

MINISTRY FOR PROTECTION OF THE ENVIRONMENT AND ENERGY

**FOURTH NATIONAL ENERGY  
EFFICIENCY ACTION PLAN  
FOR THE PERIOD  
FROM 2017 TO 2019**

**ANNEX: MEASURES FOR ESTABLISHING AN  
ALTERNATIVE FUELS INFRASTRUCTURE**

**(unofficial version)**

April 2017

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## LIST OF ABBREVIATIONS

APN	Agency for Transactions and Mediation in Immovable Properties
ASSO	Agency for Vocational Education and Training and Adult Education
BAU	business as usual
GDP	gross domestic product
BU	bottom-up
CEI	Centre for Monitoring Business Activities in the Energy Sector and Investments
CVH	Vehicle Centre of Croatia
DGU	State Geodetic Administration
DOOR	Society for Sustainable Development Design
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
HBOR	Croatian Bank for Reconstruction and Development
HERA	Croatian Energy Regulatory Agency
HGI	Croatian Geological Survey
HGK	Croatian Chamber of Economy
HOPS	Croatian Transmission System Operator Ltd.
HROTE	Croatian Energy Market Operator
HSZG	Croatia Green Building Council
INA	Industrija nafte (Oil Industry)
IPMVP	International Performance Measurement and Verification Protocol
JANAF	Jadranski naftovod (Adriatic Oil Pipeline)
LRSGU	Local and regional self-government unit
MFIN	Ministry of Finance
MGIPU	Ministry of Construction and Physical Planning
MINGO	Ministry of the Economy
MINT	Ministry of Tourism
MMPI	Ministry of the Sea, Transport and Infrastructure

MRRFEU	Ministry of Regional Development and EU Funds
SME	Small and medium-sized enterprises
MSPM	Ministry of Demography, the Family, Youth and Social Policy
MZOE	Ministry of Protection of the Environment and Nature
MZOS	Ministry of Science, Education and Sports
NEEAP	National Energy Efficiency Action Plan
NCB	National energy efficiency coordinating body
RES	renewable energy sources
PBZ	Privredna banka Zagreb
UNDP	United Nations Development Programme
ZABA	Zagrebačka banka

### INTRODUCTION

It is with great pleasure that we present the **Fourth National Energy Efficiency Action Plan** for the period from 2017 to 2019. Energy efficiency represents a strategic commitment of the European Union, and as a full member of the European Union Croatia has recognised the importance of energy efficiency in the protection of the environment, thereby making this economically relevant issue one of its top strategic objectives.

Furthermore, Croatia has brought environmental and energy policy together in a single ministry, which was the first step towards harmonizing its energy and climate policies, in accordance with the EU policy apparent in the proposed package “Clean Energy for All Europeans”. The basic pillars of the clean energy policy, which require not only the commitment of the energy sector, but also a wider societal consensus, are energy efficiency, renewable energy sources and innovative technologies and development. The challenge faced by the creators of this “new” energy policy is no longer to ensure the supply of energy, but to “direct” a sustainable way towards an energy system so that the need for “cleaning” energy production does not put at risk societal progress or the productivity of the commercial sector.

The Government of Croatia has proven its commitment to this objective through many associated documents, with the three-year National Energy Efficiency Action Plans (NEEAP) representing comprehensive documents implementing energy efficiency policy, which all Member States of the European Union are required to produce. The production of an NEEAP includes over 180 different institutions responsible for implementing Croatia’s energy efficiency policy at different levels. One of the strategic documents is the Operational Programme Competitiveness and Cohesion 2014-2020, which promotes energy efficiency and the use of renewable energy sources in industry, tourism and the public and housing sectors.

After several years of implementation, we can see results and we have gained invaluable experience. The harmonization of national objectives with the interests of the investor and the interests of end energy consumers is an important implementation task. The results show that end consumers in the housing sector have recognized the energy efficiency measures proposed in the National Action Plan as an efficient way of reducing the total

costs, while the commercial sector has realized that investment in energy efficiency is actually investment in greater productivity. One of the key tools for boosting investments in energy efficiency is the Energy Efficiency Obligation Scheme (EEO, Article 7 of Directive 2012/27/EU on energy efficiency), which defines energy entities as obligated parties that shall achieve end-use energy savings and complements other national energy efficiency policies.

The thirty-seven measures of the Fourth National Action Plan build on the work towards meeting the objective by 2020. By using the top-down method, the savings achieved in 2015 are at 170 % of the 2016 objective, which means that the achieved savings are greater than the 2016 objective. This is in accordance with the estimates from previous National Action Plans, which indicated that the 2016 objective would be significantly surpassed in 2016. Energy efficiency represents the sustainable approach of our future, which is why we are all invited to participate in the creation of the present and should apply energy principles that will facilitate general welfare, economic safety and protection of the environment. During the next period, the emphasis is placed on combating energy poverty, development of sustainable transport and promoting energy efficiency in the industry and service sectors.



Associate Professor Slaven Dobrović, PhD, Minister for the Protection of the Environment and Energy

### 1 SUMMARY

The Fourth National Energy Efficiency Plan of the Republic of Croatia is a document that meets the obligations stipulated in the EPBD Directive (recast) (2010/31/EU), the EED directive (2012/27/EU) and the Directive on the deployment of alternative fuels infrastructure (2014/94/EU). The content of the Fourth National Action Plan (hereinafter: 4th NEEAP) is in accordance with the 3rd NEEAP and the document has been produced pursuant to EC Guidance for National Energy Efficiency Action Plans of 22 May 2013. As a comprehensive implementing document, the NEEAP defines the energy efficiency policy for the relevant three-year period (2017-2019) and features an evaluation of the achieved energy savings compared to the objectives set in the 3rd NEEAP of the Republic of Croatia until the end of 2015. For ease of reference, Table 3-1 in Chapter 3 provides an overview of all measures, with a reference to measures from the 3rd NEEAP.

The National Action Plan has been produced by the National energy efficiency coordinating body (NCB), which operates within the Centre for Monitoring Business Activities in the Energy Sector and Investments (CEI) in coordination with several ministries in charge of energy efficiency and many institutions and public bodies. Pursuant to the Energy Efficiency Act (OG 127/14), the CEI has been named the National energy efficiency coordinating body (NCB). It plays the role of national energy efficiency agency, and represents the main body for planning, coordination and implementation of energy efficiency policy in Croatia. The NCB has information on all the activities in the field of energy efficiency in Croatia and has a database of the energy savings achieved and verified at national level, which serves as the key tool for notifying the EC and defining the new cycle of measures necessary for achieving the national energy savings objective. The institutional structure, which is made up of ministries in charge of defining energy efficiency, the NCB as the national implementing agency and the Environmental Protection and Energy Efficiency Fund, which is in charge of financing, has been recognised as a crucial and necessary factor for achieving energy savings objectives in all Member States of the EU. Moreover, pursuant to the Act on the deployment of alternative fuels infrastructure (OG 120/16), the NCB has been assigned the role of national implementing body regarding the support and monitoring of alternative fuels policy.

The 2020 national objective has been amended and the projections of this objective have been revised, which changed the savings expressed in PJ [petajoule]. Although the EC guidelines provide for a special chapter for financing and savings for every subset of measures in Chapter 3, this document describes in detail, for every measure individually, what the sources of financing and savings projections are; this was included as aggregate information under the relevant chapters entitled "Financing of measures" and "Savings resulting from measures".

The second chapter of the document features information on the national objectives and achieved savings since the 3rd NEEAP. The indicative national target pursuant to Article 3 of the EED, expressed as the expected direct and primary energy consumption in 2020, has been revised in accordance with the latest projections of direct and primary energy consumption. It features an overview of achieved savings and progress made in the achievement of the national objective pursuant to the ESD, which provides for savings in the amount of 19.77 PJ by 2016 compared to 2007. In addition to the above, it is important to emphasize the national objective of increasing energy efficiency pursuant to Article 7 of the EED, which has been calculated as the cumulative objective of energy savings in end consumption in the period between 2014 and 2020 and amounts to 54.250 PJ, and the national objective of increasing energy efficiency pursuant to Article 5 of the EED, which provides for the obligation to renovate 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government and amounts to 0.00489 PJ/year.

As opposed to the methodology used in the 3rd NEEAP, the methodology used for calculating the savings and projection of savings in this document is based on the new Ordinance on the system for monitoring, measuring and verifying energy savings from June 2015, pursuant to Article 22 (1) of the Energy Efficiency Act (Official Gazette No 127/2014). The applied methodology is in accordance with the international EMEES (Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services) guidelines and the international

IPMVP protocol (International Performance Measurement and Verification Protocol). Furthermore, bottom-up and top-down calculations have been used, but the official information was obtained taking into account the top-down calculation seeing as how the bottom-up calculation covered only a minor part of savings.

Although the EC guidelines provide for a special chapter for financing and savings for every subset of measures in Chapter 3, this document describes in detail, for every measure individually, what the sources of financing and savings projections are; this was included as shortened and aggregate information under the relevant chapters entitles “Financing of measures” and “Savings resulting from measures”.

As opposed to the methodology used in the 3rd NEEAP, the methodology used for the calculation of savings and projection of savings in this document is based on the new Ordinance on the system for monitoring, measuring and verifying energy savings from June 2015, adopted pursuant to Article 22 (1) of the Energy Efficiency Act (Official Gazette 127/2014)- The applied methodology is in accordance with the international EMEEES (*Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services*) guidelines and the international IPMVP protocol (*International Performance Measurement and Verification Protocol*). Both bottom-up and top-down calculations have been used, but only the top-down calculation was used for the official information. The statistical data was obtained from the annual Energy in Croatia report, and the energy balance for 2015 was prepared using the EUROSTAT method.

October 2014 saw the adoption of Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure. All members of the European Union must adopt acts and other regulations for achieving compliance with the Directive. Croatia decided to adopt the Act; the National policy framework for the deployment of alternative fuels infrastructure is in the process of adoption. The Act established the common framework of measures for the deployment of alternative fuels infrastructure with the aim of minimizing the dependence on oil and petroleum products and mitigating the negative impact of transport on the environment. CEI has been designated as the National coordinating body for alternative fuels infrastructure.

The National Policy Framework is a strategic document establishing a common framework of measures for the development of market of alternative fuels in the transport sector and establishing the appropriate infrastructure and as such it gives a general overview of measures for the deployment of alternative fuels infrastructure, while the complete overview of measures on a 3-year basis shall be stipulated and revised within the framework of NEEAPs. This will enable the adoption of implementation measures in shorter intervals than those stipulated in the Directive, as well as the monitoring of their effects, their revision and the adoption of new measures, depending on the future needs of Croatia, which transcends the requirement of the Directive on the deployment of alternative fuels infrastructure.

The measures for the deployment of alternative fuels infrastructure have been developed under the 4th NEEAP and are thus harmonized by the implementation of the policy for energy efficiency and mitigation of climate changes. An overview of these measures is given in Annex 1.

Fourth National Energy Efficiency Action Plan of the Republic of Croatia for the Period from

Table 1-1 Overview of measures under the Fourth National Energy Efficiency Action Plan									
No	Title of the measure	Executive body	Body for monitoring, measuring and verifying savings	Sector	Financing EPEEF	Financing OTHERS	Total expected funds by the end of 2019	Expected energy savings by the end of 2019 (TJ)	Expected energy savings by the end of 2020 (TJ)
H.1	Informative billing (Energy diagnosis)	Distributors, suppliers, HERA, MZOE	NCB	Household, service, industry					
H.2	Info campaigns and promotion of energy services	NCB	NCB	All sectors					
H.3	Capacity building for combating energy poverty	EPEEF	NCB	All sectors	3 310 000.00		3 310 000.00		
H.4	Education in the field of energy efficiency	HZZ and ASSO	NCB	All sectors		60 240 000.00	60 240 000.00		
H.5	Programme for combating energy poverty	MZOE, EPEEF	NCB	Household	40 200 000.00		40 200 000.00	13.7	20.6
H.6	Establishing an integrated information system for monitoring energy efficiency implementation	NCB	NCB	All sectors	1 050 000.00		1 050 000.00		
B.1	Building regulations and implementation	MGIPU	NCB	Household, service, industry				505	505
B.2	Increasing the number of nearly zero energy buildings	MGIPU	NCB	Household, service, industry					
B.3	Fostering integral renovation of multifamily housing	MGIPU, building managers, distributors and suppliers of thermal energy	NCB	Household		1 582 500 000.00	1 582 500 000.00	2190	2920
B.4	Increasing energy efficiency and use of RES in the private service sector (tourism and trade)	MZOE and EPEEF	NCB	Service sector		300 000 000.00	300 000 000.00	242	349
B.5	Programme of energy renovation of family homes 2014 - -2020	MGIPU and MRRFEU	NCB	Household		228 000 000.00	228 000 000.00	1209	1612
B.6	Energy renovation of buildings and replacement of lighting within the HEP Group	HEP-Proizvodnja d.o.o	NCB.	Industry		22 650 358.00	22 650 358.00	32.75	48.77



Fourth National Energy Efficiency Action Plan of the Republic of Croatia for the Period from

