Faculty of Civil Engineering at the University of Zagreb, Zagreb, Fra Andrije Kačića-Miošića 26
3. Faculty of Engineering at the University of Rijeka, Rijeka, Vukovarska 58
4. Energy Institute Hrvoje Požar, Zagreb, Savska cesta 163
5. Faculty of Mechanical Engineering and Naval Architecture at the University of Zagreb, Zagreb, Ivana Lučića 5
6. Brodarski institut d.o.o., Zagreb, Zagreb, Avenija Većeslava Holjevca 20
7. Society of Civil Engineers Zagreb, Zagreb, Berislavićeva 6
8. Croatian Chamber of Mechanical Engineers, Zagreb, Ulica grada Vukovara 271
9. Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture at the University of Split, Split, Ruđera Boškovića 32
10. Faculty of Civil Engineering Osijek at the Josip Juraj Strossmayer University of Osijek, Osijek, Drinska 16a

As of 31 December 2013, a total of **883 certifiers (natural and legal persons)** have been registered in the register of persons authorised to conduct energy certification, **and a total of 17 400 certificates have been submitted thus far.**

The bottom-up method was used to collect data from the public sector, the parties obligated to implement energy management (cities, counties and ministries), on the number of energy audits conducted in 2013. Data were collected from 23 cities, nine counties, and the Ministry of Health, with a total of 651 energy audits conducted. In accordance with the methodology for measuring and verifying savings, this number does not include the audits which were followed by energy renovation of a facility, in order to avoid savings being double counted. The Energy Management Information System was of great use in calculating savings, and savings were calculated using level 2b of the methodology, wherever applicable. For facilities for which there was insufficient data, calculations were made using reference values, level 1. **The results of the energy audits of the public sector, which self-financed the energy audits of its buildings, are total estimated savings of 7 062 592 kWh/year or 0.025 PJ for 2013.**

Table A4-17. Savings achieved by conducting energy audits in the public sector, self-financed

City/County/Ministry	Number of buildings	E savings level 2b (kWh/year)	CO_2 emissions savings (kg/year)
Zagreb	239	2 625 484	13 488 399
Ministry of Health	31	1 164 000	
Sisak-Moslavina	58	739 927	221 978
Osijek-Baranja	48	643 755	2 300 000
Split	56	610 142	2 805 624
Krapina-Zagorje	28	313 118	
Karlovac	35	197 115	2 729 950
Brod-Posavina	15	156 858	781 179
Rijeka	38	136 356	456 533
Primorje-Gorski Kotar	13	101 144	882 981
Šibenik-Knin	8	82 000	
Koprivnica	22	39 658	203 197
Slavonski Brod	6	39 572	429 164
Bjelovar	10	39 500	
Zadar	7	36 000	
Slatina	3	28 004	66 637
Bjelovar-Bilogora	1	20 380	84 967
Pazin	2	20 000	103 600
Virovitica	6	12 845	135 030
Međimurje	1	10 739	64 000
Duga Resa	1	10 000	
Ozalj	2	8 000	
Zabok	1	7 016	29 074
Knin	2	5 450	104 510
Klanjec	1	4 400	
Beli Manastir	1	3 000	
Varaždinske Toplice	2	2 113	
Hrvatska Kostajnica	3	2 100	38 200
Vodice	3	1 535	15 300
Dugo Selo	2	1 016	7 300
Nin	1	825	6 206
Rab	1	540	2 850
Total:	647	7 062 592	kWh
		0.0254	PJ

The Ministry of Construction reported that approximately 5 300 energy audits of non-residential buildings were conducted. A register for entering certificates has been developed, but it is still not fully functional so there is no official data on the number of certificates obtained by public administration for its facilities. However, it is assumed, with great accuracy, that 90 % of the total number of non-residential facilities are public administration buildings. **When the aforementioned savings, collected using the BU method, are extrapolated onto 4 500 facilities (the**

estimated number of valid certificates issued in the past three years), the total calculated savings amount to 0.11 PJ.

Many energy audits were co-financed by the Environmental Protection and Energy Efficiency Fund. In the 2011–2013 period, a total of 64 projects (77 energy audits) were reviewed and the total amount of funding paid out for those projects was HRK 593 358.26, with the total investments amounting to HRK 1 101 646.49. The **energy savings** calculated for those projects **amounted to 1.98 TJ (551 233.48 kWh).** Greenhouse gas emissions were reduced by 202.04 tCO2 in total, and HRK 283 765.23 were saved. Since the life cycle of the measure is 5 years, the energy audits performed before 2008 were no longer valid in 2013, and they are no longer taken into account for the total savings achieved in 2013. However, the savings achieved after 2008 were added to the savings achieved in the 2011–2013 period, but attention was paid to avoid double counting the savings, or doubling them, in the calculations.

By the end of 2013 (which includes the periods of the first and second NEEAP), a total of 105 projects (148 energy audits) were implemented and the total amount of funding paid out for those projects was HRK 3 870 073.94, with the total investments amounting to HRK 5 724 367.83. The energy savings calculated for those projects amounted to 8.23 TJ (2 286 914.73 kWh), which is 0.063 % of the national intermediate target for 2013, or 0.041 % of the national target for 2016. Greenhouse gas emissions were reduced by 569.56 tCO2 in total, and HRK 669 613.25 were saved.

Most energy audit projects were conducted in the public service sector, while the largest energy savings were achieved in the industry sector. Table A4-18 shows savings per sector.

Table A4-18. Savings achieved from conducting energy audits per final consumption sectors (for the period of the 1st and 2nd NEEAP)

Sector	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total CO_2 emissions savings [t]	Total funds paid out from the Fund [HRK]*
Industry	16	1 289 215.94	4.64	245.09	2 069 851.14
Public services	86	877 178.79	3.16	288.59	1 545 075.60
Commercial services	3	120 520.00	0.43	35.88	255 147.20
Total:	**105**	**2 286 914.73**	**8.23**	**569.56**	**3 870 073.94**

*pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Only the savings for public buildings collected using the bottom-up method were calculated for this measure. Savings for buildings certified in the industrial and commercial sector are shown in the report on the implementation of measures C.1 and I.3.

In addition to high-quality and controlled education and training for certifiers, the education of end users on the importance and significance of energy certification is also vital. The Ministry of Construction and Physical Planning (MCPP) gave a strong impetus for providing information on energy certification, and later the certifier market undertook its role in informing citizens and popularising energy efficiency measures. Of all the mechanisms that provide information on and advertise the importance of energy certification, we highlight the following:

- On its website, MCPP published a brochure with basic information on energy certification;
- The Croatian Association of Energy Certifiers (HUEC) is a non-profit organisation established with the aim of promoting, developing and improving energy efficiency and renewable energy sources in the Republic

of Croatia. Through its activities, it promotes improving the quality of operations in the field of energy audits and energy certification, and it informs the public about the application, rules, regulations and standards for conducting energy audits and energy certification;

- The Environmental Protection and Energy Efficiency Fund has made great steps in informing the public by co-financing energy audits and publishing tenders which additionally encouraged all sectors to fulfil their legal obligations of energy certification.

In the second NEEAP it was planned to introduce total energy consumption up to primary consumption level into the energy performance certificate, however, no work on the matter has yet been undertaken.

The rules regulating energy audits have been significantly improved, and further information on regulations was provided under measure B.1.

B.4 Increasing the number of nearly zero energy buildings

Overview of the measure from the 2nd NEEAP		***Increasing the number of nearly zero energy buildings***
Measure index		*B.4*
Description	Category	*Regulations; Financial instruments*
	Time frame	*Start: 2012* *End: 2016 (2020)* *Planned major modifications, amendments, improvements:* *New measure in accordance with the planned activities on alignment with EPBD II requirements.*
	Objective / outline	*EPBD II requires the introduction of more stringent requirements regarding the energy performance of buildings. The Member States are asked to prepare national plans for increasing the number of nearly zero energy buildings, and to regularly report their activities to the European Commission. The sector of buildings intended for public use must assume the leading role in the field of improving energy efficiency in buildings and set more ambitious targets for buildings intended for public use. EPBD II requires that, as of 31 December 2020, all new buildings be nearly zero energy buildings; or that, as of 31 December 2018, new buildings intended for public use be nearly zero energy buildings. The Member States are asked to prepare national plans for increasing the number of nearly zero energy buildings. The public sector should be stimulated towards energy renovation compliant with the standard for nearly zero energy buildings.*
	Target final consumption	*New buildings and existing buildings undergoing reconstruction*
	Target group	*Construction participants and owners of the buildings undergoing reconstruction*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Planned funds by the end of 2013:* • *MCPP: planned under the Ministry's budget for drawing up the plan: HRK 100 000; Potential financing sources for plan implementation: MCPP budget, EPEEF, HBOR, commercial banks*
	Executive body	*MCPP – drawing up the plan* *EPEEF, in coordination with the Centre – establish and implement an incentive scheme*
	Monitoring bodies	*MCPP*

EPBD II requires the introduction of more stringent requirements regarding the energy performance of buildings. The Member States are asked to prepare national plans for increasing the number of nearly zero energy buildings, and to regularly report their activities to the European Commission. The sector of buildings intended for public use must assume the leading role in the field of improving energy efficiency in buildings and set more ambitious targets for buildings intended for public use. EPBD II requires that, as of 31 December 2020, all new buildings be nearly zero energy buildings; or that, as of 31 December 2018, new buildings intended for public use be nearly zero energy

buildings. The Member States are asked to prepare national plans for increasing the number of nearly zero energy buildings.
MCPP has drawn up the Plan for Single-Family Homes, and other plans will be drawn up in 2014. All finalised and adopted programmes are annexed to the 3rd NEEAP is expected.

Measures for households

R.1 Info campaigns and network of EE info centres

Overview of the measure from the 2nd NEEAP		***Info campaigns and network of EE info centres***
Measure index		*R.1*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2007* *End: 2013* *Planned major modifications, amendments, improvements:* *An extensive national campaign will no longer be conducted; targeted campaigns combined with financial incentives for certain measures will be conducted; all other activities will continue to be implemented*
	Objective / outline	*This measure also plans the establishment of EE info centres at city and county administrations where energy advisers will offer citizens, at their request, free advice on the possibilities for energy and financial savings in their homes. Targeted educational activities should include the participants involved in reaching the energy efficiency improvement target.*
	Target final consumption	*Household appliances; all appliances which consume energy in any operating mode*
	Target group	*Owners of housing units (citizens); decision makers on appliance procurement in other sectors*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *UNDP/GEF: HRK 2 000 000* • *EPEEF: HRK 9 684 300* • *ME: 150 000* • *Planned funds by the end of 2013:* • *EPEEF: ensure funding for the promotion of measures defined in the 2nd NEEAP* *The measure can be implemented using EPEEF funding, without jeopardising the financing of environmental protection measures, when new systems for charging greenhouse gas emission fees are activated and those fees are paid into a special account from which the funds can be allocated for financing the measure.*
	Executive body	*UNDP project team within the framework of SEM (measure P.1) and HiO (measure P.2) projects* *EPEEF – ensure co-financing for stakeholders who are implementing educational and informational* *activities on energy efficiency* *Holders of target group training programmes aimed at improving EnE*
	Monitoring bodies	*ME, MCPP, MENP*
	Method of monitoring/measuring energy savings	*The effects of this measure are monitored by using the European Commission's recommended TD indicators for the household sector (P1-P5). It will also produce effects in other sectors, especially in services, where the effects will be monitored using TD indicators (P6 and P7). It is important to ensure that market research be conducted before implementing every info campaign, and that the results be presented by repeating the same research after the campaign is concluded.*

The following played the key roles in the implementation of this measure: EPEEF, UNDP and the City of Zagreb. Many cities were also included in the implementation of informational activities through EU projects and independent activities. However, most of the activities of cities and counties were fostered through the UNDP project 'Systematic Energy Management', and this document will only list the activities implemented under the UNDP SEM project.

What follows is an overview of activities undertaken by UNDP, Zagreb and EPEEF with the aim of informing the public:

The City of Zagreb conducted various campaigns to educate and change the behaviour of employees and users of City-owned buildings. Educational and promotional energy efficiency activities were also endorsed for the commercial sector, but most efforts were expended towards the public. Since 2010, the City of Zagreb has been successfully organising the 'Zagreb Energy Week' for citizens, with the motto 'We don't want to stop progress, but we can stop pollution!'

The UNDP Energy Efficiency Info Campaign was active from 2007 until the end of 2013, with the establishment of regional centres. The national media campaign conducted via TV and radio advertisements was renewed. The implementation of this measure will continue, but since the UNDP national programme has ended, the executive body is now exclusively EPEEF.

The overview of UNDP's info activities is divided into info points and local informational-educational events.

a) UNDP EE info points

EE info points are intended for informing and educating citizens at local level, and they are established in cooperation with cities/counties. By 31 October 2013, 128 info points were established in Croatia, in 52 cities and 12 counties, and they differ by the type of information they offer to citizens. Table A4-19 lists all the measures, and their description follows below:

Table A4-19. Description of EE info points

Info points in the Republic of Croatia			
Type of info point	Total number of locations	No. of locations in cities	No. of locations in counties
Info office	41	37	4
Info gallery	41	33	8
Info corner	6	3	2
Info centre	7	3	3
Info billboard	24	7	1
Info counter	1		
GEEL	8		
TOTAL:	**128**	**In 52 cities**	**In 12 counties**

- EE info offices are usually found in city/county administration offices and, in their working hours, they are open for citizens' queries which are handled by trained EE advisers. In addition to information, training and advisory services, at the EE info offices citizens can also review scale models or brochures of various EE products and obtain informative brochures on EE projects (200 EE Advice; The Challenge That Weighs a Tonne). There are currently 41 EE info offices in Croatia, 37 of which are city offices, and 4 are county offices.
- An EE info office usually includes an EE info gallery which contains 7 informative posters on energy saving methods in households, and advice on energy efficient construction, as well as a poster on the activities of the city/county where the office and gallery are located (implemented projects, achieved savings, planned projects). There are 41 EE info galleries in Croatia, 33 of which are city galleries, and 8 are county galleries. EE info billboards (double-sided citylight communication systems) are installed at busy locations in public areas of cities, and they contain energy efficiency advice and information on SEM project implementation in the city/county. There are 24 EE info billboards currently installed in 7 cities and one county.
- An EE corner is a simulation of an EE house made of efficient building materials, properly installed insulation, and energy efficient doors, windows and roofing. In addition to construction, the corner may feature solar, photovoltaic and other energy-efficient heating/cooling systems, as well as A+ class household appliances.

The appliances are accompanied by informative brochures about the exhibited appliances, as well as 200 EE Advice and The Challenge That Weighs a Tonne. A total of 6 EE info corners have been established, 3 of which are at city level, 2 at county level, and one is a city and county cooperation effort.

- EE info centres are the most comprehensive info points that integrate the functions of info offices and info corners – they display energy efficient products and systems of partner companies (when possible, some of the EE systems are even functional) and they provide free advisory services to citizens. There are 7 EE info centres in Croatia, 3 of which are at city level, 3 at county level, and one is a city and county cooperation effort.
- 'EE' info counter was also established at the premises of the Zagrebački holding Customer Centre,
- providing citizens informative brochures on EE projects.
- Green Energy Efficiency Libraries (GEEL) are EE info points where citizens and professionals can obtain information by perusing all professional publications and brochures published under the EE project and displayed on a dedicated shelf. GEELs are installed in university and city libraries, and 8 of them currently exist in 7 Croatian cities.

b) Local UNDP informational-educational events and the media

Local informational-educational events present an opportunity to interactively provide information to the local population on energy efficiency, the activities the local (self-)government has undertaken in regard to the energy efficiency of its facilities, and the co-financing options for the citizens' EE projects. The types of the aforementioned events are public openings of EE info points, conferences, lectures, EE info days, and informative-educational school classes *Think of Tomorrow*. A total of 53 public events were held between 31 October 2012 and 31 October 2013:

- public openings of 17 info points;
- 20 different lectures on EE and renewable energy sources were held for citizens or students;
- within the scope of the *Energy Efficiency Week* in Zadar, a letter of intent was signed with the city about the implementation of green offices in schools, and an EE info day was organised in Zadar (27 April 2013);
- an informative-educational school class *Think of Tomorrow* was held for students at 16 schools, 4 of which were in the Split area, and the others were in Zadar, Krk, Klanac, Skradin, Pakoštane, Pridraga, Kistanj, Udbina, Donji Lapac, Sv. Filip i Jakov, Sukošane and Poreč;
- all technical publications and brochures developed over the eight years of EE project implementation were donated to the new department of the Technical Museum;
- a closing conference, marking eight years of EE project implementation, was held and the formal notice on the transfer of activities to the public sector was announced, in accordance with the agreement signed between the UNDP, MCPP, APN and EPEEF.

Theme programs, features, reportages and short media campaigns were produced in cooperation with the local media with the aim of promoting energy efficiency, and educating and informing citizens. From October 2012 to October 2013, 2 television and 6 radio reportages were produced on various EE project events. Press clipping is used to regularly monitor media items about the SEM project and other EE activities. From October 2012 to October 2013, there were 31 television items on EE projects, 85 print items, and 28 radio items, as well as a substantial number of articles on various websites. In total, that is more than 150 media items related to various EE project activities.

In the previous period, the Environmental Protection and Energy Efficiency Fund also financed various projects which indirectly affect energy efficiency improvements. Those projects were:

1 Promoting educational and informational activities in energy efficiency

DESCRIPTION OF ACTIVITIES: Organising educational-informational events at national, regional and local level, advising citizens, and preparing and producing various educational-informational materials. The main objectives of this activity were: to raise awareness of all stakeholders on the significance and benefits of energy efficiency improvements, to include the largest possible number of stakeholders in the Fund's co-financing programmes, and to present and promote the Fund's programmes and activities on energy efficiency and the use of renewable energy sources to the general public.

IMPLEMENTED: Within the scope of cooperation with the UNDP through the SEM and HiO programmes, and in accordance with the public sector's obligations, referred to in the Act on Efficient Energy Use in Final Consumption, regarding energy management in its facilities, in 2012 the Fund organised regional educational workshops in six Croatian cities – Zadar, Split, Osijek, Varaždin, Rijeka, and Zagreb – for all municipalities, cities and counties in the Republic of Croatia. The Fund held the workshops in cooperation with the Ministry of Economy, Ministry of Environmental and Nature Protection, Ministry of Construction and Physical Planning, UNDP, energy and development agencies, associations and companies in the counties in which individual regional workshops were held, as well as with the representatives of the cities in which regional workshops were held. The workshops were attended by 383 participants, the representatives of competent ministries, 5 international and Croatian institutions, 12 regional agencies, 3 associations and 12 companies. The important effect of these workshops was that the stakeholders from the public sector were introduced to their legal obligations on energy efficiency, and especially that counties were alerted of their requirement of drawing up county programmes and plans on energy efficiency.

A national informative media campaign on energy efficiency was conducted in 2013, within the scope of which targeted advertising in electronic media was used to raise public awareness of energy efficiency and the importance of energy certification in building construction. Four television and three radio commercials were broadcast within the scope of the campaign on a total of 15 television stations (3 973 times) and 2 radio stations (173 times), a total of 4 046 times. Following the conducted campaign, the Fund also organised market research in order to monitor and analyse the effects of the educational and informational activities. The analysis has shown that the public awareness of energy efficiency is continuously growing, as is their attention to that type of information in the media. Public awareness of energy efficiency in building construction increased by 100 % in comparison to 2008 when the Energy Efficiency Project (EE Project) was started in Croatia. 46 % of respondents knew what energy efficiency was and recognised the benefits of using energy efficient devices and materials in buildings, of which they were most familiar with the energy efficiency measure of installing energy saving light bulbs (66 %) and the purchase of energy efficient household appliances (46 %). Among the advanced energy efficiency measures they were ready to implement was the installation of solar collectors (34 %) and thermal insulation of their house/apartment (33 %).

In December 2013, the Fund held an informational-educational conference 'Energy Efficiency in the Public Sector', with the aim of exchanging experiences and providing information on the results achieved in rational energy management, energy efficiency, the use of renewable energy sources, environmental protection, and the contribution to achieving the objectives and assumed obligations of the Republic of Croatia under the EU energy efficiency policy framework. The conference was attended by 150 representatives of counties, cities, municipalities, development agencies, ministries and other state administration bodies and, in addition to the support to project development and measure implementation, the Fund also started stimulating and promoting green (i.e. environmentally friendly and responsible) public procurement following the cooperation within the framework of the project 'Promoting green public procurement (GPP) in support of the 2020 goals' (GPP Project). Environmentally friendly public procurement can greatly contribute to environmental protection, combating climate change, increasing energy efficiency, creating new jobs, and to a general transformation towards a 'green' economy.

In the implementation of all the aforementioned activities, the Fund cooperated with local and regional self-government units, regional energy agencies and civil society organisations, companies providing energy services, energy management offices of the parties obligated to implement energy management, public information centres, and other legal persons operating in rational energy management. By conducting these activities, the Fund contributed to informing the general public and the public sector on the significance, options and benefits of energy efficiency, all with the aim of reducing energy consumption and achieving national energy policy objectives.

R.2 Energy labelling of household appliances and energy standards

Overview of the measure from the 2nd NEEAP		***Energy labelling of household appliances and energy standards***
Measure index		*R.2*
Description	Category	*Information and mandatory information measures; Financial instruments*
	Time frame	*Start: 2005* *End: 2016* *Planned major modifications, amendments, improvements:* *The measure was revised in accordance with the planned future activities on alignment with EPBD II requirements.*
	Objective / outline	*The obligation of energy efficiency labelling for seven groups of appliances has been in force in Croatia since 2006. Energy labels provide customers with information on the energy consumption of an appliance and direct their choice towards more efficient ones. Furthermore, a prompt adoption of ecodesign requirements for products should ensure that only the products compliant with EU regulations can be placed on the Croatian market.*
	Target final consumption	*Existent residential buildings*
	Target group	*Owners of residential units (citizens)*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010: / Planned funds by the end of 2013:* • *ME (regulations): within the scope of regular activities (activities 1, 2 and 4)* • *IPA and Končar Elektroindustrija d.d. (for establishing a testing laboratory): HRK 1 500 000 (activity 3)* • *commercial banks and/or electricity suppliers with EPEEF co-financing (co-financing the procurement of high-efficiency appliances): HRK 10 000 000 (activity 5)* • *The measure can be implemented using EPEEF funding, without jeopardising the financing of environmental protection measures, when new systems for charging greenhouse gas emission fees are activated and those fees are paid into a special account from which the funds can be allocated for financing the measure.*
	Executive body	*ME – improving the regulatory framework and establishing laboratories;* *EPEEF – establishing a co-financing scheme for the procurement of the most efficient products*
	Monitoring bodies	*ME, MENP, DIRH*
	Method of monitoring/measuring energy savings	*The effects of this measure are monitored by using the European Commission's recommended TD indicators for the household sector (P4). The European Commission's BU method as well as national reference values should be used for programmes introduced by EPEEF.*

The Rules on the requirements for the ecodesign of energy-related products (NN No 80/13) adopted on the basis of Article 27(2) of the Act on Efficient Energy Use in Final Consumption (NN Nos 152/08, 55/12, 101/13, 153/13 and 14/14). The Rules lay down the general requirements for the ecodesign of products, the requirements for placing energy-related products on the market and for their use, the duties of an importer, the conformity assessment procedure and the mark of conformity, as well as other conditions which ensure the application of the requirements for the ecodesign of energy-related products, with the aim of ensuring the free movement of those products on the domestic market. This Rules transpose the Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products into Croatian legislation.

On the date of entry into force of these Rules, the following have ceased to have effect:

- Rules on determining ecodesign requirements for energy-related products (NN No 97/2009);
- Rules on the energy efficiency requirements of fluorescent lighting chokes (NN No 32/2009);
- Rules on the energy efficiency requirements of household electric refrigerators, freezers and combinations thereof (NN No 135/2005).

The aforementioned repealed regulations (which transposed directives which are no longer in force) were replaced by implementing measures in the sense of Directive 2009/125/EC and they lay down ecodesign requirements for certain energy-using products or for their environmental aspects.

There are more than 20 regulations currently in force, adopted by the Commission for certain groups of products (see: http://ec.europa.eu/energy/efficiency/ecodesign/doc/overview_legislation_eco-design.pdf).

The said Regulations are obligatory in their entirety, they are directly applicable in all Member States and therefore do not require the adoption of an implementing act in the Republic of Croatia. New decrees are being drafted for certain groups of products. The idea of establishing a special testing laboratory was never implemented. Several attempts were made to submit an application to the EC for a project through which such a laboratory could be established at Končar, but the project was never approved.

R.3 Financial support programme for natural persons investing in solar heating systems and other EE measures

Overview of the measure from the 2nd NEEAP		***Financial support programme for natural persons investing in solar heating systems and other energy efficiency improvement measures***
Measure index		*R.3*
Description	Category	*Financial instruments*
	Time frame	*Start: 2009* *End: 2016* *Planned major modifications, amendments, improvements:* *Strong cooperation between EPEEF and LRSGUs is planned in order to ensure incentives for natural persons. The measure was revised and priority placed on stimulating: the replacement of existing and installation of new energy efficient windows, the improvement of thermal protection of the building envelope, the use of heat pumps in heating systems and of geothermal heat pumps, the use of solar heating systems for domestic hot water (DHW) preparation, and the installation of biomass furnaces for heating and domestic hot water preparation.*
	Objective / outline	*The objective of this measure is to ensure financial support to natural persons for investments in energy efficiency and RES. The Programme should be developed by EPEEF, in cooperation with LRSGUs. Furthermore, this measure also provides for the establishment of a financial incentives scheme for the use of RES in heat production, through special subordinate legislation – new regulations which govern the incentives for and the acquisition of the status of eligible heat energy producer.*
	Target final consumption	*All energy efficiency measures and use of RES (solar heating systems, heat pumps, biomass)*
	Target group	*Owners of residential units (citizens)*

	Regional application	*National, in cooperation with counties*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *EPEEF: HRK 1 080 000* *Planned funds by the end of 2013 amount to HRK 626 600 000:* • *ME – 100 000 (drawing up the programme)* • *EPEEF: HRK 188 000 000 (30 %)* • *LRSGU: N/A* *HBOR, commercial banks and citizens: HRK 438 500 000 (69.98 %)*
	Executive body	*LRSGUs, regional energy agencies, in cooperation with the Centre* • *EPEEF – ensuring co-financing*
	Monitoring bodies	*ME,* MENP

The implementation of projects that stimulate the use of renewable energy sources has a direct impact on the increase of production and consumption of electric and heat energy obtained from renewable sources, and on the reduction of harmful gas emissions. Through its activities, the Fund supports the achievement of the mandatory national target for the use of renewable energy sources by 2020, defined in the National Action Plan for Renewable Energy Sources. This measure includes financial support programmes for households for:

1. Energy efficiency measures such as: full renovation, replacement of doors and windows, replacement of the building envelope, and other measures that reduce the energy requirements of a building;
2. Measures for installing renewable energy sources, such as:
   - installing solar thermal collectors;
   - installing photovoltaic systems;
   - installing geothermal heat pumps;
   - installing biomass furnaces;
3. Measures for replacing heating fuels with those that are more energy efficient; and
4. Drawing up project documentation for the implementation of such projects.

In the 3rd NEEAP this measure will be divided into four aforementioned individual measures for households, in accordance with obligation schemes which also provide for the division of measure R.3 into these 4 new measures.

The most effective programmes under this measure were the co-financing programmes of the Environmental Protection and Energy Efficiency Fund which allocated the funding for the co-financing programmes for these measures through cities and counties.

In the 2011–2013 period, the Environmental Protection and Energy Efficiency Fund implemented a total of 15 projects for which HRK 6 155 819.90 of funding was paid out, with the total investments amounting to HRK 21 510 369.55. **The energy savings calculated for those projects amounted to 7.29 TJ (2 024 965.56 kWh).** Greenhouse gas emissions were reduced by 506.99 tCO2 in total, and HRK 873 175.31 were saved. In view of the life cycle of the measures implemented through projects on renewable energy sources, the savings achieved by 2010 are also valid until the end of 2013 so the savings from those two periods can be added, but attention was paid to avoid double counting the savings, or doubling them, in the calculations. By the end of 2013 (which includes the periods of the first and second NEEAP), a total of 37 projects that stimulate the use of renewable energy sources were implemented and the total amount of funding paid out for those projects was HRK 14 465 167.12, with the total investments amounting to HRK 47 424 641.69. **The energy savings calculated for those projects amounted to 14.14 TJ (3 928 569.80 kWh)**, which is 0.11 % of the national intermediate target for 2013, or 0.07 % of the national target for 2016. Greenhouse gas emissions were reduced by 1 006.42 tCO_2 in total, and HRK 1 500 994.06 were saved.

The following tables show the total amounts invested by the Fund in renewable sources in all sectors, and the amounts of savings per individual sector.

Table A4-20. Savings per type of renewable energy source by the end of 2013 (for the period of the 1st and 2nd NEEAP)

RES type	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
Biomass	8	199 374.08	0.72	80 641.36	52.34	3 410 703.09
Heat pumps	4	659 866.16	2.38	268 896.88	141.61	903 249.85
Photovoltaic modules	0	3 925.72	0.01	3 591.95	1.48	0.00
Solar heating systems	25	3 065 403.84	11.04	1 147 863.88	811.00	10 151 214.18
Total:	**37**	**3 928 569.80**	**14.14**	**1 500 994.06**	**1 006.42**	**14 465 167.12**

* savings in HRK were calculated in accordance with the electricity and gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Solar heating systems are the most numerous, and their use has achieved the largest energy savings. The largest number of projects on renewable energy sources was implemented in 2010 so the largest energy savings were also achieved in that year.

Table A4-21. Savings of evaluated projects on renewable energy sources per final consumption sectors (for the period of the 1st and 2nd NEEAP)

Sector	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
Industry	4	519 250.00	1.87	201 852.99	173.43	1 877 275.52
Public services	15	879 298.02	3.17	357 271.49	186.86	4 164 841.19
Commercial services	6	518 963.77	1.87	259 041.63	125.69	2 873 446.27
Households	12	2 011 058.02	7.24	682 827.96	520.45	5 549 604.14
Total:	**37**	**3 928 569.80**	**14.14**	**1 500 994.06**	**1 006.42**	**14 465 167.12**

* savings in HRK were calculated in accordance with the electricity and gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Most of the projects fostering renewable energy sources were implemented in the public service sector, but the greatest energy savings were achieved in the household sector. The total savings for the household sector amount to 0.00724 PJ.

There was also a great impetus towards stimulating households to improve the building envelope of individual households by way of joint co-financing by the Fund and local self-government. Local self-government was competent for designing the programmes and allocating EPEEF funds to citizens. Under the programmes, the citizens could improve the thermal characteristics of their homes with only 50 % of their own funds. There was enthusiastic response to the tender, but the financial structure is still not finalised so the specific data on achieved savings and the number of implemented projects will be processed in the next report.