Table 1-1 Overview of measures under the Fourth National Energy Efficiency Action Plan									
No	Title of the measure	Executive body	Body for monitoring, measuring and verifying savings	Sector	Financing EPEEF	Financing OTHERS	Total expected funds by the end of 2019	Expected energy savings by the end of 2019 (TJ)	Expected energy savings by the end of 2020 (TJ)
P.1	Continuation of funding of the Programme of energy renovation of public sector buildings 2014-2015	MGIPU, EPEEF and APN	NCB	Service sector	195 000 000.00		195 000 000.00	226.8	226.8
P.2	Programme of energy renovation of public sector buildings 2016 -2020	MGIPU, EPEEF and APN	NCB	Service sector		277 658 487.00	277 658 487.00	540	720
P.3	Systematic energy management in the public sector	APN and NCB	NCB	Service sector		17 580 000.00	17 580 000.00	1052	1352
P.4	'Energy Efficient Public Lighting' Programme	MZOE, NCB and EPEEF	NCB	Service sector		150 200 000.00	150 200 000.00	270	378
P.5	'Green' public procurement	MZOE, MINGO, Central Procurement	NCB	Service sector		Defined in the GPP NAP			
I.1	Industrial Energy Efficiency Network (IEEN)	EPEEF, NCB and HGK	NCB	Industry	90 000.00		90 000.00		
I.2	Improving energy efficiency in industrial production plants	MZOE, EPEEF and NCB	NCB	Industry		450 000 000.00	450 000 000.00	806	1164
T.1	Eco-driving training	EPEEF and NCB	NCB	Transport	4 416 000.00	6 624 000.00	11 040 000.00	52.5	70
T.2	Legislative adaptation to the provision on the deployment of alternative fuels infrastructure	MMPI, MZOIE, MGIPU, MINFIN, MoI	NCB	Transport					
T.3	Fostering integrated and intelligent transport and development of alternative fuels infrastructure on a local and regional level	EPEEF and LRSGU	NCB	Transport	21 500 000.00		21 500 000.00	210.8	415.1
T.4	Financial incentives for energy efficient vehicles	EPEEF	NCB	Transport	60 000 000.00	90 000 000.00	150 000 000.00	17	23
T.5	Development of alternative fuels infrastructure	EPEEF and LRSGU	NCB	Transport	24 100 000.00		24 100 000.00		

Fourth National Energy Efficiency Action Plan of the Republic of Croatia for the Period from

Table 1-1 Overview of measures under the Fourth National Energy Efficiency Action Plan									
No	Title of the measure	Executive body	Body for monitoring, measuring and verifying savings	Sector	Financing EPEEF	Financing OTHERS	Total expected funds by the end of 2019	Expected energy savings by the end of 2019 (TJ)	Expected energy savings by the end of 2020 (TJ)
T.6	Introduction of a special motor vehicle tax based on CO <sub>2</sub> emissions	MZOE and CVH	NCB	Transport				132	176
T.7	ELEN strategic project for the HEP Group	HEP Group	NCB	Transport					
HC.1	Detailed mapping of the energy system	MZOE, MGIPU, FSB, HGI and DGU	NCB	All sectors	1 100 000.00	750 000.00	1 850 000.00		
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	NCB	Industry		59 500 000.00	59 500 000.00	84.6	167.4
E.2	Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group	HEP-Proizvodnja d.o.o. Hydroelectric power plant sector	NCB	Industry		179 562 958.00	179 562 958.00	252	468
E.3	“Reduction of specific heat consumption of turbine 210 MW TPP PLOMIN”	HEP-Proizvodnja d.o.o. Thermal power plants sector	NCB	Industry		53 541 296.00	53 541 296.00		
E.4	Installation of new measurements of temperature and energy losses	HEP-Proizvodnja d.o.o. Thermal power plants sector	NCB	Industry		1 900 000.00	1 900 000.00		
E.5.	Improving energy efficiency in researching and production of oil	INA d.d.	NCB	Industry				36.72	55.8
E.6	Improving energy efficiency in oil refining	INA d.d.	NCB	Industry				1980	1980
E.7	Replacements and reconstructions of the hot water and steam network	HEP-Toplinarstvo d.o.o.	NCB	Industry			103 700 000.00	54	72
E.8	Measures for managing the energy power plants and short- and long-term development of the transport network	HOPS	NCB	Industry			300 000 000.00	174.96	285.12

Table 1-1 Overview of measures under the Fourth National Energy Efficiency Action Plan									
No	Title of the measure	Executive body	Body for monitoring, measuring and verifying savings	Sector	Financing EPEEF	Financing OTHERS	Total expected financing by the end of 2019	Expected energy savings by the end of 2019 (TJ)	Expected energy savings by the end of 2020 (TJ)
E.9	Reducing losses in the electric power distribution network	HEP ODS	NCB	Industry				108	144
E.10	Reducing losses in the natural gas transmission system	JANAF	NCB	Industry					
<b>Total</b>					350 766 000.00	3 480 707 099.00	4 235 173 099.00	10 189.83	13 152.59

### Statistical indicators

The last year for which there was national data at the time of writing of this document is 2015. According to the annual energy audit, it is evident that in 2015 the total energy consumption in Croatia in 2012 was 0.9 % lower than the previous year. Simultaneously, the gross domestic product was increased by 1.6 %, which resulted in the reduction of energy intensity of overall energy consumption by 2.5 %. In comparison to the average energy intensity in the European Union (EU28), the energy intensity in Croatia was higher by 29.4 %.

The total primary energy production in 2015 was by 6.7 % lower compared to the previous year. A reduction of 30.7 % was achieved in the exploitation of water potential, while the production of all other primary energy sources was increased. The increase in production for other renewable sources (wind power, solar power, biogas, liquid biofuels and geothermal energy) amounted to 3.4 %, while the production of wood fuel and other solid biomass was increased by 10.7 %. The production of crude oil was increased by 12.7 % and of natural gas by 1.8 %. The production of heat from heat pumps was increased by 20.3 %. In 2015 energy self-supply amounted to 57.1 %, which is 3.5 percentage points lower than the previous year.

Overall energy consumption in Croatia in 2014 dropped by 3.1 % compared to the overall consumption achieved during the previous year. Consumption of other renewable sources, which increased by 36.4 %, marked the biggest increase. Energy of water potential increased by 4.8 % thanks to very favourable hydrology, and the import of electricity amounted to 2.2 %. The consumption of other forms of energy decreased. The consumption of natural gas decreased by 11.4 %, consumption of wood fuel and biomass by 11.3 % and of liquid biofuels by 2 %. The consumption of heat from heat pumps dropped by 15.9 %, while the consumption of coal and coke fell by 1.8 %.

In the structure of total energy consumption, final energy consumption increased by 5.5 %, while transport and distribution losses rose by 3.8 %. Other energy needs in the structure of total energy consumption were lower. Energy conversion losses decreased by 19.5 %, while the energy consumption of power plants decreased by 6.5 %- Non-energy consumption was reduced by 1.9 %. In 2015 final energy consumption in industry was decreased by 0.5 % compared to the energy consumed during the previous year. At the same time, final energy consumption in the general consumption sector increased by 7.9 % and in transport by 4.5 %. During 2015 the efficiency of energy consumption in Croatia continued to improve compared to the previous period. Energy efficiency, expressed with the energy efficiency progress index, increased by 0.5 index points for all end-use energy consumers monitored as a whole. The aforementioned index decreased by 1.3 index points in industry, while the positive trend of its decrease also continued in transport and households. Thus the index decreased by 0.3 index points in transport and by 0.4 index points in households. The period between 1995 and 2015 saw the positive trend of decrease on the energy efficiency progress index by 20.1 % for all end-use consumers of energy as a whole. All sectors contributed to this positive change, but the biggest contribution came from industry, which improved the energy efficiency index by 32.8 %. For households, this improvement amounted to 17.6 %, and for transport to 15.9 %.

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<sup>1</sup> Ministry of the Protection of the Environment and Energy, Energy in Croatia 2015.

**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 for the Protection of the Environment and Energy
- Ministry of Construction and Physical Planning
- Ministry of the Sea, Transport and Infrastructure
- Ministry of Tourism
- Ministry of Internal Affairs
- Ministry of Enterprise and Small Business
- 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
- Faculty of Civil Engineering, University of Zagreb
- UNDP Croatia
- HSZG – Croatia Green Building Council
- Smart Grids Association
- DOOR – Society for Sustainable Development Design
- IMO – Institute for International Relations
- HRPSOR – Croatian Business Council for Sustainable Development
- HEP d.d.
- HEP-Proizvodnja d.o.o.
- 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,
- INA – Industrija nafte (Oil Industry)
- JANAF – Jadranski naftovod (Adriatic Oil Pipeline)
- PLINACRO
- IRENA – Istarska Regionalna Energetska Agencija (Istrian Regional Energy Agency)
- MENEJA – Međimurska energetska agencija d.o.o. (Medjimurje Energy Agency Ltd.)
- REA Kvarner – Regionalna energetska agencija Kvarner (Regional Energy Agency Kvarner)
- REA Sjever – Regionalna energetska agencija Sjever (Regional Energy Agency North)
- REGEA – Regionalna energetska agencija Sjeverozapadne Hrvatske (North-west Croatia Regional Energy Agency)
- HUB – Croatian Banking Association
- ZABA – Zagrebačka banka
- PBZ – Privredna banka Zagreb

- HBOR – Croatian Bank for Reconstruction and Development
- OTP banka
- HGK – Croatian Chamber of Economy
- EBRD – European Bank for Reconstruction and Development
- many privately owned companies operating in this field
- consortiums of several regional, national and international (EU) projects

## 2 OVERVIEW OF NATIONAL OBJECTIVES AND ACHIEVED SAVINGS

### 2.1 National energy efficiency targets for 2020

#### **National energy savings targets by 2016 and 2020 pursuant to the requirements of Directive 2006/32/EC on energy end-use efficiency and energy services (ESD)**

Under the Energy Strategy, the National Energy Efficiency Programme, and the First National Energy Efficiency Action Plan, Croatia set itself the target of reducing final energy consumption in 2016 by 19.77 PJ, in accordance with the requirements of ESD. The target is in accordance with the absolute amount of 9 % of average final energy consumption between 2001 and 2005.

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 potential by sector. However, the sectoral distribution represents only the indicative target. The target and the sectoral distribution are shown in Table 2-1.

**Table 2-1** National energy savings target in final consumption for 2016

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

For 2020 the energy savings target was set at 22.76 PJ. The target is in accordance with the absolute amount of 10 % of average final energy consumption between 2001 and 2005.

The achievement of these targets is monitored pursuant to the requirements of the ESD and the Ordinance on the methodology for monitoring, measuring and verifying energy savings (OG 71/2015), applying the top-down and bottom-up methods.

#### Change in historic energy consumption

In 2015, a survey on energy consumption in households and services for 2012 was carried out under the EU IPA programme (Data on energy efficiency in households and services in 2012, DZS, 2015).

The survey showed a significant increase in the consumption of biomass energy compared to the previous data in the energy balance. In 2012 the consumption of **wood fuel in the households sector increased** from 21.43 PJ to 47.96 PJ, i.e. by **31.22 PJ**, or 123.8 %. Thus final energy consumption in all general consumption sectors increased by 24.7 %, final energy consumption in all sectors increased by 12.2 %, and total energy consumption rose by 8.6 % compared to the data before the survey. Based on this data, a correction of consumption of biomass energy was carried out for other historic years (for the period between 1990 and 2015).

During 2016, new projections of final and primary energy consumption were prepared; they include data on energy consumption from the revised energy balances. New projections were harmonized with the Low Carbon Development Strategy of the Republic of Croatia by 2030 with an outlook to 2050. The Low Carbon Development Strategy applies to all sectors of the economy and has a horizontal effect, which means that the sectoral development and strategic documents, including the Energy Development Strategy, must be aligned with the principles, basic objectives, priorities and measures of low carbon development.

Table 2-2 and Figure 2-1 show the historic consumption and projections of energy consumption by 2020.

**Table 2-2** Achieved consumption and projections of energy consumption

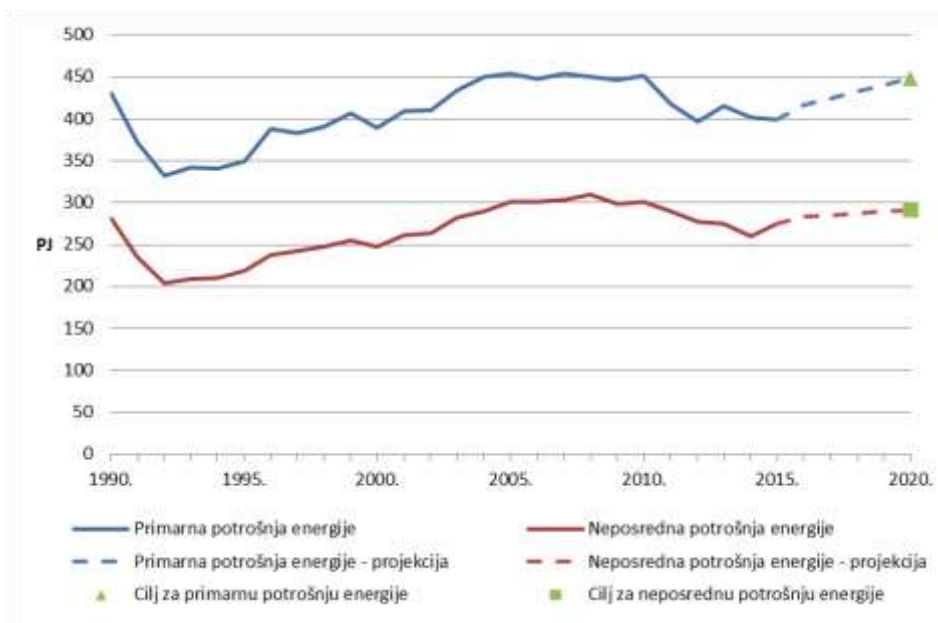
PJ	Achieved			Projection
	2007	2010	2015	2020
Primary energy consumption	453.9	451.5	398.8	448.5
Final energy consumption	303.4	300.9	275.2	291.3

Source: EIHP, EKONERG

**Indicative national target for increasing energy efficiency pursuant to Article 3 of the EED**

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 **291.3 PJ (6.96 Mtoe)**,
- the corresponding target expressed as the absolute amount of primary energy in 2020 is **448.5 PJ (70.71 Mtoe)**.