The local self-government units involved in this programme thus far are as follows:

- Cities: Ivanić Grad, Sisak, Kutina, Karlovac, Križevci, Bjelovar, Gospić, Čakovec, Požega, Zadar, Šibenik, Vukovar, Split, Pazin, Pula, Novigrad;
- Counties: Osijek-Baranja, Koprivnica-Križevci, Bjelovar-Bilogora, Brod-Posavina, Vukovar-Srijem and Dubrovnik-Neretva; and
- Municipalities: Lepoglava, Bednjan and Sv. Ilija.

R.4 Programme of using liquefied petroleum gas (LPG) and solar energy on the islands

Overview of the measure from the 2nd NEEAP		***Programme of using liquefied petroleum gas (LPG) and solar energy on the islands***
Measure index		*R.4*
Description	Category	*Financial instruments*
	Time frame	*Start: 2008* *End: 2012 (2016)* *Planned major modifications, amendments, improvements:* *At the end of Programme implementation, its effects must be analysed in detail, it must be revised in regard to its identified shortcomings, and its continuation until 2016 must be ensured.*
	Objective / outline	*The primary objective of this measure is to ensure the availability of basic energy commodities to citizens in all parts of the Republic of Croatia. Furthermore, this measure stimulates the use of LPG, the only energy commodity in Croatia whose domestic production exceeds consumption. Finally, LPG is an excellent option for the islands in both the environmental (partially) and the economic sense, because it eliminates fuel oil and electricity consumption for household heating purposes (the structure of energy consumption on the islands is: 32 % wood, 30 % electricity, 29 % fuel oil, and approximately 8 % LPG). The installation of new equipment for LPG use improves the efficiency of heating systems and DHW preparation, and additional energy savings are achieved in combination with solar heating systems.*
	Target final consumption	*Heating and DHW preparation systems in households*
	Target group	*Owners of residential units (citizens)*
	Regional application	*National, in cooperation with counties*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *EPEEF: HRK 3 517 000* • *MMATI: HRK 6 942 135.31* *Planned funds by the end of 2013:* • *EPEEF: HRK 5 000 000* • *ME: additional funds ensured under the ME budget* *MRDEUF: additional funds ensured under the MRDEUF budget*
	Executive body	• *MRDEUF, ME, EPEEF, authorised LPG distributors in coordination with the Centre*
	Monitoring bodies	*MRDEUF, ME, MENP*

Projects in this programming area were co-financed on the basis of a special programme of the Government of the Republic of Croatia, and practically all activities implemented under this measure were co-financed by the Environmental Protection and Energy Efficiency Fund. In addition to increasing the energy efficiency of heating systems, these projects also increase the use of solar thermal energy for domestic hot water preparation, for which the natural conditions on the islands are extremely favourable. A substantial contribution of this projects lies in the significant reduction of liquid fuel (fuel oil) use for heating requirements on the islands. Fuel oil is an extremely unfavourable fuel source, both environmentally and economically, and the elimination of its use for heating requirements in buildings is one of the objectives of the national Energy Strategy. Consequently, these projects reduce the emissions of harmful substances and carbon dioxide, and increase the standard and comfort of living on the islands of the Republic of Croatia.

In the 2011–2013 period, a total of 11 projects were implemented with EPEEF co-financing, for which HRK 299 334.17 of funding was paid out, with the total investments amounting to HRK 703 874.93. The energy savings calculated for those projects amounted to 0.29 TJ (80 154.19 kWh), which is 0.0022 % of the national intermediate target for 2013, or 0.0015 % of the national target for 2016. Greenhouse gas emissions were reduced by 17.36 tCO2 in total, and HRK 26 560.47 were saved.

Since the life cycle of the measure is 20 years, the savings achieved in the 2009–2012 period were added to the savings achieved in the 2011–2013 period, but attention was paid to avoid double counting the savings, or doubling them, in the calculations. By the end of 2013 (which includes the periods of the first and second NEEAP), a total of **48 projects** were conducted by implementing the programme of LPG and solar power use on the islands, and the total amount of funding paid out for those projects was HRK 1 088 652.58, with the total investments amounting to HRK 2 590 667.16. **The energy savings calculated for those projects amounted to 0.00093 PJ (258 010.76 kWh)**, which is 0.007 % of the national intermediate target for 2013, or 0.0047 % of the national target for 2016. Greenhouse gas emissions were reduced by 32.53 tCO2 in total, and HRK 77 472.48 were saved.

Table A4-22.A Savings under the programme of using liquefied petroleum gas (LPG) and solar energy on the islands by year (for the period of the 1st and 2nd NEEAP)

Year	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO_2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
2009	13	75 840.98	0.27	19 736.82	4.69	167 875.19
2010	24	102 015.60	0.37	31 175.20	10.48	621 443.22
2011	7	60 976.53	0.22	18 981.10	13.01	182 927.17
2012	4	19 177.66	0.07	7 579.37	4.36	116 407.00
Total:	**48**	**258 010.76**	**0.93**	**77 472.48**	**32.53**	**1 088 652.58**

* savings in HRK were calculated in accordance with the gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

The expected energy savings from this measure by 2016 amount to 0.005 PJ. The implementation of the Fund's projects achieved 18.58 % of the aforementioned target by the end of 2013.

R.5 Plan for energy renovation of residential buildings

Overview of the measure from the 2nd NEEAP		***Plan for energy renovation of residential buildings***
Measure index		*R.5*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016 (2020)* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*This measure provides for the design of a detailed action plan for the renovation of existing residential buildings by 2016 (2020), and for the implementation of that plan. The plan primarily focuses on residential buildings of up to 400 m^2 and multifamily housing constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The measure plans for energy certification before and after the energy renovation.*
	Target final consumption	*Existent residential buildings*
	Target group	*Owners of residential buildings (citizens); companies that manage multifamily housing*
	Regional application	*National*
Information on implementation	Funds and financing sources	*The planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 1 500.00 per m^2 and amount to HRK 2.25 billion.* • *MCPP: HRK 100 000 (EUR 13 354) for drawing up the programme by the end of 2013* *Implementation annually: HRK 2 250 100 000* • *EPEEF: HRK 10 000 000* • *EU Funds, commercial banks, EIB: HRK 2 240 000 000* • *ESCO companies – the ESCO market should be included in programme implementation* • *The detailed requirements and sources of financing will be laid down in the Programme.*
	Executive body	*MCPP – drawing up a detailed plan* *LRSGU – plan implementation in coordination with the Centre* *EPEEF – ensuring necessary co-financing*
	Monitoring bodies	*MCPP*

This measure provided for the design and preparation of a detailed plan for the renovation of existing residential buildings by 2016 (2020), and for the implementation of that plan. The plan primarily focuses on residential buildings of up to 400 m^2 and multifamily housing constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The measure plans for energy certification before and after the energy renovation. The design of the multi-annual action plan for the renovation of residential buildings by 2016 (2020) was started by MCPP, and a draft action plan was presented. The adoption of the programme by the Government of the Republic of Croatia, and the alignment of EPEEF plans with the programme requirements are expected in the first half of 2014.

The objectives of this programme are: to determine and analyse energy consumption and energy efficiency in the existent housing stock of the Republic of Croatia; to determine the potential and possibilities for reducing energy consumption in existent residential buildings; to develop the implementation of measures for stimulating energy efficiency improvements in existent residential buildings, and to evaluate their effects.

Measures for the public sector

The 3rd NEEAP features collected data on public bodies, and the first systematic analysis of the information on measures implemented in LRSGUs which were not co-financed by EPEEF. The bottom-up method was used to calculate the amounts of savings from those measures achieved at local level. The following data were collected:

- Renovation of public buildings;
- Conducted energy audits of public buildings;
- Replacement of public lighting;
- Energy efficiency measures in transport – replacement of vehicles with more energy-efficient ones;
- Data on drawn up county plans/programmes.

Data were provided by 13 counties, 30 cities and one ministry.

Data are outlined individually per corresponding measure featured in this report, and are summarised in **Table A4-22.B**.

Table A4-22.B Total savings in cities and municipalities

Total savings:	40 453 124.83	kWh	Total kWh:	7 062 591.74	32 025 966.07	720 267.02	644 300.00
	0.145631249	**PJ**	Total PJ:	0.02542533	0.115293478	0.00259296	0.00231948

Name of city/ county	city/ county	EnE Plan submitted	EnE Programme submitted	SEAP	Energy audits		Building renovation		Public lighting		Transport	
					Number of buildings	E savings level 2b (kWh/year)	Number of buildings	Energy savings (kWh/year)	Number of light bulbs	Energy savings (kWh/year)	Number of cars	Energy savings (kWh/year)
Bjelovar-Bilogora	County	YES	YES	N/A	1	20 380.00	4	303 000.00				
Brod-Posavina	County	NO	NO	N/A	15	156 857.94						
Karlovac	County	yes	yes	N/A	35	197 114.88						
Krapina-Zagorje	County	no	being drafted	N/A	28	313 118.00	10	909 426.00				
Međimurje	County	no	yes	N/A	1	10 738.70						
Sisak-Moslavina	County	yes	yes	N/A	58	739 927.17						
Varaždin	County	yes	no	N/A								
Šibenik-Knin	County	yes	yes	N/A	8	82 000.00					7	50 000
Primorje-Gorski Kotar	County	no	no	N/A	13	101 143.89	6	2 182 970.65			2	15 000
Požega-Slavonia	County	yes	yes	N/A								
Osijek-Baranja	County	yes	yes	N/A	48	643 755	107	9 593 910.00				
Zagreb	County	yes		N/A								
Zadar	County	no	yes	N/A								
Klanjec	City	N/A	N/A	Adopted	1	4400					1 lorry	6000
Beli Manastir	City	N/A	N/A	Drawn up	1	3000	2	276 450.00	22	5 082.00		
Bjelovar	City	N/A	N/A	Adopted	10	39 500	3	560 000.00		153 278.50		
Buzet	City	N/A	N/A	Adopted						137 781.00		
Hrvatska Kostajnica	City	N/A	N/A		3	2100						
Knin	City	N/A	N/A		2	5450						

Koprivnica	City	N/A	yes	Adopted	22	39 658.25						
Nin	City	N/A	N/A		1	825.25						
Pazin	City	N/A	N/A		2	20 000				276 400.00		
Poreč	City	N/A	yes	Drawn up								
Pula	City	N/A	N/A	Adopted								
Rab	City	N/A	N/A		1	539.78						
Slatina	City	N/A	N/A		3	28 004.44			147	23 609.72		
Slavonski Brod	City	N/A	N/A		6	39 572.23						
Valpovo	City	N/A	yes									
Varaždinske Toplice	City	N/A	N/A		2	2 113.00						
Vinkovci	City	N/A	N/A	Drawn up								
Vodice	City	N/A	N/A		3	1 535.30						
Zabok	City	N/A	N/A		1	7 015.50						
Zadar	City	N/A	N/A	Drawn up	7	36 000.00					2	11 300
Duga Resa	City	N/A	N/A	Adopted	1	10 000.00						
Dugo Selo	City	N/A	N/A	Adopted	2	1 016.00			10	2988		
Delnice	City	N/A	N/A	Drawn up								
Ozalj	City	N/A	N/A	Drawn up	2	8 000.00						
Slunj	City	N/A	N/A	Adopted								
Umag	City	N/A	N/A	Adopted	4	No data	4	No data		26 323		
Virovitica	City	N/A	N/A		6	12 845.01						
Zagreb	City	N/A	N/A	Adopted	239	2 625 484.20						
Split	City	N/A	N/A		56	610 141.60			262	33 064.00	22 buses	17 500
Rijeka	City	N/A	N/A	Adopted	38	136 355.61	3	189 950.00	387	61 740.80	22 buses	504 500

P.1 Project 'Systematic energy management in cities and counties'

Overview of the measure from the 2nd NEEAP		***Project 'Systematic energy management in cities and counties'***
Measure index		*P.1*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2007* *End: 2013 (2016)* *Planned major modifications, amendments, improvements:* *The measure will continue to be implemented as planned. The measure should be amended by applying complex technical measures for improving energy efficiency based on the ESCO principle.*
	Objective / outline	*The objective of the project is to apply a model of continuous and systematic energy management, strategic energy planning, and sustainable management of energy resources at local and regional level, which would contribute to reducing the consumption of energy commodities and consequently reducing harmful gas emissions. The project is based on the establishment of an organisational structure for energy management, employee training, and the application of IT tools for continuous monitoring and analysis of energy and water consumption in buildings owned by* LRSGUs.
	Target final consumption	*Existent buildings owned by* LRSGUs
	Target group	*Public sector employees*
	Regional application	*The project is implemented throughout Croatia, with varying intensity. All 21 counties and 127 cities are involved with the project.*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010: HRK 34 473 300* • *GEF: HRK 16 077 230 or 46.6 %* • *EPEEF: HRK 18 296 070 or 53.1 %* • *MELE: HRK 100 000 or 0.3 %* *Planned funds by the end of 2013: HRK 15 150 000* *EPEEF: HRK 15 150 000 or 100 % (cumulatively, the amount represents the total funds for 2012 and 2013)*
	Executive body	*UNDP project team – project 'Removing Barriers to Energy Efficiency in Croatia' in coordination with the Centre* • *EPEEF – co-financing*
	Monitoring bodies	*ME, MCPP, MENP*

All planned activities were completed under this measure, and substantial savings were achieved.

The fifth project year was significantly different from the previous ones by way of it being the last year of EE project implementation, and consequently SEM project implementation, as the segment aimed at LRSGUs. Therefore, most of the activities throughout the year, and with particular intensity in the last several months, were aimed at finalising and transferring activities and resources to national implementing institutions, the Ministry of Construction and Physical Planning and the Environmental Protection and Energy Efficiency Fund. The transfer itself was formalised with the signing of the Agreement on the Transfer of Activities, signed on 29 August 2013 and publicly announced at the Final Conference of the EE Project on 23 ¤September 2013. Since 31 October 2013, MCPP has been the principal energy management activities holder, EPEEF has taken over the implementation of energy audits and informative-educational activities, and APN has taken over
SEM coordination, ISGE system administration and development, and energy management coordination at national level. The achieved results show that a basis for continuous and systematic energy management in Croatia has been established, which was the basic objective of the project. An organisational structure for systematic energy management at national, regional and local level was established within that scope. The National Energy Management Information System (ISGE) was developed and established as the basic tool for collecting, analysing and reporting on energy and water consumption in the facilities owned by cities and counties. Furthermore, the necessary human resources were developed for energy management and the implementation of projects for improving the energy efficiency of buildings. As of the end of the SEM project, 5 672 facilities have been entered into ISGE, of which 4 690

are detached buildings and 732 are sections within detached buildings, for 107 cities and 20 counties. Of the aforementioned number, the required basic data was entered for 4 239 facilities, which is approximately 75 % of the total number of featured facilities. It also bears mentioning that the number of facilities in the ISGE system is continuously increasing, namely, preliminary lists of facilities show that there are approximately 7 000 facilities owned by cities and counties. The last three years are 'locked' for a total of 1 636 facilities, which confirms that the calculation data for the 2010–2012 period for these facilities is complete, verified and as such can be used for analyses. The ISGE system is open for 2 449 SEM beneficiaries, of which 1 166 are currently active beneficiaries.
By signing a letter of intent, 6 new cities have become actively involved in the SEM project: Cres, Kraljevica, Poreč, Rab, Drniš, Obrovac; as well as 3 municipalities: Kostrena, Matulji and Viškovo. The total number of actively involved cities and counties in the territory of the Republic of Croatia is shown in Table A4-23. A new information point entitled Green Energy Efficiency Library (GEEL) was introduced with the aim of spreading general expert knowledge on energy efficiency in building construction. The Green EE Library is a location, i.e. a shelf, which provides all professional publications and brochures published under the EE project at a single location, making them available in the physical format to all those interested in improving energy efficiency by applying energy efficient measures and renewable energy sources. Eight such libraries have been opened thus far. Three courses for energy advisers were held in the fifth project year: in Split, Rijeka and Zadar, with a total of 97 participants and among them city, county and ministry representatives. The course for energy advisers in Zadar was also the last, 40th one, under the
SEM project. The second working conference entitled Systematic Energy Management at Zagrebački Holding was held at the premises of Zagrebački Holding, and it presented all the activities of energy-efficient management implemented thus far at the Holding subsidiaries, the results of SEM project implementation and the plans for future development. As of this year, Zagrebački Holding has taken over the independent SEM project management.

Table A4-23. Total number of actively involved cities and counties in the territory of the Republic of Croatia

	Signed Letter of Intent	EE policy published	EE office established	Number of persons at the EE office	Green office established
Counties	20	14	16	50	6
Cities	102	87	85	403	18
TOTAL:	122	101	101	453	24

The savings achieved from the implementation of measures P.1 and P.2 were calculated together, and they will be outlined together in this document. From a sample of 1540 analysed facilities, a team of experts from APN calculated the savings achieved due to the introduction of energy management. If 2010 is taken as a reference year, the absolute achieved savings for 2011 and 2012 for all energy commodities and water are 13 850 111 kWh (2011) and 13 826 002 kWh (2012). The achieved savings from 2010 to the end of 2012 are 49 420 000 kWh, and when that value is extrapolated onto all the facilities in the ISGE (10 912 buildings with a total area of 8 231 508 m2) and corrections are made with regard to degree days, one can arrive at savings of 141 830 126 kWh in 2012. Since very few new facilities were entered in 2013, the savings in 2013 are only marginally higher, therefore the data the ISGE experts from APN have calculated for 2012 will be taken into account for 2013.

The savings calculated for 1540 facilities were extrapolated by net usable floor area to all the facilities in the ISGE, and it was calculated that the total savings of all energy commodities amounted to 141 830 126 kWh or 0.51 PJ.

Since the planned duration of this measure is five years, in accordance with the methodology for monitoring, measuring and verifying savings, we have taken into account that these savings will remain valid until 2016. Since project implementation officially ended in late October 2013, we present an overview of activities and achieved results and savings since the start of implementation. Overall, during the 5 years of implementation, the SEM project achieved the following results:

Table A4-24. SEM project activities

Activities	Achieved results
1. Creating political will and a positive impetus	All counties (20) and cities (127) in the Republic of Croatia have signed the Energy Charter
2. Letter of intent for SEM implementation	Signed by 20 counties and 102 cities
3.Energy Efficiency and Environmental Protection Policy published	In 14 counties and 87 cities
4. Green Office Policy adopted – Green Office established	In 6 counties and 18 cities
5. Energy management offices established	16 counties and 85 cities, with a total of 453 employees
6. Register of buildings owned by the city/county established	19 counties and 94 cities have compiled preliminary lists of their facilities (4 106 buildings listed in cities and 3 132 in counties)
7. Energy Management Information System (ISGE) introduced	Data collected and entered into ISGE for 5 672 facilities (4 690 detached buildings and 732 sections within buildings) for 107 cities and 20 counties
8. Conducting energy audits	Completed: 1021 energy audits
9. Energy savings and CO_2 emissions reduction potentials:	Total of approximately 7 000 buildings owned by cities and counties: Annual consumption approximately 3.8 billion kWh Costs approximately HRK 1.32 billion Emissions approximately 1.22 million tCO_2 **Savings potentials:** 10 % (through SEM implementation): 380 million kWh, HRK 132 million, 122 thousand tCO_2 20 % (further EE measures): 764 million kWh, HRK 264 million, 244 thousand tCO_2
10. Education and training	**Course for energy advisers:** 25 courses for 634 participants **'Green Office' workshops:** held in 22 cities and counties for approximately 393 participants **Green Office motivational workshops:** held in 25 cities and counties for approximately 1 700 participants **Workshop on establishing the register:** 90 workshops were organised for approximately 2 341 participants **Workshops on ISGE use:** 147 workshops were organised for approximately 1500 participants **SEM workshop:** weekly and daily analysis and interpretation of energy consumption data: 25 workshops were held in 12 counties for 86 participants **Other workshops:** 145 various workshops were additionally organised for

	approximately 1300 participants
11. Local promotion	**EE info points (EE info centres; EE info offices; EE info galleries, EE info corners; EE info billboards):** 128 EE info points were opened in 52 cities and 12 counties 41 info offices 41 info galleries 6 info corners 7 info centres 24 info billboards **Local media campaign** 126 television and 204 radio programs were broadcast; campaign featuring brief EE advice on 7 radio stations; and over 400 articles in printed and electronic media

In addition to the activities promoted by UNDP, it is important to mention the plans with which many cities independently decided to adopt a systematic approach to planning energy efficiency measures. Many cities have joined the Covenant of Mayors, an initiative which encourages European cities to combat climate change by developing Sustainable Energy Action Plans (SEAPs) which are a basis for future implementation of specific projects on energy efficiency and use of renewable energy sources.

Thus far, 39 Croatian cities have drawn up SEAPs, 11 of which have already been adopted by the project council.

The cities which have drawn up SEAPs are: Vinkovci, Beli Manastir, Belišće, Osijek, Poreč, Labin, Brdovec, Samobor, Ozalj, Velika Gorica, Bjelovar, Rovinj, Buzet, Krk, Otočac, Umag, Kastav, Barban, Buje, Grožnjan, Dugo Selo, Oprtalj, Križevci, Ogulin, Gospić, Karlovac, Opatija, Pregrada, Slunj, Sveta Nedelja, Duga Resa, Jastrebarsko, Sisak, Koprivnica, Zaprešić, Klanjec, Rijeka, Ivanić Grad, Zagreb.

Regional energy agencies

It is important to mention the energy agencies on the territory of the Republic of Croatia which, through their activities, not only encourage public administration offices to meet their energy efficiency requirements, but they also encourage them to go further and improve the lives of citizens by implementing various EE and RES measures. In many cities and counties, energy agencies have been mediators for and have assisted in SEM project implementation. For example, MENEA collected data on achieved savings for the Međimurje County and REGEA for the Krapina-Zagorje County. Through their projects, the agencies allocated essential funds to cities and counties for improving the energy efficiency of their facilities, either through educational measures or with specific reconstructions. Five agencies and their most important activities implemented in the period from 2011 to the end of 2014 are specified below.

REA Kvarner

The Regional Energy Agency Kvarner was established in 2009. The aim of its establishment was to set up a single organisational and institutional framework for a more rational use of existent energy resources, and to promote energy production from renewable and alternative sources in the Primorje-Gorski Kotar County. The agency's establishment and activities in the first three years of operation were financed with funding from EU funds, within the framework of the CIP – Intelligent Energy Europe Programme.

In addition to helping the Primorje-Gorski Kotar County and the cities on county territory to apply for the EPEEF tender for the allocation of funds to citizens for building reconstruction, REA Kvarner also conducted other activities:

- The 'Public Building Roof Exchange', the project used to prepare documentation for acquiring the status of eligible electricity producer and for the installation of photovoltaic systems on the roofs of eight public buildings owned by the Primorje-Gorski Kotar County, was started in 2012. By signing the contract on electricity purchase, REA Kvarner has demonstrated that, despite a complex administrative procedure and numerous obstacles in process implementation, the status of eligible electricity producer can be obtained through a systematic approach to the terms of reference. With its accomplishments, the agency attracted considerable media interest, as well as the interest of natural and legal persons for that type of investment, which is an indicator of the development potential of the goods and services market of renewable energy sources. REA Kvarner was an investor at six locations, investing in the construction of photovoltaic systems at 6 public buildings in 2012.
- Certification of public buildings – conducting energy audits and drawing up energy performance certificates for a select group of public buildings owned by the Primorje-Gorski Kotar County.
- Educational info centre for energy – establishment and operation of an educational centre for training workers who will install photovoltaic and solar panels, and for holding workshops. The centre will also act as an info point since demonstration equipment (solar and photovoltaic modules) will be exhibited at the location.
- Solar conference and solar equipment fair (EUROsun 2012) – participation in organising the conference, in cooperation with the Faculty of Engineering, and the participation at the conference and the solar equipment fair.
- An Energy Week was also held in Rijeka, from 17 to 20 June 2013. It was organised by the City of Rijeka and the Faculty of Engineering at the University of Rijeka, in cooperation with the Regional Energy Agency Kvarner and the Croatian Solar Energy Association. One of the days was dedicated to energy agencies, and REA Kvarner was the event moderator. For that occasion, REA Kvarner published a brochure on the benefits of using wood biomass as fuel, and printed promotional billboards depicting six photovoltaic power plants in which REA Kvarner had invested, as well as a promotional billboard of the photovoltaic system at the administrative building of the Primorje-Gorski Kotar County – Slogin kula.
- Implementation of the following EU projects:

Table A4-25. Projects implemented by the REA Kvarner agency

Project	Project title	Total project value / REA share (EUR)	Duration
IPA ADRIATIC	ADRIACOLD, *'Diffusion of Cooling and Refreshing Technologies using the Solar Energy Resource in the Adriatic Regions'*	2 635 000.00 / 245 000.00	1 October 2012–31 March 2015
MEDITERRANEAN	EMILIE, *'Enhancing Mediterranean Initiatives Leading SMEs to Innovation in Building Energy Efficiency Technologies'*	2 220 668.32 / 313 450.03	1 January 2013–30 June 2015
MEDITERRANEAN	SMILE, *'Smart Green Innovative Urban Logistics for Energy Efficient Mediterranean Cities'*	1 872 533.00 / 150 000.00	1 January 2013–30 June 2015
IPA ADRIATIC	ALTERENERGY, *'Moving towards a Low Carbon Economy in the Adriatic Area'*	12 499 600.00 / 350 700.00	1 September 2011–31 August 2015

IRENA

The Istrian Regional Energy Agency Ltd. Labin, was established in 2009 by the Istria County. In accordance with the Intelligent Energy Europe (IEE) programme, IRENA was established as an independent non-profit organisation providing public advisory services in the form of information, assistance in raising awareness, training, and similar, to local decision makers on energy issues in the public and private sector, households and citizens. Below is a list of projects implemented in the last three years:

Table A4-26. Projects implemented by the IRENA agency

Financing programme	Project acronym	Partners	Project description	Total budget / IRENA budget
IPA Adriatic CBC Programme 2007–2013	**SEA-R** Sustainable Energy in the Adriatic Regions: Knowledge to Invest	Lead partner: Comune di Pesaro, IT Partners: Chamber of Economy Tirana, AL Centuria RIT Romagna Innovazione Technologia, IT Provincia di Ferrara, IT Regional Development Centre Kopar, SLO IRENA – Istrian Regional Energy Agency LIR – Local Development Initiative, BIH	Promoting RES and EE knowledge in the Adriatic region, with emphasis on investments. Installation of a photovoltaic power plant on the roof of the Pjerina Verbanac kindergarten in Labin, 10 kW power. The value of the investment is EUR 34 514.78.	Total budget: EUR 1 960 338.00 IRENA: EUR 370 380.00
IPA Adriatic CBC Programme 2007–2013	**LEGEND** Low Enthalpy Geothermal Energy Demonstration Cases for Energy Efficient Building in the Adriatic Area	**Project head**: Provincia di Ferrara **Partners**: Geological Survey of Slovenia, IRENA, LIR Evolution, Region Emilia, Region Veneto, Bashkia Shkoder, Teramo Province, Regional Economic Development Agency for Šumadija and Pomoravlje, Kotor Municipality, DUNEA, Region Puglia, Montenegro Green Building Council Associate: European Geothermal Energy Council - EGEC	Promotion of EE and low enthalpy geothermal energy in the Adriatic region, through the development of demonstration projects of geothermal heat pumps in public and residential buildings	Total budget: EUR 3 085 540.00 IRENA: EUR 285 400.00
SEE	**TERRE**	Lead partner: Province of Forli-Cesena	Objective: experimentally demonstrate that, with integrated	Total

South East Europe Programme	**TERritory, eneRgy & Employment**	Partners: Province of Rovigo, Iuav University of Venice, Local Government of Ujszilvas, Municipality of the City Szolnok with County Rank, Technology Promotion Burgenland Ltd, European Centre for Renewable Energy, Municipality of Odorheiu Secuiesc, Centre for Sustainable Rural Development Kranj, Municipality of Dimitrovgrad, IRENA, LIR Evolution, Chamber of Commerce and Industry of Tirana	use of endogenous resources for energy production from renewable sources, we can establish an efficient model for self-sufficient and sustainable local development.	budget: EUR 2 185 630.00 IRENA: EUR 118 350.00

REGEA

The North-west Croatia Regional Energy Agency was established by the joint application of the Krapina-Zagorje County, Zagreb County, Karlovac County, and the City of Zagreb to a tender for the *Intelligent Energy Europe* programme. With the support of the European Commission, the Agency started its operations in April 2008 with five employees. At the end of 2013, the Agency employs 25 experts and highly educated professionals from various fields.

In 2013, the role of the Agency at the international level was expanded with several new approved projects, but also with a new role in FEDARENE – the European Federation of Agencies and Regions for Energy and the Environment, and Agency director Julije Domac, Ph.D., was elected president of the Federation for the next three years.

Following the significant results of the project IEA Bioenergy Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects, in 2013, REGEA started its participation in a new International Energy Agency project. Project Task 43 – Biomass Feedstocks for Energy Markets. The objective of the project is to promote the sustainable development of the biomass market which will be driven by well-informed business decisions of business operators, governments and other stakeholders.

The implementation of the project **EESI2020** – European Energy Service Initiative under the Intelligent Energy Europe (IEE) programme also started in 2013. The objective of the project is to achieve energy savings in the EU amounting to 20 %. The EESI2020 project aims to provide support to large cities and metropolitan regions in the systematic implementation of EPC projects – 9 European metropolises (such as Berlin, Prague, Barcelona, Oslo, Dublin, and among them the City of Zagreb) are participating in the project and will be the locations of pilot projects.

In 2013, activities continued under the **RE-SEEties** project which started in October 2012 and is implemented under the South East Europe Transnational Cooperation Programme. RE-SEEties is a two-year project aimed at addressing the issue of inefficient use of natural resources in European Cities. With the participation of eight cities and regions, as well as numerous professional institutions, the project aims to improve the processes of adopting integrated strategic documents and the level of expertise of local authorities in the field of energy efficiency, renewable energy sources and waste management. The project partner of the North-west Croatia Regional Energy Agency is the town of Ivanić Grad for which a local waste management and energy management strategy will be developed within the scope of the project, as will an educational and promotional campaign aimed at changing consumer behaviour and reducing energy demand.

The implementation of the **SMARTinMED** project – Smart interregional cooperation strategy for innovation capacities in the energy sector on the MED area – started in February 2013, financed by the European Commission

under the transnational operative programme Mediterranean (MED). The project will be implemented until June 2015, and its main objective is to provide support to small and medium-sized enterprises in the energy sector of Mediterranean countries through the establishment and successful operation of energy clusters in project partner countries.
The project **ZagEE** – Zagreb Energy Efficient City was jointly prepared by the City Office for Energetics, Environmental Protection and Sustainable Development of the City of Zagreb, and the Agency, and they applied it for the IEE MLEI programme. The scope of the project includes: the energy renovation of buildings owned by the City of Zagreb by applying energy efficiency measures and renewable energy sources for 87 public buildings; and the modernisation of 3 000 public lighting fixtures which will be replaced with LED lighting fixtures with a control and management system. The project is valued at nearly two million EUR, and it will be implemented until March 2016.

The **IPA Varčuj/Štedi** (Save) project was completed last year, aimed at informing the representatives of cities and municipalities, as well as other stakeholders in the territory of the Republic of Croatia about the importance of planning and conducting public lighting projects in an environmentally and economically sustainable manner. The project was implemented under the cross-border cooperation programme IPA SI-HR. The consortium was comprised of partners from Slovenia (Krško municipality, Local Energy Agency Dolenjska- Posavje- Bela Krajina, Local Energy Agency Spodnje Podravje, the Faculty of Electrical Engineering at the University of Ljubljana) and the North-west Croatia Regional Energy Agency, the Town of Zaprešić and the Town of Jastrebarsko as the Croatian representatives in the project. Last year, the Agency employees organised lectures on financing lighting projects, and launched the Technical Manual and Catalogue of Energy Efficient Public Lighting. The most interesting part of the project were the pilot projects under which promenade lighting was reconstructed in the Town of Zaprešić, and a trial line was installed for decorative lighting of the Church of St. Nicholas and the Church of St. George in Jastrebarsko.

The implementation of the following projects, implemented under the Intelligent Energy Europe (IEE) programme, was continued in 2013:

- **BiomassTradeCenter II -** Development of biomass trade and logistics centres for sustainable mobilisation of local wood biomass resources - 11 partners; lead partner - Slovenian Forestry Institute (Slovenia); The project aims to increase the production and use of energy from wood biomass by organising events which will motivate the identified target groups to invest in biomass collection and logistics centres in 9 EU Member States.

- **Euro-Topten-Max** - Maximising Topten Communication on Top Runner Products - 22 partners; lead partner- ADEME - French Agency for Environment and Energy Management (France); The project aims to create a national reference centre for the selection of most energy-efficient appliances available on the Croatian market via the national TOPTEN website.

- The **ERENET** project - Rural Web Energy Learning Network for Action - was successfully completed on 20 December 2013; 10 partners; lead partner - National Technical University of Athens (Greece); the main objective of the project was to foster the energy development of rural communities through the development, implementation and monitoring of Sustainable Energy Action Plans (SEAPs), as well as continuous informative-educational activities.

- **SolidStandards -** Enhancing the implementation of quality and sustainability standards and certification schemes for solid biofuels - 11 partners; lead partner - WIP Renewable Energies (Germany). The project is aimed towards the latest achievements and developments related to the quality and sustainability of solid biofuels, and especially towards the development of the appropriate standardisation and certification systems.

- The **Sustainable Energy for Rural Communities - SUSTAINCO** project is aimed at European legislation related to improving the energy efficiency in buildings, with emphasis on the obligation that, by 2020, all new

buildings should be nearly zero energy buildings (NZEB). It bears mentioning that, for the first time, the Croatian partner (North-west Croatia Regional Energy Agency) is the project coordinator within the framework of the Intelligent Energy Europe programme. Project activities include the development of high-quality technical and financial manuals aimed at laying down parameters for NZEBs, providing information to citizens about such a standard of construction, organising workshops and expert visits, and the development of pilot projects compliant with the NZEB standard.

- The Agency's activities under the **BUY SMART +** (Buy Smart + Green Procurement in Europe) project were continued in 2013 within the framework of the IEE programme. The objective of the BUY SMART + project is to strengthen the green public procurement system in 7 EU Member States and transfer knowledge to 8 future Member States (one of which is Croatia). The total project value is EUR 1.5 million.

REA North

The Regional Energy Agency North was established as a public, independent and non-profit institution whose activities are based on energy planning, conducting energy audits of public and private sector buildings, providing advisory services on energy and energy technologies to the business sector and the public, and promotional and marketing activities. In the last three years, REA North participated in, among others, the following EU projects:

The **EduTech** project - 'Cross-border promotion of new technologies in education' (acronym: EduTech) is financed by the European Union through the Hungary-Croatia IPA Cross-border Co-operation Programme. Project activities are aimed at the students and teachers at 3 elementary schools in the Town of Koprivnica. The total project budget is EUR 154 478.00, of which the EU co-finances 85 %. The implementation period is 1 March 2013 - 28 February 2014.

The **GeoSEE** project (full title: Innovative uses of low-temperature geothermal resources in South East Europe) was approved for co-financing under the South East Europe (SEE) Transnational Cooperation Programme, it was applied for and it is jointly implemented by the Regional Energy Agency North and its 16 partners from South East Europe. The general objective of the project is to contribute to the rapid development and implementation of energy-efficient technologies based on renewable energy sources in South East Europe and its wider area, and especially those technologies that enable the countries represented in the project to utilise a clean, sustainable and widespread domestic resource. GeoSEE wants to prove that low-temperature geothermal resources are an important energy resource which meets these requirements and which can contribute to climate change mitigation, the reduction of carbon dioxide emissions, and improving energy independence.

IGER CsK - IPA CBC a Hungary-Croatia cross-border cooperation programme aimed at conducting expert geological, geophysical and magnetotelluric measurements and the accompanying feasibility studies and environmental impact studies in the area of the Town of Koprivnica, with the objective of identifying clearly defined geothermal water reservoirs which could ultimately be used for combined electricity and heat energy production.

MENEA

The Međimurje Energy Agency - MENEA was established in 2008 under the EU project 'Creation of energy agencies in Lleida (ES), Međimurje (HR) and Montpellier (FR)', financed from the Intelligent Energy Europe (IEE) programme. The project idea was developed at the encouragement from the Međimurje County and the Regional Development Agency Međimurje (REDEA). In addition to the IEE funds, the financial backing for the start of activities was provided by the Međimurje County, the towns of Čakovec and Prelog, and the companies HEP-ESCO, INA and Končar.

From 1 May 2011 to 31 March 2013, Menea participated in the IR-OVE project (Innovative cross-border region of renewable energy sources), approved under the Slovenia-Croatia IPA Cross-border Programme. The general objective of the project was to increase the competitiveness and sustainable development of the entire cross-border territory covered by the project. The specific objectives were to improve business cooperation among companies, primarily SMEs in the field to which the project pertains, which are active in the sector of developing RES-related technologies and products/services.

2 Improving cooperation among companies and knowledge-based institutions which develop technological solutions for RES.

P.2 Programme 'House in Order'

Overview of the measure from the 2nd NEEAP		*Programme 'House in Order'*
Measure index		*P.2*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: October 2008* *End: October 2013 (2016)* *Planned major modifications, amendments, improvements:* *The measure will continue to be implemented as planned. The continuation of activities will be ensured after the formal end of the UNDP project team's involvement (2013). The measure should be amended by applying complex technical measures for improving energy efficiency based on the ESCO principle.*
	Objective / outline	*The project objective is to apply a model of continuous and systematic energy management in the buildings owned and used by the Government of the Republic of Croatia. The project is based on the establishment of an organisational structure for energy management, employee training, and the application of IT tools for continuous monitoring and analysis of energy and water consumption in state-owned buildings.*
	Target final consumption	*Existent buildings owned and used by the Government of the Republic of Croatia*
	Target group	*Public sector employees*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010: HRK 29 658 210* 3.7.1 *EPEEF: HRK 29 503 210 or 99.5 %* 3.7.2 *MELE: HRK 155 000 or 0.5 %* *Planned funds by the end of 2013:* *EPEEF: HRK 32 345 000 or 100 % (cumulatively, the amount represents the total funds for 2012 and 2013)*
	Executive body	*UNDP project team – project 'Removing Barriers to Energy Efficiency in Croatia' in coordination with the Centre* • *EPEEF – financing*
	Monitoring bodies	*MCPP, MENP, ME*

In 2013, energy audits were conducted in 25 institutions, reports on the conducted energy audits were drawn up, as were the terms of reference aimed at implementing the Programme of energy renovation of public sector buildings 2012–2013 of the Ministry of Construction and Physical Planning, and the corresponding energy performance certificates were issued. The total gross building area of the facilities in question is 125 338 m^2.In the last project year, 65 energy performance certificates were drawn up for 24 institutions for which the reports on conducted energy audits were drawn up in 2012. The total gross building area of the facilities in question is 175 890 m^2.

By the end of October 2013, the implementation of 'free measures' achieved cumulative financial savings of over HRK 11.7 million. The implementation of the said measures also resulted in a cumulative reduction of CO_2 emissions by 2 528 tonnes. The cumulative savings achieved from the implementation of investment measures amount to HRK 29.5 million, which additionally entails a reduction of CO_2 emissions by 14 000 tonnes. The total cumulative savings from implemented investment and free EE measures amount to HRK 41 200 000 and reduce CO_2 consumption by 18 264 tonnes, which is financially close to the overall HiO programme budget.
Since project implementation officially ended in late October 2013, we present an overview of activities and achieved results and savings since the start of implementation. Overall, during the 5 years of implementation, the HiO programme achieved the following results:

- All the ministries joined the Programme activities by signing a letter of intent, whereby they officially established their obligation of implementing the Programme activities in the facilities under their competence.
- The Central Register of Facilities – there are 3 783 facilities registered in the Central Register, which exceeds the initial estimate of 3 500 facilities under the competence of the central state administration. All the data collected for 2 809 facilities have been entered into the ISGE, which is more than 75 %. The ISGE system users have been trained to regularly monitor and record consumption at a monthly and weekly basis.

- A total of 1 887 responsible and technical persons were trained, and a further 8 046 employees were trained through various professional workshops and courses aimed at better identifying the possibilities for energy efficiency improvements. A total of 10 518 state administration employees have undergone training.
- Remote reading of energy consumption – In order to automate the obligation of monitoring energy consumption in the public sector, as laid down by the law, a remote reading system for energy consumption was introduced into 45 facilities. The system enables the automatic collection of data on electricity, heat energy, gas and water consumption. The information on energy and water consumption are displayed in real time on the educational-informative panel, 'EE panel', which encourages energy-efficient behaviour of all employees and allows for the possibility of achieving savings of up to 5 %.
- Conducting energy audits and certification – During the programme, energy audit reports and terms of reference were drawn up, and energy performance certificates were issued for a total of 145 facilities. The total gross building area of the facilities in question amounts to approximately 760 504 m^2. Energy performance certificates were issued for 203 facilities based on the conducted energy audits.
- Detailed investment studies and other projects – A total of 8 detailed investment studies were drawn up with the objective of providing a detailed estimate of the potential for the application of measures on energy efficiency and renewable energy sources. Thirteen main projects for the reconstruction of mechanical and electrical installations were drawn up for institutions in which a potential for certain changes was observed and whose users had expressed interest for cooperation on such projects. Drawing up preliminary designs and design support. The designers developed various preliminary designs for 8 locations: installations of solar collectors for domestic hot water preparation, and various proposals of energy efficiency improvement measures for 32 facilities.
- Implementation of EE measures – During the programme, the implementation of 'free measures' achieved cumulative financial savings of over HRK 11.7 million. The implementation of the said measures also resulted in a cumulative reduction of CO_2 emissions by 4 028 tonnes. The cumulative savings achieved from the implementation of investment measures amount to HRK 29 500 000, which additionally entails a reduction of CO_2 emissions by 18 264 tonnes. The total cumulative savings from implemented investment and free EE measures amount to HRK 41 200 000, which is close to the overall HiO programme budget. During the Programme, the facilities in which the 'small measures' were implemented were chosen following the analysis of their energy and structural condition. The selection also endeavoured to comprise the highest possible number of ministries and counties. A total of HRK 516 937.00 was invested in small measures for 21 EE measures at 19 facilities.

Table A4-27. Activities and results of UNDP HiO programme implementation

Activities	Achieved results
1 Preparing ministries for programme implementation	All the ministries and 11 other state institutions have signed a letter of intent.
2 Establishing a building register	A total of 2 168 institutions and 3 783 facilities/commercial properties with a total area of 2 759 931 m^2 were included in the programme. A total of 2 809 facilities were entered in the ISGE, with a total annual consumption exceeding HRK 425 million. Monthly consumption is regularly monitored at 759 facilities. Remote reading of energy consumption is performed at 45 facilities.
3 Education and training	1. 'Green Office' workshop for all ministry employees: 7228 2. Workshop for 'Green Office' managers: 67 3. Course for energy advisers: 229 4. Course 'Energy Management in Buildings' (EMB): 271 5. Energy management course for responsible persons: 972 6. Course for technical staff: 915 7. ISGE course: 836 A total of **10 518** state administration employees have undergone training.
4 Conducting energy audits and certification	Energy audit reports and terms of reference were drawn up, and energy performance certificates were issued for 145 facilities. The total area of the facilities in question amounts to approximately 760 504 m^2 GBA (gross building area). Energy performance certificates were issued for 203 facilities based on the reports on conducted energy audits. Eight detailed investment studies were drawn up. Thirteen main projects for the reconstruction of mechanical and electrical installations were drawn up for institutions in which a potential for certain changes was observed and whose users had expressed interest for cooperation on such projects. The designers developed various preliminary designs for 8 locations: installations of solar collectors for domestic hot water preparation, and various proposals of energy efficiency improvement measures for 32 facilities.
5 Implementation of EE measures	During the Programme, the implementation of 'free measures' achieved cumulative financial savings of over HRK 11.7 million. The implementation of the said measures also resulted in a cumulative reduction of CO_2 emissions by 4 028 tonnes. The cumulative savings achieved from the implementation of investment measures amount to HRK 29.5 million, which additionally entails a reduction of CO_2 emissions by 18 264 tonnes. The total cumulative savings from implemented investment and free EE measures amount to HRK 41 200 000, which is close to the overall HiO programme budget. Small measures During the Programme, the facilities in which the measures were implemented were chosen following the analysis of their energy and structural condition. The selection also endeavoured to comprise the highest possible number of ministries and counties. A total of HRK 516 937.00 was invested in small measures for 21 EE measures at 19 facilities.

The savings from the HiO project measures are shown under measure P.1 as the accumulative result of activities in the segment of systematic energy management in public facilities - be they at city, county or state level - calculated with the help of the Energy Management Information System.

P.3 'Green' public procurement

Overview of the measure from the 2nd NEEAP		*'Green' public procurement*
Measure index		*P.3*
Description	Category	*Voluntary agreements and cooperation instruments*
	Time frame	*Start: 2008* *End: 2016* *Planned major modifications, amendments, improvements:* *It is necessary to intensify the activities which can provide the public procurement officers with the legal and technical know-how for including and evaluating energy efficiency requirements in public procurement procedures by applying the criterion of the economically most favourable bid.*
	Objective / outline	*The aim of this measure is to enable the practical application of the Public Procurement Act (NN No 90/2011) through the energy efficiency criterion by drawing up a guide or instructions for 'green', energy-efficient public procurement, because the general knowledge of energy efficiency is insufficient, which can lead to a retention of old habits and failure to utilise the legal possibilities for energy efficiency promotion in the public sector. The guide will describe how energy efficiency criteria must be taken into account during public procurement procedures, and it will define the criteria for typical product groups that can be easily integrated into tender documentation. The guide will aid the persons competent for public procurement, and it will contain detailed recommendations for the procurement of the following:* • *electric devices and machines* • *heating, ventilation and air-conditioning equipment (HVAC)* • *vehicles and construction machinery* • *reconstruction and construction of new buildings* *Of course, the instructions can and should be expanded to environmental criteria and the procurement of other equipment such as office paper, cleaning supplies, food, furniture, etc. Since the public sector is a large purchaser of goods and services, energy efficient public procurement can be very effective in transforming the market towards more efficient solutions, reducing the prices of new technologies and broadening their use.*
	Target final consumption	*All types of energy consumption in the public sector, including liquid fuel consumption for vehicles used by the public sector.*
	Target group	*Persons competent for public procurement at national and LRSGU level.*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Estimated funds by the end of 2013: 7 ME: HRK 500 000 – drawing up the guide (instructions)*
	Executive body	*ME, in cooperation with the Centre – drawing up instructions* *LRSGUs – participate in the campaign* • Central Procurement Office of the Government of the Republic of Croatia – application
	Monitoring bodies	*ME* *MCPP*

The aim of this measure is to enable the practical application of the Public Procurement Act (PPA) through the criterion of the economically most favourable bid, by drawing up a guide or instructions for 'green', energy-efficient public procurement, because the general knowledge of energy efficiency is insufficient, which can lead to a retention of old habits and failure to utilise the legal possibilities for energy efficiency promotion in the public sector. In order to achieve that, there is further work to be done on producing appropriate educational materials (reference books, guides) and distributing the existing educational and promotional materials (including EC materials available in Croatian) electronically and through workshops.

The Act on the Promotion of Clean and Energy-efficient Road Transport Vehicles (NN No 127/13) was adopted in October 2013 for the purposes of harmonisation with Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles, and pursuant to this Act, the State Office for Metrology adopted the Rules on the methodology for calculating operative costs during the exploitation of a road transport vehicle (NN No 136/13), and the Ministry of Economy adopted the Rules on the criteria used in public procurement procedures for road transport vehicles (NN No 11/14).

In accordance with the aforementioned Act, the purchasers in public procurement procedures and the carriers who provide public passenger transport services are obliged, when purchasing vehicles used for road transport, to take into account the energy efficiency and the environmental impact during the exploitation of a vehicle. The Rules adopted by the State Office for Metrology laid down the methodology for calculating operative costs during the service life of a vehicle, on the basis of which cleaner vehicles should be given priority. The Rules adopted by the Ministry of Economy laid down the criteria with which a purchaser must comply in the public procurement of road transport vehicles.

The monitoring of energy savings achieved under this measure was not implemented correctly in the 2011–2013 period, i.e. it was not implemented by applying the BU method for each individual group of procured devices, taking into account the energy efficiency criteria. The BU method, recommended by the EC, will be used to monitor and measure the savings achieved through the 'green' public procurement of household appliances and office equipment. A national method was developed for vehicles, based on the difference in fuel consumption of a standard automobile with an internal combustion engine and a new vehicle with advanced technology (hybrid or electric), and the average annual mileage of a vehicle. The methods are described in detail in the document 'Measuring and Verification of Energy Savings Using the Bottom-Up Method'. It is extremely important that the Central Procurement Office monitors the data on the quantities and types of procured equipment.

Central Procurement Office of the Government of the Republic of Croatia

The Central Procurement Office is the administrative and professional service of the Government of the Republic of Croatia which conducts central public procurement activities for central state administration bodies. One of the tasks of the Office is sustainable procurement, the practical implementation of which is hindered due to a lack of knowledge and experience in integrating energy efficiency and environmental protection criteria into public procurement procedures. In 2013, the Central Procurement Office prepared the Strategy and the Action Plan for the 2013–2015 period. The Office Strategy depends on the overall strategy, policy and plans of the Government of the Republic of Croatia. Numerous national and EU regulations were used for drawing up the Strategy and the Action Plan. For example, one of the documents taken into account was the strategy entitled Europe 2020, with emphasis on sustainable development.

The most significant initiatives of the Europe 2020 strategy underline the importance of sustainable development, and of increasing the competitiveness of an economy with a low level of carbon dioxide emissions and an efficient and sustainable use of resources. Among other things, the strategy also emphasises the need to improve the business environment, especially in the case of small and medium-sized enterprises. Public procurement is an area in which the market and the public sector interact. According to 2011 data, public procurement accounts for 9.04 % of the gross domestic product of the Republic of Croatia. By introducing green and sustainable products, Croatia will contribute to the EU vision.

Furthermore, EU regulations on green public procurement were also taken into account, such as Regulation (EC) No 106/2008 of the European Parliament and of the Council on a Union energy-efficiency labelling programme for office equipment, and the proposals for new EU directives on public procurement or their impact on Office operations. In accordance with the aforementioned proposals, the most important change, from the Office's viewpoint, is the requirement that central public procurement bodies conduct their procurement procedures electronically. However, the new directives should be transposed into the Croatian Public Procurement Act within two years of their entry into force, which is probably in mid-2015.

Procedures conducted by the Central Procurement Office in 2013, which included green public procurement criteria or which were conducted in accordance with the criterion of the economically most favourable bid:

1. In the public procurement procedure for office supplies, the copy paper was required to originate from legitimate and sustainably managed forests which observe environmentally friendly principles. As proof of compliance with the aforementioned requirements, the bidders had to submit a Forest Stewardship Council (FSC) certificate issued by an organisation accredited by the FSC.
2. In the public procurement procedure for electricity for all central public procurement users (ministries, state administrative organisations, state offices, the Government of the Republic of Croatia and the Croatian Parliament) for the 2014–2015 period, the share of electricity produced from renewable energy

sources was evaluated as one of the criteria for selecting the economically most favourable bid. The chosen bidder offered electricity supply produced solely (100 % share) from renewable sources.

3. In the public procurement procedure for vehicle tyres and services related to vehicle tyre supply (tyre-repair services, disposal of old tyres), the tender documents include a provision which requires that all the pneumatics that are bid for tender (for vehicle categories M, N, O) must be labelled with the EU label for pneumatics (Regulation 1222/2009/EC and 1235/2011/EU). The label for pneumatics contains information on the following three basic characteristics: fuel consumption efficiency, wet grip, and external rolling noise. The individual criteria require a minimum value with which a bidder must comply. Furthermore, the documentation prescribes that the chosen bidder is obliged to collect and dispose of the tyres which are no longer used.
4. In the public procurement procedure for motor vehicles purchased through operating leases, the provisions regarding the Euro V standard and the maximum amount of CO_2 emissions are specified in the section of the documentation where the bidders must enter the characteristics of the tendered automobiles. Since the bidders are free to decide on the choice of a vehicle (brand and type) for operating leasing, the application of the new Act on Special Motor Vehicle Tax and the provisions on the financial competitiveness of a bid direct the bidders towards tendering vehicles with lower CO_2 emissions because such vehicles ultimately have a lower procurement cost for the leasing company.

Further application of green public procurement criteria, or the criteria for the economically most favourable bid, is planned in the following period.

1. In regard to the procurement of computer equipment for the 2014 2015 period, in addition to the application of the criterion of the economically most favourable bid, as related to the warranty period, technical specifications are defined in such a manner that the tendered computer equipment must comply with the following requirements:
   a. Energy Star 5.0 is the basic requirement for personal computers, laptops and monitors, pursuant to EU GPP criteria. A certificate or a possibility of verifying the compliance with the energy standards laid down by Energy Star 5.0 is a precondition for compliance with the EU GPP criteria for this product group.
   b. The WEEE symbol, i.e. the marking that designates the sorted collection of electrical and electronic waste regulated by Directive 2012/19/EU on waste electrical and electronic equipment, i.e. the Act on Sustainable Waste Management (NN Nos 94/13) into which the Directive was transposed and laid down in detail in the Rules on the management of waste electrical and electronic appliances and equipment (NN Nos 74/07, 133/08, 31/09, 156/09, 143/12, 86/13).
   c. RoHS is a designation certifying that a product was manufactured in compliance with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment, i.e. the Rules on the restriction of the use of certain hazardous substances in electrical and electronic equipment (NN No 131/2013) with which the Directive was transposed, and in accordance with Article 4(1) of the Act on Technical Requirements for Products and on Conformity Assessment (NN No 80/2013). In this way, EU Member States ensure that the electrical and electronic equipment placed on the market does not contain hazardous substances.
2. In the public procurement procedure for the purchase of motor vehicles, the Central Procurement Office of the Government of the Republic of Croatia will apply the provisions of the new Rules on the criteria used in public procurement procedures for road transport vehicles (NN Nos 11/2014).

Project: Low-carbon economy procurement (Green Public Procurement 2020)

The awareness of green public procurement (GPP) has increased substantially in recent years. GPP tools, guidelines and conditions are now widely available in many countries. However, the vast majority of public procurement tenders in Europe still do not include effective conditions on environmental protection and therefore do not result in the purchase of sustainable solutions. The project coordinator is ICLEI – Local Governments for Sustainability (the leading

global association of cities and local governments dedicated to sustainable development), and the project head for the Republic of Croatia is UNDP Croatia.

The project Green Public Procurement 2020 aims to harmonise low-carbon procurement throughout Europe by implementing the following activities:

1. project partners will conduct more than 100 low-carbon tenders in order to immediately achieve a substantial reduction of CO_2 emissions;
2. events which will include education and networking – both for the purchasers and for the providers of procurement-related training – on GPP implementation in the field of energetics in Austria, Croatia, Germany, Italy, the Netherlands, Portugal, Slovenia, and Spain;
3. improving the permanent GPP support structures, such as user support in the aforementioned eight countries: Austria, Croatia, Germany, Italy, the Netherlands, Portugal, Slovenia, and Spain.

Buy Smart+ project (Green procurement in Europe)

The Buy Smart+ project is implemented under the EU programme Intelligent Energy Europe, and it officially started in March 2012. The main objective of the project is to promote the procurement of energy efficient products and services, which should have a positive effect on changing the behaviour of consumers from both the public and the private sector, and stimulate the production and use of products which have a less harmful environmental impact. The project, which includes 18 partners from 15 countries, is coordinated by the Berlin Energy Agency, and the Croatian representative in the project is the North-west Croatia Regional Energy Agency.

The project activities are aimed at increasing the level of expertise of all the green procurement stakeholders, and they include: establishing a customer service for providing information on the construction sector, lighting, procurement of vehicles, household appliances and office equipment (IT); an overview of the existent legislation in project partner countries; trainings and consultations on the possibilities of introducing green procurement; the implementation of a green procurement pilot project; and the evaluation of the success and promotion of the results of the green procurement project.

P.4 'Energy Efficient Public Lighting' Programme

Overview of the measure from the 2nd NEEAP		***'Energy Efficient Public Lighting' Programme***
Measure index		*P.4*
Description	Category	*Energy services for energy savings*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *This is an entirely new measure. It was designed on the basis of the best practical experiences of the company HEP-ESCO d.o.o., as well as on EPEEF experiences in co-financing public lighting reconstruction projects. The measure aims to stimulate the ESCO market in Croatia.*
	Objective / outline	*Public lighting in Croatia consumes 446.33 GWh of electricity, which is approximately 3 % of total final electricity consumption (2009 data). Energy efficiency improvement projects for public lighting are profitable, the savings are immediately visible, easily provable and verifiable. These projects, therefore, have an excellent use in stimulating energy services. The basic objective of this measure is to stimulate the energy services market in Croatia. Although this measure is entirely new in relation to the 1st NEEAP, it will include the experiences gained by EPEEF and HEP ESCO, and it will stimulate the development of the ESCO financing model.*
	Target final consumption	*Electricity consumption for public lighting*
	Target group	*Responsible persons at LRSGUs*
	Regional application	*National*

Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010: HRK 131.86 million* *EPEEF: HRK 29.54 million* • *LRSGU: HRK 43.84 million (estimate)* • *HEP-ESCO: HRK 55.3 million* *Estimated funds by the end of 2013: HRK 300 million* • *ESCO model* *4 Drawing up the programme: HRK 100 000 MCPP and ME budgets*
	Executive body	*ME – regulations and instructions for LRSGUs* • *LRSGU and ESCO companies in coordination with the Centre – implementation*
	Monitoring bodies	*ME, MCPP, MENP*

The following contributed to the implementation of this measure:

- cities and municipalities that recognised the benefits of replacing old lighting and invested their own funds in replacing public lighting;
- EPEEF with its co-financing scheme for public lighting;
- ministries which accompanied this measure by adopting legislative acts and sets of rules.

The Act on the Protection from Light Pollution (NN No 114/2011) entered into force on 1 January 2012, regulating protection from light pollution, the principles of such protection, the operators who implement protection, the method for establishing lighting management standards in order to reduce the consumption of electricity and other types of energy, and obligatory lighting methods; it establishes measures of protection from excessive lighting, limitations and prohibitions related to light pollution, planning lighting construction, management and reconstruction, and the responsibility of manufacturers of lighting products and other persons.

The bottom-up method was used to collect data from the nine cities which submitted reports on the projects of replacing public lighting with a more energy efficient technology. Calculations showed that total energy savings of 0.0026 PJ were achieved, and CO_2 emission savings amounted to 270.810 kg per year. It is believed that the actual amount of achieved savings is much higher and there are plans to improve the data collection methodology for the 4th NEEAP so that the bottom-up method could cover a larger number of implemented projects.

Table A4-28. Overview of achieved results from replacing lighting fixtures in nine cities, and BU calculations of achieved savings:

City:	Number of lighting fixtures	Energy savings (kWh/year)	
Pazin		276 400.00	
Bjelovar		153 278.50	
Buzet		137 781.00	
Rijeka	387	61 740.80	
Split	262	33 064.00	
Umag		26 323	
Slatina	147	23 609.72	
Beli Manastir	22	5 082.00	
Dugo Selo	10	2988	
Total:	828	443 867	kWh
		0.0016	PJ

The basic aims of the modernisation projects for public lighting systems co-financed by the Fund are to improve road transport safety by improving the lighting-technical values in compliance with HRN EN 13 201, increasing energy

efficiency and environmental protection by reducing greenhouse gasses and light pollution. Moreover, these projects reduce the peak connection power and load of the electric power system, which delays the necessary increases of installed electricity production capacities. The savings per individual project of reconstruction and construction of energy efficient and environmentally friendly public lighting systems amount to 30–50 % of the electricity consumption of the existing system.

A total of 123 projects were implemented in the 2011–2013 period, for which HRK 49 176 373.29 of funding was paid out, with the total investments amounting to HRK 96 526 571.57. The energy savings calculated for those projects amounted to 51.36 TJ (14 267 664.22 kWh), which is 0.38 % of the national intermediate target for 2013, or 0.925 % of the national target for 2016. Greenhouse gas emissions were reduced by 5 364.64 tCO_2 in total, and HRK 13 892 057.08 were saved. Approximately 80 % of all projects were reconstructions of existing public lighting systems, 17 % were constructions of new lighting systems, and 3 % were installations of regulation. Before the reconstruction, most of the light bulbs were high-pressure mercury vapour lamps and they were replaced with high-pressure sodium lamps (in 77 % of cases), LED light bulbs (in 10 % of cases), and a combination of several types of light bulbs (in 13 % of cases).

Since the life cycle of the 'Energy Efficient Public Lighting' measure is 15 years, the energy savings achieved in the 2006–2010 period (1st NEEAP) were added to the savings achieved in the 2011–2013 period, but attention was paid to avoid double counting the savings, or doubling them, in the calculations.