**Figure 2-1.** Primary energy and final energy consumption

*Primarna potrošnja energije = Primary energy consumption; Primarna potrošnja energije – projekcija = Primary energy consumption, projection; Cilj za primarnu potrošnju energije = Primary energy consumption target; Neposredna potrošnja energije = Final energy consumption; Neposredna potrošnja energije - projekcija = Final energy consumption - Projection; Cilj za neposrednu potrošnju energije = Final energy consumption target*



The estimate of primary energy consumption and energy consumption by 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	Amount	Unit
Total primary energy consumption	448.5	PJ
Fuel consumption in condensing power plants	11.0	PJ
Electricity production in condensing power plants	3.7	PJ
Fuel consumption in co-generation	42.3	PJ
Electricity and heat production from co-generation	22.0	PJ
Transmission and distribution losses (all energy forms)	9.9	PJ
Total final energy consumption	291.3	PJ
Final energy consumption – Industry	44.9	PJ
Final energy consumption – Transport	87.3	PJ
Final energy consumption – Households	111.9	PJ
Final energy consumption – Services	33.1	PJ
Final energy consumption – Construction	4.7	PJ
Final energy consumption – Agriculture	9.5	PJ

## 2.2 Additional energy efficiency objectives

### **National objective of increasing energy efficiency pursuant to Article 7 of the EED**

Cumulative end-use energy savings target from 1 January 2014 to 31 December 2020 amounts to **54.250 PJ**.

A detailed description of the methodology for calculating the target and the method for achieving the target is shown in Chapter 3.1.1.

### **National objective of increasing energy efficiency pursuant to Article 5 of the EED**

The national renovation target of 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government and amounts to **0.00489 PJ/year**.

A detailed description of measures for achieving this target is given in Chapter 3.3.1.

### 2.3 Primary energy savings

No methodology has been prescribed for estimating savings in primary energy consumption that result from the application of energy efficiency measures. In this NEEAP the primary energy savings are considered as the consequence of two main causes:

- primary energy savings due to measures for increasing the efficiency of transformations and reducing losses in transmission and distribution,
- primary energy savings due to energy savings in final consumption.

The estimated savings that result from the measures for increasing energy efficiency in energy transformation, transmission and distribution in the previous period were taken from companies that implemented the measures in these sectors, and the estimated primary energy savings in 2016 and 2020 are described in Chapter 3.6.

The starting point for estimating primary energy savings are the savings calculated using the TD method. There are different consequences for primary energy savings depending on the type of energy savings in final consumption, which is each type of saved energy is multiplied by an appropriate *primary energy factor* (MGIPU, 2014) in order to calculate the impact on reduced primary energy consumption.

The savings were studied compared to 2007.

Table 2-4 provides an overview of achieved and estimated primary energy savings.

**Table 2-4** Achieved and estimated primary energy savings

PJ/year	2010 - achieved	2015 - 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	7.91	9.79	13.23
Savings in primary energy consumption due to higher efficiency in final consumption (TD method)*	15.62	39.60	32.85	42.03
Total primary energy savings in comparison to 2007	17.76	47.51	42.63	55.26

\* Described in the next chapter 2.4.

According to the described methodology for estimating achieved energy savings, the achieved primary energy savings in 2015 amounted to 55.3 PJ compared to 2007. According to the energy balance (MZOE, 2016), in 2015 Croatia saw primary energy consumption of 398.8 PJ, which is by 55.1 PJ less than the 2007 consumption, which amounted to 453.9 PJ. These methodologies do not establish the real causes of savings and less consumed energy, which vary; some of the causes are the implementation of energy efficiency measures, demographic trends or changes in economic activities.

## 2.4 Energy savings in final consumption

### Calculation obtained by applying the top-down method

The savings achieved in 2010 and 2015 were calculated by using the top-down indicators, in accordance with the Ordinance on the methodology for monitoring, measuring and verifying energy savings (OG 71/2015). The total achieved savings and sectoral distribution in 2010 and 2015 are shown in Table 2-5. The degree of target achievement for 2016 pursuant to the ESD is also shown.

**Table 2-5** Progress overview for target achievement, estimated by using the TD method

Sectoral distribution of targets	2010		2015		2016	
	Achieved savings (PJ)	Share (%)	Achieved savings (PJ)	Share (%)	Sectoral targets pursuant to the ESD (PJ)	Share in the overall target (%)
Households	9.74	73%	20.23	60%	6.70	34%
Services	0.00	0%	0.00	0%	3.64	18%
Industry (non-ETS)	2.32	17%	6.48	19%	3.40	17%
Transport	1.36	10%	6.86	21%	6.03	31%
TOTAL	13.42	100 %	33.57	100 %	19.77	100%
Degree of target achievement for 2016 (%)	68%		170%		100%	

It is evident that, by applying the TD method, the achieved savings in 2015 were at 170 % of the 2016 target, which means that the achieved savings exceeded the 2016 target. This is in accordance with the estimates from previous National Action Plans, which indicated that the 2016 target would be significantly surpassed in 2016.

In comparison to 2010, savings have increased in every sector except for the services sector, while the household sector saw the highest increase. However, it should be pointed out that, when calculating savings in accordance with the Ordinance on the system for monitoring, measuring and verifying energy savings in final consumption (OG 71/15), 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, the TD method determines savings taking into account the consumption of energy per activity unit. In the services sector energy consumption per number of employees is observed. Seeing as how the consumption of energy in the services sector, especially tourism, depends on many factors, such as the increase in the number of visitors and in the number of air conditioning units, etc., it is possible to explain why it was estimated that this sector did not achieve savings. The services sector is also the sector where minimal indicators were used due to a lack of data for calculating preferred indicators (see below).

For the purpose of calculating energy savings achieved in 2015, TD indicators pursuant to the Ordinance on the system for monitoring, measuring and verifying energy savings in final consumption (OG 71/15) were used. The methodology stipulated by the Ordinance is in accordance with the EED. The data obtained from the Croatian Bureau of Statistics, the Meteorological and Hydrological Service, data from the energy balance of the Republic of Croatia (MZOE), data from the ODYSSEE database, the Ministry of Internal Affairs, 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 2015. 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 2-6.

**Table 2-6** Overview of TD indicators used for calculating and reporting achieved energy savings

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		+	-	

**Calculation obtained by applying the bottom-up method**

Table 2-7 shows the achieved savings estimated applying the bottom-up 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 incentive energy efficiency policy. Total achieved savings and the sectoral distribution in 2010 and 2015 are shown in Table 2-7. The degree of target achievement for 2016, measured by applying the BU method, is also shown. An overview of savings by measures and sources of funding is shown in tables 2-8 and 2-9.

**Table 2-7** Progress overview for target achievement, estimated by using the BU method in accordance with ESD

Sectoral distribution of targets	2010		2015		2016	
	Achieved savings (PJ)	Share (%)	Achieved savings (PJ)	Share (%)	Sectoral targets (PJ)	Share in the overall target (%)
Households	1.53	43%	2.25757	41%	6.70	34%
Services	1.32	37%	2.43853	45%	3.64	18%
Industry (non-ETS)	0.6	17%	0.60620	11%	3.40	17%
Transport	0.08	2%	0.14535	3%	6.03	31%
TOTAL	3.53	100%	5.44765	100%	19.77	100%
Degree of target achievement for 2016 (%)	18%		28%		100%	

The BU method estimate shows that the achievement of target savings in 2010 was at 18 % of the 2016 target, while the estimate for 2015 was at 28 % of the said target. Table 2-7 serves as a comparison of the degree of target achievement using the BU method that, unlike the TD method, does not encompass all implemented measures; however, it demonstrates that, even by separated collection of data on every project, the said target is achieved at approximately 30 %.

Table 2-8 provides an overview of achieved savings of all measures from the 3rd NEEAP monitored and verified via the System for monitoring, measuring and verifying energy savings in final consumption. It should be noted that this only shows verified measures subsidised by Croatia, while the exact information on other measures entered in the System for monitoring, measuring and verifying energy savings in final consumption is expected by the end of 2017, which means that the total amounts of savings using the BU method will further increase.

**Table 2-8** Overview of achieved annual savings using the BU method during the 3rd NEEAP (2014- 2016)

INDEX to measures under the 3 <sup>rd</sup> NEEAP	Title of the measure	Savings [PJ]	Savings [tCO <sub>2</sub> ]	Total amount of investment [HRK]	Total funds paid out from the Fund [HRK]
	RESIDENTIAL BUILDINGS				
B.6.	Programme of energy renovation of family homes 2014 - 2016	0.70014	28 591.66	778 492 028.45	487 329 822.20
B.3.	Programme of energy renovation of multifamily housing	0.1495	11 478.41	154 535 990.29	61 997 642.77
H.2.	Introduction of the individual metering system of the consumption of heat energy	0.30553	24 266	116 930 071.23	46 313 643.72
	PUBLIC SECTOR BUILDINGS				
P.1.	Programme of energy renovation of public sector buildings (2014 - 2015)	0.17711	13 192.02	344 258 164.79	155 309 742.45
P.2.	Programme of energy renovation of public sector buildings (2016 - 2020)	0	0	0	0
	COMMERCIAL NON-RESIDENTIAL				

B.4.	Programme of energy renovation of commercial non-residential buildings	0.04355	3 364.08	49 781 776.24	20 279 641.08
	PUBLIC LIGHTING				
P.4.	'Energy Efficient Public Lighting' Programme	0.08175	8 045.46	160 986 313.89	84 028 721.96
	TRANSPORT				
T.6.	Financial incentives for energy efficient vehicles	0.032646	2 889.61	207 250 726.57	39 996 341.06
T.1.	Promoting eco-driving	0.03686	2 731.51	2 986 214.63	977 649.24
T.9.	Introduction of a special motor vehicle tax based on CO2 emissions	0	0	0	0
	TOTAL	1.52709	94 559.20	1 815 221 286.09	896 233 204.48

### Overview of achieved savings by 2015 and expected savings by 2020

Table 2-10 provides a comparison of achieved savings according to TD and BU methods for 2010 and 2015 and the comparison of expected savings pursuant to the TD method regarding 2016 and 2020 targets, in accordance with the requirements of the ESD.

**Table 2-10** Summary overview of targets and achieved savings per sector in final consumption

PJ/year	Achieved energy savings				Expected energy savings			
	2010		2015		2016		2020	
	BU	TD	BU	TD	BU	TD	BU	TD
Households	1.53	9.74	2.25	20.23	2.80	15.77	7.36	20.36
Services	1.32	0.00	2.44	0.00	2.52	1.53	4.24	1.36
Industry (non-ETS)	0.6	2.32	0.60	6.48	0.64	6.56	1.80	7.54
Transport	0.08	1.36	0.14	6.86	0.15	3.99	0.24	6.37
TOTAL	3.53	13.42	5.44	33.57	6.11	27.84	13.65	35.63

TD estimates for 2016 show that the achieved savings could be slightly lower than the ones achieved in 2015<sup>2</sup>, and, considering the indicative sectoral targets, it is possible that the indicative savings targets in services and transport sectors may not be achieved. However, it is expected that savings in the households and industry sectors will be greater than the indicative targets. Therefore, it is expected that the energy savings target for 2016 pursuant to the requirements of the ESD and the established national savings target for 2020 will be achieved with the estimate obtained using the TD method. The table provides an overview of the savings achieved for 2016 according to the BU method; for the TD method, the estimate of expected savings is given.

<sup>2</sup> Projections have been made using minimal indicators projections, and not preferred indicators projections.

### 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. The contents have been adjusted to facilitate compliance with the obligations laid down in the EED. A table providing a summary overview of all of the measures of the 4th NEEAP was featured in previous chapters. The said table also provided references to the measures of the 3rd NEEAP. The chapters of the 4th 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 bodies	P
4. Industry	I
5. Transport	T
6. Heating and cooling	HC
7. Energy transformation, distribution, transmission and demand response	E

Table 3-1 shows all measures of the 4th NEEAP compared to the measures from the 3rd NEEAP.