By the end of 2013 (which includes the periods of the first and second NEEAP), a total of 236 public lighting modernisation projects were implemented and the total amount of funding paid out for those projects was HRK 84 177 061.09, with the total investments amounting to HRK 174 818 819.98. **The energy savings calculated for those projects amounted to 79.62 TJ (22 117 855.82 kWh)**, which is 0.60 % of the national intermediate target for 2013, or 0.40 % of the national target for 2016. Greenhouse gas emissions were reduced by 8 316.31 tCO_2 in total, and HRK 21 768 750.78 were saved.

Table A4-29. Savings from the activities on energy efficient and environmentally friendly public lighting per year (for the period of the 1st and 2nd NEEAP)

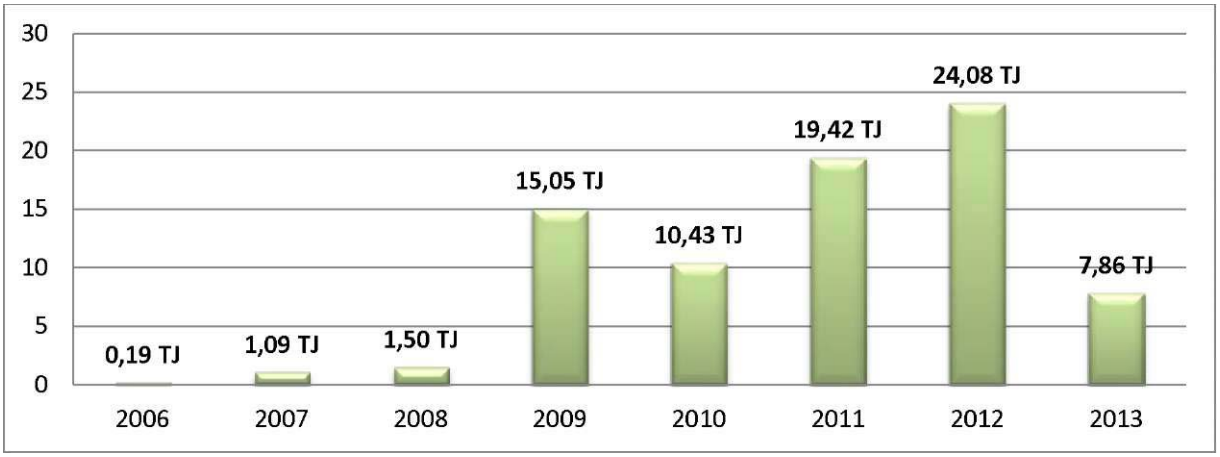
Year	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO_2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
2006	2	52 290.00	0.19	38 694.60	19.66	635 000.00
2007	12	302 599.98	1.09	223 923.99	113.78	2 725 170.68
2008	10	416 749.60	1.50	379 242.14	156.70	3 173 058.45
2009	56	4 180 401.22	15.05	4 222 205.24	1 571.83	17 055 049.35
2010	33	2 898 150.79	10.43	3 012 627.75	1 089.70	11 412 409.32
2011	44	5 395 059.34	19.42	5 640 534.54	2 028.54	13 116 286.20
2012	59	6 689 387.50	24.08	6 221 130.38	2 515.21	27 251 152.74
2013	20	2 183 217.37	7.86	2 030 392.16	820.89	8 808 934.35
Total:	**236**	**22 117 855.82**	**79.62**	**21 768 750.78**	**8 316.31**	**84 177 061.09**

* savings in HRK were calculated in accordance with the electricity prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

In the 2006–2013 period, the highest number of projects were implemented in 2012, and the largest energy savings were also achieved in that year.

Diagram A4-2. Energy savings in TJ from public lighting projects per year (for the period of the 1st and 2nd NEEAP)



The expected energy savings from this measure by 2016 amount to 0.25 PJ. The implementation of the Fund's projects achieved 31.85 % of the aforementioned target by the end of 2013.

P.5 Plan for energy renovation of commercial non-residential buildings

Overview of the measure from the 2nd NEEAP		*Plan for energy renovation of public sector buildings*
Measure index		*P.5*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016 (2020)* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*The measure provides for the design of a detailed action plan for the renovation of existing public sector buildings by 2016 (2020) and for the implementation of the said plan. Public sector buildings, within the meaning of the 2nd NEEAP, are buildings owned by the LRSGUs (cities, municipalities, counties), buildings owned by the central government – budget beneficiaries (ministries, bureaus, institutes, academies, offices) and non-budgetary funds, as well as buildings owned by public companies. The plan will primarily focus on public sector buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. In view of the requirements of the EPBD II directive that all buildings intended for public use should be renovated and constructed in compliance with the nearly zero energy standard from 2018, the criteria for the renovation of buildings intended for public use must be stricter than the legal minimum prescribed by 2020. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation.*
	Target final consumption	*Public sector buildings*
	Target group	*Buildings owned by LRSGUs (cities, municipalities, counties)* *Buildings owned by the central government*

		- Budget beneficiaries (ministries, bureaus, institutes, academies, offices) *- Non-budgetary funds* *- Buildings owned by public companies*
	Regional application	*National*
Information on implementation	Funds and financing sources	*The planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 1 500.00 per m^2 and amount to HRK 0.72 billion.* *- MCPP: HRK 100 000 – for drawing up the plan* *- MCPP: HRK 2 000 000 – own funds for financing the project documentation for the pilot stage in 2012* *Implementation annually: HRK 724 100 000* *- Commercial banks, HBOR, EIB (ELENA funds for covering project documentation costs) 99.43 %* *- EPEEF: HRK 2 000 000 – financing energy performance certificates for buildings 0.27 %* *- EU co-financing funds* *- ESCO companies – the ESCO market should be included in programme implementation* *- The detailed requirements and sources of financing will be laid down in the Plan.*
	Executive body	*MCPP – drawing up the plan* *EPEEF – ensuring a portion of required co-financing* *Centre – plan implementation and promotion*
	Monitoring bodies	*MCPP*

The Centre for Monitoring Business Activities implemented the programme 'Energy renovation of public sector buildings 2012–2013' on the basis of an agreement with the Ministry of Construction and Physical Planning.

Programme implementation started on 1 May 2012 and ended on 3 August 2013, and the Centre for Monitoring Business Activities in the Energy Sector and Investments was the programme's implementing authority.

The Centre implemented the programme on the basis of the Act on Efficient Energy Use in Final Consumption (NN No 55/12) and the Regulation on contracting and the implementation of energy services (NN No 69/2012), which were in force at the time and pursuant to which the Centre was competent for implementing public procurement procedures for energy services for budget and non-budgetary beneficiaries (AEEU, Article 25(5)).

The programme entails contracting the energy renovation of buildings by way of public tender, which results in the signing of an energy performance contract between the bidding company and the owner of the public building, and this model has been recognised as the most efficient method for achieving energy savings.

The programme was implemented for those buildings for which it was established that they meet the criteria of the economic potential for reconstruction, i.e. that the savings allow for the recovery of funds invested in energy renovation. The evaluation of potential renovation measures was based on a conducted energy audit which, for public buildings, is an obligation defined by the Act on Efficient Energy Use in Final Consumption and the Rules on energy audits and energy certification of buildings (NN Nos 81/12, 29/13, 78/13).

The following documents were drawn up during programme implementation:
The programme of energy renovation of public sector buildings, which applies a model of energy services market development (ESCO), with emphasis on the leading role of the public sector in establishing an energy services market and utilising business opportunities in energy efficiency;

Standardised documents for conducting public procurement procedures for building renovation through ESCO services, in accordance with the guidelines of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, and alignment with the Croatian legislative framework;

Standardised energy performance contract (EPC) in conformity with the provisions of the Croatian legal system;

Proposal of a model for establishing a risk-sharing instrument for ESCO market development.

Education and training was conducted on the specifics of business operations on the energy services market (ESCO market).

56 energy audits were conducted for public buildings.

35 public procurement procedures for the energy renovation of public sector buildings were conducted.

The renovation of 5 public sector buildings was completed.

12 workshops were held for companies interested in conducting energy renovation of buildings.

After the renovation of 5 schools, the achieved savings were proven with the design and the energy performance certificate, and they amount to 1 952 838.97 kWh/year or 0.007 PJ.

The Decree on Amendments to the Act on Efficient Energy Use in Final Consumption was adopted on 3 August 2013. The competence for implementing energy efficiency measures in housing construction, and for preparing and drawing up renovation programmes for existent residential buildings in compliance with energy efficiency principles is transferred from the Centre to the Agency for Transactions and Mediation in Immovable Properties, which will continue programme implementation in the 2014–2015 period.

Within the scope of this activity, EPEEF co-finances projects for improving the thermal insulation of buildings, using renewable energy sources in buildings, improving the energy efficiency of thermal energy systems and lighting systems, and drawing up project documentation for energy efficiency improvement projects in building construction. Under this measure, EPEEF calculates the savings achieved in both the public and the commercial sector. A summary overview of all projects is presented below, but only the savings achieved from the renovation of public sector buildings are calculated under this measure, while the renovation of commercial buildings is calculated under measure C.5.

A total of 66 projects for public and commercial buildings were implemented in the 2011–2013 period, for which HRK 23 500 276.00 of funding was paid out, with the total investments amounting to HRK 90 388 956.87. The energy savings calculated for those projects amounted to 20.96 TJ (5 823 218.29 kWh), which is 0.15 % of the national intermediate target for 2013, or 0.11 % of the national target for 2016. Greenhouse gas emissions were reduced by 1 428.25 tCO_2 in total, and HRK 2 957 134.72 were saved.

Since the life cycle of the measures was until the end of 2013, the savings achieved by 2010 were added to those achieved in the 2011–2013 period, but attention was paid to avoid double counting the savings, or doubling them, in the calculations.

By the end of 2013 (which includes the periods of the first and second NEEAP), a total of 119 projects were implemented and the total amount of funding paid out for those projects was HRK 49 610 262.42, with the total investments amounting to HRK 243 246 293.94. The energy savings calculated for those projects amounted to 37.15 TJ (10 318 701.1 kWh), which is 0.28 % of the national intermediate target for 2013, or 0.18 % of the national target for 2016. Greenhouse gas emissions were reduced by 2 360.58 tCO_2 in total, and HRK 4 330 594.62 were saved.

Table A4-30. Savings from sustainable construction projects per year (for the period of the 1st and 2nd NEEAP)

Year	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO_2 emissions savings [t]	Total funds paid out from the Fund [HRK]
2006	1	54 490.00	0.20	12 179.89	10.95	212 000.00
2007	3	10 000.00	0.04	2 235.25	2.01	976 503.93
2008	2	809 000.00	2.91	181 705.49	162.61	1 780 732.23
2009	17	1 535 807.86	5.53	404 653.12	310.61	7 361 982.88
2010	30	2 086 185.00	7.51	772 686.14	446.16	15 778 767.38
2011	19	1 244 764.58	4.48	554 369.81	313.92	5 205 874.57
2012	38	3 686 992.95	13.27	1 934 927.78	874.72	13 867 211.44
2013	9	891 460.76	3.21	467 837.13	239.61	4 427 189.99
Total:	**119**	**10 318 701.14**	**37.15**	**4 330 594.62**	**2 360.58**	**49 610 262.42**

* savings in HRK were calculated in accordance with the electricity and gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Most sustainable construction projects were implemented in 2012 (Diagram A4-2.), so the largest energy savings were also achieved in that year.

Diagram A4-2. Number of implemented sustainable construction projects per year (for the period of the 1st and 2nd NEEAP)

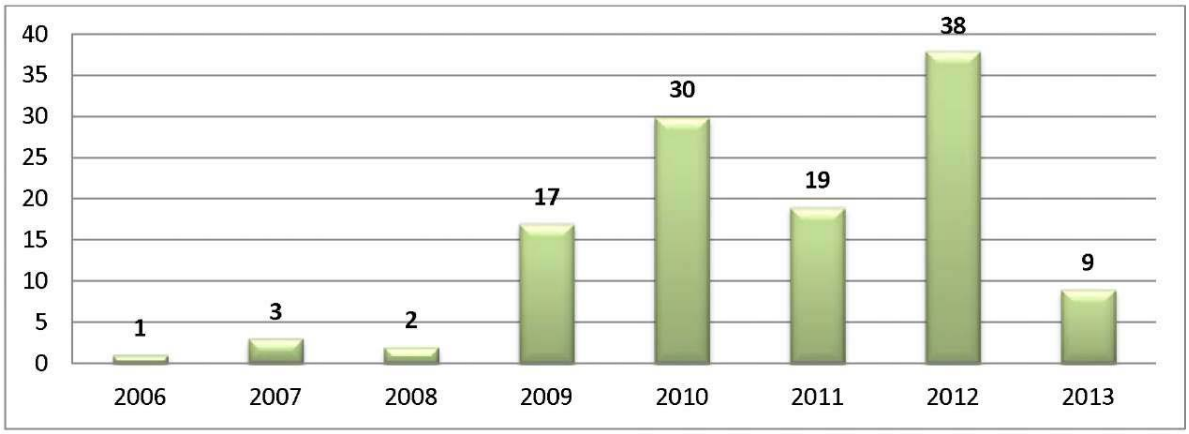
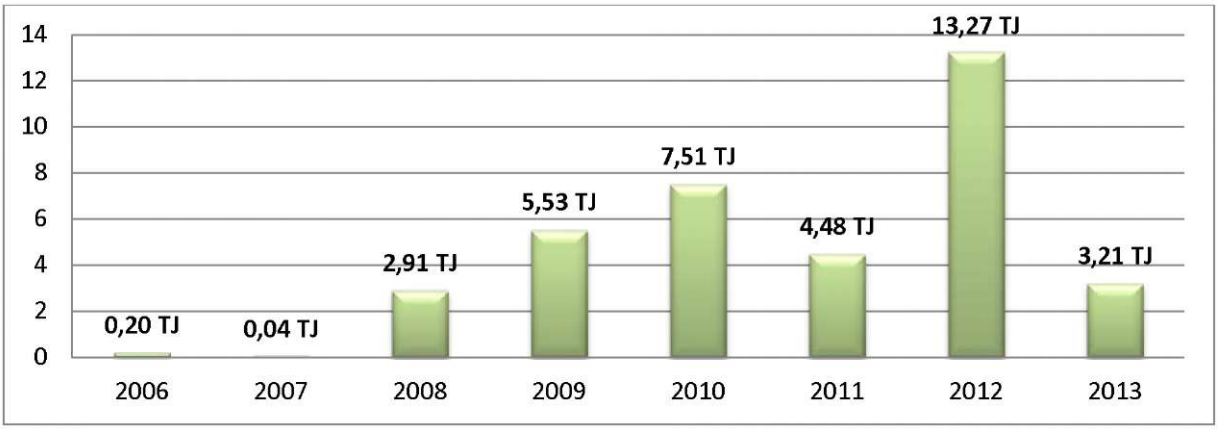


Diagram A4-1. Energy savings in TJ from sustainable construction projects per year (for the period of the 1st and 2nd NEEAP)



The implementation of these Fund projects achieved 6.17 % of the target of this measure. Since **the majority of the projects were implemented in the public services sector, the largest energy savings, amounting to 37.2 TJ, were also achieved in that sector.**

Table A4-31. Savings from sustainable construction projects per final consumption sectors

Sector	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
Public services	113	9 083 188.17	32.70	3 958 936.81	2 065.41	45 599 163.89
Commercial services	6	1 235 512.98	4.45	371 657.81	295.17	4 011 098.53
Total:	**119**	**10 318 701.14**	**37.15**	**4 330 594.62**	**2 360.58**	**49 610 262.42**

* savings in HRK were calculated in accordance with the electricity and gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Some public bodies undertook the renovation of their public buildings using their own funds. One ministry, four counties and three cities reported such renovations with sufficient data to calculate achieved savings. A total of 151 facilities were renovated, and the total savings at annual level were 32 025 966 kWh/year or 0.12 PJ.

Table A4-32. Overview of public building renovations financed from LRSGU budgets

City/County/Ministry	Number of buildings	Energy savings (kWh/year)
Bjelovar-Bilogora	4	303 000.00
Krapina-Zagorje	10	909 426.00
Primorje-Gorski Kotar	6	2 182 970.65

Osijek-Baranja	107	9 593 910.00
Beli Manastir	2	276 450.00
Bjelovar	3	560 000.00
Rijeka	3	189 950.00
Ministry of Health	17	18 010 259.42
Total:	152	32 025 966
		0.12

Measures for the commercial services sector

C.1 Systematic energy management and energy audits in the commercial services sector

Overview of the measure from the 2nd NEEAP		*Systematic energy management and energy audits in the commercial services sector*
Measure index		*C.1*
Description	Category	*Financial instruments*
	Time frame	*Start: 2009* *End: 2016* *Planned major modifications, amendments, improvements:* *The measure was revised from the 1st NEEAP and focused on providing financial support to stakeholders in the commercial services sector for implementing activities of introducing the practice of energy management, implementing energy audits and implementing complex technical measures for energy efficiency. The 1st NEEAP had planned for activities modelled after the public sector programmes (measures P.1 and P.2), but due to a lack of capacities in national implementing institutions, new legal obligations, as well as the substantial differences between the public and commercial sector, the most important segment is co-financing.*
	Objective / outline	*The objective of this measure is to provide financial support to companies from the commercial services sector for starting and conducting energy efficiency improvement activities, specifically for: introducing an energy management system (energy consumption monitoring and analysis, energy managers and teams, promotion of energy efficiency, and promotional-educational activities for employees), conducting energy audits, and applying complex technical measures for energy efficiency.*
	Target final consumption	*Commercial services buildings (privately owned)*
	Target group	*Owners and occupants of commercial services buildings*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Planned funds by the end of 2013:* • *ME HRK 50 000 drawing up the plan* *HBOR; Commercial banks: HRK 6 500 000 co-financing*
	Executive body	• *HBOR and EPEEF, in coordination with the Centre*
	Monitoring bodies	*ME, MCPP*

This measure was not implemented in its planned scope. It is planned to revise this measure for the following period or integrate it into other measures, for example I.3, and include it in the group of horizontal measures.
This measure was related to the legal obligations of energy management for large consumers (> 10 000 MWh/year), however, in the proposed new legal obligations, these provisions will be changed and it is planned for them to pertain to 'large companies'. The measure should be adjusted to reflect the aforementioned changes for the following period.

During the application of the 2nd NEEAP, this measure was not applied as planned. However, energy audits and energy performance certificates were co-financed through EPEEF activities.

In the period of the 1st and 2nd NEEAP, EPEEF co-financed the implementation of 3 projects in the commercial services sector, and the total savings achieved from those 3 projects in 2013 amount to 0.43 TJ. This measure is described in further detail under measure B.3 Energy certification of buildings.

C.2 Incentive programme for solar energy use in camps

Overview of the measure from the 2nd NEEAP		***Incentive programme for solar energy use in camps***
Measure index		*C.2*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements: New measure*
	Objective / outline	*The objective of this measure is to achieve widespread use of solar heating systems for domestic hot water preparation in camps. Camps were selected because their activities and occupancy directly correspond with the availability of insolation. This could eliminate a great part of the demand for electricity and fuel oil for heating purposes, which would achieve additional environmental effects and reduce peak loads in the electric power system. An added value is the creation of a 'green' image of camps and attracting guests for whom environmental protection is an important criterion when choosing a holiday destination. The measure plans for the installation of 125 000 m^2 of solar thermal collectors (which is approximately 13 % of the 0.225 m^2 per capita target to be achieved by 2020, as set in the Energy Strategy).*
	Target final consumption	*Domestic hot water preparation in camps*
	Target group	*Camp owners*
	Regional application	*Primarily littoral Croatia, applicable nationally*
Information on implementation	List and description of activities for measure implementation	*Future activities:* *1 ME and MT will include this measure in their work programme by the end of 2013, and promote it among camp owners – the promotional activities should be entrusted to MT. A decision on revising and extending the programme should be reached based on the achieved results.*
	Funds and financing sources	*It is assumed that a total of 25 000 m^2/year of solar thermal collectors will be installed under the measure. Planned funds by the end of 2013:* - *ME: HRK 100 000 – drawing up a detailed programme* - *EPEEF: co-financing HRK 1 500 000 (28.03 %)* *HBOR; commercial banks: HRK 3 750 000 (70.09 %)*
	Executive body	*MT, ME (promotion) and EPEEF (co-financing), in coordination with the Centre – programme implementation*
	Monitoring bodies	*ME*

This measure was not widely implemented, and it is part of the package of measures for the renovation of commercial buildings in the 3rd NEEAP.

C.3 Incentive programme for investments in solar heating systems and other EE improvement measures in hotels

Overview of the measure from the 2nd NEEAP		***Incentive programme for investments in solar heating systems and other EE improvement measures in hotels***
Measure index		*C.3*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements: New measure*
	Objective / outline	*The objective of this measure is to achieve widespread use of solar heating systems for domestic hot water preparation and the installation of heat pumps in hotels. This aims to minimise the use of electricity and fossil fuels for heating the premises, and maximise the use of solar power wherever such use is sound. In principle, every building used for tourism should at least consider using solar power for DHW preparation. In order for such interventions to become widespread, standardised analyses and standardised construction designs should be developed, which would enable higher-quality support for maintenance and remove obstacles for application. In regard to the installation of heat pumps, priority should be given to those pumps which can achieve a minimum average annual COP of 3.5 in their planned service life.*
	Target final consumption	*Domestic hot water preparation in hotels*

	Target group	*Owners of hotels and other tourism facilities, except camps*
	Regional application	*Primarily littoral Croatia, applicable nationally*
Information on implementation	List and description of activities for measure implementation	*Future activities:* *ME and MT will include this measure in their work programme by the end of 2013, and promote it among hotel owners – the promotional activities should be entrusted to MT. A decision on revising and extending the programme should be reached based on the achieved results.*
	Funds and financing sources	*It is assumed that a total of 4 600 m^2/year of solar thermal collectors and 100 heat pumps per year will be installed under the measure. Planned funds by the end of 2013:* • *ME and MT: HRK 100 000: drawing up a detailed programme* • *EPEEF: co-financing solar thermal collectors and other energy efficiency measures HRK 23 750 000, (HRK 5 000 000 for solar thermal collectors and HRK 5 250 000 for heat pumps)* • *HBOR; Commercial banks: HRK 64 250 000 for solar collectors and other energy efficiency measures*
	Executive body	*MT and ME (promotion), and EPEEF and HBOR (financing), in coordination with the Centre – programme implementation*
	Monitoring bodies	*MCPP, ME, MENP and MT*

This measure was not widely implemented, and it is part of the package of measures for the renovation of commercial buildings in the 3rd NEEAP.

C.4 Increasing the efficiency of cooling systems in hotels and other tourism facilities

Overview of the measure from the 2nd NEEAP		***Increasing the efficiency of cooling systems in hotels and other tourism facilities***
Measure index		*C.4*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements: New measure*
	Objective / outline	*The objective of this measure is to stimulate widespread use of efficient cooling systems in hotels. This pertains to the centralisation of cooling systems in larger hotels in which centralisation has not been implemented yet, the use of heat pumps, and the use of the environment as a thermal reservoir (seawater) in order to achieve the highest possible COP. In addition to electricity savings, reductions of the peak loads in the electric power system are also achieved. Furthermore, centralisation enables the use of condensation heat for domestic hot water preparation. This would also make the centralised system available for heating the premises, which could extend the hotel season in the winter.*
	Target final consumption	*Cooling systems in hotels*
	Target group	*Hotel owners*
	Regional application	*Throughout Croatia*
Information on implementation	List and description of activities for measure implementation	*Future activities:* *ME and MT will include this measure in their work programme by the end of 2013, and promote it among hotel owners – the promotional activities should be entrusted to MT.* *A decision on revising and extending the programme should be reached based on the achieved results.*
	Funds and financing sources	*Planned funds by the end of 2013:* • *ME and MT: HRK 100 000 drawing up a detailed programme* • *EPEEF; HBOR; Commercial banks: co-financing*
	Executive body	*MT and ME (promotion), and EPEEF and HBOR (co-financing), in coordination with the Centre – programme implementation*
	Monitoring bodies	*MCPP, ME and MT*

This measure was not widely implemented, and it is part of the package of measures for the renovation of commercial buildings in the 3rd NEEAP.

C.5 Plan for energy renovation of commercial non-residential buildings

Overview of the measure from the 2nd NEEAP		***Energy renovation of commercial non-residential buildings***
Measure index		*C.5*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016 (2020)* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*This measure provides for the design of a detailed action plan for the renovation of existing non-residential buildings intended for commercial use by 2016 (2020), and for the implementation of that plan. The Plan primarily focuses on the sector of commercial buildings constructed before 1987, on their renovation in compliance with low-energy standards and achievement of a B, A or A+ energy class. The measure provides for the production of energy performance certificates for buildings intended for public use, before and after renovation.*
	Target final consumption	*Existing non-residential buildings intended for commercial use (privately owned)*
	Target group	*Owners of non-residential buildings intended for commercial use*
	Regional application	*National*
Information on implementation	Funds and financing sources	*The planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 2 000.00 per m^2 and amount to HRK 1.96 billion.* • *MCPP and MT: HRK 500 000 – for drawing up the programme (each with 0.01 %)* • *ESCO companies – the ESCO market should be included in programme implementation* • *HBOR, Commercial banks: implementation annually HRK 1o960o000o000 (99.97 %)* • *The detailed requirements and sources of financing will be laid down in the Programme. The programme should design a model which would enable the end users of buildings to retain a portion of the financial savings and to invest in improving the standards.*
	Executive body	*MCPP – drawing up the programme* *HBOR, in coordination with the Centre – programme implementation*
	Monitoring bodies	*MCPP, MT*

This measure planned for the design of a detailed action plan for the renovation of commercial buildings by 2020 in order to apply the technical measures for energy efficiency, especially the renovation of the building envelope, and the implementation of the plan. The term 'commercial buildings' will also be defined under the Programme. The definition of the term 'commercial buildings' is determined by each country in accordance with its particularities and specific qualities. The programme of energy renovation of commercial non-residential buildings will apply economically justified, energy efficient technologies and measures in buildings intended for commercial non-residential use with the aim of developing new business activities and enterprises, continuous and systematic energy management, strategic planning and sustainable management of energy resources at national, regional and local level. Furthermore, an analysis and evaluation will be made regarding the beneficial impact a building that has undergone energy renovation can have on improving the health of the building's occupants, reducing energy consumption, reducing CO2 emissions, as well as on induced and indirect employment, and changes in the economy.

In order to achieve the multiplication effect and attract the interest of the owners of commercial buildings for the renovation of their buildings, the public should be regularly presented with completed projects and the benefits they have brought to their owners. The measure also provides for energy audits and energy certification of buildings.

Under this measure, EPEEF financed 6 renovation projects of commercial buildings, which achieved savings amounting to 0.005 PJ.

Table A4-33. Savings from sustainable construction projects per final consumption sectors

Sector	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
Public services	113	9 083 188.17	32.70	3 958 936.81	2 065.41	45 599 163.89
Commercial services	6	1 235 512.98	4.45	371 657.81	295.17	4 011 098.53
Total:	**119**	**10 318 701.14**	**37.15**	**4 330 594.62**	**2 360.58**	**49 610 262.42**

* savings in HRK were calculated in accordance with the electricity and gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

Measures in industry

I.1 Industrial Energy Efficiency Network (IEEN) and measure I.2 Voluntary agreements with industry

Overview of the measure from the 2nd NEEAP		***Industrial Energy Efficiency Network (IEEN)***
Measure index		*I.1*
Description	Category	*Voluntary agreements and cooperation instruments*
	Time frame	*Start: 2008* *End: 2016* *Planned major modifications, amendments, improvements: The measure was revised and amended with target activities.*
	Objective / outline	*A series of activities will be implemented through IEEN, aimed at promoting energy efficiency in industry. The basic objective is to increase the awareness and knowledge of the management and employees of industrial companies in order to utilise the potentials of measures with very low implementation costs. An activities plan for key industrial sectors should be drawn up under the measure, and the implementation of target energy efficiency measures should be co-financed.*
	Target final consumption	*Consumption of all types of energy and energy commodities in industrial processes*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Source of financing: EPEEF* *Potential source of co-financing: EU funds* *The required funds will be set in the detailed work programme of the Network.*
	Executive body	*ME and EPEEF – drawing up the programme* EIHP, in coordination with the Centre – programme implementation *EPEEF – co-financing*
	Monitoring bodies	*ME*
Overview of the measure from the 2nd NEEAP		*Voluntary agreements with industry*

Measure index		*I.2*
Description	Category	*Voluntary agreements and cooperation instruments*
	Time frame	*Start: 2007* *End: 2016* *Planned major modifications, amendments, improvements:* *The measure was integrated with measure I.5 and is described in further detail under the latter.*
	Objective / outline	*The objective is to improve energy efficiency in industrial plants which are obliged to pay the CO_2 emissions fee. Through voluntary agreements, companies assume the obligation of implementing a series of EnE measures and establishing an energy management structure. They simultaneously conclude a contract with EPEEF, under which EPEEF assumes the obligation of reducing a portion of the CO_2 fee to be paid by the company.*
	Target final consumption	*Consumption of all types of energy and energy commodities in industrial processes*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*EPEEF – finances the drawing up of the study*
	Executive body	*EIHP, EPEEF*
	Monitoring bodies	*ME, MENP*

Measures I.1 and I.2 were not implemented as planned. The Work Programme of the Industrial Energy Efficiency Network by 2016, which was supposed to be a precondition for measure I.1, is only in the drafting stage so this measure is planned to be implemented in the 2013–2016 period. The measures in industry have generally failed to perform as expected, but there are various associations whose operations were aimed at encouraging the commercial sector and industry to introduce energy efficiency measures. One such association is the Croatian Business Council for Sustainable Development, www.hrpsor.hr.

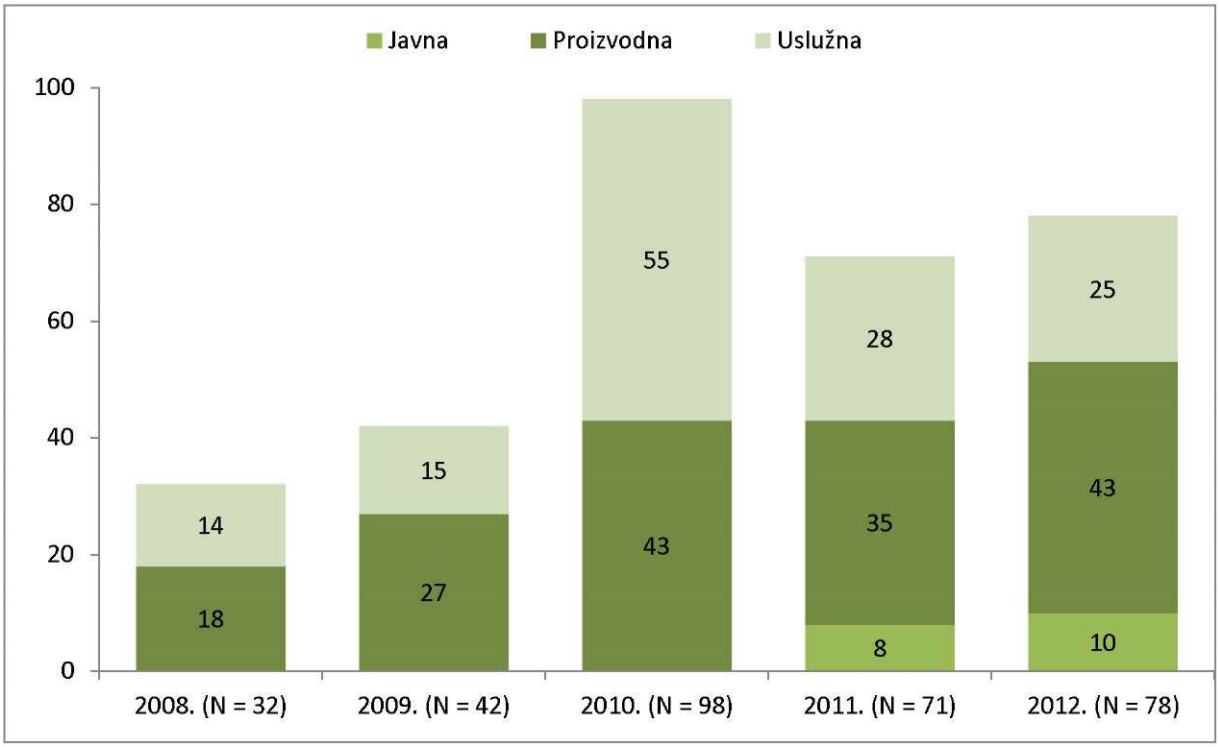
The Croatian Business Council for Sustainable Development has been fostering the application of sustainable development in business for 17 years. In the broadest sense, its activities involve improving the understanding of the requirements and benefits that the application of sustainable development, which also includes high environmental standards, has on business and improving competitiveness. Although it is not exclusively aimed at industry, the vast majority of HRPSOR members, as well as other business operators who utilise HRPSOR's services, are representatives of industry - the first sector to recognise the advantages of investments in environmental protection standards and energy efficiency as measures that can increase the competitiveness of a company. In the 2011–2013 period, HRPSOR implemented several activities which are important for encouraging the application of sustainability or socially responsible business (SRB), including energy efficiency measures.

SRB Index: In this period, as in every previous year starting from 2008, HRPSOR, in cooperation with HGK, conducted an SRB Index, a ranking process based on a thorough review of non-financial effects of the companies participating in the process, which ultimately results in the proclamation of the best companies followed by an award ceremony. The methodology was created by a group of experts from various fields, who defined the key areas and indicators for each of those fields. The Index evaluates six areas of responsible business: economic sustainability, a company's dedication to strategic implementation of sustainable development and SRB, work environment, environmental protection, market relations, and investments in the community. Each of these categories is defined by a set of indicators developed on the basis of their significance, availability and verifiability in Croatian conditions. The indicators were translated into questions, thus forming the SRB questionnaire. For example, the environmental protection area is defined by five sub-areas: Management; Measuring and monitoring environmental impact; Implementation of environmental protection measures; Stakeholders and environmental management; and Additional questions mandatory for production companies. Each sub-area is defined by a different number of relevant questions.
Templates of similar available methodologies were used to define the areas and sub-areas, such as the CR Index of the British organisation Business in the Community, as well as the GRI Sustainability Reporting Guidelines. However,

the final design of the methodology is the result of the work performed by domestic experts, and it comprises 119 questions for large and medium-sized and 61 questions for small enterprises.

The companies have been ranked and awarded for five years, and the number of participants has risen from the initial thirty-odd to nearly one hundred, which can be considered a success in view of the deteriorating economic situation in Croatia in recent years. Diagram A4-4 shows the dynamic of the rising interest of Croatian companies for participation in the SRB index, as well as the industry share in the overall numbers. Data for 2013 have still not been processed, but it is known that the interest trend is still growing and that the total number of participants has risen to 88, approximately 40 of which represent industry.

Diagram A4-4. Number of SRB Index participants over the years, by type.



Javna = Public
Proizvodna = Production
Uslužna = Service

The SRB Index questionnaire encourages the industry to invest in environmental protection and energy efficiency measures by asking them: to describe the method they use to monitor their environmental impact, whether they have an environmental management system, whether they measure and monitor the environmental impact, and whether there is a plan of reducing the impact (with the corresponding funds).

Some of the particularly relevant questions are: Do you undertake measures for reducing energy consumption?; Do you undertake measures for reducing emissions into the air and atmosphere (greenhouse gases, gases that damage the ozone layer, dust, odours, etc.)?; Do you undertake measures for reducing the environmental impact of products in the process of improving and innovating products and production?; as well as other questions that encourage the industry to undertake energy efficiency measures.

The Lexicon of Sustainable Development and other publications: Within the scope of activities of promoting socially and environmentally responsible business, HRPSOR regularly issues publications aimed at improving the understanding of good business practice and adopting it. The Lexicon of Sustainable Development was published in 2012 in 1 000 copies which were distributed to the business sector. The second publication is the journal entitled The Economy and Sustainability, published four times per year and distributed to over 1 000 addresses. The contents of the journal are educational, emphasising good practice in responsible business and the reduction of environmental impact. A series of project examples were published over the years for the business sector, aimed at reducing energy consumption and environmental impact.

Sustainability reporting: Sustainability reporting or non-financial reporting has long been recognised as a method of fostering responsible business. By publishing the effects they achieved in such areas as social or environmental impact, companies are encouraged to improve those achievements and invest in various improvement measures. The Global Reporting Initiative published the fourth generation of the Reporting Guidelines, G4, in 2013. HRPSOR previously translated the G2 and G3 guidelines, and the translation of the G4 guidelines is currently being drafted. The translation of the GRI guidelines is just one of the methods for encouraging Croatian companies to provide sustainability reports. In the last 3 years, sustainability reports were published by the following companies: Agrokor, Atlantic, Banco Popolare Croatia, Carlsberg Croatia, Cemex, Coca-Cola HB Croatia, Hartmann, Hauska and Partner, HEP, Holcim, HT, JGL, Karlovačka pivovara, Končar, Končar Electrical Engineering Institute, Pliva. The majority of those reports were made using GRI's G3 Reporting Guidelines.

I.3 Energy auditing scheme for industry

Overview of the measure from the 2nd NEEAP		***Energy auditing scheme for industry***
Measure index		*I.3*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2009* *End: 2016* *Planned major modifications, amendments, improvements:* *The measure is related to the legal obligation of energy management for large consumers.*
	Objective / outline	*This measure should ensure support for estimating the energy savings potential in industrial plants by co-financing energy audit implementation. The energy auditing scheme for industry should include:* • *mandatory energy audits for companies whose annual energy consumption exceeds the consumption laid down by the Rules on the energy audits of buildings (> 10 000 MWh);* • *a voluntary energy auditing scheme for other companies, and especially for SMEs, for whom energy audit subsidies should be provided.*
	Target final consumption	*Consumption of all types of energy and energy commodities in industrial processes*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *EPEEF: HRK 2 111 281* *Planned funds by the end of 2013:* *EPEEF: HRK 5 000 000 – the estimate is based on the assumed number of energy audits (100) and the average energy audit cost of HRK 50 000 (according to EPEEF data).*
	Executive body	*EIHP, in coordination with CEI – drawing up and promoting the scheme* • *EPEEF – co-financing*
	Monitoring bodies	*ME, MCPP, MENP*

This measure was not implemented in its planned scope. It is planned to revise this measure for the following period or integrate it into other measures, for example C.1, and include it in the group of horizontal measures.
This measure was related to the legal obligations of energy management for large consumers (> 10 000 MWh/year), however, in the proposed new legal obligations, these provisions will be changed and it is planned for them to pertain to 'large companies'. The measure should be adjusted to reflect the aforementioned changes for the following period.

During the application of the 2nd NEEAP, this measure was not applied as planned. However, energy audits and energy performance certificates were co-financed through EPEEF activities.

In the period of the 1st and 2nd NEEAP, EPEEF co-financed the implementation of 16 projects in the industry sector, and the total savings achieved from those 16 projects in 2013 amount to 4.64 TJ. This measure is described in further detail under measure B.3 Energy certification of buildings.

I.4 High-efficiency cogeneration in industry

Overview of the measure from the 2nd NEEAP		***High-efficiency cogeneration***
Measure index		*I.4*
Description	Category	*Financial instrument; regulations*
	Time frame	*Start: 2007 End: 2016* *Planned major modifications, amendments, improvements: /*
	Objective / outline	*In addition to the system of incentives for the production of electricity from high-efficiency cogeneration, this measure also provides for the adoption of the appropriate regulations for stimulating the production of heat energy from cogeneration (defining the status of eligible heat energy producer).*
	Target final consumption	*Production of heat energy and electricity in industrial plants*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *HROTE: depending on the quantity of electricity produced, and on the basis of the incentive unit prices defined in the Tariff system for the production of electricity from renewable energy sources and cogeneration (NN No 33/07), the total funds paid out from the system of incentives for the production of electricity from renewable energy sources and cogeneration amount to HRK 143 118.99 for cogeneration plants in 2010.* *Planned funds by the end of 2013:* *1. HROTE: depending on the quantity of electricity produced, and on the basis of the incentive unit prices defined in the Tariff system (NN No 63/2012).*
	Executive body	• *HROTE, ME, HERA – regulations and the system of incentives for the production of electricity from renewable energy sources and cogeneration.*
	Monitoring bodies	*ME, in coordination with CEI*

The adoption of the regulations on the status of eligible heat energy producer, which would further stimulate cogeneration, was planned during the application of the 2nd NEEAP. Although that was not accomplished, the measure was implemented by expanding the regulations on the promotion of electricity from renewable energy sources and cogeneration, and specifically by adopting the new Tariff system for the production of electricity from renewable energy sources and cogeneration (NN Nos 133/13, 151/13).

The incentives for utilising heat from cogeneration plants that use renewable energy sources can be obtained by applying the corrective coefficient to the energy production tariff, provided that the condition of overall utilisation of produced energy exceeding 45 % or 50 % has been met.
The funds for the implementation of this measure were provided by HROTE, depending on the quantity of electricity produced, and on the basis of the incentive unit prices defined in the Tariff system for the production of electricity from renewable energy sources and cogeneration (NN No 33/07).

From the end of 2010 to the end of 2013, the eligible producer status was granted to 43 cogeneration plants with a total installed electric power of 85.854 MW and thermal power of 156.47 MW, which is an 855.72 % increase compared to the period from 2007 to the end of 2010.

I.5 CO_2 emissions fee for large polluters, except polluters involved in the Emissions Trading System

Overview of the measure from the 2nd NEEAP		***CO_2 emissions fee for large polluters, except polluters involved in the Emissions Trading System***
Measure index		*I.5*
Description	Category	*Financial instrument; regulations*
	Time frame	*Start: 2007* *End: 2016* *Planned major modifications, amendments, improvements:* *EPEEF is obliged to implement the measure.*
	Objective / outline	*Croatia introduced the CO_2 emissions fee in 2007. The Government Decree (NN No 73/07) lays down that the fee must be paid by all the polluters registered in the Environmental Emissions Register (EER). The revenues from the fee (EUR 10–20 million per year are expected) will be handled by EPEEF, which shall allocate those funds towards co-financing energy efficiency improvement activities, especially in industry. From 1 January 2013, 73 plants involved in the Emissions Trading System will be exempt from CO2 fee payments. This provision pertains to: thermal power facilities exceeding 20 MW; refineries; coking plants; the metal, cement, paper, ceramics, glass industry; ammonia, nitric acid production, etc.*
	Target final consumption	*Consumption of all types of energy and energy commodities in industrial processes*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total expended funds by the end of 2010:* • *EPEEF: HRK 31 830 248 – co-financed projects in industry* *Planned funds by the end of 2013:* *1. EPEEF: HRK 30 000 000*
	Executive body	• *EPEEF*
	Monitoring bodies	*ME, MENP*

This measure was implemented as planned in the 2nd NEEAP is expected. The 2013rd the CO2 fee was replaced by the ETS system, and this measure is no longer implemented.

I.6 Introduction of efficient electric motor drives

Overview of the measure from the 2nd NEEAP	***Introduction of efficient electric motor drives***
Measure index	*I.6*

Description	Category	*Financial instrument; regulations*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Electric motor drives account for the largest share of electricity consumption in industry – up to 90 %. This area has a great potential for savings, but systematic measures or programmes have not been implemented. The introduction of efficient electric motor drives pertains to the installation of high-efficiency electric motors and the introduction of variable-speed drive (VSD) management by frequency and/or amplitude, where appropriate, for example in processes where the flow of the working substance is continuously changing. Depending on the power category of the motor, this measure can achieve technical savings of electricity exceeding 16 % and economic savings exceeding 10 %. Reducing the installed power would have a positive effect on the operating stability of the electric power system.*
	Target final consumption	*Electricity consumption in industrial plants*
	Target group	*Industrial plants*
	Regional application	*National*
Information on implementation	List and description of activities for measure implementation	*Future activities:* 3. *Development of standardised energy audits of rational energy consumption of electric motor drives in industrial plants with evaluation of cost-effectiveness of improvements, with a simple methodology applicable to practically all industrial plants* 4. *Establishment of favourable financing models with the development of guarantee mechanisms acceptable to banks*
	Funds and financing sources	*Sources of financing: EPEEF and commercial banks* *The required funds will be set in the detailed work programme of the Network.*
	Executive body	*EIHP, HEP, ESCO companies – measure implementation in coordination with the Centre; EPEEF – co-financing*
	Monitoring bodies	*ME, MENP*

This measure was not implemented in its planned scope. The measure must be revised for the following period, particularly in regard to the responsibilities of the executive bodies. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

Measures in transport

T.1 Eco-driving training

Overview of the measure from the 2nd NEEAP		***Eco-driving campaign for drivers of road vehicles***
Measure index		*T.1*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Eco-driving has been recognised as one of the most efficient measures for promoting energy efficiency at EU level. Launching the* ***National Eco-driving Campaign*** *could achieve the maximum level of awareness of all citizens and drivers in the Republic of Croatia on the advantages of this modern, intelligent and environmentally friendly style of driving, through active implementation of eco-driving training among* ***licensed (existing) drivers****. Special elements of the national campaign should be dedicated to eco-driving education for:* - *drivers of passenger cars;* - *bus drivers;* - *drivers of freight vehicles > 3.5 tonnes.*
	Target final consumption	*Passenger cars, freight vehicles, and buses.*
	Target group	*All drivers of passenger cars who obtained their driving licence* ***prior to the entry into force*** *of the Rules on training learner drivers (NN No 13/09); bus drivers in public transport;*

		drivers of public and commercial freight vehicles of maximum authorised mass > 3.5 tonnes.
	Regional application	*National*
Information on implementation	Funds and financing sources	*Total required funds HRK 5 545 000.00 per year:* • *IEE: HRK 83 333.33, ensured for 2011, 2012 and 2013 (activity 1)* • *EPEEF: HRK 1 365 471.00 (activity 2)* • *MMATI: HRK 1 365 417.00 (activity 2)* • *MENP: HRK 1 365 417.00 (activity 2)* *LRSGU: HRK 1 365 417.00 (activity 2)*
	Executive body	• *HAK, EIHP, in coordination with the Centre*
	Monitoring bodies	*MMATI, MENP, MI, EPEEF*

In the EPEEF projects, this measure is classified under the measures for cleaner transport. The implementation of cleaner transport projects reduces final energy consumption and greenhouse gas emissions in this sector, which participates in overall final energy consumption with approximately 30 % and is also a significant factor in the negative environmental impact since more than 20 % of overall greenhouse gas emissions originate from transport. The Fund co-finances all programmes, projects and similar activities that contribute to the reduction of fuel consumption and the establishment of cleaner, sustainable transport systems. Technical and organisational measures, and projects on introducing alternative fuels are also eligible for co-financing.

EPEEF has also financed other projects promoting cleaner transport, and they are listed in this Appendix A under measure T.6.

In autumn 2013, the 'ORYX Safe Driving Centre', an ORYX Grupa d.o.o. subsidiary, commissioned a study analysing the eco-driving results. The study was produced by the Energy Institute Hrvoje Požar and it was used to establish, based on the results, the positive effects that eco-driving training can have on the economy, the environment and the society. The results also encouraged EPEEF to publish tenders for subsidising eco-driving trainings.

A total of 18 companies participated in the study with 170 drivers (119 for freight vehicles and 51 for passenger cars). Data on freight vehicles was analysed for 14 companies, and data on passenger cars for 10 companies.

The study has shown that training helped achieve fuel consumption savings of 8.87 % for all freight vehicles and buses, and fuel consumption savings of 18.70 % for all passenger vehicles.

In 2010, the Energy Institute Hrvoje Požar joined the Intelligent Energy Europe project ECOWILL which ran until April 2013. Thirteen European partners were involved in the project, and the subject of the project was the mass implementation of eco-driving standards in training programmes for learner drivers and the implementation of the campaign among licensed drivers.

The project results in Croatia are as follows:

- 67 coaches completed eco-driving training;
- 500 trainings were conducted for citizens;
- 6 public presentations of the project were held;
- The project received media coverage through 10 radio features, 5 TV features, and 40 articles in print and on-line.

The implementation of this measure will continue in the future period.

T.2 Intermodal freight transport

Overview of the measure from the 2nd NEEAP		***Intermodal freight transport***
Measure index		*T.2*
Description	Category	*Regulations, Financial instruments*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Intermodal transport includes several methods of transportation both in passenger and in freight transport. This measure focuses only on freight transport and the potential it offers for unburdening road routes and reducing fuel consumption by using railway infrastructure and inland waterways. In order for this measure to be implemented, it is necessary to provide an appropriate regulatory framework as well as an appropriate infrastructure for unloading/loading containers.*
	Target final consumption	*Road freight transport*
	Target group	*Transport companies; motorway, railroad, river port concessionaires*
	Regional application	*National*
Information on implementation	List and description of activities for measure implementation	1. *Drawing up a programme for stimulating intermodal freight transport;* 2. *Applying the programme for stimulating intermodal freight transport.*
	Funds and financing sources	*MMATI (activity 1)* *It is not possible to provide estimates or propose financing sources for activity 2.*
	Executive body	*MMATI, in coordination with the Centre*
	Monitoring bodies	*MMATI, ME, MENP*

The Act on Combined Transport came into force in 2009, regulating: distances in combined transport, the exemption from paying the annual fee for the use of public roads, the exemption from licences and quotas, the exemption from road transport limitations for combined transport participants, and the documents that a freight vehicle driver in combined transport is obliged to hold. The amendments to the aforementioned Act are currently being drafted, in compliance with the European Commission's comments regarding the text of the Act.

On the basis of the Act, the Rules on combined transport terminals and transshipment terminals were adopted in 2010, regulating: combined transport terminals, transshipment terminals, as well as road routes to or from the nearest combined transport or transshipment terminal along which the exemptions from quotas and licences apply. The programme for stimulating intermodal freight transport has not been drawn up, but it is planned to be in the following period.

The new amendments to the Act on Combined Transport provide for the exemption from 50 % of the road fee during road vehicle registration for carriers who use combined transport. This would allow for substantial energy savings. To the companies for which this would mean a 'loss' of 50 % of funds, those funds will be allocated from the state budget of the Republic of Croatia (e.g. Hrvatske ceste d.o.o., which will sustain a 50 % loss of income from the fee the carrier is obliged to pay to Hrvatske ceste at vehicle registration, will have the loss compensated from the state budget of the Republic of Croatia).

T.3 Establishing a new payment system for the special environmental charge for motor vehicles

Title of the measure		*Establishing a new payment system for the special environmental charge for motor vehicles*
	Category	Financial instruments
	Time frame	Start: 2013 End: 2020

Description	Objective / outline	In order to reduce emissions from transport, one of the measures for achieving the objective is the establishment of a new payment system for the special environmental charge for motor vehicles. Based on the 'polluter pays' principle, the current model would be upgraded and calculated on the basis of emissions of CO_2 and other pollutants from motor vehicles. The final result of this project will be the adoption of a regulation drafted on the basis of a study which would propose the optimum model of a fee collection system. Introducing a system which would stimulate certain vehicle categories and penalise vehicles with higher emissions, guided by the 'polluter pays' principle, would ultimately motivate and direct buyers towards opting to purchase more efficient new automobiles with lower CO2 emissions. The collected funds would be directed towards the implementation of other measures: development of infrastructure and a fuelling station system; incentives/subsidies for the purchase of environmentally friendlier vehicles (electric and hybrid vehicles); promoting the use of eco-vehicles and the designation 'environmentally friendly'.
	Target final consumption	Road vehicles
	Target group	Vehicle owners
	Regional application	National
Information on implementation	List and description of activities for measure implementation	With the objective of achieving valid application of the new EU acquis communautaire in the transport sector, under this project MENP (in cooperation with expert institutions) will prepare a comprehensive expert analysis of the condition of the vehicles in use in the Republic of Croatia and an analysis of the regulations of EU Member States which have developed a CO_2 fee/tax system, as well as a comparison of the positive European practice and EU regulations with the legislation in the Republic of Croatia. Activities: • Designing a model for establishing a payment system for CO_2 emission charges, with a high-quality economic analysis of its effects; • Drafting a proposal of the Decree on unit fees, corrective coefficients and detailed criteria and measures for determining the special environmental charge for motor vehicles; • The full application of the new payment system.
	Executive body	MENP EIHP EPEEF CEI
	Monitoring bodies	MMATI, MENP, MI
Energy savings	Method of monitoring/measuring energy savings	The project implementation is monitored through the influx of funds to the EPEEF, collected from the payments of the emissions charge for CO_2 and other pollutants from motor vehicles.
	Energy savings expected in 2016	0.521 PJ
	Energy savings expected in 2020	1.664 PJ
	Assumptions	The collection of funds will enable the implementation of other measures. Raising the awareness of producers and end users on the need to protect the environment, which includes an active role in environmental protection and nature preservation. Fostering the development of new technologies, production and consumption of products which are less harmful to the environment, reducing pollution, and a more rational management of raw materials and energy.
	Overlapping, multiplication effect, synergy	The collected funds will enable the implementation of other measures. The purchase of vehicles with lower emissions results in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions. Stimulating the purchase of eco-vehicles results in the reduction of emissions from passenger cars, and therefore a reduction of total transport sector emissions.

The application of the Decree adopted in 2004 has, over time, systematically neglected the technological progress and development of engines which today comply with the most stringent environmental criteria and emissions standards used to limit emissions. The previously used model did not acknowledge the long-term objectives related to reducing CO_2 emissions, and it was necessary to include a proactive approach to the problem of CO_2 emissions from road motor vehicle transport into a new fee calculation method.

The 'Model for charging fees for carbon dioxide (CO_2) emissions from road vehicle engines' was drawn up in December 2013. The objective was to design a model calculation for CO_2 emission fees which would pertain to all passenger cars, or the M1 category of road vehicles. There are no official data on CO_2 emissions for the majority of such vehicles, and the EU Member States that have already introduced the fees are encountering the same problem. The ideal model, which would be based on actual CO_2 emissions, is nearly impossible to achieve.

Therefore, a model which would include the factors affecting CO_2 emissions was designed by taking into account available data.

A classification model for the fee calculation was proposed on the basis of analysed vehicle data for those vehicles for which there are no official CO_2 emission data. A division into classes based on the factors affecting CO_2 emissions was proposed, and corrective factors and their values were defined for the division.

The proposal of the Decree on unit fees, corrective coefficients and detailed criteria and measures for determining the special environmental charge for motor vehicles from 2013 aims to establish a more equitable method for collecting the fee by respecting the 'pollute more - pay more' principle and, on the other hand, the aim is to base the fee calculation on both CO_2 emissions and the emission level of a vehicle. Furthermore, the calculation method for the unit fee, as well as the initial fee values and the corrective coefficient which depends on the annual mileage, have also been laid down.

The ultimate fee amount to be paid by the tributary will not change substantially, but it will be more equitably distributed. The objective of this measure is also to direct customer demand towards more environmentally friendly and economical vehicles. The new calculation pertains only to M1 category vehicles (passenger cars) because other vehicles are generally classified as vehicles intended for business use and, in accordance with EU practice, it is preferred not to impose additional costs on them when calculating the fee.

T.4 Introducing a car-sharing scheme in cities

Overview of the measure from the 2nd NEEAP		***Introducing a car-sharing scheme in cities***
Measure index		*T.4*
Description	Category	*Organisation*
	Time frame	*Start: 2012* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*The introduction of a car-sharing scheme is an organisational measure, primarily aimed at increasing the degree of utilisation of vehicles in urban areas, with the objective of reducing traffic congestion in cities and increasing vehicle efficiency by stimulating the use of efficient vehicle models.*
	Target final consumption	*Road vehicles – automobiles*
	Target group	*Inhabitants of urban areas*
	Regional application	*Regional/ National*
Information on implementation	Funds and financing sources	*Cities and municipalities, EPEEF, private investors*
	Executive body	*EIHP, local administration bodies, cities and municipalities in cooperation with private partners*
	Monitoring bodies	*MMATI, MENP, ME*

This measure was not implemented in its planned scope. The measure must be revised for the following period. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

T.5 Speed limits

Overview of the measure from the 2nd NEEAP		***Speed limits***
Measure index		*T.5*
Description	Category	*Regulations*
	Time frame	*Start: 2012* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Experiences of such European countries as Denmark, Estonia, Finland, France, Hungary, Ireland, Luxembourg, Malta, etc., indicate that limiting speeds to levels below standard, especially on motorways, is a strong contribution towards the systematic reduction of fuel consumption in road transport. However, a more stringent enforcement of the existing speed limits, with lower tolerance for exceeding the limits, could yield very good results by itself. Therefore, under the 2nd NEEAP, this measure was focused on lowering the tolerance threshold for exceeding the regulated speed limits.*
	Target final consumption	*Road vehicles*
	Target group	*Vehicles circulating on motorways*
	Regional application	*National*
Information on implementation	Funds and financing sources	*No funds required*
	Executive body	*MI, DZM*
	Monitoring bodies	*MI, MMATI, ME*

This measure was not implemented in its planned scope. The measure must be revised for the following period, particularly in regard to the responsibilities of the executive bodies. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

T.6 Financial incentives for energy efficient vehicles

Overview of the measure from the 2nd NEEAP		***Financial incentives for energy efficient vehicles***
Measure index		*T.6*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*As part of its activities, EPEEF co-finances cleaner transport schemes. This programme should be improved by developing special co-financing lines for specific purposes, such as:* 3. *installing devices for more efficient use of waste heat from the engine coolant while the engine is turned off;* 4. *procurement of eco-tyres;* 5. *purchase of electric vehicles (automobiles, scooters, buses);* 6. *purchase of hybrid vehicles;* 7. *modification/purchase of vehicles powered by liquefied petroleum gas (LPG) and compressed natural gas (CNG), including the dual-fuel diesel (DFD) option;* 8. *improving the aerodynamics of freight vehicles.*
	Target final consumption	*Road vehicles; maritime transport*
	Target group	*Drivers and owners of passenger cars and fleet cars*
	Regional application	*National*
Information on implementation	List and description of activities for measure implementation	• *Installing devices for more efficient use of waste heat from the engine coolant while the engine is turned off* • *Procurement of eco-tyres* • *Purchase of electric vehicles (automobiles, scooters, buses)* • *Purchase of hybrid vehicles* • *Modification/purchase of LPG & CNG powered vehicles* • *Installation/modification of vehicles to a diesel and gas combination (dual-fuel diesel)*

		• *Improving the aerodynamics of freight vehicles*
	Funds and financing sources	*Detailed financial projections must be made in a special programme dedicated to the implementation of this measure* *EPEEF; commercial banks; state support*
	Executive body	*EPEEF, in coordination with the Centre*
	Monitoring bodies	*MMATI, ME, MENP*

This measure was not implemented in its planned scope. The measure must be revised for the following period, particularly in regard to the responsibilities of the executive bodies. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

In the period preceding the 2nd NEEAP (before 2011), EPEEF implemented a total of 552 cleaner transport projects and, since the life cycle of the cleaner transport measures is 8 years, the savings achieved by 2010 are also valid until the end of 2013. The energy savings calculated for those projects amounted to 80.79 TJ (22 442 276.51 kWh), which is 0.61 % of the national intermediate target for 2013, or 0.41 % of the national target for 2016. Since some of these measures (eco-driving trainings) are calculated under measure T.1, the total savings from measures for energy efficient vehicles were reduced by the amount of savings achieved from eco-driving. **The total savings for the measure T.6 therefore amount to 0.07 PJ.**

The projects co-financed by the Fund were: the Euro 5 programme, procurement of electric vehicles, and eco-driving training for drivers in road transport. By the end of 2013 (which includes the periods of the first and second NEEAP), a total of 552 cleaner transport projects were implemented, for which the total paid out funding amounted to HRK 81 667 888.65. The energy savings calculated for those projects amounted to 80.79 TJ (22 442 276.51 kWh), which is 0.61 % of the national intermediate target for 2013, or 0.41 % of the national target for 2016. Greenhouse gas emissions were reduced by 5 449.00 tCO_2 in total, and HRK 17 429 277.17 were saved. Under the 2nd NEEAP, the promotion of eco-driving is classified under measure T.1 Eco-driving training for drivers of road vehicles, and the implementation of the eco-driving project achieved 0.91 % of the target for that measure.

Table A4-34. Savings per type of clean transport by the end of 2013 (for the period of the 1st and 2nd NEEAP)

Activity	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
Eco-driving training	1	3 094 078.48	11.14	2 565 577.87	751.35	476 978.52
Procurement of electric vehicles	3	3 736.00	0.01	2 932.11	1.04	360 910.13
EURO 5 programme	548	19 344 462.03	69.64	14 860 767.19	4 696.61	80 830 000.00
Total:	**552**	**22 442 276.51**	**80.79**	**17 429 277.17**	**5 449.00**	**81 667 888.65**

* savings in HRK were calculated in accordance with the diesel fuel prices specified in the annual reports Energy in Croatia

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

T.7 Financial incentives for developing the infrastructure for city bikes

Overview of the measure from the 2nd NEEAP		***Financial incentives for developing the infrastructure for city bikes***
Measure index		*T.7*
Description	Category	*Financial instruments*
	Time frame	*Start: 2012* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*By providing support for developing the infrastructure of public city bikes, the inhabitants of urban areas will be offered an alternative mobility solution which will have a direct positive impact on the direct avoidance of fossil fuel consumption, the reduction of environmental load, and an overall improvement of the citizens' quality of life through increased physical activity.*
	Target final consumption	*Road vehicles – passenger cars and scooters*
	Target group	*Drivers of passenger cars, scooters, but also citizens without personal transport vehicles.*
	Regional application	*Urban/ National*
Information on implementation	Funds and financing sources	*Cities and municipalities, EPEEF, commercial banks*
	Executive body	*LRSGUs*, in coordination with the Centre
	Monitoring bodies	*MMATI, ME, MENP*
	Method of monitoring/measuring energy savings	*The number of public bikes should be monitored. The effect of the measure will be evaluated on the basis of that number, by applying methods specified in the description of activities.*

City bike projects have taken hold in many cities, initiated primarily by the cities themselves. The project with the strongest response was, logically, the one in the City of Zagreb, which encouraged smaller towns to carry out similar undertakings.