**Table 3-1** Overview and status of the measures of the 4th NEEAP

Overview and status of the measures of the 4th NEEAP				
	List of measures	Ref. to index measures of the 3rd NEEAP	Status of the measure	Chapter
H.1	Informative billing (Energy diagnosis)	H.5	Retained, updated	3.1.4
H.2.	Info campaigns and promotion of energy services	H.6	Retained, updated and extended by the activities of measure H.8 Promotion of energy services	3.1.4
H.3	Capacity building for combating energy poverty		New measure	3.1.4
H.4	Education in the field of energy efficiency	H.7	Retained, updated	3.1.5
H.5	Programme for combating energy poverty		New measure	3.1.7
H.6	Establishing an integrated information system for monitoring energy efficiency implementation	H.9	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.2	Retained, updated	3.2.1
B.3	Fostering energy renovation of multifamily housing	B.3	Retained, updated	3.2.2

B.4	Increasing energy efficiency and use of RES in the private service sector (tourism and trade)	B.4	Retained, renamed and adapted to the MZOE programme	3.2.2
B.5	Programme of energy renovation of family homes 2014 -2020	B.6	Retained, completely amended	3.2.3
B.6	Energy renovation of buildings and replacement of lighting within the HEP Group		New measure	3.2.3
P.1	Continuation of funding of the Programme of energy renovation of public sector buildings 2014-2015	P.1	Retained, updated	3.3.1
P.2	Programme of energy renovation of public sector buildings 2016-2020	P.2	Retained, updated	3.3.1
P.3	Systematic energy management in the public sector	P.3	Retained, renamed and updated	3.3.1
P.4	'Energy Efficient Public Lighting' Programme	P.4	Retained, updated	3.3.2
P.5	'Green' public procurement	P.5	Retained, updated	3.3.3
I.1	Industrial Energy Efficiency Network (IEEN)	I.1	Retained, updated, promotes activities of new measure I.2	3.4.1
I.2	Improving energy efficiency in industrial production plants	I.2. I.3 and I.4	New measure, brings together measures I.2, I.3 and I.4	3.4.1
T.1	Eco-driving training	T.1	Retained, updated	3.5.1
T.2	Legislative adaptation to the provision on the deployment of alternative fuels infrastructure		New measure	3.5.1
T.3	Fostering integrated and intelligent transport and development of alternative fuels infrastructure on a local and regional level	T.4 and T.8	New measure, brings together measures T.4 and T.8	3.5.1
T.4	Financial incentives for energy efficient vehicles	T.6	Retained, updated	3.5.1
T.5	Development of alternative fuels infrastructure	T.7	Retained, updated	3.5.1
T.6	Introduction of a special motor vehicle tax based on CO <sub>2</sub> emissions	T.9	Retained, updated	3.5.1
T.7	ELEN strategic project for the HEP Group		New measure	3.5.1
HC.1	Detailed mapping of the energy system		New measure	3.6
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	E.1	Retained, updated	3.7
E.2	Improving efficiency by revitalising the existing hydroelectric power plants within the HEP Group	E.2	Retained, updated	3.7
E.3.	"Reduction of specific heat consumption of turbine 210 MW TE PLOMIN"		New measure	3.7
E.4	Installation of new measurements of temperature and energy losses		New measure	3.7
E.5	Improving energy efficiency in researching and production of oil	E.3	Retained, updated	3.7
E.6	Improving energy efficiency in oil refining	E.4	Retained, updated	3.7
E.7	Replacements and reconstructions of the hot water and steam network	E.5	Retained, updated	3.7.2



E.8	Measures for managing the energy power plants and short- and long-term development of the transport network		New measure	3.7.2
E.9	Reducing losses in the electric power distribution network	E.7	Retained, updated	3.7.2
E.10	Energy efficiency in the natural gas transmission system		New measure	3.7.2

### 3.1 Horizontal measures

All existing measures under the 3rd NEEAP have been revised; some have been suspended, while others have been consolidated. Furthermore, the advantages of introducing new measures with a great potential for intersectoral contribution have been observed.

### ***3.1.1 Energy efficiency obligation schemes and alternative policy measures (Article 7 and Annex XIV Part 2 of the EED)***

As provided in the 3rd NEEAP, Croatia has opted for an alternative approach, i.e., a combination of alternative policy measures and energy efficiency obligation schemes. Alternative policy measures are implemented fairly well and are reported to the EC on an annual basis, pursuant to the requirement of the EED. Alternative measures are given in more detail and the latest results of achieved savings are presented below. The beginning of implementation of the energy efficiency obligations scheme in Croatia has been postponed; it will begin as soon as the Energy Efficiency Act has been amended. The target for the obligation schemes is some 40 % of the total target from Article 7 of the EED; Croatia will meet the remaining 60 % through alternative policy measures.

The energy efficiency coordinating body (NCB) is responsible for implementing the obligation scheme. The NCB proposes the establishment of the obligation scheme to the Ministry of Protection of the Environment and Energy. Suppliers of electricity, gas, oil and petroleum products shall be the obligated parties. Smallest suppliers shall not be included in the obligations scheme. Some 40 entities should be included in total. The savings obligation shall be calculated individually for each obligated party taking into account their supplied energy in the final consumption sector.

It will be possible to achieve savings in all final consumption sectors (including transport and industry). In the event that an obligated party does not meet the targets, it shall pay a contribution into the Environmental Protection and Energy Efficiency Fund equivalent to a fixed amount of every kWh of unachieved savings.

The Ordinance on the system for monitoring, measuring and verifying energy savings in final consumption for most common standard energy efficiency measures has been adopted. This system is managed by the NCB, which has the function of the national energy efficiency agency in Croatia. The NCB uses this system with great success and it serves for BU monitoring of achievement of targets from articles 1, 3, 5 and 7 (in the alternative policy measures part) of the EED and the execution of the government of Croatia and the EC.

#### ***Calculation methodology for energy savings targets***

Article 7 of the EED stipulates that the cumulative energy savings target in final consumption shall 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, by volume, used in transport may be partially or fully excluded from this calculation.

Annual energy sales to final customers (final energy consumption) of all energy distributors or all retail energy sales has been averaged over the most recent three-year period prior to 1 January 2013 i.e., for 2010, 2011 and 2012. The used data was obtained from the energy balance of Croatia according to the IEA methodology (Table 3-2).

**Table 3-2** Final energy consumption (excerpt from the energy balance of Croatia)

PJ	2010	2011	2012
<b>FINAL ENERGY CONSUMPTION</b>	<b>265.839</b>	<b>259.186</b>	<b>247.527</b>
<b>INDUSTRY</b>	<b>50.298</b>	<b>46.964</b>	<b>41.560</b>
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
<b>TRANSPORT</b>	<b>86.892</b>	<b>84.974</b>	<b>84.018</b>
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
Maritime and river	1.650	1.654	1.577
Public transportation	1.447	1.408	1.349
Other	0.177	0.075	0.069
<b>GENERAL CONSUMPTION</b>	<b>128.649</b>	<b>127.248</b>	<b>121.949</b>
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

Pursuant to Article 7(1) of the EED, the amount of sold energy used in the transport sector is excluded from this calculation (Table 3-3).

**Table 3-3** Determining average final energy consumption

PJ	2010	2011	2012	Average 2010 -2012
Final energy consumption	265.839	259.186	247.527	
Transport	86.892	84.974	84.018	
<b>FINAL ENERGY CONSUMPTION - TRANSPORT</b>	<b>178.947</b>	<b>174.212</b>	<b>163.508</b>	<b>172.222</b>

Pursuant to Article 7(1) of the EED, 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 3-4.).

**Table 3-4** Setting a target taking into account Article 7(1) of the EED

Article 7(1)								
Savings by 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								<b>72.333</b>
ANNUAL								<b>2.583</b>

Article 7(2) and (3) of the EED specifies 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) calculating energy savings achieved in the energy transformation, distribution and transmission sectors;
- d) calculating 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 EED, the cumulative amount resulting from all the chosen options cannot exceed 25 % of the savings laid down in Article 7(1) (Table 3-5).

**Table 3-5** Application of the reduction factor

	Annual savings (PJ)	Cumulative savings (PJ)	Reduction of cumulative savings
Energy savings pursuant to Article 7(1) of the EED	2.583	72.333	-
Application of Article 7(3) of the EED	1.938	55.250	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).

**Table 3-6** National energy savings target for the 2014-2020 period

Target								
Savings by 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								<b>54.250</b>
ANNUAL								<b>1.938</b>

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

**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 3-7 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.

As evident from Table 3-7, total savings planned to be achieved through alternative policy measures by 2020 amount to 30.722 PJ. The effects of measures calculated using the BU methodology are monitored through the system for monitoring, measuring and verifying energy (SMIV).

**The national energy savings target pursuant to Article 7 of the EED is planned to be achieved: 57 % by implementing alternative policy measures and 43 % through the energy efficiency obligations scheme.**

**Table 3-7** Policy measures in sectors of final energy consumption

Title of the measure	Annual savings (PJ)							TOTAL
	2014	2015	2016	2017	2018	2019	2020	PJ
<b>RESIDENTIAL BUILDINGS</b>								
Energy renovation of family homes	0.068	0.337	0.364	0.364	0.767	1.170	1.573	4.640
Energy renovation of multifamily housing	0.037	0.273	0.434	0.638	1.368	2.098	2.828	7.695
Combating energy poverty	0.000	0.000	0.000	0.000	0.007	0.014	0.021	0.041
<b>PUBLIC SECTOR BUILDINGS</b>								
Energy renovation of public sector buildings	0.000	0.124	0.177	0.253	0.508	0.764	0.944	2.770
Systematic energy management in the public sector	0.000	0.682	1.363	1.698	2.033	2.415	2.069	10.259
<b>COMMERCIAL BUILDINGS</b>								
Energy renovation of commercial non-residential buildings	0.000	0.027	0.051	0.051	0.159	0.266	0.373	0.927
<b>PUBLIC LIGHTING</b>								
Energy efficiency of public lighting systems	0.048	0.068	0.082	0.082	0.190	0.298	0.406	1.173
<b>INDUSTRY</b>								
Energy efficiency in manufacturing industries	0.000	0.026	0.055	0.055	0.413	0.772	1.130	2.451
<b>TRANSPORT</b>								
Energy efficient vehicles	0.022	0.029	0.033	0.036	0.048	0.063	0.081	0.310
Eco-driving training	0.019	0.036	0.018	0.018	0.036	0.036	0.036	0.198
Special motor vehicle tax based on CO2 emissions	*	*	*	0.044	0.088	0.132	0.176	0.440
City bicycle system	*	*	*	0.001	0.001	0.001	0.001	0.003
<b>TOTAL</b>	<b>0.193</b>	<b>1.601</b>	<b>2.598</b>	<b>3.238</b>	<b>5.616</b>	<b>8.026</b>	<b>9.636</b>	<b>30.908</b>
* A study must be conducted								

Between 2014 and 2016 cumulative savings in the amount of 4.392 PJ have been achieved. Considering the life cycle of implemented measures, by 2020 they shall cumulatively contribute to savings in the amount of 14.029 PJ, which is 26 % of the national target pursuant to Article / of the EED; or approximately 45 % of the alternative measures target.

The contribution of alternative policy measures between 2017 and 2020 was estimated in accordance with the measures described herein, taking into account the usual time lapse between contracting and implementation of projects and the status of contracting projects in 2016. Due to the above, the estimates of new savings for some measures in Table 3-7 are different from estimates described below.

### 3.1.2 Energy audits and consumption management systems (Article 8 of the EED)

By 28 February 2017,

- the authorization for implementing the training programme for performing energy audits of large companies was issued to 5 legal persons.
- 28 legal persons is authorized to perform energy audits of large enterprises.
- The number of energy audits of large enterprises in the energy audits reports register in 8; the estimated investment in measures for these 8 companies amounts to HRK 79 million.
- The number of natural persons who have completed the training programme is available from persons who are authorized to perform the training programme.

The energy audit obligation for large enterprises is stipulated in Article 19 of the Energy Efficiency Act (OG 127/14); this article transposes the obligation from Article 8 of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency into the national legislation. The manner of conducting a large enterprise energy audit, conditions for issuing and revoking authorizations for large enterprises energy audits and other issues concerning authorizations for large enterprises energy audits, as well as the contents and management of the register are laid down in the Ordinance on energy audits for large enterprises (OG 123/15).

According to accounting criteria, large enterprises are defined as companies meeting at least two of the following requirements: total assets of no less than HRK 130,000,000.00, annual turnover of no less than HRK 260,000,000.00, an average of no less than 250 workers during the financial year. Large enterprises shall conduct an energy audit of the enterprise every four years; the energy audit shall be carried out by persons authorized by the ministry in charge of energy. Registers of authorized persons and reports on conducted energy audits for large enterprises shall be conducted by the Ministry of Protection of the Environment and Energy.

The mandatory parts of the final report of a large enterprise energy audit are as follows:

1. cover page of the energy audit, which shall feature: name and seal of the authorized legal person, name and surname of the designated person who has prepared the audit, start and end dates of the energy audit,
2. analysis of the current state of the building and all energy systems of the large enterprise,
3. if the company uses 50 or more registered vehicles or if the power of all registered vehicles owned by the company exceeds 3000 kW, transport analysis, which shall include at least a list of vehicles and an analysis of consumption of energy and energy sources,
4. analysis of consumption of energy and energy sources and water, which shall include at least a detailed overview of the consumption of energy, energy sources and water, model of the consumption of energy, energy sources and water and an analysis of efficiency of water consumption,
5. diagram of energy, matter, water and waste flow,
6. report on implemented measurements,
7. analysis of the possibility of connecting to the distribution network of a central and closed heating system and central cooling system, and
8. conclusion with recommendations of measures for increasing energy efficiency, including a calculation of estimated value of investment and internal rate of profitability for the life cycle of an energy efficiency measure, based on the data obtained in accordance with Article 8(1)(2) to (7) of the Ordinance on energy audits for large enterprises (OG 123/15).

Large enterprises may not conduct an energy audit in accordance with the Ordinance if they implement the ISO 50000 standard into their operations and obtain a certificate issued by an authorized person.

### 3.1.3 Metering and billing (Articles 9 to 11 of the EED)

These measures shall not be incentivised during the 4th NEEAP, but the effects of previous periods shall be continued to be monitored through the SMIV (system for monitoring, measuring and verifying energy savings in final consumption). However, in the future these measures shall be implemented by parties obligated under the Energy Savings System (energy utilities).