Zagreb started implementing the project in May 2013, initially putting 50 bicycles at the citizens' disposal and thereby making Croatia the 34th country in the world to introduce a public bicycle system. The project initially included six locations and within three months it had 1500 users. The main partners of the project are the City of Zagreb, Zagrebačka banka and VIPNET.

The Osijek Business Incubator started implementing a similar idea in 2011, but the project was stopped after its test phase, and restarted in May 2013. It had put five new bicycles at the disposal of 85 users.

Similar projects have been announced in 4 more Croatian cities, but no specific information is currently available on their scope or implementation time.

T.8 Promoting e-mobility and developing a network of charging stations for electric vehicles

Overview of the measure from the 2nd NEEAP		***Promoting e-mobility and developing a network of charging stations for electric vehicles***
Measure index		*T.8*
Description	Category	*Financial instruments*
	Time frame	*Start: 2011*

		End: 2016 *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*In order to introduce politicians, entrepreneurs, decision makers, citizens inspired by electric vehicles and those who are about to become inspired by them to the concept of electromobility, the promotion of electromobility technologies will have to be appropriately implemented.* *Quality promotion is necessary for illustrating the notion of e-mobility, its advantages, shortcomings, possibilities and challenges. The development of a network of charging stations for electric vehicles is an infrastructural measure that provides the precondition for e-mobility development in urban areas.*
	Target final consumption	*Road vehicles*
	Target group	*Automobiles, scooters, and light delivery vehicles*
	Regional application	*National*
Information on implementation	Funds and financing sources	*EPEEF, LRSGUs (detailed funds will be estimated during the development of the campaign and the development programme), EU funds, possible co-financing through changes to electricity distribution tariff systems and/or special fees/prices imposed by suppliers (HERA)*
	Executive body	*EIHP and HEP – campaign preparation and implementation, and design of the development programme for the network of charging stations; LRSGUs, in coordination with the Centre, are competent for programme implementation; preparation of e-vehicle infrastructure regulations – ME, MMATI, MCPP, HERA, HEP-ODS*
	Monitoring bodies	*MMATI, ME, MENP, HERA, EPEEF, LRSGU*
	Method of monitoring/measuring energy savings	*The effects of the measure will be monitored by conducting surveys and public opinion polls on e-mobility. These types of research should be conducted after each block of promotional activities during the campaign. The development of the network does not produce direct energy savings, but it is the necessary precondition for increasing the number of electric cars.*

This measure was not implemented in its planned scope. The measure must be revised for the following period, particularly in regard to the responsibilities of the executive bodies. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

In cooperation with the Energy Institute Hrvoje Požar, the City of Zagreb launched the project 'The Development strategy for the energy infrastructure for charging electric vehicles in the City of Zagreb' under which the potentials for electric vehicle (EV) market development and the accompanying infrastructure in the City of Zagreb will be determined.

The initiative E-mobilnost.hr was launched under the 2nd NEEAP as a platform for long-term partnership with all relevant market stakeholders. The intention of the E-mobilnost.hr initiative is to raise public awareness of new technologies and the possibilities they offer.

Based on establishing strategic partnerships and launching pilot projects in urban areas, the intention is to develop locations in urban areas and the region that will initiate further mass development of the electric vehicle market and the accompanying infrastructure. E-mobility is the foundation of sustainable mobility, if it is directly related to the production of electricity from renewable energy sources. In that regard, the intention is to additionally stimulate the market development of renewable energy sources in Croatia.

There are 2 charging stations for electric vehicles in Croatia:

- The electric vehicle charging station at the Vocational School Vice Vlatković in Zadar (the charging station is equipped with two 3.1 kW single-phase sockets);
- The electric vehicle charging station at EIHP in Zagreb (the charging station is equipped with two 3.1 kW single-phase sockets).

T.9 Modification of calculating tax reliefs based on travel expenses

Overview of the measure from the 2nd NEEAP		***Modification of calculating tax reliefs based on travel expenses***
Measure index		*T.9*
Description	Category	*Financial instruments*
	Time frame	*Start: 2012* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outlineoutline	*The existing practice of calculating tax reliefs based on travel expenses does not provide additional stimulation to employees to use public transport more frequently. A change of the tax relief calculation practice could therefore additionally stimulate citizens to use public transport.*
	Target final consumption	*Road vehicles*
	Target group	*Employees who commute to work by car*
	Regional application	*National*
Information on implementation	List and description of activities for measure implementation	*MF, in cooperation with ME, should draft a proposal for the modification of calculating tax reliefs based on travel expenses, which would stimulate the use of public transport. The application of the modification should start in 2012.*
	Funds and financing sources	/
	Executive body	*MF*
	Monitoring bodies	*MF, ME*

This measure was not implemented in its planned scope. According to current experience, it is unlikely that the measure will be implemented and it is proposed that the measure be abandoned.

T.10 Promotion of sustainable urban transport systems

Overview of the measure from the 2nd NEEAP		***Promotion of sustainable urban transport systems***
Measure index		*T.10*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Traffic congestion is becoming a growing problem in cities and it has a great impact on the unnecessarily increased fuel consumption. Sustainable development of urban transport systems should therefore be promoted by:* • *optimising freight transport logistics in the city;* • *banning deliveries in city centres between 6:00 and 18:00;* • *intelligent management of public parking spaces;* • *promoting e-working or teleworking.*
	Target final consumption	*Road vehicles*
	Target group	*Drivers of passenger cars and freight vehicles in cities*
	Regional application	*Urban/ National*
Information on implementation		
	Funds and financing sources	*LRSGU budgets and EPEEF (a detailed estimate of the required co-financing will be made through the implementation guidelines), EU funds*
	Executive body	*EIHP in cooperation with LRSGUs in coordination with the Centre; regional energy agencies and institutes*
	Monitoring bodies	*ME, MMATI, MI, MENP*

The promotion of sustainable urban transport systems failed to implement the planned measures. Guidelines for increasing the efficiency of freight transport have not been drawn up, and the plan for the intelligent management of parking spaces was not implemented. The measures were well designed, but there is work to be done regarding the competent bodies which are to assume the responsibility for measure implementation.

However, progress was made with regard to this measure due to the EU project initiative entitled 'CIVITAS - City, Vitality, Sustainability' that was launched in 2002 and will run until 2016. Croatia joined the initiative with two projects: the City of Zagreb with the project CIVITAS ELAN and Koprivnica with the project CIVITAS DYNAMO.

CIVITAS ELAN was implemented from 2008 to September 2012, but its beneficial effects are ongoing. The project involves 39 European partners and it comprises eight areas of activity:

- Alternative fuels and energy efficient vehicles;
- Joint passenger transport services and integrating various types of transport;
- Mobility management towards specific requirements;
- Behavioural changes in transport;
- Protection, safety and health;
- Innovative transport services.

The objective of the project is to improve the citizens' quality of life by introducing quality solutions in urban transport and promoting and stimulating sustainable, clean and energy efficient methods of transport.

The project gives special emphasis to the participation of citizens in a wide range of activities, from providing information and raising awareness, to sensitising the public about transport issues and encouraging their active participation in decision making.

The following has already been achieved in Zagreb:

- More efficient and cleaner public transport –70 low-floor trams, 100 biodiesel powered buses and 60 natural gas powered buses were co-financed, 147 displays were installed at public transport stops providing information on the time of arrival of vehicles; video-surveillance was installed in 140 new and 50 old trams and in 74 buses;
- Environmentally friendlier public vehicle fleet and introduction of new methods of mobility – Čistoća introduced biodiesel powered waste collection vehicles and sweeping machines – co-financed procurement of 52 biodiesel powered vehicles;
- Several mobility surveys were conducted, as well as studies and research on various mobility issues, all indicating towards new guidelines for improving transport and mobility plans. Two thousand citizens participated in a survey on the quality of public transport; a study on the planned intermodal passenger transport terminal was prepared; research was conducted on the delivery of goods and congestion charges;
- Promoting the use of bicycles, walking and public transport – an 'A Car for All' carpooling system was developed (http://www.fpz.unizg.hr/autozasve/); mobility plans were drawn up for eight companies along the Savska cesta corridor; a system of public bikes for students and employees of the Faculty of Transport and Traffic Sciences (named 'Studocikl') was designed and put into operation;
- Establishing dialogue with citizens – more than 150 citizens participated in the dialogue on mobility; 143 citizens were trained on communication with city authorities; a handbook for the organisation of successful counselling on mobility issues was printed; approximately 500 senior citizens were given instructions on safer use of public transport; a brochure was printed in 8 000 copies; a short film was made; approximately 160 public transport drivers attended workshops on safer use of public transport and methods for treating the elderly in public transport;

- CIVITAS ELAN forum – the CIVITAS ELAN info point was opened on 17 September 2009 during the European mobility week, with the CIVITAS ELAN Day being celebrated on 19 September. Lectures 'Wednesdays in the Tram', round table discussions and other events were held, providing information to the citizens and the media; the www.civitaszagreb.hr website, an e-newsletter, the Facebook group 'Za bijeli Zagreb grad' and three short films on mobility were also used to disseminate information. 21 630 info point visitors; 1 400 attendees at various events; 95 032 website clicks; 1 321 likes and 208 946 views on Facebook; three short films on various mobility topics; approximately 200 media appearances;
- The project budget for the activities in Zagreb amounted to EUR 5 140 000 of which 58 % was financed from EU funds and the rest by partners.

The second project whose activities generate savings planned under this measure is the CIVITAS DYN@MO project, in which the City of Koprivnica participates as a partner. It is aimed towards the development of the most efficient measures of transport sustainability based on electromobility and planning sustainable urban transport, and it was approved under the CIVITAS initiative in the CIVITAS PLUS II cycle (2012–2015). The budget of the City of Koprivnica amounts to EUR 920 000.00, with the EU contributing EUR 556 221.00. The local partners of the City of Koprivnica are the city companies Kampus d.o.o. and Komunalac d.o.o., Development Agency North (DAN), Čazmatrans Nova d.o.o. and HŽ infrastruktura.

Project implementation in Koprivnica comprises 6 measures:

7. Planning public transport;
8. A plan for sustainable urban transport;
9. Zero CO_2 university campus;
10. Low-emission public transport;
11. Development of a sustainable transport curriculum for the University of Koprivnica; and
12. A municipal electric car-sharing scheme.

T.11 Advanced regulation of intersections equipped with smart traffic lights

Overview of the measure from the 2nd NEEAP		***Advanced regulation of intersections equipped with smart traffic lights***
Measure index		*T.11*
Description	Category	*Infrastructure*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*Smart traffic lights, equipped with an autonomous power supply system from renewable sources (sun, wind) will contribute to the reduction of primary energy consumption, as well as the reduction of carbon dioxide and other harmful gas emissions. On the other hand, installing a visual indicator for the duration of the red light phase will contribute to raising the drivers' awareness of the possibility of deciding whether to turn off the engine while waiting in traffic at an intersection. Supporting the integration of such traffic lights into busy intersections will contribute to a systematic reduction of fuel consumption in transport by providing appropriate and timely information to drivers about the flow of an intersection, based on which a driver can decide on whether to switch the engine into start-stop mode.*
	Target final consumption	*Road vehicles*
	Target group	*LRSGUs – Cities* *Road vehicle drivers*
	Regional application	*National*
Information on implementation	Funds and financing sources	*LRSGUs, EPEEF (detailed estimate to be provided in the programme), EU funds*
	Executive body	*EIHP in cooperation with LRSGUs in coordination with the Centre*

	Monitoring bodies	*ME, MCPP, MMATI*

Establishing the Automatic Traffic Management System in the City of Zagreb

The introduction of the Automatic Traffic Management System in the City of Zagreb started in 2013. The implementation of the Automatic Traffic Management System will increase individual traffic flow, accelerate public transport, and ultimately unburden roads in the City of Zagreb. The system includes:

13. replacing and modernising obsolete signalling devices and equipment;
14. tuning and installing new microprocessors;
15. surveillance cameras for detecting traffic congestion;
16. renovation and completion of the communication network with the installation of optical fibre cables;
17. construction and equipment of the main operative centre for the surveillance and control of intersections with traffic lights.

The fully equipped System, whose completion is planned for 2019 (duration: 6 years), will allow:

18. surveillance and control of connected traffic lights and peripheral equipment in order to optimise traffic flow;
19. collection of traffic data in order to plan the optimum management strategy, keep records of traffic conditions and changes;
20. control of the operation of devices and management programmes, planning the maintenance of devices and programme sections;
21. quick adaptation to emergency traffic situations and altered traffic requirements.

Other cities in the Republic of Croatia also have plans to introduce and prepare such system, but have yet to commit to them. In the future period, it is important that CEI, as the National Coordinating Body for Energy Efficiency, encourages other cities to undertake such actions.

T.12 National campaign 'One Day a Month without Cars'

Overview of the measure from the 2nd NEEAP		***National campaign 'One Day a Month without Cars'***
Measure index		*T.12*
Description	Category	*Information and mandatory information measures*
	Time frame	*Start: 2011* *End: 2016* *Planned major modifications, amendments, improvements:* *New measure*
	Objective / outline	*The campaign 'One Day a Month without Cars' encourages drivers to leave their cars at home for one day a month and, in return, receive a cheaper public transport ticket, discounts for cultural and sporting activities, discounts in stores or shopping centres.*
	Target final consumption	Road vehicles
	Target group	All users of passenger cars
	Regional application	National
Information on implementation	Funds and financing sources	*LRSGUs and EPEEF*
	Executive body	EIHP – management and monitoring campaign effects
	Monitoring bodies	*ME, MMATI, MENP*

This measure was not implemented in its planned scope. The measure must be revised for the following period, particularly in regard to the responsibilities of the executive bodies. Furthermore, the National Coordinating Body should encourage and coordinate the implementation of this measure because the measure will not be achieved without a systematic approach to implementation.

The activity under the European Mobility Week campaign was entitled 'Clever Commuting'. The idea of an European Car-free Day is an offshoot of the World Car-free Day campaign, held annually on 21 September. The basic intention is to direct public attention to the problem of car transport, increase their awareness of the burning issue of air pollution in large cities, and offer alternative mass transport in cities. The intention is also to showcase the cities in a different light, as they were at a time when the air was cleaner, the roads less congested and city life was better and more tolerable than today.

The European Car-free Day is organised in 18 Croatian cities and one municipality (Vukovar, Đurđevac, Crikvenica, Ivanić Grad, Karlovac, Koprivnica, Labin, Ogulin, Pula, Šibenik, Trogir, Varaždin, Zabok, Delnice, Dubrovnik, Kaštela, Rijeka and Zagreb, and the Sračinec municipality).
For example, on the European Car-free Day in Zagreb, on 22 September, the entire Gornji grad and a part of the central city zone were closed for motor vehicle traffic between 8:00 and 20:00.

For the past 12 years, the City of Rijeka has been organising events within the scope of the European Mobility Week, with various activities and programmes aimed at excluding motor vehicle transport. Motor vehicles are banned from traffic along the waterfront which is, on that day, reserved exclusively for pedestrians, cyclists and everyone using human-powered transport.

Measures for energy companies

E.1 Individual metering and informative billing

Overview of the measure from the 2nd NEEAP		***Individual metering and informative billing***
Measure index		*E.1*
Description	Category	*Information and mandatory information measures; Financial instruments*
	Time frame	*Start: 2008* *End: 2016* *Planned major modifications, amendments, improvements:* *There are plans to launch a special EPEEF co-financing programme for projects on introducing heat manifolds and regulation valves, aimed at operators/suppliers and/or ESCO companies.*
	Objective / outline	*Clear and comprehensible energy bills (electricity, heat energy and natural gas) and individual metering of consumption are obligations of the distribution system operator and the supplier. This will raise the consumers' awareness of the way in which they consume energy. The bills should contain graphic comparisons of consumption in the billing period of the current year and the corresponding period in the previous year. The bills should be based on the actual achieved consumption. The bills should also contain information on where to obtain advice on efficient energy consumption, and a toll-free phone number is recommended.*
	Target final consumption	*Consumption of electricity, heat energy and natural gas in households*
	Target group	*Distribution system operators and suppliers of electricity, heat energy and natural gas; building managers; apartment owners in buildings connected to DHS*
	Regional application	*National*
Information on implementation	Executive body	*Distribution system operators, suppliers, in coordination with the Centre* *4 EPEEF (financial support for introducing individual metering of heat energy)*
	Monitoring bodies	*ME, HERA*
	Method of monitoring/measuring energy savings	*The effects of this measure are monitored by analysing supplier data on achieved end-user energy consumption before and after the implementation of the measure, with normalisation by climate conditions (heating degree day). The distributors/suppliers are obliged to supply this data to HERA, and to EPEEF if they were granted co-financing. Furthermore, the effect*

		of this measure can be covered by TD indicators in accordance with the European Commission recommendations (indicators P1 and P3).
	Savings expected in 2010 in accordance with the 1st NEEAP	*Not estimated*

In the section pertaining to informative billing, this measure is more aimed at citizens than at energy companies. The CENEP project plans for a new measure for households, which will be entitled 'I Know How Much I Consume' and classified under the R measures. The informative billing measure remains a necessity, especially as a response to the amendments on energy consumption reporting that came into force in 2013 and caught the customers unprepared (this primarily pertains to the changes in expressing heat energy in kWh, and in separating the household electricity bill into the supply bill and the network use bill). These changes caused additional confusion for the public, and actions will be taken in the following period to inform the public on the new features of bills (more information about the Plan can be found in Chapter 3.1.3).

This measure will remain active for energy companies, as announced in the obligation schemes, but the emphasis will be on individual metering of heat energy.

In regard to individual metering, the greatest contribution was made by the Environmental Protection and Energy Efficiency Fund, which co-financed projects of introducing individual metering of heat energy in multifamily housing. One project was implemented in the 2011–2013 period, for which HRK 1 143 951.50 of funding was paid out, with the total investments amounting to HRK 4 800 000.00. The energy savings calculated for this project amounted to 104.11 TJ (28 920 247.00 kWh), which is 0.792 % of the national intermediate target for 2013, or 0.53 % of the national target for 2016. Greenhouse gas emissions were reduced by 8 676.07 tCO_2 in total, and HRK 11 429 816.75 were saved.

The implemented project pertains to the installation of manifolds and thermostatic valves in multifamily housing in Rijeka. The city published a tender to which a total of 115 residential buildings applied, 95 of which managed to comply with the required criteria and install the equipment in question. Not all buildings managed to perform the installation because the allocated funds (by the EPEEF) were fully utilised or the documentation they submitted was incomplete. Through three stages and via their building managers, the users of central heating selected the companies Brunata and Ti-san as the suppliers of the equipment which was installed into their apartments. The installation was performed by the company ENERGO d.o.o. from Rijeka, and a total of **24 759** manifolds and **23 730** thermostatic valves were installed in **6 298** apartments (total number of users: 10 010). On the basis of accepted bids for all the three stages, the average price per manifold was HRK 242.51 (VAT included), and the average price per thermostatic valve was HRK 152.97 (VAT included).

Since the life cycle of the measure is 10 years, the savings achieved in the period up to 2010 were added to the savings achieved in the 2011–2013 period, but attention was paid to avoid double counting the savings, or doubling them, in the calculations.

By the end of 2013 (which includes the periods of the first and second NEEAP), a total of **3 projects of installing individual metering of heat energy in multifamily housing were implemented and the total amount of funding paid out for those projects was HRK 1 088 652.58, with the total investments amounting to HRK 2 590 667.16. The energy savings calculated for those projects amounted to 114.19 TJ (31 720 247.00 kWh)**, which is 0.86 % of the national intermediate target for 2013, or 0.57 % of the national target for 2016. Greenhouse gas emissions were reduced by 9 522.79 tCO_2 in total, and HRK 12 285 475.61 were saved.

Table A4-35. Savings from projects of introducing individual metering of heat energy in multifamily housing per year (for the period of the 1st and 2nd NEEAP)

Year	Total number of implemented projects	Total achieved savings [kWh]	Total achieved savings [TJ]	Total achieved savings [HRK]*	Total CO_2 emissions savings [t]	Total funds paid out from the Fund [HRK]**
2010	2	2 800 000.00	10.08	855 658.86	846.72	2 580 023.75
2012	1	28 920 247.00	104.11	11 429 816.75	8 676.07	1 143 951.50
Total:	3	31 720 247.00	114.19	12 285 475.61	9 522.79	3 723 975.25

* savings in HRK were calculated in accordance with the gas prices specified in the annual reports Energy in Croatia (2012 prices were used for 2013)

**pertains to the full payments for projects from the date of concluding a contract with the Fund to the end of 2013

The expected savings from this measure by 2016 amount to 7.61 PJ. The implementation of the Fund's projects achieved 1.5 % of the aforementioned target by the end of 2013.

E.2 Preparation for establishing a white certificate scheme

Overview of the measure from the 2nd NEEAP		***Preparation for establishing a white certificate scheme***
Measure index		*E.2*
Description	Category	*Mechanisms for achieving energy savings*
	Time frame	*Start: 2011* *End: 2013 (it is planned that the scheme will start functioning in 2014) Planned major modifications, amendments, improvements:* *This is a new measure which will be used for detailed analyses of the establishment of the white certificate scheme, and for proposing all the actions necessary to establish such a system.*
	Objective / outline	*The white certificate scheme is based on the obligation of energy distributors and/or suppliers to achieve certain energy savings on the part of their end users (customers) at annual level. The fulfilment of this obligation is proven by a white certificate, which can but need not be marketable. The objective of this measure is to build detailed foundations for establishing such a scheme. The foundations should answer the following questions: to whom to impose the obligation; what should be the scope of the obligation; who are the possible participants in the scheme; which are the penalties for not achieving the objective; which measures are eligible for achieving the objectives; how to measure and verify the achieved savings; which body will be competent for supervision; and define all the necessary preconditions (legislative-regulatory, institutional) for the future establishment of the scheme.*
	Target final consumption	*Consumption of electricity, heat energy and natural gas in all final consumption sectors*
	Target group	*Distribution system operators and suppliers of electricity, heat energy and natural gas*
	Regional application	*National*
Information on implementation	Funds and financing sources	*Planned funds by the end of 2013:* *ME: HRK 2 x 1 000 000 (in two fiscal years)*
	Executive body	• *ME*
	Monitoring bodies	*ME*

In the implementation period of the 2nd NEEAP, the activities planned under this measure were not implemented according to plan. Consulting services are planned to be contracted for the elaboration of or amendments to the appropriate development model for white certificates as an energy efficiency policy instrument (financial mechanism) for Croatia, but the application is currently postponed.

Quality materials and an elaboration of a possible model for Croatia exist within the framework of the RELEEL project, but they are somewhat obsolete (documentation available at the website: releel.mingorp.hr).

Horizontal measures

In line with the 2nd NEEAP, this section will describe the 'horizontal measures' which produce effects in several sectors. Some of these intersectoral measures were 'assigned' to individual final consumption sectors because they are expected to produce the strongest effects in those sectors, for example energy audits. Such measures will not be described in this chapter because they were described previously by sector. However, a brief description of the horizontal measures planned under the 2nd NEEAP is given below.

H.1 Energy audit programmes

This intersectoral (horizontal) measure is described in more detail in previous chapters, under specific sectoral measures: B1, B2, B3, P1, P2, C1, I3, and will not be repeated here. These measures are partly co-financed by EPEEF but, since the adoption of new regulations made conducting energy audits and drawing up energy performance certificates a legal obligation, the largest part of the work and investments was performed by the owners of buildings.

By 31 December 2013, approximately 17 400 energy performance certificates were submitted to the Ministry of Construction database. The total number of authorised certifiers is 883 (all natural and legal persons).

H.2 Lines of credit for projects on energy efficiency and renewable energy sources

HBOR – Croatian Bank for Reconstruction and Development

Since its establishment, the Croatian Bank for Reconstruction and Development, in its role as the national development bank, directed its efforts towards financing sustainable projects which protect the environment and improve energy efficiency, as well as projects involving renewable energy sources.

In the 2007–2013 period, HBOR approved approximately HRK 1 213 million of loan funding intended for investments in environmental protection, renewable energy sources and energy efficiency projects. Of the aforementioned amount, HBOR approved approximately HRK 98.4 million of loan funding for energy efficiency projects in the 2011–2013 period. It should be noted that the aforementioned HBOR loan funding was approved through business banks operating in the Republic of Croatia, directly through HBOR, and through the risk distribution model in cooperation with business banks.

HRK 2 million were allocated from the energy efficiency credit financing programme in 2012, and HRK 96.4 million in 2013, for a total of HRK 98.4 million.

The aforementioned funds were allocated from:

7. The credit financing programme for projects on environmental protection, energy efficiency and renewable energy sources;
8. The credit financing programme for the energy renovation of buildings;
9. Other credit financing programmes from HBOR which meet the requirements of individual programmes.

Moreover, based on the multi-annual successful cooperation with the EIB, HBOR currently also has European Commission funds at its disposal for financing projects on energy efficiency and renewable energy sources, and such funds can be used when approving HBOR loans from EIB funds.

Lines of credit at commercial banks

Zagrebačka banka is one of the market leaders in financing projects related to EE and RES. Providing credit to RES-related projects dates back to 2006 when the first loan for the Trtar Krtolin wind farm was approved. Since then, the Bank has been very active in financing EE and RES projects, and it introduced a product closely related to EE - the 'Green Loans' - which form the basis of the financial solutions offered for energy efficiency projects.

Changes in the organisational structure of the Bank were also initiated in accordance with the impulse of change in the clients' needs. A Special Financing Department was formed, unique on the Croatian banking market, providing the clients interested in investing in RES and EE with the professional assistance they require for the particularities of their projects. Clients are assisted in financing their specific projects from the project's start until its final implementation.

As a logical continuation of the successful cooperation between the Bank and international financial institutions, and due to the increasing interest of clients and the regulatory framework which stimulates investments in clean energy and energy efficiency, Zagrebačka banka provides its clients with, among other things, loans through two lines of credit intended for these types of projects.

The aim of the credit lines in cooperation with the European Bank for Reconstruction and Development (line WeBSEFF II) and the Green for Growth Fund South-east Europe (GGF) is to increase investments in RES and EE projects. The WeBSEFF II credit line offers grants and free technical assistance, provided there is compliance with certain savings criteria, while the GGF credit line offers loan funding under more favourable terms than the commercial ones, with the technical assistance of consultants for individual projects.

PBZ finances the following energy efficiency projects: energy renovation of buildings, including multifamily housing, but also natural persons by way of 'green' loans.

The financing programme for energy efficiency projects implemented by small and medium-sized enterprises and LRSGUs is structured in cooperation with the European Investment Bank. The programme ensures incentives (EU grants) for the clients, as well as technical assistance in the form of consultants who assist the clients in defining measures which generate energy savings, and such assistance is offered free of charge. In regard to incentives, it is possible to obtain between 7.5 % and 15 % of the amount of the approved loan, but it is important to note that the incentive amount differs from project to project because it depends on the structure of the project itself, i.e. on the number and scope of measures through which energy savings are to be achieved. Furthermore, there is also a financing programme for projects on energy efficiency and renewable energy sources, concluded with the GGF, which can be utilised by all types of clients. This programme is intended for financing larger projects with longer periods for the return on investment. Privredna banka Zagreb started providing loans for projects aimed at improving energy efficiency in 2010. A total of 19 projects on energy efficiency and renewable energy sources have thus far been financed from the aforementioned programmes, with a total value of approximately HRK 30 million.

H.3 Guaranteed pricing scheme for RES and high-efficiency cogeneration

The Tariff system for the production of electricity from renewable energy sources and cogeneration (NN No 33/07) and the Decree on incentive fees for promoting electricity production from renewable energy sources and cogeneration (NN No 33/7) lay down the mechanisms for the collection and distribution of funds for supporting electricity producers who use RES and cogeneration. The Decree on the minimum share of electricity produced from renewable energy sources and cogeneration whose production is incentivised (NN No 33/07, 08/11) lays down the national targets for increasing the share of RES and cogeneration in total electricity consumption, to be provided by

suppliers and offered to customers by 2020. The target for cogeneration is 4 % of electricity from incentivised production in total final electricity consumption.

There are currently ten eligible producers in the system of incentives who are receiving incentives for cogeneration, with 51.64 MW of total electric power and 88 MW of thermal power.

The new Tariff system for renewable energy sources and cogeneration was issued in October 2013, laying down higher incentives for cogeneration plants. Furthermore, efficient cogeneration is additionally stimulated with the corrective factor which differentiates three degrees of efficiency for produced electricity and useful heat:

- for production plants that achieve overall annual efficiency lower than 45 %, the corrective coefficient is 0.9;
- for production plants that achieve overall annual efficiency higher than/including 45 % and lower than/including 50 %, the corrective coefficient (k) is 1;
- for production plants that achieve overall annual efficiency higher than 50 %, the corrective coefficient (k) is 1.2.

A higher price stimulates eligible producers to consider channelling the largest possible share of heat energy into safe consumption when designing cogeneration plants.

H.4 EPEEF – financial support for EnE, RES and clean transport

The Environmental Protection and Energy Efficiency Fund (hereinafter: the Fund) was established by the Act on the Environmental Protection and Energy Efficiency Fund (NN Nos 107/03, 144/12) as a non-budgetary fund with the status of a legal person with public authority, with the objective of raising earmarked funds for financing the preparation, implementation and development of programmes, projects and similar activities in the field of environmental preservation, sustainable use of the environment, environmental protection and amelioration; the participation in financing national energy programmes aimed at improving energy efficiency, the use of renewable energy sources, as well as organising and implementing a management system for special categories of waste.