### 3.1.4 Consumer information and training programmes (Articles 12 to 17 of the EED)

Title of the measure		Informative billing (Energy diagnosis)
Measure index		H.1
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2019 Planned major modifications, amendments, improvements: updated measure
	Objective / outline	<p>The objective of the measure are 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.</p> <p>Overview and comparison of energy costs are an important requirement for changing consumers' behaviour and making decision on the technical measures for saving energy. In order for the supplier to inform the consumer in an appropriate manner, in addition to monthly bills, it must also deliver data on the comparison and trends of monthly consumption. Current legislation (the Energy Efficiency Act) stipulates that the consumer be informed of the total state of consumption on an annual basis and of sources providing information on possible savings. Amendments to the Energy Efficiency Act introducing the obligation of monthly informing of consumers are planned.</p>
	Target final consumption	Consumption of electricity, heat energy, natural gas in households
	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 implementation of measure



		<p>monthly consumption. Current legislation (the Energy Efficiency Act) stipulates that the consumer be informed of the total state of consumption on an annual basis and of sources providing information on possible savings. As such, it does not enable monthly regulation, information on savings or the control of final consumer in periods shorter than one year. Therefore, it is proposed that a measure establishing the Instructions for informing final energy consumers mandatory for all energy suppliers be adopted. The Instructions would define all necessary data that would be featured in monthly bills for the purpose of informing consumers.</p> <p>Monthly bills should contain information on the portion of bill amount corresponding to taxes, network fees, excise duties, fee for the selected connection power and the amount of actual consumption. In cooperation with the Ministry of Protection of the Environment and Energy, the NCB shall prepare instructions defining the manner of informing users with monthly bills - graphic overviews, overview of percentage per amounts. It is crucial that bill be easily to understandable to consumers (citizens and companies).</p>
	Funds and sources of financing	/
	Executive body	HERA – supervision of the implementation of regulations Distribution system operators, suppliers NCB in coordination with the MEE:
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effect of this measure can be covered by TD indicators in accordance with the recommendations of the European Commission (indicators P1 and P3). (Indicators: P1: Energy consumption for heating per unit area with climate correction P3: Energy consumption for water heating per capita
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	/
	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 National Energy Efficiency Portal - ENU.HR.

		Info campaigns and promotion of energy services
Measure index		H.2
Description	Category	Information and mandatory information measures
	Time frame	Start: 2007 End: 2025 Continuation of implementation of current activities with co-financing
	Objective / outline	The purpose of info campaigns is to raise the awareness of target groups about the benefits and possibilities of energy efficiency improvements. The most efficient campaigns are those conducted in a limited time period and targeted towards specific activities, such as thermal insulation of buildings, more efficient lighting, etc. Targeted info campaigns should cover all the participants involved in reaching the energy efficiency improvement target.
	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 implementation of measure	<p>Future activities:</p> <p>The implementation of the general national media campaign has been suspended, with the exception of the National Energy Efficiency Portal. 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 an implementing body under the measures defined in this NEEAP must be accompanied by strong promotional activities. Each implementing body should finance such activities and coordinate with the NCB. 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, as well as the Industrial Energy Efficiency Network as the measure fostering energy efficiency in economy. Furthermore, campaigns shall be regularly implemented and monitored via the National Energy Efficiency Portal <a href="http://www.enu.hr">www.enu.hr</a>. The National Energy Efficiency Portal is the central information hub on actualities in the field of energy savings in Croatia. The contents of the portal are grouped around three basic change agents: citizens, the public sector, the commercial sector with the section EE in Croatia, which contains all important documents, strategic guidelines and information on institutions operating within the energy efficiency field. The Portal publishes all information on activities, advice, events, projects, competitions, new and obligations regarding energy efficiency in Croatia.</p>

	Funds and sources of financing	Planned funds by the end of 2019: Every implementing body shall ensure the necessary funds for the promotion of measures defined in the NEEAP. For financing horizontal measures for the promotion and visibility of projects, the funds allocated to the thematic objective “Supporting transition to low CO <sub>2</sub> emissions economy in all sectors” are used since this is one of the selected targets to which funds within the Operational Programme Competitiveness and Cohesion 2014 - 2020 are directed, all with the cooperation with 1st level intermediary bodies with expert and technical cooperation with the Environmental Protection and Energy Efficiency Fund.
	Executive body	NCB – coordination of implementing activities and managing the National Energy Efficiency Portal <a href="http://www.enu.hr">www.enu.hr</a> Implementing bodies - ensure co-financing for promotion of measures set forth in the NEEAP, each body within its jurisdiction, in coordination with the NCB
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effects of this measure are monitored by using the European Commission’s recommended TD indicators. It shall have effect in other sectors as well, especially the service sector, where the effects shall also be covered with the TD indicators. It is recommended that a market survey is conducted before every info campaign and that the results are given by repeating the same survey after the campaign has been conducted.
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	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 each implementing body or implemented/coordinated by the NCB. Each implementing body should financially monitor the implementation of promotional, educational and informational activities aimed at the general public regarding all the measures financed/co-financed by an implementing body or implemented/coordinated by the NCB.

<b>Title of the measure</b>		<b>Capacity building for combating energy poverty</b>
Measure index		H.3
Description	Category	Information and mandatory information measures
	Time frame	Start: 2017 End: continuous

	Objective / outline	<p>The objective of the measure is capacity building for combating energy poverty within local self-government units and in general public. Capacity building shall include providing information on energy efficiency measures contributing to the combating of energy poverty, and the possibilities of co-financing in this area. This will contribute to combating energy poverty, as well as the threat level thereof and will foster the use of available funds from ESI and national sources.</p> <p>To that end, mechanisms for counselling vulnerable buyers and implementing energy efficiency measures in households at risk of energy poverty will be set up in 15 cities with over 30,000 people.</p> <p>The work of advisers for citizens stricken with energy poverty will be coordinated by the NCB.</p>
	Target final consumption	Consumption of electricity, heat energy, natural gas, fuel oil in water in households at risk of energy poverty
	Target group	Vulnerable consumers; citizens at risk of energy poverty
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>In 2017, the NCB shall explore the existing capacity in the area of energy counselling and evaluate the need for additional knowledge, set up a counselling mechanism and criteria for allocating funds to interested cities (existence of an educated person to provide advice to interested parties, etc.) and design promotional materials. The EPEEF shall publish a call for no more than 3 cities to conclude a cooperation agreement with.</p> <p>In 2018, no more than 3 centres for combating energy poverty shall be launched; their work shall be coordinated by the NCB. In these cities, the NCB shall carry out an initial study on the risk level for the population, and the average level of knowledge and the needs of vulnerable households and shall conduct three local promotional campaigns. A mechanism for counselling vulnerable consumers and those at risk of energy poverty shall be launched in the cities with which the EPEEF has concluded agreements, as well as the implementation of technical measures. The EPEEF shall publish a call for all interested cities with a population of over 30,000 people, where counselling of vulnerable consumers and the implementation of technical measures in vulnerable households will be set up in 2019.</p> <p>In 2019, CEI shall conduct an initial study and local promotional campaigns in all cities with over 30,000 inhabitants with which the EPEEF has concluded a contract on cooperation, and shall launch a mechanism for counselling vulnerable consumers and those at risk of energy poverty.</p>
	Funds and sources of financing	<p>2017 evaluating existing capacities, assessing the need for further knowledge, designing promotional material, preparing tenders for the cities, drafting contracts: HRK 200,000</p> <p>2018 three local studies and promotional campaigns, launching 3 local pilot programmes: 3xHRK 70,000, 3xHRK 150,000 HRK 660,000</p> <p>2019 work of 15 local programmes, coordination, monitoring, promotion: 15xHRK 150,000 + 200,000 = HRK 2,450,000</p>

		EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14)
	Executive body	NCB - coordination of activities EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14)
	Body for monitoring, measuring and verifying savings	NCB
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 stakeholders and achieving other energy efficiency measures.
	Expected energy savings in 2019	Not estimated
	Expected impact on energy savings for 2020	Not estimated
	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 the EPEEF or implemented/coordinated by CEI whose target group are citizens. The EPEEF shall perform financial monitoring of contractual obligations undertaken by self-governments units.

### 3.1.5 Availability of qualification, accreditation and certification schemes (Article 16 of the EED)

Energy audits and energy certification of buildings are carried out by a legal or natural person with an authorization of the Ministry of Construction and Physical Planning pursuant to the Ordinance 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 (OG 73/15, 133/15).

Ordinances under the Construction Act (OG 153/13) set forth 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

- other issues related to conducting energy audits, energy certification of buildings and independent control of reports on energy audits and energy certification.

Ordinances under the Energy Efficiency Act (OG 127/14) set forth the following:

- authorization and/or certification system or an equivalent qualification system for construction workers installing energy-related construction elements, workers installing energy-related parts of buildings, including the certification system or an equivalent qualification programme for persons installing small boilers and biomass furnaces, photovoltaic systems, solar thermal systems, shallow geothermal systems and heat pumps.
- Managing energy consumption, analysis of energy consumption and reporting

Energy certificate and the report on regular inspection of heating and cooling or air-conditioning systems in buildings are subject to independent control pursuant to articles 39 and 40 of the Construction Act (OG 153/13). The independent control is carried out by authorized legal persons on the order of the Ministry. MGIPU declares an energy certificate which has obtained a negative score within the independent control as invalid.

The Construction Act stipulates, inter alia, fines for offences by natural and legal persons acting as investors if they fail to obtain an energy certificate for the building or a part thereof, as well as fines for offences by persons authorized for energy certification and energy audit of a building and persons authorized for independent control of energy certificate of buildings.

The register of natural and legal persons authorized for energy audits and energy certification of buildings, holders of educational programmes for persons performing energy audits and energy certification of buildings, the register of certified installers of renewable energy systems, holders of the certified installer of renewable energy systems training programme and other information for citizens are published on the MGIPU website.

Title of the measure		Education in the field of energy efficiency
Measure index		H.4
Description	Category	Educational measures
	Time frame	Start: 2017 End: 2020 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 Croatia. This measure defines the activities for achieving those objectives and the steps for their implementation Activities: <ul style="list-style-type: none"> <li>Establishment of the system for certification and lifelong learning of construction workers in the field of energy efficiency</li> <li>Upgrade of existing knowledge and skills of workers in the construction sector</li> </ul>
	Target final consumption	All energy consumption segments
	Target group	Employed and unemployed construction workers and construction sector workers, workers seeking retraining and further training
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p><u>Implemented activities:</u></p> <p>A system for the energy certification of buildings has already been established in Croatia, and certificates are issued by legal or natural persons authorised by MGIPU. Energy advisers on almost all major public sector buildings (central state administration, LRSGU) were educated via educational programmes implemented by MINGO and UNDP under the EE Project. Under the UNDP pilot project, energy advisers for households in energy poverty were educated in the Koprivnica-Križevci County.</p> <p>At the incentive of MGIPU and for the purpose of establishing continuous education of construction workers and craftsmen in an energy efficiency way, the CROSKILLS project has been launched at the Faculty of Civil Engineering in Zagreb. The needs and possibilities of Croatia's construction sector were determined and quantified in order to contribute to the achievement of national energy efficiency objectives and the transformation of the construction sector via new technologies and requirements (<a href="http://croskills.hr/assets/dokumenti/2015/Status-Quo-Analiza-HRV.pdf">http://croskills.hr/assets/dokumenti/2015/Status-Quo-Analiza-HRV.pdf</a>). In 2012, the National qualification platform was set up as the project's advisory body, while in 2013 the National guidelines for continuous education of construction workers in the field of energy efficiency were prepared (<a href="http://croskills.hr/assets/dokumenti/2015/Roadmap-Croatia-HR.pdf">http://croskills.hr/assets/dokumenti/2015/Roadmap-Croatia-HR.pdf</a>).</p> <p>2016 saw the drafting of the educational syllabus and of training materials for educating coaches; furthermore, 12 training centres were selected to carry out trial trainings of workers pursuant to the CROSKILLS programme.</p> <p><u>Future activities:</u></p> <ul style="list-style-type: none"> <li>Drafting and adoption of the Ordinance on the system of education and certification of construction workers installing parts of buildings affecting energy efficiency in the buildings sector, which will enable the establishment of the system of certification and continuous education of construction workers under the CROSKILLS programme, which should increase the number of qualified workers for energy efficient constructions to guarantee quality construction of buildings.</li> </ul>

		<ul style="list-style-type: none"> <li>• During 2017: training of coaches under the CROSKILLS programme; trial trainings for app. 1200 workers; authorization of the first group of 12 training centres across Croatia for the implementation of the programmes of continuous education of workers under the CROSKILLS programme.</li> <li>• Preparation of sustainability plan of the system of continuous education and certification of construction workers in EnE; preparation of sustainability plans for all centres authorized under the CROSKILLS programme.</li> <li>• From mid-2017: further implementation of the system of continuous education and certification of construction workers via authorized CROSKILLS trainings centres, pursuant to the Ordinance on the system of education and certification of construction workers installing parts of buildings affecting energy efficiency in the buildings sector. This should lead to increased use of energy efficiency and renewable energy sources in everyday construction practice and demand of educated workforce, via an increase in practical knowledge of workers working on site specialized in all stages of building and maintaining a construction.</li> </ul>
	Funds and sources of financing	<p>Estimated need of financing lifelong learning (formal/informal education) of workers for energy efficiency: EUR 8,032,000</p> <p>a) Planned funds in 2017:</p> <ul style="list-style-type: none"> <li>• The CROSKILLS project (via the Faculty of Civil Engineering of the University of Zagreb) finances the material costs of the implementation of trial trainings, preparation of training materials and initial set-up of the system of continuous education and certification of construction workers under the CROSKILLS programme</li> </ul> <p>b) European Social Fund - co-financing of costs of education of workers:</p> <ul style="list-style-type: none"> <li>• MRMS, as the implementing body for OP <i>Efficient human resources</i> 2014.-2020 – grants under Priority axis 3 “Education and lifelong learning”, Investment priorities 10.iii and 10.iv, e.g., for preparing professional standards</li> <li>• MZO – grants under Priority axis 3, “Education and lifelong learning”, Investment priorities 10.iii and 10.iv (OP <i>Efficient human resources</i>) for implementing energy issues in the existing vocational training and adult education systems</li> </ul> <p>c) Participants (workers and employers) co-finance a part of costs of trainings in authorized training centres</p>
	Executive body	<ul style="list-style-type: none"> <li>• ASOO – co-financing training centres for education of workers</li> <li>• HZZ – co-financing education/retraining of the unemployed</li> <li>• Faculty of Civil Engineering in Zagreb, under the CROSKILLS project</li> </ul>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure can be monitored using a method based on studying demands for educated workers among participant of the educational programme, training centres/vocational schools conducting programmes of educating adults, beneficiaries of services of HZZ, public/private investors for the purpose of building renovation, etc.