One of the basic objectives of the Fund is the implementation of the energy policy of the Government of the Republic of Croatia in regard to energy efficiency improvements and increasing the use of renewable energy sources. The Fund co-finances energy efficiency programmes and projects in accordance with the Energy Strategy of the Republic of Croatia (NN No 130/09), the National Energy Efficiency Programme for the 2008–2016 period, national energy efficiency action plans, as well as other programmes derived from the aforementioned strategy documents adopted by the ministries competent for energy, construction, environmental protection and transport. In addition to the Act on the Environmental Protection and Energy Efficiency Fund, the Fund's energy efficiency activities are also regulated by the AEEU, whose Article 16 lays down that the Fund is obliged to provide financing for the implementation of energy efficiency improvement measures laid down in the National Energy Efficiency Action Plan (NEEAP). It should be pointed out that the Government of the Republic of Croatia adopted the 2nd NEEAP in February 2013 (first adopted by the Government of the Republic of Croatia in April 2010).

Furthermore, the Fund's activities under the 2nd NEEAP are regarded as a horizontal measure (measure H.3 – Financial support for energy efficiency, renewable energy sources and clean transport). All of the Fund's activities are therefore considered to be part of the implementation of the NEEAP, and the energy savings that result from the projects co-financed by the Fund are counted towards the achievement of the national indicative energy savings target.

EPEEF results

In the period of the 2nd NEEAP, 2011–2013, a total of 305 projects were implemented and the amount of funding paid out for those projects exceeded HRK 90 million, with the total investments exceeding HRK 250 million. Savings amounting to 0.22 PJ were achieved, which is 1.7 % of the national intermediate target for 2013, or 1.13 % of the national target for 2016. Greenhouse gas emissions were reduced by more than 20 000 tCO_2 in total, and more than HRK 34 million were saved. The relatively small number of projects in the previous triennial period resulted from the reduced number of calls for tender in 2011 and 2012, which slowed down the influx of new projects. However, 14 new calls for tender were published in 2013, and the implementation of projects approved from those tenders is expected in the following period, which will also increase the Fund's contribution to achieving national targets. The largest number of projects in the analysed period was implemented by way of reconstruction, modernisation and construction of energy efficient and environmentally friendly public lighting, while the largest savings were achieved from the installation of individual metering of heat energy in multifamily housing. The largest number of implemented projects in this period was in the public sector which, together with the household sector, achieved the most substantial savings. Each of these two sectors achieved 48 % of the total energy savings achieved in the analysed period. Projects were implemented in all the counties in Croatia. The largest number of projects was implemented in the Osijek-Baranja County, and the largest savings were achieved in the Primorje-Gorski Kotar County.

If we analyse the periods of both the 1st and the 2nd NEEAP, i.e. the implementation of the Fund's projects from 2005 to 2013, a total of 1 191 projects were implemented with the Fund's support, for which more than HRK 297 million of funding was paid out, with the total investment amount exceeding HRK 826 million. The achieved energy savings amounted to 1.03 PJ, which is 7.79 % of the national intermediate target for 2013, or 5.19 % of the national target for 2016. Emissions were reduced by 477 650.40 tCO_2 in total, and nearly HRK 112 million were saved. Although the shares in the achievement of national targets are small, this is by no means a negligible effect, and the Fund's projects have thus far been the only projects in Croatia for which this type of energy savings calculations were made. Since 2013, and including the 2011–2013 period, the National Coordinating Body for Energy Efficiency (CEI – Centre for Monitoring Business Activities in the Energy Sector and Investments) has been making these calculations for all other projects, measures and sectors and, together with the data submitted by the EPEEF, it has been drawing up the National Report on Energy Efficiency Implementation. The process of monitoring projects and savings calculations must, therefore, be continuously improved in order to obtain the best possible data on the achieved effects. To that end, EPEEF is one of the top users of the Energy Savings Measuring and Verification System (SMIV) run by the CEI. In this period, the largest number of projects was implemented in 2010, while the largest savings were achieved in 2008 due to energy efficiency projects in industry. The largest energy savings were generally achieved in the industry sector, and they account for nearly 58 % of the overall savings from the Fund's implemented projects. If we examine project implementation per county, we can observe that two counties dominate in the absorption of funding from the Fund – the Primorje-Gorski Kotar County and the Osijek-Baranja County.

Civil society organisations

The Fund also co-finances projects by civil society organisations (CSOs) in the field of energy efficiency and renewable energy sources, as well as other energy efficiency programmes and projects that are used to achieve the objectives of the national energy efficiency policy.

The main objective of this activity is to build the capacities of civil society organisations (associations) whose primary activities are aimed at energy efficiency and the use of renewable energy sources, and at co-financing projects which achieve the objectives of the national energy efficiency policy but which cannot be thematically classified under any other Fund activity.

The Fund participated in the implementation of joint programmes and projects with the ministry competent for energy, other state authorities, local and regional self-government units, non-governmental organisations, and international institutions. On the basis of the tenders published in 2010, 15 CSO projects were accepted for co-financing in the fields of stimulating energy efficiency, utilisation of renewable energy sources, stimulating sustainable construction, cleaner transport, and fostering education and training in all the aforementioned areas. A portion of the approved funding was expended only in 2012, since the associations were generally unable to provide their own funding or ensure other sources of co-financing required to finalise the financial structure, so they delayed project implementation for 2012. In 2013, the Fund published a new call for tender for CSOs, under which co-financing was approved for only four CSO projects. That resulted from both the stringent tender requirements and the unpreparedness of associations to draw up quality project proposals.

However, the Fund will continue its cooperation with CSOs, and the number of civil society organisations which operate in the fields of energy efficiency and renewable energy sources is expected to rise in the following period.

In the previous period, the Environmental Protection and Energy Efficiency Fund also financed various projects which indirectly affect energy efficiency improvements. Those projects were:

Implementation of energy efficiency activities at local and national level in the Republic of Croatia

The Fund provided expert assistance and financial support to local and regional self-government units, and to other legal persons, in drawing up strategy and planning documents.

The main objective of this activity is to build the capacities of local and regional self-government units, and of other legal persons, for planning sustainable energy development in their areas of competence/operation. However, this activity was included in the Fund's work programme only in late 2013, and it is expected to produce results during the implementation period of the 3rd NEEAP is expected.

International cooperation

The Fund also co-financed the participation of various stakeholders in international projects that contribute to achieving the objectives of energy efficiency and renewable energy sources.

Since 2006, the Fund has participated in the implementation of energy efficiency programmes and projects conducted by the United Nations Development Programme (UNDP) in Croatia. In the 2007–2013 period, the fund ensured funds amounting to HRK 92 000 000.00 for the implementation of the aforementioned projects and programmes. The project 'Systematic energy management in cities and counties' (SEM) is an independent activity in the 1st and 2nd NEEAP, so the savings from this project are not shown in this Fund report. The results of the implementation of this project are shown under measure P.1 and P.2.

Since 2006, pursuant to the Decree on the publication of the Global Environment Facility Trust Fund Grant Agreement between the Republic of Croatia and the International Bank for Reconstruction and Development for the Renewable Energy Resources Project and on the basis of the Agreement between the Fund and the Croatian Bank for Reconstruction and Development (HBOR), the Fund is obliged to provide guarantee funds for 15 contracted individual projects for the drawing up of project documentation. In this way, the Fund additionally participates in fostering the use of renewable energy sources and in the achievement of the mandatory national target defined in the National Action Plan for Renewable Energy Sources. In 2013, the Fund ensured the funds for co-financing the national share in projects on energy efficiency and renewable energy sources which are also co-financed with EU funds, as well as from other international sources, and foundations were made for publishing calls for tender which will ensue in 2014.

H.5 Energy efficiency in education, science and research

Fostering educational, research and development studies on energy efficiency and the use of renewable energy sources is vital for the promotion and dissemination of knowledge and for recognising the importance of rational and sustainable energy use. Under this measure, the greatest impact was achieved by EPEEF and the activities implemented through the Intelligent Energy Europe project CROSKILLS in which Croatia is a partner.

EPEEF

Within the framework of this activity, the Environmental Protection and Energy Efficiency Fund stimulates the implementation of educational activities on energy efficiency and the use of renewable energy sources, the implementation of projects co-financed by EU programmes and funds, the production of feasibility studies as groundwork for project applications for financing investments in energy efficiency and the use of renewable energy sources via EU structural funds, and the organisation of scientific and professional conferences.

In the 2011–2013 period, 29 projects were implemented under this activity of the Fund, with a total of HRK 2 255 423.38 of funding paid out for: expert studies, drawing up project documentation, drawing up manuals, software development, education and training on energy efficiency and renewable energy sources, and various congresses and conferences.

The aforementioned activities improved the level of information on energy efficiency and the use of renewable energy sources. Educating the public on issues related to energy efficiency and the use of renewable energy sources, as well as the production of expert and scientific projects and programmes, enables better application of energy efficiency measures and better utilisation of renewable energy sources. By disseminating information, the Fund encourages business operators to invest funds into programmes and projects aimed at improving energy efficiency and utilising renewable energy sources, and raises public awareness of the need for rational energy use.

The Fund has also raised awareness among beneficiaries of rational and sustainable energy use, promoted and disseminated knowledge and awareness of energy efficiency and the use of renewable energy sources through various congresses and conferences, publishing promotional materials, producing project documentation and various expert studies, etc. In the 2011–2013 period, 29 projects were implemented under this activity of the Fund, with a total of HRK 2 255 423.38 of funding paid out for: expert studies, drawing up project documentation, drawing up manuals, software development, education and training on energy efficiency and renewable energy sources, and various congresses and conferences.

CROSKILLS

Croatia is a partner in the CROSKILLS project which, as part of the EU initiative BUILD UP Skills, promotes the creation of a sustainable workforce in construction, in the area of energy efficiency and renewable energy sources. Experiences of EU Member States and Croatia show that energy efficient restoration and new construction currently pose a great challenge for the Croatian construction sector and its associated activities, due to a lack of qualified construction workers caused by a lack of specialised institutional education programmes and low market demand for low-energy buildings. Such a situation requires a change of the typical ‘a job is a job’ way of thinking and a change in the professional qualifications of the workers on the market, i.e. the creation of a workforce (workers, entrepreneurs) with sufficient knowledge or specialisation for the construction of low-energy, passive or nearly zero energy buildings is paramount and it guarantees the achievement of high-quality construction.

The first project stage lasted from 2011 to 2013, and during that time a national qualification platform was formed, bringing together 64 representatives from 51 organisations from various sectors and creating the guidelines for achieving the 2020–20 targets. In order to achieve the targets, activities were coordinated with numerous institutions (state authorities and agencies; vocational associations, unions and chambers which bring together various profiles of construction vocations in trades and crafts, the construction industry and energetics; vocational schools for construction and technical schools; local and regional self-government units; energy agencies; financial institutions; building managers and tenant associations; and individual companies that operate in the field of energy efficiency). Several surveys were conducted and information was gathered for the preparation of the second part of the project – CROSKILLS 2 – in which more tangible results are expected to be achieved. In this document, the continuation of the project is classified under the results achieved from the new measure H.5, and the description of the results can be found under that measure.

In addition to EPEEF and the CROSKILLS project, UNDP Croatia also established the Solar Education Centre in Zadar. The partners were the Zadar County and UNDP, and the Centre was co-financed with the support of the Dutch Government. Total value of the Centre is HRK 360 000. The intention of the Centre is to encourage the use of renewable energy sources, the creation of 'green' jobs and the retraining of the unemployed inhabitants of the Zadar County. The Centre offers two adult education programmes, and an elective programme for high-school students within the scope of the regular classes at the Vocational School Vice Vlatković.

The courses available for adults are those for installers of solar photovoltaic systems and solar heating systems.

A curriculum for two elective courses was designed for regular students, accredited by the Ministry of Science, Education and Sports. Third grade students can attend the course 'Solar Heating System Technology', and second and third grade students can attend the course 'Solar Photovoltaic System Technology'.

H.6 Advanced energy network

During the second NEEAP, this measure was not implemented in its planned scope. The working group established for that purpose was not active, and a series of activities were related to the establishment and operation of the Smart Grids Association and the scientific project SmartGrids ERA-net under the Seventh Framework Programme (7FP), in which MSES was the partner from the Republic of Croatia and EPEEF participated as the implementing authority (reports that cover the results from Croatia can be viewed at www.eranet-smartgrids.eu).

SmartGrids ERA-Net published the 3rd call for research projects as part of its support for joint European research projects on advanced electric power networks. The Republic of Croatia is eligible for participation in the call. In accordance with the set national limitations, the SmartGrids ERA-Net call is open for all researchers, institutions or business operators in the countries taking part in the call.

Certain obligations and activities regarding this subject are related to the implementation of the third energy package (energy legislation) which lays down the obligations for the installation of smart meters. HEP is preparing a comprehensive programme for the installation of new meters with remote reading and data processing which will be implemented through a set of public tenders and accompanying activities by 2020.

H.7 Improving the legislative-regulatory framework for policy implementation and policy implementation monitoring

AEEU (NN Nos 152/08, 55/12, 153/13 and 14/14) is the basic regulation laying down the obligations related to energy management, especially in the public sector and by large energy consumers. The enforcement of AEEU is based on a series of subordinate pieces of legislation, some of which are still in the process of being adopted. The tree years of

the enforcement of the Act have shown its deficiencies and indicated the need for improvements, with the aim of facilitating the implementation of the energy efficiency policy and achieving the targets.
The necessary amendments to the AEEU were adopted in May 2012, with the aim of removing a series of ambiguities and unnecessary obstacles for the development of the ESCO market – providing energy services in the sense of energy efficiency improvement measures. Furthermore, the ambiguous distribution of responsibilities between the Ministry of Economy, the Ministry of Construction and Physical Planning, and the Environmental Protection and Energy Efficiency Fund had to be regulated. The ambiguous distribution of responsibilities caused problems in the enforcement of the Act, since the Fund is primarily an institution competent for co-financing energy efficiency projects, without the capacities to act as an implementing authority, and with the questionable justifiability of the fact that the same institution was supposed to both prepare projects and approve co-financing for energy efficiency projects.

Moreover, the obligation of submitting data on final energy consumption for suppliers and customers was thus far based on the planned rules on the single energy efficiency information system, which proved to greatly overlap with the issues regulated by the Rules on energy balance, and it was more advisable to improve the data collection process defined by the latter Rules than develop a parallel system for data collection and processing.

Pursuant to the 2nd NEEAP, adopted by the Government of the Republic of Croatia on 14 February 2013, the Centre for Monitoring Business Activities in the Energy Sector and Investments was appointed as the National Coordinating and Implementing Body for Energy Efficiency. The 2nd NEEAP entrusted CEI with the implementation activities for certain measures, the coordination of the implementation of all measures implemented by other institutions and companies, and the management of the information system for monitoring and verifying achieved energy savings. In addition to strengthening the overall institutional framework for the implementation of the NEEAP, this also contributes to a more effective method of monitoring and reporting achieved energy savings.

This has made CEI the central authority which will possess the information on all energy efficiency activities in the Republic of Croatia, and will have a database of achieved savings which is the key tool for reporting and defining a new cycle of measures necessary for the achievement of the national energy savings target.

The tasks of the National Coordinating Body:

1. Manages the SMIV – the system for monitoring, measuring and verifying energy savings;
2. Acts as the central authority which collects data, analyses and reports on achieved energy savings in all energy consumption sectors at national level;
3. Prepares the foundations for drawing up national documents and plans on energy efficiency;
4. Launches and runs information campaigns, education and training activities;
5. Implements activities aimed at achieving energy policy targets in the field of EnE and RES;
6. Prepares and implements projects for the absorption of funding from EU funds, and provides expert assistance in the development and implementation of EnE and RES projects;
7. Provides expert assistance and cooperates with ME and MCPP in the adoption of legislation and implementing regulations, programmes and plans;
8. Encourages and coordinates the activities of central state administration bodies, EPEEF, EIHP, local and regional energy agencies;
9. Cooperates with international organisations, especially EU organisations and professional networks within the EU.

In other words, CEI is assigned the activities which would fall under the competence of an **energy efficiency agency**, and that will contribute to strengthening the institutional framework for the implementation and monitoring of the third and all the following NEEAPs. In that sense, in the majority of the measures in the 3rd NEEAP, the Centre is specified as the body with which all the other **implementing institutions and companies must coordinate their activities**. Furthermore, all the other institutions and companies that implement energy efficiency improvement activities and measures defined in the 3rd NEEAP are obliged to report to the CEI in regard to those activities. This will make the Centre the central authority which will possess the information on all energy efficiency activities in Croatia, and will have a database of achieved savings (SMIV – Energy Savings Measuring and Verification System) which is the key tool for reporting and defining a new cycle of measures necessary for the achievement of the national energy savings target. In that regard, CEI was conferred the authority to request all other institutions and companies to submit the data necessary for the evaluation of achieved energy savings.

Other institutions and companies also have the duty to implement certain measures from this NEEAP, as specified under each measure. Substantial efforts of LRSGUs and regional energy and development agencies are expected primarily in regard to fostering energy efficiency in households.

A clear distribution of responsibilities and direction of activities will facilitate much better cooperation and coordination of key institutions – ME, MCPP, MENP, other ministries, EIHP, EPEEF, and other institutions and companies – under the leadership of the Centre.

The Directorate for Climate Activities, Sustainable Development and Protection of Soil, Air and Sea was established within MENP, in accordance with the Decree on the internal organization of the Ministry of Environmental and Nature Protection (NN No 10/14), and within its scope of activities the Directorate connects environmental protection policy with renewable sources and energy efficiency. The Sector for Climate Activities and Sustainable Development was established within the Directorate, to implement the active policy on sustainable development, and especially to propose measures and projects for the sustainable development of the Republic of Croatia and foster the use of renewable energy sources, the application of energy efficiency measures, cleaner production, cleaner transport, and green industries. MENP, therefore, participates in the creation and implementation of strategic, legislative and implementing documents on energy efficiency and acts as the body which approves, implements and monitors the implementation of all NEEAP measures directly and indirectly related to environmental protection. As the state administration body competent for environmental protection, MENP is the coordinator for the Policy Framework for Climate and Energy for the 2020–2030 period, the competent authority for drafting the Low Carbon Development Strategy of the Republic of Croatia by 2030, and the competent authority for programming EU funds in regard to planning the transformation of the economy into low carbon development with the application of new, green technologies and innovations. MENP is focused on creating the preconditions for achieving the strategic and development objectives of the European Union and the Republic of Croatia for the reduction of greenhouse gas emissions, increasing the share of renewable energy sources and energy savings by 2020, by way of, *inter alia*, developing financial mechanisms, primarily via the Fund as the key implementing authority. MENP's role is, therefore, very important for the successful implementation of the 3rd NEEAP, as is the role of the aforementioned ministries and institutions.

The 3rd NEEAP plans for the launch and implementation of complex programmes (for example, measures for building renovation P.5, R.4, C.5 or the Industrial Energy Efficiency Network, measure I.1), which will not yield the required results without an appropriate institution to coordinate and verify the results.

Since 2013, but also in the 2011–2013 period, the National Coordinating Body for Energy Efficiency (CEI), as the central national authority, has been performing BU calculations for all projects, measures and sectors in which energy savings are achieved, drawing up the National Report on Energy Efficiency Implementation and preparing the national energy efficiency action plans.

This process of monitoring projects and savings calculations must be continuously improved in order to obtain the best possible data on the achieved effects. The development of the National Energy Savings Measuring and

Verification System (SMIV) was started with that aim, run by the CEI in cooperation with GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH), the German Agency for International Cooperation. SMIV will greatly facilitate the monitoring of energy efficiency policy implementation and the drafting of the annual implementation reports. It is, therefore, very important to continuously improve and develop this system. It is proposed that, in the future period, emphasis be put on SMIV as the central national database which stores the main information on the measures, plans, programmes, and projects that are used to implement the national energy efficiency policy.

A5 Central government buildings

The Republic of Croatia has opted for the alternative approach to determining the area of central government buildings. Due to the possibility of monitoring savings by way of the supplied energy, energy renovation of public buildings will be conducted at national level with the scope of 17 buildings per year (14 in continental Croatia and 3 in littoral Croatia), which corresponds to the total heated area of 33 267 m^2 for a standard set of buildings or, per specific savings which differ substantially from office buildings to hospitals, ranging from 10 941 m^2 to 51 309 m^2 per year. This will achieve the equivalent savings of the energy renovation of 3 % of buildings per year, amounting to 0.00489 PJ per year.

The additional measure of changing the behaviour of users will be evaluated for buildings which are not subject to energy renovation measures, and will bridge the required savings until the start of the investment cycle for the renovation of public buildings.

The 'Register of public central government buildings and the calculation of savings targets pursuant to Directive 2012/27/EU of 25 October 2012 on energy efficiency' is annexed to this document.

A6 Energy efficiency obligations

In January 2014, the Republic of Croatia submitted a notification to the EC with regard to addressing the energy efficiency obligations referred to in Directive 2012/27/EU, and in the notification opted for addressing Article 7 of the EED by way of alternative measures. In the meantime, a consultative meeting was held with DG Energy representatives, at which it was concluded that the calculation method in accordance with Article 7 should be reconsidered and it was decided that amendments to the aforementioned notification would be made in order to benefit calculation accuracy. New calculations were made and it was established that the set targets could not be achieved by using only alternative measures. For that reason, Croatia subsequently opted for a combination of approaches of both alternative measures and energy efficiency obligations, and this decision was transposed into the Energy Efficiency Act which is currently in the process of being adopted.

The new notification of compliance with Article 7 of the EED can be found in Chapter 3.1.1. herein, with amended descriptions of all measures and the accurate calculations of expected savings. The methodology for calculating savings can be found in Appendix E to this document.

APPENDIX B PLAN FOR THE ENERGY RENOVATION OF BUILDINGS

The strategy for stimulating investments in the energy renovation of buildings was drawn up and notified by the EC, and it is annexed to this document as a separate PDF file.

APPENDIX C NATIONAL PLAN FOR INCREASING THE NUMBER OF NEARLY ZERO ENERGY BUILDINGS

Following the proposal of the Republic of Croatia, the European Commission extended the submission deadline for these data for the Republic of Croatia by July 2014.

The 'Plan for Increasing the Number of Nearly Zero Energy Single-Family Homes by 2020' has been drawn up at the time of writing and it is contained in Appendix C (PDF annexed to this document). The documents for other types of buildings are being drawn up and will be submitted at a later date.

APPENDIX D HEATING VALUES AND CONVERSION FACTORS

Table D-1. Heating values and nationally accepted conversion factors, Energy in Croatia 2012, Ministry of Economy

Heating values:	Unit	kcal	MJ	kgoe	kgce
Hard Coal	Kg	5800–7000	24.28 29.31	0.580 0.700	0.829 1.000
Coking coal	Kg	7000	29.31	0.700	1.000
Brown Coal	Kg	4000–4600	16.75 19.26	0.400 0.460	0.571 0.657
Lignite	Kg	2300–3000	9.63–12.56	0.230 0.300	0.329 0.429
Coke Oven Coke	Kg	6300–7000	26.38 29.31	0.630 0.700	0.900 1.000
Fuel Wood	dm3	2150	9.00	0.215	0.307
Biodiesel	kg	8837	36.90	0.884	1.262
Bioethanol	kg	6370	26.67	0.637	0.910
Landfill Gas	m3	4060	17.00	0.406	0.580
Biogas	m3	4299–4777	18–20	0.430 0.478	0.614 0.682
Natural Gas	m3	8120–8570	34–35.88	0.812 0.857	1.160 1.224
Crude Oil	kg	10 127	42.40	1.013	1.447
Liquefied Petroleum Gas	kg	11 200	46.89	1.120	1.600
Motor Gasoline	kg	10 650	44.59	1.065	1.521
Naphtha	kg	10 650	44.59	1.065	1.521
Kerosene	kg	10 500	43.96	1.050	1.500
Jet Fuel	kg	10 500	43.96	1.050	1.500
Light Heating Oil	kg	10 200	42.71	1.020	1.457
Diesel Oil	kg	10 200	42.71	1.020	1.457
Fuel Oil	kg	9600	40.19	0.960	1.371
Petroleum Coke	kg	7400	31.00	0.740	1.057

Other Products	kg	8000–9600	33.49 40.19	0.800 0.960	1.143 1.371
Refinery Gas	kg	11 600	48.57	1.160	1.657
Ethane	kg	11 300	47.31	1.130	1.614
Coke Oven Gas	m3	4278	17.91	0.428	0.611
Gas Works Gas	m3	6630	27.76	0.663	0.947
Blast Furnace Gas	m3	860	3.60	0.086	0.123
Electricity	kWh	860	3.60	0.086	0.123

APPENDIX E CALCULATION METHODOLOGY FOR ENERGY SAVINGS

TOP-DOWN METHOD

Energy efficiency indicator P1 – Energy consumption for heating per unit area with climate correction

The P1 indicator is the ratio of energy consumption for heating the premises, corrected for climate conditions, and the total area of permanently inhabited dwellings. It is expressed with the unit of measurement toe/m^2.

The following data are required to calculate the P1 indicator:
- number of permanently inhabited dwellings;
- average area of a dwelling (m^2);
- energy consumption for heating corrected by climate conditions (toe).

The following data are required to calculate energy consumption for heating the premises corrected by climate conditions:
- actual energy consumption for heating the premises (toe);
- actual number of heating degree days;
- average number of heating degree days.

The P1 indicator is calculated using the mathematical formula:

$$\frac{E^{HPH}}{F} \times \frac{MDD_{25}^{heating}}{ADD^{heating}}$$

and the energy savings:

$$\left[\left(\frac{E_{2013}^{HPH}}{F_{2013}} \times \frac{MDD_{25}^{heating}}{ADD_{2013}^{heating}}\right) - \left(\frac{E_t^{HPH}}{F_t} \times \frac{MDD_{25}^{heating}}{ADD_t^{heating}}\right)\right] \times F_t$$

whereat it is as follows:

E_{2013}^{HPH}, E_t^{HPH} [toe]	Energy consumption for heating premises in 2013 and in year *t*
F_{2013}, F_t [m^2]	Total area of permanently inhabited dwellings in 2013 and in year *t* (calculated by multiplying the number of permanently inhabited dwellings and the average size of a dwelling)
$MDD_{25}^{heating}$,	Median value of heating degree days in the last 25 years
$ADD_{2013}^{heating}$, $ADD_t^{heating}$	Actual value of heating degree days in 2013 and in year *t*

Energy efficiency indicator P3 – Energy consumption for water heating per capita

The P3 indicator is the ratio of energy consumption for domestic hot water preparation in households and the total number of inhabitants. It is expressed with the unit of measurement toe/inhabitant.

The following data are required to calculate the P3 indicator:
- energy consumption for domestic hot water preparation (ktoe);
- total number of inhabitants (in thousands).

Energy consumption for domestic hot water preparation in households is not common data in energy statistics and is usually derived from more detailed evaluations. Energy consumption for domestic hot water preparation includes the consumption of petroleum products, natural gas, coal and lignite, electricity, heat from district heating systems.

The P3 indicator is calculated using the mathematical formula:

$$\frac{E^{HWH}}{P}$$

and the energy savings:

$$\left(\frac{E_{2013}^{HWH}}{P_{2013}} - \frac{E_t^{HWH}}{P_t}\right) \times P_t$$

whereat it is as follows:

E_{2013}^{HWH} EH, E_t^{HWH} [toe]	Energy consumption for domestic hot water preparation in households in 2013 and year *t* (without solar power consumption)
P_{2013}, P_t	Number of inhabitants in 2013 and in year *t*

BOTTOM-UP METHOD

Integral renovation measures for existing residential and service buildings

Integral renovation of buildings pertains to complex projects which concurrently include improvements to the building envelope and the heating system, as well as to other energy systems in the building.

Unit energy savings in final consumption are calculated as a difference of ratios of specific heat energy requirements of buildings and the efficiency of heating systems 'before' and 'after' EnE measure implementation. The 'before' situation is specified by the parameters of each building or reference values can be used, depending on the period when the building was constructed and the regulatory requirements at the time of construction. The values of the specific heat energy requirements of buildings must be adjusted by heating degree day.

The total annual savings of final energy for a building are determined by multiplying unit energy savings with the area of the building.

Formulas for calculating energy savings achieved from improving thermal protection and replacing the equipment of heating systems for residential buildings and service sector buildings:

$$UFES = \frac{SHD_{init}}{\eta_{init}} - \frac{SHD_{new}}{\eta_{new}}$$

$$FES = \sum_{i=1}^{n} UFES_i \times A_i$$

whereat it is as follows:

UFES [kWh/m^2/year]	Unit energy savings in final consumption
SHD_{init} [kWh/ m^2]	Specific annual heat energy requirements for heating a building before EnE measure implementation
SHD_{new} [kWh/m^2]	Specific annual heat energy requirements for heating a building after EnE measure implementation
@init	Efficiency of old heating system before EnE measure implementation
@new	Efficiency of new heating system after EnE measure implementation
FES [kWh/year]	Total annual savings of final energy
A [m^2]	Heated usable floor area of a building

Mandatory input data:
It is required to know the data on the total heated area of a facility, although reference values can be used for that input parameter. It is advisable to know the efficiency of the existent and the new heating system (according to manufacturer or project data), as well as the data on the specific annual heat energy requirement for heating a building (which becomes available following the introduction of the obligation to conduct energy certification of buildings). The most accurate results are obtained by conducting a detailed energy audit before and after reconstruction and application of EnE measures.

Reference values should be used in cases when there is a lack of specific data for an individual project:

Reference values:		
SHD_{init} [kWh/ m^2]	180 for the residential sector 190 for the service sector	→ Table 1
SHD_{new} [kWh/m^2]	85 for the residential sector 107.5 for the service sector	→ Table 1
□init	0.595 → Table 2	
□new	0.848 → Table 2	
A [m^2]	It is recommended to use actual data on the heated areas of a building. The heated area of residential buildings is estimated to approximately 66.25 % of the total usable floor area, and the heated area of non-residential buildings to 43.9 % of the total usable floor area.	
Reference unit energy savings:		
Residential sector		
UFES [kWh/m^2/year]	180/0.595 - 85/0.848 = 202.3	
FES [kWh/year]	202.3 x m^2 of heated usable floor area of a building	
Service sector		
UFES [kWh/m^2/year]	190/0.595 - 107.5/0.848 = 192.6	
FES [kWh/year]	192.6 x m^2 of heated usable floor area of a building	

Table 1: Recommended reference values for the specific heat energy requirements of buildings

Construction period	Specific useful energy for heating (SHD) [kWh/(m^2 x year)]
before 1940	180
1940 - 1970 PERIOD	250
1970 - 1987 PERIOD	200
1987 - 2006 PERIOD	150
2006 - 2013	on average 85 for the residential sector on average 107.5 for the service sector
Average	180 for the residential sector 190 for the service sector

Table 2: Recommended reference values for the efficiency of heating system components

Subsystems of the heating system	Degree of subsystem efficiency before EnE measure implementation	Degree of subsystem (equipment) efficiency on the market	Minimum degree of subsystem efficiency after EnE measure implementation
Heat production subsystem (boiler) - □boiler	0.82	0.89	0.94
Heat distribution subsystem - □dis	0.93	-	0.97
Subsystem for emitting heat into space - □em	0.78	0.83	0.93
□ = □boiler * □dis * □em	0.595		0.848

Measures for the renovation of thermal insulation on certain sections of the building envelope

Thermal insulation of certain sections of the building envelope includes walls, windows and ceilings (roofs) of buildings.

Unit energy savings in final consumption are calculated as a difference of heat transfer coefficients of construction components 'before' and 'after' EnE measure implementation. The 'before' situation is specified by the parameters of each building or reference values can be used, depending on the period when the building was constructed and the regulatory requirements at the time of construction. The heat transfer coefficients of construction components must be adjusted by heating degree days and, if possible, by heating system efficiency and intermittence.

The total annual savings of final energy for a building are determined by multiplying unit energy savings with the renovated area of the building envelope.

Formulas for calculating energy savings that result from the renovation of the elements of the building envelope (wall, window, roof), without replacing heating equipment:

$$UFES_{wall} = \frac{\left(\left(U_{init\_wall} - U_{new\_wall} \right) \times HDD \times 24h \times a \times \frac{1}{b} \times c \right)}{1000}$$

$$UFES_{window} = \frac{\left(\left(U_{init\_window} - U_{new\_window} \right) \times HDD \times 24h \times a \times \frac{1}{b} \times c \right)}{1000}$$

$$UFES_{roof} = \frac{\left(\left(U_{init\_roof} - U_{new\_roof} \right) \times HDD \times 24h \times a \times \frac{1}{b} \times c \right)}{1000}$$

$$FES = \sum_{i=1}^{n} UFESi \times Ai$$

whereat it is as follows:

UFES [kWh/m^2/year]	Unit energy savings in final consumption
U_{init} [W/ m^{2}K]	Heat transfer coefficient for typical old element before reconstruction
U_{new} [W/ m^{2}K]	Heat transfer coefficient for typical element after reconstruction
HDD	Heating degree day
24h	24 hours
a	Correction factor dependent on the climate zone in which the building is located
b	Seasonal efficiency of the heating system
c	Heating interruption coefficient
FES [kWh/year]	Total annual savings of final energy

A_i = □+ A_p + A_k [m^2]	Area of building envelope

Mandatory input data:

It is required to know the data on the area of the reconstructed building envelope structure and the heat transfer coefficient before and after reconstruction, although reference values can be used for those input parameters. It is advisable to know the efficiency of the heating system, as well as the accurate data on the degree ... [translator's note: original text incomplete]

Reference values should be used in cases when there is a lack of specific data for an individual project:

Reference values:	
U_{init_wall} [W/ m^2K]	1.4 → Table 3
U_{new_wall} [W/ m^2K]	0.45
U_{init_window} [W/ m^2K]	3.6 → Table 3
U_{new_window} [W/ m^2K]	1.4 for the residential sector 1.8 for the service sector
U_{init_roof} [W/ m^2K]	2.0 → Table 3
U_{new_roof} [W/ m^2K]	0.35
HDD	2200 → Table 4
a	1
b= □	0.595 → Table 2
c	1 for the residential sector 0.62 for the service sector
Reference unit energy savings:	
Residential sector	
$UFES_{wall}$ [kWh/m^2/year]	84.3
$UFES_{window}$ [kWh/m^2/year]	195.2
$UFES_{roof}$ [kWh/m^2/year]	146.4
Service sector	
$UFES_{wall}$ [kWh/m^2/year]	57.75
$UFES_{window}$ [kWh/m^2/year]	98.99
$UFES_{roof}$ [kWh/m^2/year]	90.74

Table 3: Characteristic heat transfer coefficients for building envelope structures

Characteristic coefficients U (W/m^2K)	before 1940	1940.-1970.	1970.-1987.	1987.-2006.
Wall	1.63	2.23	1.08	0.595
Window	4.4	4.4	3.08	2.23
Ceiling (roof)	1.31	2.93	1.96	0.86
Share of buildings in total housing stock	0.16	0.31	0.40	0.12
Average coefficients U (W/m^2K)				
Wall	1.46			
Window	3.6			
Ceiling (roof)	2.02			

Table 4: Heating degree day

	Heating degree day
Continental Croatia	3200
Adriatic Croatia	1200
Average	2200

Measures for new installation or replacement of heating systems and domestic hot water preparation systems in residential and service buildings

In regard to new installation or replacement of existing heating systems, the annual unit energy savings in final consumption are calculated by multiplying the difference of heating system efficiency 'before' and 'after' EnE measure implementation, the specific heat energy requirements of a building and the heated area.

The total annual energy savings are determined by adding up all annual unit energy savings from each individual project.

Formulas for calculating energy savings achieved from replacing heating equipment in residential buildings and service sector buildings:

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}}\right) \times SHD \times A$$

$$FES = \sum_{i=1}^{n} UFES_i$$

whereat it is as follows:

UFES [kWh/(unit x year)]	Unit energy savings in final consumption
□init	Seasonal degree of efficiency of old heating system before EnE measure implementation
□new	Seasonal degree of efficiency of new heating system after EnE measure implementation
SHD [kWh/m^2]	Specific annual heat energy requirements of a building
A [m^2]	Average heated area in a heating system
FES [kWh/year]	Total annual savings of final energy

In regard to domestic hot water preparation systems, the annual unit energy savings in final consumption are calculated by multiplying the difference of domestic hot water preparation system efficiency 'before' and 'after' EnE measure implementation, and the specific heat energy requirements for heating domestic hot water.

The total annual energy savings are determined by adding up all annual unit energy savings from each individual project.

Formula for calculating annual unit energy savings achieved from replacing or installing new domestic hot water preparation systems in residential buildings and service sector buildings:

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}}\right) \times SWD$$

$$SWD = \frac{(C_{hot\_water\_daily} \times 365d \times n_{persons/building} \times X)}{1000}$$

$$X = (t_{hot\_water} - t_{cold\_water}) \times c_{water} \times c_f$$

$$FES = \sum_{i=1}^{n} UFESi$$

whereat it is as follows:

UFES [kWh/(unit x year)]	Unit energy savings in final consumption
□init	Efficiency of old domestic hot water preparation system before EnE measure implementation
□new	Efficiency of new domestic hot water preparation system after EnE measure implementation
SWD [kWh/(unit x year)]	Specific energy required for domestic hot water preparation
365d	365 days
$C_{hot\_water\_daily}$	Average daily hot water consumption per person
$n_{persons/building}$	Average number of persons supplied with hot water in a building
t_{hot_water}	Hot water temperature (usually 60 °C)
t_{cold_water}	Cold water temperature (usually 15 °C)
c_{water}	Specific heat capacity of water = 1 kcal/(kg - °C)
C_f	Conversion factor 0.001163 kWh/kcal with 1 litre of water = 1 kg of water
FES [kWh/year]	Total annual savings of final energy

Mandatory input data:

It is required to know the data on the heated area of a building. It is advisable to collect the basic data on the existing boiler (type, year of production, degree of efficiency) and the new one (type, year of production/installation, degree of efficiency).

Domestic hot water preparation systems are frequently integrated in the building's space heating system, especially in the case of district heating systems or autonomous heating systems. A heating system generally comprises a heat production subsystem (heat energy source), a heat energy distribution subsystem, and a subsystem for emitting heat into space (heating elements). The heat energy produced in the heat energy production subsystem is distributed via the heat energy distribution subsystem to the final subsystem of the heating system - the heating elements. Each of the aforementioned subsystems of the heating system produces heat losses, including the losses due to regulation, which must be taken into account when calculating the final annual heat energy for heating. The final annual heat energy is the required useful heat energy plus heat losses, including the losses due to regulation.

The energy efficiency improvement measures for heating systems and domestic hot water preparation systems can be defined for residential buildings and service sector buildings for the following three cases:

- new installation of heating systems and domestic hot water preparation systems (new buildings, installation of equipment which is more efficient than the average equipment currently available on the market);
- replacement of an existing heating system and domestic hot water preparation system (replacing equipment at the end of its life cycle with more efficient equipment);
- pre-emptive replacement of an existing heating system and domestic hot water preparation system (forcible replacement of equipment before the end of its life cycle with more efficient equipment).

New installation of heating systems and domestic hot water preparation systems

Formula for calculating energy savings in residential buildings and service sector buildings that result from the installation of efficient equipment for heating systems and domestic hot water preparation systems, instead of installing equipment of average efficiency available on the market:

$$UFES = \left(\frac{1}{\eta_{average}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$

$$FES = \sum_{t=1}^{n} UFES_t$$

whereat it is as follows:

UFES [kWh/(unit x year)]	Unit energy savings in final consumption
□average	Total seasonal degree of efficiency of heating systems with average efficiency available on the market
□new	Total seasonal degree of efficiency of heating systems after EnE measure implementation
SHD [kWh/(m^2 x year)]	Specific annual heat energy requirements of a building (designed value, value specified in the energy performance certificate)
SWD [kWh/(m^2 x year)]	Specific annual energy requirements for domestic hot water preparation
A [m^2]	Average heated area of a building
FES [kWh/year]	Total annual savings of final energy

Reference values should be used in cases when there is a lack of data for an individual project:

Reference values:	
□average	□average=□boiler •□dis • □em → Table 5
□new	□new =□boiler •□dis • □em → Table 5
SHD	Table 6
SWD	Table 7
A	It is recommended to use actual data on the heated areas of a building.

Table 5: Recommended reference values for the degree of efficiency of heating systems in residential buildings and service sector buildings

Subsystems of the heating system	Degree of subsystem efficiency before EnE measure implementation	Degree of subsystem (equipment) efficiency on the market	Minimum degree of subsystem efficiency after EnE measure implementation
Heat production subsystem (boiler) - □boiler	0.82	0.89	0.94
Heat distribution subsystem - □dis	0.93	-	0.97
Subsystem for emitting heat into space - □em	0.78	0.83	0.93
	□old = □boiler • □dis•□em □old = 0.595	□average = □boiler • □dis•□em	□new = □boiler • □dis•□em □new = 0.848

Table 6: Recommended reference values for specific annual useful energy for heating (SHD) for residential buildings and service sector buildings

Type of building	Specific useful energy for heating (SHD) [kWh/(m^2 x year)]	
	Current condition	New condition
Residential buildings	180	85
Service sector buildings	190	107.5

Table 7: Recommended reference values for specific annual useful energy for domestic hot water preparation (SWD) for residential buildings and service sector buildings

Type of building	Specific useful energy for domestic hot water preparation (SWD) [kWh/(m^2 x year)]
Residential buildings	
– with up to three housing units	12.5
– with more than three housing units	16.0
Service sector buildings	
– tourism and hospitality	3.5
– other service sector buildings	0.5

<u>Replacement of an existing heating system and domestic hot water preparation system (at the end of the equipment's life cycle)</u>

Energy savings are achieved by replacing the equipment of an existing heating system and domestic hot water preparation system with efficient equipment. Reference values pertaining to the current condition are used for calculating all energy savings, and reference values for equipment of average efficiency available on the market are used for calculating additional energy savings.

Formula for calculating energy savings achieved from replacing the equipment of heating systems and domestic hot water preparation systems in residential buildings and service sector buildings at the end of the equipment's life cycle:

All energy savings:

$$UPES = \left(\frac{1}{\eta_{old}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$

Additional energy savings:

$$UFES = \left(\frac{1}{\eta_{average}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$

whereat it is as follows:

UFES [kWh/(unit x year)]	Unit energy savings in final consumption
□old	Total seasonal degree of efficiency of heating systems before EnE measure implementation
□average	Total seasonal degree of efficiency of heating systems with average efficiency available on the market
□new	Total seasonal degree of efficiency of heating systems after EnE measure implementation
SHD [kWh/(m^2 x year)]	Specific annual heat energy requirements of a building (designed value, value specified in the energy performance certificate)
SWD [kWh/(m^2 x year)]	Specific annual energy requirements for domestic hot water preparation
A [m^2]	Average heated area of a building

$$FES = \sum_{i=1}^{n} UFES_i$$

whereat it is as follows:

FES [kWh/year]	Total annual savings of final energy

Reference values should be used in cases when there is a lack of data for an individual project:

Reference values:	
□old	□old = □boiler • □dis•□em → Table 5
□average	□average = □boiler • □dis•□em → Table 5
□new	□new = □boiler • □dis•□em → Table 5
SHD	Table 6
SWD	Table 7
A	It is recommended to use actual data on the heated areas of a building.

Pre-emptive replacement of an existing heating system and domestic hot water preparation system (before the end of the equipment's life cycle)

Energy savings are achieved by replacing the equipment of an existing heating system and domestic hot water preparation system with efficient equipment, before the end of the life cycle of the existing equipment. Reference values pertaining to the current condition are used for calculating energy savings until the end of the life cycle of the existing equipment, and reference values for equipment of average efficiency available on the market are used for calculating energy savings after the end of the life cycle of the existing equipment.

Formula for calculating energy savings achieved from pre-emptive replacement of equipment for heating systems and domestic hot water preparation systems in residential buildings and service sector buildings before the end of the life cycle of the existing equipment:

All energy savings:

$$UFES = \left(\frac{1}{\eta_{old}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$

Additional energy savings:

$$UFES = \left(\frac{1}{\eta_{old}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$ → *until the end of the life cycle*

$$UFES = \left(\frac{1}{\eta_{old}} - \frac{1}{\eta_{new}}\right) \times (SHD + SWD) \times A$$ → after the end of the life cycle

whereat it is as follows:

UFES [kWh/(unit x year)]	Unit energy savings in final consumption
□old	Total seasonal degree of efficiency of heating systems before EnE measure implementation
□average	Total seasonal degree of efficiency of heating systems with average efficiency available on the market
□new	Total seasonal degree of efficiency of heating systems after EnE measure implementation
SHD [kWh/(m^2 x year)]	Specific annual heat energy requirements of a building (designed value, value specified in the energy performance certificate)
SWD [kWh/(m^2 x year)]	Specific annual energy requirements for domestic hot water preparation
A [m^2]	Average heated area of a building

$$FES = \sum_{i=1}^{n} UFES_i$$

whereat it is as follows:

FES [kWh/year]	Total annual savings of final energy

Reference values should be used in cases when there is a lack of data for an individual project:

Reference values:	
□old	□old = □boiler • □dis•□em → Table 5
□average	□average = □boiler • □dis•□em → Table 5
□new	□new = □boiler • □dis•□em → Table 5
SHD	Table 6
SWD	Table 7
A	It is recommended to use actual data on the heated areas of a building.

Replacement of existent and purchase of new, more efficient vehicles

There are two typical cases:

a. replacement of old petrol or diesel powered vehicles with new, more efficient petrol or diesel powered vehicles (vehicles powered by other fuels, such as LPG or CNG, can also be taken into account). In this case, the calculation is based on the difference in fuel consumption of old and new vehicles, multiplied by the average annual mileage and the number of cars that were replaced.

b. purchase of new electric or hybrid vehicles. In this case it is required to have data on the energy consumption of electric vehicles, and savings are calculated based on the difference between the unit consumption of a vehicle with an internal combustion engine and an electric vehicle, which is then multiplied by the average annual mileage and the number of cars that were replaced (or newly purchased).

In case a), unit energy savings will be calculated using the following formula:

$$UFES = (FC_{OLD} \times f_{C\_OLD} - FC_{NEW} \times f_{C\_NEW}) \times D$$

$$FES = \sum_{i=1}^{n} UFES_i \times N_i$$

whereat it is as follows:

UFES [kWh/vehicle/year]	Unit energy savings in final consumption
FC_{OLD} [l/100 km]	Fuel consumption of old vehicle
FC_{NEW} [l/100 km]	Fuel consumption of new vehicle
F_{C_OLD} [kWh/l]	conversion factor l/100 km to kWh/100 km for old vehicles
f_{C_NEW} [kWh/l]	conversion factor l/100 km to kWh/100 km for new vehicles
D [km]	average mileage for a certain type of vehicle
FES [kWh/year]	Total annual energy savings in final consumption
N [number of vehicles]	Number of replaced or newly purchased cars covered by the measure

Whereat the conversion factors are as follows:

	Fuel consumption		
Fuel type	l/100 km or m^3/100 km	MJ/100 km [4]	kWh/100 km [5]
Petrol	1	34.4235	9.5622
Diesel	1	36.0899	10.0251
LPG	1	25.9771	7.2159
CNG	1	34.43	93.5640

In case b), for the purchase of new electric or hybrid vehicles, the data on energy consumption in kWh/100 km must be known for a new vehicle, which equals to the product of $FC_{NEW}xf_{C\_NEW}$ in the above formula.

Data on several types of electric and hybrid cars:

[4] 1 MJ = 0.27778 kWh

[5] The conversion factors were obtained from the annual energy report 'Energy in Croatia'. Those factors were used for drawing up the national energy balance. The basic unit of measurement for petroleum products (petrol, diesel and LPG) is kg, so the data on density were also taken into account.

Vehicle model	Final energy (Tank-to-Wheel) [kWh/100 km]	Primary energy (Well-to-Wheel) [kWh/100 km]	CO_2 emissions (Well-to-Wheel) [gCO2/km]
Toyota Prius	44	55	122
REVAi	11	30	50
QUICC!	14	39	63
TESLA Roadster	13	34	56
Nissan LEAF	15	41	67
Mitsubishi i-MiEV	10	27	45
Think	16	43	71
Smart Fortwo EV	12	33	53
Citroen C- Zero	13	35	58

In order to calculate energy savings, it is necessary to know the consumption of an equivalent vehicle with an internal combustion engine. Assuming that the average consumption is 7 litres/100 km (with city driving dominant), the equivalent energy consumption is approximately 67 kWh/100 km. This value can be used as a reference value for the product of FC_{OLD} x f_{c_OLD}. If the vehicle in question is not an automobile, e.g. a motorcycle or a special purpose vehicle (tourism vehicles and special vehicles for national parks), the reference assumption is that the equivalent petrol powered vehicle would consume three times more energy.

The last item of data required to calculate energy savings is the average annual mileage of a vehicle. Reference values can be used when there is a lack of specific data for each case:

Vehicle type	Average annual mileage (km/year)
Automobile	12 000
Lorry	38 000
Light delivery vehicle	18 300
Bus	54 700

For automobiles, the life cycle of the energy efficiency measure corresponds to a mileage of 100 000 km[6], which is equivalent to 8 years. This value will therefore be used as a reference for all vehicles.

Mandatory input data:

- *trade-in: average consumption of old and new vehicle;*
- *purchase of electric or hybrid vehicle: average consumption of new vehicle.*

[6] EMEEES project: http://www.evaluate-energy-savings.eu/emeees/en/evaluation_tools/bottom-up.php

Promoting eco-driving

The calculation of savings resulting from promoting eco-driving is based on recommended formulas and reference values for eco-driving programmes and projects developed by the EMEEES project:

$$UFES = E \times ER \times EC$$

$$FES = \sum_{i=1}^{n} UFES_i \times N_i$$

whereat it is as follows:

UFES [kWh/vehicle/year]	Unit energy savings in final consumption
E [%]	Efficiency – share of drivers who changed their habits as a result of the implemented eco-driving activity
ER [%]	Efficiency rate – effect on energy savings in %
EC [kWh]	Average energy consumption of activity participants in kWh
FES [kWh/year]	Total annual energy savings in final consumption
N [number of drivers]	Number of drivers who have undergone training/education or number of installed fuel consumption monitoring devices

Reference values were set for factors E and ER which represent the minimum amount of energy savings that can be expected to result from the measures. The values are recommended by the EMEEES project:

Type of activity	Efficiency E [%]	Efficiency rate ER [%]
Driver training (education)	26	7.5
Integration into the programme for obtaining a driving licence	26	7.5
Training on driving simulators	10	7.5
Installation of fuel consumption monitoring devices	67.5	3.8

It is necessary to know the number of participants in the activities in order to calculate total energy savings. In regard to the installation of fuel consumption monitoring devices, it is necessary to know the number of installed devices.

In regard to the life cycle of such activities, the data indicating that training effects annually decrease by 10 % was used within the EMEEES project framework, while European Commission guidelines set a duration time of 2 years. European Commission guidelines were used to calculate savings from the measures, and the duration time was set to 2 years.

EC is determined based on fuel consumption for a vehicle/driver participating in eco-driving activities, as well as on average annual mileage, i.e. it follows: EC is determined for every participant (driver) on the basis of the vehicle they drive. However, this value can also be determined from the national statistics, by dividing the total energy consumption in the transport sector with the number of drivers, or data on unit consumption for certain vehicle categories from the ODYSSEE database[7] can be used.

7 http://www.indicators.odyssee-mure.eu/energy-efficiency-database.html

In cases when there is a lack of data for an individual project, the reference values for EC (average annual energy consumption per eco-driving programme participant, per driver or vehicle) are:

- automobiles: 8 723 kWh/year
- Light delivery vehicles (<3.5 t): 46 520 kWh/year
- buses and lorries (>3.5 t): 120 720 kWh/year

Mandatory input data:

- *number of drivers who underwent training/education;*
- *number of installed fuel consumption monitoring devices.*

If possible, the recommended data are average fuel consumption before and after training/education.

Special motor vehicle tax based on CO_2 emissions

A national method for calculating savings resulting from the introduction of a special motor vehicle tax based on CO_2 emissions was developed. The special motor vehicle tax was introduced pursuant to the Act on Special Motor Vehicle Tax (NN Nos 15/13, 108/13). The introduction of the tax encourages the purchase of more energy efficient vehicles and vehicles with lower greenhouse gas emissions. Fuel (i.e. energy) savings are calculated based on price elasticity and, consequently, reduced greenhouse gas emissions, using the following formula:

$$UFES = \frac{(UE_{CO2BAU} - UE_{CO2M}) \times D}{EF_{FUEL}}$$

$$FES = \sum_{i=1}^{n} UFES_i \times N_i$$

whereat it is as follows:

UFES [kWh/vehicle/year]	Unit energy savings in final consumption
UE_{CO2BAU} [gCO2/km]	Unit emissions of the vehicle the customer would have purchased had the tax not been introduced
UE**CO2M** [gCO2/km]	Unit emissions of the vehicle the customer purchased because the tax was introduced
EF_{FUEL} [gCO2/kWh]	Unit emission factor for the fuel
D [km/year]	Average mileage for a certain type of vehicle
FES [kWh/year]	Total annual energy savings in final consumption
N [number of drivers]	Number of drivers who purchased automobiles with lower unit greenhouse gas emissions due to the tax. Determined based on the price elasticity of demand.

A representative price elasticity of demand must be set for vehicles that are subject to this Act, as well as the reference average unit reduction of emissions ($UE_{CO2BAU} - UE_{CO2M}$) per purchased vehicle included in this measure.

Reference values for unit emission factors for fuels[8]:

Fuel	EF [gCO2/MJ]	EF [gCO2/kWh][12]
Motor gasoline	69.30	249.48
Diesel	74.07	266.65

Mandatory input data:

- number of drivers who purchased automobiles with lower greenhouse gas emissions due to the tax;
- unit emissions of the vehicle the customer would have purchased had the tax not been introduced and unit emissions of the vehicle the customer purchased after the tax was introduced, or the difference of the two cases.

Replacement or installation of a new public lighting system

Annual energy savings result from the replacement of lighting fixtures (light bulbs) with new, more efficient ones, or from the reconstruction and installation of new, efficient lighting fixtures. Unit energy savings in final consumption are calculated as a difference of the nominal electric power of lighting fixtures in the reference year (power 'before' the implementation of the energy efficiency measure) and the nominal electric power of new lighting fixtures (power 'after' the implementation of the energy efficiency measure). The total annual energy savings are calculated by multiplying the unit energy savings with the number of installed new lighting fixtures.

The most frequently used light bulbs in the Croatian public lighting systems are mercury lamps. They are usually replaced with high-pressure sodium lamps, metal-halide lamps that offer the same light flow and the same lighting quality. In regard to the modernisation of public lighting with LED technology, the replacement of the lighting fixture (lamp) frame is also usually required. Furthermore, public lighting systems in Croatia frequently do not comply with the requirements of the standard HR EN 13 201, and co-financing energy efficiency measures requires a reconstruction of the system in order to comply with the requirements of the standard and other laws[9]. In those cases it is necessary to increase the light flow and/or reduce the distance between lighting fixtures and/or adjust the shape of lighting fixtures. Due to the aforementioned, savings calculations simulate a lighting situation with existent technologies, whilst meeting the transport safety indicators laid down by the standard HRN EN 13 201, and the associated energy indicators for such a configuration are calculated (installed power in kW and annual energy consumption in kWh/year)[10]. Such a simulated condition is regarded as the *reference current condition*, and is taken into account through the introduced simulation factor. In regard to the construction of new public lighting, the simulation is performed with mercury lamps of a 125, 250 or 400 W nominal power as a calculation assumption for the current condition.

Due to the aforementioned, there will be two different cases:

[8] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook

[8] 1 MJ = 0.27778 kWh

[9] Act on the Protection from Light Pollution (NN No 114/11) with relevant by-laws, Construction Act (NN No 153/13), and other technical regulations in force.

[10] In accordance with the Instructions for bidders for drawing up bids for EPEEF's public call for tender for direct co-financing of projects on energy efficient and environmentally friendly public and outdoor lighting, available at:
http://www.fzoeu.hr/hrv/index.asp?s=natjecajifzoeu
http://www.fzoeu.hr/hrv/pdf/JP%20JR%20Provedba%202014%20Upute%20pon.pdf

- a) replacement of light bulbs (which includes the possible replacement of lighting fixtures) without the reconstruction of the entire public lighting system, for systems which were compliant with the requirements of the HR EN 13 201 standard and other laws before the implementation of energy efficiency measures;

- b) reconstruction and application of energy efficiency measures in public lighting systems which are not compliant with the requirements of the HR EN 13 201 standard and other laws.

Formula for calculating savings in case a):

$$UFES = \frac{P_{OLD} \times n_{hOLD} - P_{NEW} \times n_{hNEW}}{1000}$$

$$UFES = \frac{P_{OLD} - P_{NEW} \times r}{1000} \times n_h$$

$$FES = \sum_{i=1}^{N} UFES_i \times N_i$$

whereat it is as follows:

UFES [kWh/light bulb/year]	Unit energy savings in final consumption
P_{OLD} [W]	Installed power before measure (W)
P_{NEW} [W]	Installed power after measure (W)
n_{hOLD} [h/year]	Number of operating hours of old light bulb per year
n_{hNEW} [h/year]	Number of operating hours of new light bulb per year. It usually follows that $n_{hOLD} = n_{hNEW}$, unless a new lighting management strategy is also introduced under the EnE measure. The effect of the new management strategy can be taken into account using the reduction factor r, which depends on the applied lighting management strategy, wherein it follows that $n_{hOLD} = n_{hNEW}$ x r
r	Reduction factor which depends on the applied public lighting management strategy, and it amounts to: 1 no management strategy 0.72 power reduced by 50 % from 23:00 to 6:00 0.65 power reduced by 100 % from 1:00 to 5:00
n_h [h/year]	Reference number of lighting system operating hours per year (h), n_h = 4 100 h/year
FES [kWh/year]	Total annual energy savings in final consumption
N [number of light bulbs]	Number of new light bulbs

It should be pointed out that, in the case of public lighting, power must be calculated by adding up the power of light bulbs, chokes, and by taking into account grid losses. In existing public lighting systems, choke and grid losses amount to approximately 25 %, and the power of light bulbs should be increased by the same amount. After installing new light bulbs and replacing chokes, the losses usually amount to approximately 19 %.

In cases when the entire public lighting system is reconstructed in order to comply with the requirements of the HR EN 13 201 standard and other laws (case b.), a simulation factor F_S is introduced. In those cases, it is necessary to observe the entire area in which the measures are being applied (e.g. street or square) when making calculations. The simulation factor is calculated by dividing the simulated number of light bulbs (which would comply with the requirements of the HR EN 13 201 standard and other laws) and the actual number of light bulbs before the application of measures:

$$F_S = \frac{N_S}{N_{OLD}}$$

$$P_{OLDS} = P_{OLD} \times F_S$$

$$UFES = \frac{P_{OLDS} \times h_{OLD} - P_{NEW} \times h_{NEW}}{1000}$$, wherein it is

$$UFES = \frac{P_{OLDS} - P_{NEW} \times \eta}{1000} \times n_h$$

$$FES = \sum_{t=1}^{n} UFES_t \times N_t$$

Wherein it is as follows:

N_s	Number of light bulbs before measure implementation
F_s	Simulation factor which is: <1 in the case when the existing system exceeds the requirements of the HR EN 13 201 standard 1 in the case when the existing system meets the requirements of the HR EN 13 201 standard >1 in the case when the existing system does not meet the requirements of the HR EN 13 201 standard, and the simulation shows that the distance between the pillars should be reduced or the power of the existing light bulbs should be increased 1.3 reference value for Croatia, however there are case-by-case differences and a simulation must be made[11]
P_{oLDS} [W]	Simulated light bulb power before the measures

The life cycle of this EnE measure is 15 years, as recommended by the EC.

Reference value for *UFES,* with $F_S = 1$*:*

- in the case of replacing 400 W mercury lamps with 250 W metal-halide lamps or 250 W high-pressure sodium lamps: 830 kWh/unit/year
- in the case of replacing 250 W mercury lamps with 150 W metal-halide lamps or 150 W high-pressure sodium lamps: 550 kWh/unit/year
- in the case of replacing 400 W mercury lamps with 135 W LED lamps and light bulbs: 1 390 kWh/unit/year
- in the case of replacing 250 W mercury lamps with 85 W LED lamps and light bulbs: 860 kWh/unit/year

Mandatory input data in case a):

- *the number, type and power of replaced light bulbs, and the number of operating hours per year or the reduction factor, if there was a public lighting management strategy;*
- *the number, type and power of new light bulbs, the number of operating hours per year or the reduction factor, if a public lighting management strategy is planned.*

[11] In accordance with the Instructions for bidders for drawing up bids for EPEEF's public call for tender for direct co-financing of projects on energy efficient and environmentally friendly public and outdoor lighting, available at:
http://www.fzoeu.hr/hrv/index.asp?s=natjecajifzoeu
http://www.fzoeu.hr/hrv/pdf/JP%20JR%20Provedba%202014%20Upute%20pon.pdf

Since lighting systems have energy consumption measuring devices, the users/parties obligated to implement energy management who have implemented such projects should be obliged to submit the metered values of electricity consumption before and after EnE measure implementation, which would provide the most accurate evaluation of savings, without expending great efforts for data collection.

Mandatory input data in case b):

- *the number, type and power of replaced light bulbs, the determined simulation factor, and the number of operating hours per year or the reduction factor, if there was a public lighting management strategy;*
- *the number, type and power of new light bulbs, the number of operating hours per year or the reduction factor, if a public lighting management strategy is planned.*