		This measure is a pre-requisite for informing all stakeholders and implementing other energy efficiency measures.
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	<ul style="list-style-type: none"> <li>- Stimulating production of RES: We expect that informational campaigns under the CROSKILLS project on the available possibilities of education for installers of technical systems on RES will stimulate demand for RES systems and education corresponding to app. <u>10 % of the national target of RES production in the buildings sector</u>. Considering the dynamics of informational campaigns under the project, it is expected that this effect will be generated only during the last year of the project (09/2016-08/2017) and that a similar effect (10 % a year) can be expected by 2020.</li> <li>- Energy savings and reduction of GHG emissions have been calculated bases on the Status Quo analysis conducted under the CROSKILLS project (p. 19, <a href="http://croskills.hr/assets/dokumenti/2015/Status-Quo-Analiza-HRV.pdf">http://croskills.hr/assets/dokumenti/2015/Status-Quo-Analiza- HRV.pdf</a>) regarding the information on energy consumption in households and the potential for energy savings.</li> <li>- The expected impact of all 3 indicators for 2020 has been calculated under the assumption that the results achieved under the CROSKILLS project will continue at an equal annual pace, and the value of the 2020 indicators has been given as fourfold value of the 2017 indicators, which corresponds to the next 4-year period (2017-2020).</li> </ul> <p>The costs of education of workers are estimated at approximately EUR 8,032,000, or EUR 400 per worker for the total estimate of 20 080 workers who must be educated on energy efficiency in the buildings sector by 2020 (cost during 2017 is covered with the already secured financing from the CROSKILLS project). From mid-2017, after the completion of the CROSKILLS project the authorized training centres shall bear their own costs of further education of workers (from various sources).</p> <p>In 2019 the expected savings in terms of incentives for the production of RES: 23,810 Toe Energy savings compared to projections: 150.000 Toe Reduction of GHG emissions: 500.000 tonnes of CO<sub>2</sub>e</p> <p>In 2020, the expected savings in terms of incentives for the production of RES: 95,240 Toe Energy savings compared to projections: 600.000 Toe Reduction of GHG emissions: 2 million tonnes of CO<sub>2</sub>e</p>
	Overlapping, multiplication effect, synergy	This measure complements measure H-2 Info campaigns and promotion of energy services, which will also educate the general public on energy services, providers of energy services, etc.

### 3.1.6 Energy services (Article 18 of the EED)

The first projects of energy efficiency under the ESCO model in the private and public sectors were implemented during the 2000s. However, at that point there were very few companies offering energy or ESCO services on the market. This was due to a lack of a legal framework on energy efficiency regulating energy services as a separate activity.

In 2014 the market of ESCO services began to grow thanks to the following three reasons:

- the rise in energy prices encourages the consumers to make savings,
- the adoption of the Energy Efficiency Act (OG 127/2014) and the Regulation on contracting and the implementation of energy services in the public sector (OG 11/2015).
- The Environmental Protection and Energy Efficiency Fund provides grants for project of energy efficiency in public buildings, inter alia, under the ESCO model.

For this reason, during 2015 and 2016 over 50 energy efficiency project in the public sector under the ESCO model, some 20 projects of reconstruction of public lighting and some 30 projects of renovation of public buildings were contracted under open tenders. In most cases the contracts on energy efficiency are published in the electronic public procurement classifieds as a part of the tender documentation. All the projects are financed by energy services providers selected under a public tender as the most economically advantageous tenderers. The majority of tenderers participating in the tenders for the projects of reconstruction of public lighting according to the ESCO model were manufacturers and suppliers of public lighting equipment. As far as projects of reconstruction of public buildings go, most tenderers were construction and engineering companies. In many cases groupings of tenderers dividing technical, legal, commercial and financial risks, as well as the risk of performance guarantee, participate in these tenders.

Today there are over 15 energy service providers in Croatia; it is expected that in the future there will be even more interest for providing and using this type of services, especially in the event of further growths of energy prices, and the possibilities of obtaining grants and favourable loans with lower interest.

In mid-2014 the European Bank for Reconstruction and Development (EBRD) launched the Western Balkans Investment Framework: ESCO Project Pipeline Preparation in Croatia project within the REGIONAL ENERGY EFFICIENCY PROGRAMME (the Project). The Project is carried out by a consortium comprising the CMS law firm and the GREENMAX CAPITAL ADVISORS consulting firm. The purpose of the Project is to provide technical assistance to local self-government units in the preparation and implementation of tender documentation and finding appropriate solutions for projects of reconstruction of public lighting under the ESCO model, in accordance with the existing Croatia legislation, primarily in the field of public tendering and energy efficiency. Technical assistance is free of charge because it is completely financed by the European Union and is not binding for local self-government units: cooperation with the project can be stopped at any moment, without any financial consequences. An additional feature is the promotion of local self-government units and their projects of reconstruction of public lighting under the ESCO model via the official website of the Project. So far 20 local self-government units have signed a non-binding letter of intent on the use of technical assistance. The value of their projects is over EUR 10 million. The tender documentation has been prepared for 8 local self-government units, while 5 have started and ended the public tendering process.

So far over 20 local self-government units have signed a non-binding letter of intent on the use of technical assistance. The value of their projects is over EUR 20 million. The tender documentation has been prepared for 10 local self-government units, while 5 have started and ended the public tendering process. According to the EBRD technical assistance, projects have been successfully implemented in 4 local self-government units, which achieve energy savings between 40 % and 80 %. Furthermore, local self-government units are beginning to use

the tender documentation form drafted in accordance with this Project without using the technical assistance of EBRD and their consultants, which proves their wide-scale usability.

### **PROGRAMME OF ENERGY RENOVATION OF PUBLIC SECTOR BUILDINGS 2016-2020**

The aim of the Programme of energy renovation of public sector buildings is to raise the activity level in energy renovation to 3 % of the total public sector building fund per year, reduce the consumption of energy for cooling/heating renovated public sector buildings up to 70 %, or annual savings of app. 50 GWh and the achievement of target of energy savings of public sector buildings, including alternative policy measures set forth in the Third National Energy Efficiency Action Plan for the Period Between 2014 and 2016.

The programme of energy renovation of public sector buildings concerns buildings of central state administration (ministries and state administration bodies) and buildings of local and regional self-government units, i.e. buildings owned by the public sector where social activities (education, science, culture, sport, health and social care), activities of state bodies and organizations, as well as bodies and organizations of local and regional self-government units, activities of legal persons with public authorities are performed, as well as buildings for community housing, buildings of citizens' associations and religious communities.

The Programme ensures the continuity of fulfilment of requirements pursuant to the Energy Efficiency Directive, which stipulates that from 1 January 2014 Member States shall renovate 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government or use alternative means to achieve energy savings in central government buildings equal to the energy savings obtained by applying the 3 % rate of renovation.

In order to use the entire existing potential for energy savings, the objective of the Programme is comprehensive renovation of buildings, with maximum investments of private capital in public buildings, continuation of development of energy services market and using experience with public sector buildings to the field of contracting energy services among private subjects. Investments with positive effect on the state budget are encouraged, and the ESCO model ensures that measures for improvement of energy efficiency in public sector buildings are carried out without additional use of budget resources of the owner/beneficiary.

The energy efficiency programme applies economically justified, energy efficient technologies and measures in public sector buildings in the territory of Croatia, and advantage is given to public sector buildings with lowest energy features or maximum energy consumption. The Programme shall contribute to the reduction in the use of energy sources, fossil fuels and electricity and increase in the use of renewable energy sources.

Indirectly, the Programme of energy renovation of public buildings will lead to an increase in the activities of the construction sector and in employment in the crafts and construction sectors, engineering activities and the manufacturing of construction products.

The programme is co-financed with funds of the European Fund for Regional Development under Priority axis 4. Promotion of energy efficiency and renewable energy sources, Investment priority 4c Promoting energy efficiency, smart energy management and use of RES in the public infrastructure, including public buildings in the housing sector, Specific objective 4c1 Reduction of energy consumption in public sector buildings, Operational Programme "Competitiveness and Cohesion 2014- 2020", for which EUR 211,810,805 has been secured, which is given in the State budget of Croatia under source 563 - European Fund for Regional Development.

Based on the analysis of previous results, experiences, barriers and limits faced by the public sector and service providers in the implementation of energy efficiency through the implementation of the Programme of energy efficiency of public sector buildings for the period 2014. 2015, and the experience gained from the implementation of the pilot project "Energy renovation of buildings and

use of renewable energy sources in public institutions providing education” and “Drafting project documentation for energy renovation of buildings and use of renewable energy sources in public institutions providing education”, a model for the continuation of the Programme of energy renovation of public sector buildings for the period 2016 -2020 was established with maximum use of resources from ESI funds.

According to analysed scenarios, which are not mutually exclusive, it is predicted that the intensity of energy renovation of buildings will increase to 327,000 to 473,000 m<sup>2</sup>, with expected cumulative savings in primary energy from 394 to 552 GWh by 2020. A detailed description of the programme is given in measure P.2.

### ***3.1.7 Other energy efficiency measures and horizontal measures (Articles 19 and 20 of the EED)***

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 regulation hinders the implementation of energy efficiency measures, especially for large buildings which have the largest potential. The regulatory framework for the achievement of these 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 (OG 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 in charge of financing the implementation of the energy policy of the Government 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 (OG 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; OG 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 (OG 130/11, 47/14).

Title of the measure		Programme for combating energy poverty
Measure index		H.5
Description	Category	Financial instruments
	Time frame	Duration of the measure: 1 January 2017 -31 December 2026  1st intermediate period: 1 January 2017 -31 December 2018 2nd intermediate period: 1 January 2019 -31 December 2020 3rd intermediate period: 1 January 2020 -31 December 2026 End: 2026
	Objective / outline	This measure provides for the development and deployment of a systematic programme for combating energy poverty through the implementation of measures of energy efficiency. The Programme shall establish a list of available measures and rate of co-financing individual measures. A requirement for participating in the co-financing programme is gaining the status of a vulnerable customer in accordance with the regulations applicable at the moment of implementation of a measure. The specific objective of the measure is the establishment of a system that would allow vulnerable energy buyers to improve energy efficiency at household level while improving housing conditions. The Programme shall stipulate criteria for establishing the priority list for the implementation of individual energy efficiency measures, and the measure includes the following components: <ul style="list-style-type: none"> <li>- Replacement of household appliances according to the “old for new” system</li> <li>- Replacement of windows</li> <li>- Improvement or replacement of heating systems</li> <li>- Increasing the thermal protective envelope</li> <li>- Simple energy efficiency measures</li> </ul> The measure shall also establish a system for following social and demographic and energy indicators describing energy poverty at a national level, through the existing system for compiling data on the consumption and habits of households (the Croatian Bureau of Statistics). The Programme shall also develop possible extension of criteria for gaining the status of vulnerable energy buyers.
	Target final consumption	Household sector
	Target group	Vulnerable energy buyers
	Regional application	National
	Information on implementation	List and description of activities for implementation of measure

		The Programme shall also develop possible extension of criteria for gaining the status of vulnerable energy buyers.
	Funds and sources of financing	<p>The total investment for this Programme over 10 years concern the implementation of energy efficiency measures for 50,000 households (which currently have the status of vulnerable energy buyers) and HRK 200,000 of initial investment for drafting the Programme and criteria.</p> <p>During the period of the 4th NEEAP, the Programme shall cover app. 330 households a year.</p> <p>During the period of this Action Plan:</p> <p>2017 – HRK 200,000.00 for drafting the Programme and establishing criteria (EPEEF in cooperation with MZOE launches a public tender for drafting the Programme)</p> <p>2018 – HRK 20,000,000.00 for implementing the measure</p> <p>2019 – HRK 20,000,000.00 for implementing the measure</p> <p>Sources of financing:</p> <p>EPEEF - Funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14)</p>
	Executive body	<p>MZOE – developer of the Programme in cooperation with MSPM</p> <p>EPEEF – establishment of financing and co-financing scheme (including the possibility of using resources from EU structural funds)</p>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	<p>Estimated savings</p> <p>Pursuant to the Ordinance on the system for monitoring, measuring and verifying energy savings.</p> <p>The effects of the measure shall be monitored via the System for monitoring, measuring and verifying energy savings (SMIV)</p>
	Expected energy savings by the end of 2019	13.7 TJ
	Expected energy savings by the end of 2020	20.6 TJ
	Assumptions	<p>It is assumed that, on an annual level, 330 households from all over Croatia with the average surface area of 70 m<sup>2</sup> of living space, 100 m<sup>2</sup> of outer wall and 35 m<sup>2</sup> of windows will participate in the Programme and that the average energy class of the building is F. Furthermore, it is assumed that by installing thermal insulation of walls 72 kWh/m<sup>2</sup> of wall surface is saved on average (introduction of a thermal insulation layer to outer walls by implementing the ETICS system with EPS-based insulation with a thickness of 12 cm) and 192 kWh/m<sup>2</sup> of the surface of windows. It is assumed that it is necessary to insulate the ceiling towards the unheated attic in some of the buildings, which saves 30 kWh/m<sup>2</sup> of the surface area.</p>

		<p>Furthermore, it is assumed that household appliances shall be replaced in some of the households - replacement of old refrigerator, dating back to 1989-2000 with an energy efficient class A+ refrigerator and replacement of old washing machine dating back to 1970 -1975 with a new machine with A+++ energy class, which will yield savings of 370 kWh and 248 kWh of electricity a year, respectively. It is assumed that a complete replacement of the outer envelope shall be carried out on 30 % of the households, that joinery shall be replaced in another 30 % of households and that in the remaining 40 % of households only simple energy efficiency measures will be carried out (replacement of 5 light bulbs with LED lighting, installation of water saving aerators on faucets used only for sanitary purposes and for washing dishes, installation of water saving showerheads, installation of 18 m of gaskets to windows and doors), which will yield app. 900 kWh in saved heat energy and electricity a year.</p> <p>Refrigerators shall be replaced in 40 %, and washing machines in another 40 %. It is expected that the programme will be implemented at the same pace by the end of 2026.</p>
	Overlapping, multiplication effect, synergy	<p>The measure is directly connected to the measure of capacity building for combating energy poverty, where support to the implementation of the Programme for combating energy poverty shall be ensured via centres and training of advisors. Furthermore, the measure is in direct synergy with other measures directed at the household sector, with shifting of the specific focus to vulnerable energy buyers and households at risk of energy poverty. Also, the measure builds upon the measure Programme of energy renovation of family homes 2014-2020 and the measures complement one another.</p>

<b>Title of the measure</b>		<b>Establishment and development of an integrated information system for monitoring the implementation of the energy efficiency policy</b>
Measure index		H.6
Description	Category	Mechanisms for achieving and monitoring energy savings Start: 2014 End: 2025
	Time frame	Planned major modifications, amendments, improvements: Revised measure establishing and upgrading the integrated system for monitoring, measuring and verifying energy savings, and reporting, informing and preparing mechanisms and plans for the implementation of the energy efficiency policy.
	Objective / outline	<p>The integrated information system is based on the national System for measuring and verifying energy savings as the tool for planning, analysis and reporting and measuring and verifying energy savings and reduction of CO<sub>2</sub> emissions.</p> <p>The integrated system serves as the basis for the implementation of measures provided by the national action plans in terms of monitoring the implementation of all measures, methodological calculation of savings, drafting regulations in the field of energy efficiency, facilitating the implementation of measures and integration of all participants and beneficiaries.</p> <p>This measure meets and facilitates the fulfilment of obligations arising from EU directives (EPBD and EED), especially:</p> <ul style="list-style-type: none"> <li>• Article 7, which provides for the obligation of putting in place a control system for monitoring energy efficiency measures; all alternative measures aimed at meeting mandatory savings shall be measured pursuant to criteria laid down in the EED for Art. 7</li> <li>• Measurement of savings from implemented measures for meeting the target from articles 3 and 5 of the EED</li> </ul>

	Target consumption	Primary and final consumption. Implementation of measures, plans and energy efficiency projects in all final and primary consumption sectors.
	Target group	All obligated parties in terms of implementing measures (executive bodies) defined in this Action Plan, obligated parties in terms of planning (defined by the act defining the energy efficiency policy), operators of transmission and distribution systems and suppliers of electricity, heat energy and natural gas, LRSKU, EPEEF, energy service providers (ESCO)
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>The integrated information system allows the following:</p> <ol style="list-style-type: none"> <li>1. Regular reporting on the implementation of measures, programmes of energy efficiency plans to ministries in charge of energy, construction and transport, the government of Croatia and the European Commission</li> <li>2. Analysis of the implementation of measures, programmes and plans and recommendations for the following period, auditing plans, measures and programmes</li> <li>3. Easier recognition of barriers in the implementation of measures, plans and programmes</li> <li>4. Support to coordination of the implementation of the energy efficiency policy</li> <li>5. Support in the drafting of national regulations in the field of energy efficiency and support in the drafting of national planning documents</li> <li>6. Contribution to the comprehensive system of the implementation of the energy efficiency policy</li> </ol> <p>Planned future activities:</p> <ol style="list-style-type: none"> <li>1. Further upgrade and development of an integrated information and IT system for monitoring the implementation of the energy efficiency policy carried out by the NCB.</li> <li>2. Analysis of potential alternative policy measures acceptable under Article 7 of the EED</li> <li>3. Study of establishing the methodology for the calculation of energy and CO<sub>2</sub> emission savings for new energy efficiency measures under the bottom-up method.</li> <li>4. Analysis of recommendations for potential measures acceptable under the Energy efficiency obligations scheme.</li> <li>5. Calculation of the results of energy and CO<sub>2</sub> emission savings for the implementation of measures of tax policy „Introduction of a special motor vehicle tax based on CO<sub>2</sub> emissions“</li> <li>6. Expert technical and legal analysis of acceptability of EnE measures in final consumption in accordance with the criteria of materiality and additionality</li> <li>7. Capacity building of TDU for the calculation and monitoring of the performance indicators regarding the implementation of the Operational Programme Competitiveness and Cohesion (TD analysis by energy efficiency sectors)</li> <li>8. Technical and expert bases for drafting the Ordinance on energy audits of public lighting pursuant to the Energy Efficiency Act</li> <li>9. Procurement of services of technical assistance in the establishment and development of the energy efficiency obligations scheme</li> <li>10. Procurement of the legal service of drafting the Ordinance on energy audits of public lighting and the Ordinance on the energy efficiency obligation scheme</li> <li>11. Preparation of bases for the market model and tax policy in the establishment of the alternative fuel infrastructure</li> <li>12. Procurement of the service of preparing educational and promotional material for planning local self-government units (cities and counties)</li> <li>13. Procurement of the service of preparing educational and promotional</li> </ol>



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		<p>material for the beneficiaries of the System for monitoring, measuring and verifying energy savings</p> <p>14. Procurement of the service of upgrading and adaptive maintenance of the System for monitoring, measuring and verifying energy savings</p> <p>15. Procurement of the service of preparing the module of applications of bases of energy audits for companies in SMIV</p> <p>16. Design and creation of the application Calculator of costs and savings of energy efficiency measures</p> <p>17. Preparation of an interactive map of Croatia for charging stations for alternative fuel vehicles (charging stations of electrical vehicles, CNG, LNG, etc.)</p> <p>18. Analysis and preparation of bases for the introduction of implementing policy measures for the establishment of the alternative fuels infrastructure</p> <p>19. Expert bases for establishing conditions for connection to the electrical system for charging stations, terms of distribution, charging and unit price of alternative energy sources used in transport</p> <p>20. Expert and technical assistance with the drafting of the 5th National Energy Efficiency Action Plan</p>
	Funds and sources of financing	<p>EPEEF - Funds obtained from selling emission units at the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14).</p> <p>Estimated at an amount of app. HRK 350,000.00/year for the above mentioned studies, analyses and further development of the system</p>
	Executive body	MZOE
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	<p>This measure applies the calculation on the implemented measures, programmes and plans of energy efficiency according to BU and TD methods at a national level, as well as amendments to the Ordinance on the methodology for monitoring, measuring and verifying energy savings. The measure is a prerequisite for quantifying the results of all implemented measures.</p>
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	/
	Overlapping, multiplication effect, synergy	<p>This measure is compatible with all measures stated in action plans, but also concerning other obligatory parties to the implementation of the act defining energy efficiency policy. This measure affects future periods of drafting energy efficiency measures (after 2016) because a systematic integrated monitoring of implementation of measures and development of the general energy efficiency policy will yield information and allow for quality planning of future periods.</p>

### 3.1.8 Savings resulting 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 in the buildings sector***

Implementation of the majority of energy efficiency measures in the buildings sector from the 3rd NEEAP is continued, whereby the measures have been updated and adapted to new conditions for co-financing. From 2016, the funds will be taken from European funds, within the Operational Programme Competitiveness and Cohesion (OPCC). In the 4th NEEAP the main holders of the increase of energy efficiency in the buildings sector are programmes for energy renovation of multifamily housing and commercial non-residential buildings.

The interest for the Programme of energy renovation of multifamily housing has been exceptionally high. It implies investment in the amount of over HRK 1 billion, and the requested amount of grants is as much as HRK 615 million. Also, the Programme of energy renovation of multifamily housing has garnered great success. Amendments to the Programme have allowed that all citizens of Croatia apply directly to the EPEEF, and the procedure of submitting an application for an incentive has been simplified by changing the definition of a family house. In 2016 the co-financing programme has been additionally adapted due to the use of resources of European funds within the OPCC. The aim of the Programme is the increase of energy efficiency of existing houses, reduction of energy consumption and emissions of CO<sub>2</sub> into the atmosphere and the reduction of monthly costs for energy sources, with an overall improvement of the quality of life. At the same time, planning of such projects implies the engagement of local business and experts, thus stimulating economic activity, whereby family houses represent 65 % of the housing fund in Croatia, which is responsible for 40 % of the total energy consumption on a national level. The measures in commercial non-residential buildings have the purpose of developing new activities and entrepreneurship, continuous and systemic management of energy, strategic planning and sustainable management of energy resources on a national, regional and local level.

## 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: 2020 Planned major modifications, amendments, improvements: The measure has been 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, monitoring, 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 implementation of measure	<p>1. The definition of energy performance of a building regulated by the provisions of articles 20 to 47 of the Act was implemented in the Construction Act (Official Gazette No. 153/13). 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, regular audit of heating and cooling or air-conditioning systems in a building, energy performance certificate of a building, energy audit of a building, authorisations for conducting energy certification, energy audit of a building and regular audit of heating and cooling or air-conditioning systems in a building, possibility of performing energy audit and energy certification activities for persons from Contracting States to the Agreement on the European Economic Area in 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 ordinances regulating this field.</p> <p>2. Ordinance on the energy audit of a building and energy certification (Official Gazette Nos. 48/14, 150/14, 133/15, 22/16, 49/16, 87/16, 17/17)</p> <p>3. Ordinance 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 OG 47/14)</p>

		<p>4. Ordinance 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 Croatia, and the recognition of foreign professional qualifications for providing the services of energy certification and energy audits of buildings (Official Gazette No. 77/15)</p> <p>5. Energy Efficiency Act (Official Gazette 127/14)</p> <p>6. Regulation on contracting and implementation of energy services in the public sector (Official Gazette No. 69/12)</p> <p>7. Ordinance 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 (Official Gazette Nos. 73/15, 133/15)</p> <p>8. Ordinance on the control of energy performance certificates and reports on regular audits of heating and cooling or air-conditioning systems in buildings (Official Gazette No. 73/15)</p> <p>9. Ordinance on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – photovoltaic systems (Official Gazette No. 56/15)</p> <p>10. Ordinance on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – solar thermal systems (Official Gazette Nos. 33/15 and 56/15)</p> <p>11. Ordinance on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – small boilers and biomass furnaces (Official Gazette Nos. 39/15 and 56/15)</p> <p>12. Ordinance on conditions and criteria for establishing quality systems for services and works for the purpose of certifying installers of renewable energy sources – shallow geothermal systems and heat pumps (Official Gazette No. 56/15)</p> <p>13. Ordinance on systematic energy management in the public sector (Official Gazette Nos. 18/15 and 06/16)</p> <p>14. Technical regulation on the rational use of energy and thermal protection in buildings (Official Gazette No. 128/15).</p> <p>Other acts currently in force:</p> <ol style="list-style-type: none"> <li>1. Decision on the manner of submitting reports on implemented energy audits of buildings and issued energy certificates of buildings</li> <li>2. Study of the applicability of alternative systems</li> <li>3. National plan for increasing the number of nearly zero energy buildings</li> <li>4. Methodology for conducting energy audits of buildings (in force since 18 June 2014) with algorithms for calculating the energy performance of buildings:</li> </ol>
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		<p>5. Factors of primary energy and CO<sub>2</sub> emissions</p> <p>6. Algorithm for calculating the energy required for heating and cooling the areas of a building, compliant with HRN EN ISO 13790</p> <p>7. Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (Heating and domestic hot water preparation systems)</p> <p>8. Algorithm for determining energy requirements and the efficiency of thermo-technical systems in buildings (co-generation systems, remote heating systems, photovoltaic systems)</p> <p>9. Algorithm for determining the energy efficiency of lighting systems in buildings (energy requirements for lighting)</p> <p>New regulations in the process of being adopted:</p> <p>10. Ordinance on the system of education and certification of construction workers installing parts of buildings affecting energy efficiency in the buildings sector (Croskills)</p> <p>11. Amendments to the Regulation on contracting and implementation of energy services in the public sector (OG No. 11/15) for the purpose of including a standardized contract on energy performance as an annex to the Regulation</p> <p>Currently being drafted:</p> <p>12. Defining reference buildings and nearly zero energy buildings</p> <p>13. Programme of fostering the construction of new and renovation of existing nearly zero energy buildings.</p>
	Funds and sources of financing	MGIPU: planned under the Ministry's budget
	Executive body	MGIPU (preparatory activities and drafting amendments to regulations); MGIPU (improving the methodology for conducting energy audits of heating and air-conditioning systems of buildings)
	Body for monitoring, measuring and verifying savings	NCB
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 ISEM.
	Expected energy savings by the end of 2019	<p>Households: 156 TJ</p> <p>Services (public and commercial): 349 TJ</p> <p>Total: 505 TJ</p> <p>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. Concerns only the buildings constructed during the implementation of the 3rd NEEAP.</p>

	<p>Expected energy savings by the end of 2020</p>	<p>Households: 156 TJ                  Services (public and commercial): 349 TJ                  Total: 505 TJ</p> <p>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. Concerns only the buildings constructed during the implementation of the 3rd NEEAP.</p>
	<p>Assumptions</p>	<p>In 2013, 999,924 m<sup>2</sup> of residential buildings and 730,438 m<sup>2</sup> of new non-residential service sector buildings was constructed. Since 2010 the rate of construction of residential buildings has been continuously dropping by 25 % per year, while the trend of growth in the number of non-residential buildings has been dropping by 20 % per year. Taking these assumptions into account, it is expected that between 2014 and the end of 2016 a total of 1,734,243 m<sup>2</sup> of residential and 1,425,875 m<sup>2</sup> of residential surface will be constructed.</p> <p>In accordance with these assumptions, the projected total savings between 2014 and 2016 amount to 43,356.080 kWh (156 TJ) for residential and 96.978.991 kWh (349 TJ) for non-residential buildings.</p>
	<p>Overlapping, multiplication effect, synergy</p>	<p>No overlapping</p>

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	Directive 2010/31/EU on energy performance of buildings, requires Member States to ensure that by 31 December 2020 all new buildings are nearly zero energy buildings, and that all new buildings used and owned by public authorities are nearly zero energy buildings after 31 December 2018. 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, owners of buildings undergoing reconstruction, LRSGU
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	Calculations were made of cost optimum levels of minimal requirements for the energy performance of all types of buildings during 2013 and 2014, while the Technical Regulations OG 128/2015 stipulated the definitions of NZEB for all building categories (Eprim + 30 % share of RES). The National plan for increasing the number of nearly zero energy buildings was adopted in December 2014. Currently the Programme of fostering the construction of new and renovation of existing nearly zero energy buildings is being drafted, which shall design a system for encouraging participants in construction to build new and renovate existing buildings with a view of reaching the nearly zero energy standard, which will have a better energy performance than the one stipulated in minimum requirements.
	Funds and sources of financing	MGIPU: planned under the budget
	Executive body	MGIPU – drawing up the plan for increasing the number of nearly zero energy buildings
	Body for monitoring, measuring and verifying savings	NCB
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.



Expected energy savings by the end of 2019	Not estimated
Expected energy savings by the end of 2020	Not estimated
Assumptions	<p>Croatia set forth the standards for the design and construction of residential and non-residential nearly zero energy buildings and the deadlines for their implementation in the Technical regulation on the rational use of energy and thermal protection in buildings (Official Gazette No. 128/15) by stipulating the permissible values of primary energy for all building categories and the minimum share of RES. Further improvement should take the form of improvement of the definition of NZEB buildings in terms of balancing energy flows over the limits of the system, which would further encourage the use of renewable energy in NZEB buildings. Savings target - should be defined via Eprin, not QHnd.</p>
Overlapping, multiplication effect, synergy	<p>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 is no overlapping. 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.</p> <p>The plans for increasing the number of NZEB buildings should be accompanied by significant financial instruments to encourage the market to consider the concepts that are currently equally foreign to entrepreneurs and individual builders.</p>

### 3.2.2 Strategy of energy renovation of buildings (Article 4 of the EED)

Title of the measure		Fostering integral renovation of multifamily housing
Measure index		B.3
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	<p>This measure continues the implementation of the programme for energy renovation of multifamily housing 2014-2020. 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 requirement for participation in the co-financing programme is the existence of project documentation required in accordance with the construction legislation. From 2017 one of the main instruments of European cohesion policy, namely the European Fund for Regional Development, will be used for co-financing this measure. The resources allocated from this Fund for the purpose of implementation of this measure fall under the Operational Programme Competitiveness and Cohesion for objective 4c2, Reduction of energy consumption of the residential buildings.</p> <p>During the implementation of this measure between 2014 and 2016, the interest of citizens was constant and well above the estimates and the plan defined by the Programme. Therefore, for the 3-year period between 2017 and 2020 it is planned to increase the target for this sector, which will provide a greater contribution to the overall national climate and energy objective.</p> <p>For the period 2017-2020 it is planned to increase the target from 1 % to 2 %, which means that the response of citizens to energy renovation of 2 % of the total surface area of multi-apartment buildings or 1,000,000 m<sup>2</sup> every year is assumed.</p> <p>The potential of this sector for the contribution of the national energy target has been recognised and the increase of the planned target is financially achievable by increasing the allocated ERDF funds for this sector under the OPCC. This will also provide additional benefit in terms of the increase of absorption of available resources from EU funds.</p>
	Target final consumption	<p>All types and systems of energy consumption in multifamily housing. Consumption of heat energy in existing multifamily housing constructed before 1987.</p> <p>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.</p>
	Target group	Co-owners of residential buildings (citizens); companies managing multifamily housing (building managers).
Regional application	National	

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Information on implementation	List and description of activities for	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:
	implementation of measure	<ul style="list-style-type: none"> <li>• EPEEF and MGIPU invite building managers to develop renovation plans for the buildings they manage, based on the results of conducted energy audits and project documentation.</li> <li>• MGIPU (IB1) and EPEEF organize informative workshops in the territory of Croatia and conduct a promotional campaign.</li> <li>• MGIPU (IB1) prepares and published public tenders, in cooperation with IB2 and MRRFEU, in accordance with EU rules on co-financing with EU funds and Common national rules. MGIPU plans the resources.</li> <li>• The criteria for allocation of resources shall be jointly laid down by MGIPU 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.</li> <li>• Applicants submit project proposals to IB2.</li> </ul> <p>A valid energy certificate of the building and renovation project are a requirement.</p> <ul style="list-style-type: none"> <li>• A list of project proposals with score and Decision on co-financing are issued.</li> <li>• The agreement on co-financing the energy renovation of the building is signed between the beneficiary, IB1 and B2.</li> <li>• Implementation of the project, IB2 verifies the fulfilment of project obligations.</li> </ul>
	Funds and sources of financing	<p>The overall investments required for renovating 1 % of the total surface area of multifamily housing amount to HRK 527.5 million per year:</p> <ul style="list-style-type: none"> <li>• HRK 10 million per year for energy audits and energy performance certificates of buildings</li> <li>• HRK 17.5 million per year for drawing up project documentation for the renovation of buildings</li> <li>• HRK 500 million per year for integral renovation of multifamily housing. Citizens will benefit from co-financing of 80 % of the costs of energy audits and energy certification of buildings, 80 % of the costs for drafting project documentation for renovation of buildings and at least 40 % of the costs for integral renovation of multifamily housing.</li> </ul> <p>Energy efficiency project for this measure shall no longer use national resources, but rather the resources from EU structural funds.</p> <p>ERDF – EUR 70 million of grants has been allocated for reducing energy consumption in residential buildings by 2020, which includes the following:</p> <ul style="list-style-type: none"> <li>- costs of energy audits and energy certification of the building before and after energy renovation,</li> <li>- costs of drafting project documentation,</li> <li>- costs of administration and project management,</li> <li>- costs of implementation of the project, and</li> <li>- costs of expert monitoring of the construction / Project surveillance / Health safety coordinator.</li> </ul> <p>The increase of the planned target from 1 % to 2 % of the total surface area of multifamily housing represents annual savings in the amount of HRK 1,055,000,000:</p> <ul style="list-style-type: none"> <li>• HRK 20 million per year for energy audits and energy performance certificates of buildings</li> </ul>

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		<ul style="list-style-type: none"> <li>HRK 35 million per year for drawing up project documentation for the renovation of buildings</li> <li>HRK 1 billion for integral renovation of 2 % of multifamily housing</li> </ul> <p>The increase is financially achievable by re-allocating ERDF resources under the OPCC for this sector, in favour of an increased absorption of total available resources from EU funds.</p>
	Executive body	<p>MGIPU – as the first level intermediary body in the system of managing and monitoring the Operational Programme Competitiveness and Cohesion, under which it plans EU funds and drafts the co-financing contract.</p> <p>MGIPU - monitoring the work of authorized persons</p>
	Body for monitoring, measuring and verifying savings	NCB
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 energy savings by the end of 2019	2.19 PJ (730 TJ a year)
	Expected energy savings by the end of 2020	2.92 PJ
	Assumptions	<p>It is assumed that energy audits will be conducted, and energy performance certificates issued for 100 buildings a year. It is assumed that project documentation will be drawn up for 1000 buildings a year. A total of 149.38 million m<sup>2</sup> of usable floor area of residential buildings was registered in 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<sup>2</sup>. 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 2 %, or approximately 1,000,000 m<sup>2</sup>, 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<sup>2</sup> according to the Ordinance on monitoring, measuring and verifying energy savings in final consumption. Annually, that should save 101 million kWh or 730 PJ, and the life cycle of this measure is 20 years.</p> <p>The assumed cost of renovation is HRK 1 000/m<sup>2</sup>.</p>
	Overlapping, multiplication	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.

	effect, synergy	It is necessary to raise the awareness of co-owners on the condition of their buildings 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.
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Title of the measure		Increasing energy efficiency and use of RES in the commercial service sector (tourism and trade)
Measure index		B.4
Description	Category	Grants and financial instruments
	Time frame	Start: 2017 End: 2023
	Objective / outline	Achievement of energy savings through the increase of efficiency in using energy in the service sector, enabling equal or better results (services) using less input energy and reduction of the share of conventional (fossil) fuels in total consumption of energy by introducing renewable energy sources in the products sector in the service sector. Continuation of measure from the 3rd NEEAP B.4 Programme of renovation of commercial non-residential buildings 2014-2020
	Target final consumption	Infrastructure of economic entities registered for providing trade and tourism services
	Target group	Economic entities registered for tourism and trade
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>Development of the infrastructure for renewable energy sources in the service sector (tourism and trade), including transition from conventional to alternative energy sources (RES), such as: solar collector, heat pumps, highly efficient co-generation, etc.</p> <p>Implementation of measures for increasing energy efficiency in the service sector (tourism and trade), including:                      “soft measures” - introduction of systematic energy management, conducting energy audits, control of analyses of energy consumption, preparation of plans for more efficient energy management, institutional and organizational estimate and proposals for optimizing business processes in terms of energy savings.                      Infrastructural investments such as investments in smart meters and renovation of buildings, which will contribute to the achievement of goals regarding energy efficiency, improvement of currently used technologies, implementation of pilot projects.                      Additionally: depending on the availability of financial resources acquired through the sale of emission units at the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14), the implementation of measures focused on commercial buildings not in the trade and tourism sectors will be encouraged. These activities are complementary with the activities of the measure, but differ regarding the source of financing. The effects will be added to the savings achieved under the measure and the effects will be divided via SMIV depending on energy sources (OPCC and ETS).</p>

	Funds and sources of financing	<p>Implementation of activities will be directed at funds available in the Operational Programme Competitiveness and Cohesion 2014 -2020. (OPCC) under specific target 4b.2.</p> <p>The funds will be allocated in two parts:</p> <ul style="list-style-type: none"> <li>• 1st part - EUR 25,000,000 in grants</li> <li>• 2nd part - EUR 15,000,000 in combination of grants and financial instruments</li> </ul> <p>The amount of grants for the activities will be determined in accordance with Commission Regulation (EU) no. 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty. The amount of grants for project and preparatory documentation will be stipulated pursuant to the Commission Regulation (EU) no. 1407/2013 of 18 December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to <i>de minimis</i> aid.</p>
	Executive body	MZOE and EPEEF
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The measure will be monitored using the bottom-up method of estimated savings. The results of implemented measures shall be entered in the System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	0.242 PJ
	Expected energy savings by the end of 2020	0.349 PJ
	Assumptions	The savings have been estimated concerning planned resources and indicators of achieved savings per unit of paid funds of the EPEEF in 2015 and 2016. A lump sum of HRK 1.68 was paid for measures of energy renovation of commercial non-residential buildings for savings of 1 kWh/year within a measure's life cycle. The life cycles of technical measures differ; the duration of life cycle is the shortest for new office equipment (3 years), but most measures have a life cycle exceeding 15 years, e.g. 25 years for energy renovation of building envelopes, and 30 years for windows with good energy performance. The application of financial measures and the ESCO model for stimulating the implementation of measures could yield a reduction in the necessary share of grants in investments, which would lead to greater savings based on predicted public funds.
	Overlapping, multiplication effect, synergy	The activities of the measure will be promoted through measure I.1, Industrial energy efficiency network.

Title of the measure		Programme of energy renovation of family homes 2014-2020
Measure index		B.5
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020
	Objective / outline	<p>This measure is aimed at the renovation of existing family homes by 2020. It focuses primarily on family homes of up to 400 m<sup>2</sup> 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.</p> <p>From 2017, this measure will be co-financed with the resources from the European Fund for Regional Development approved under the Operational Programme Competitiveness and Cohesion 2014-2020.</p> <p>Within the framework of implementation of this measure between 2014 and 2016, the interest of citizens was constantly significantly over the plan defined by the Programme. Therefore, for the 3-year period between 2017 and 2020 it is planned to increase the target for this sector, which will provide a greater contribution to the overall national climate and energy objective.</p> <p>For the period between 2017 and 2020 it is planned to increase the target from 100 houses per county to 200 houses per county, which means that it is assumed that the citizens will respond to energy renovation of 4000 family homes in Croatia every year. The potential of this sector for the contribution of the national energy target has been recognised and the increase of the planned target is financially achievable by increasing the allocated ERDF funds for this sector under the OPCC. This will also provide additional benefit in terms of the increase of absorption of available resources from EU funds.</p> <p>In 2018 the amendments to the Programme will define the category of energy vulnerable households and, in accordance with the stipulated criteria, a significantly larger share of co-financing will be made possible considering the status of vulnerability. 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<sub>2</sub> 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', combating energy poverty, and an overall improvement of living conditions.</p>
	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)
Regional application	National, in cooperation with counties, LRSGUs and regional energy agencies	

Information on implementation	List and description of activities for implementation of measure	<p>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).</p> <p>Programme implementation:</p> <ul style="list-style-type: none"> <li>• MGIPU 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. The NCB, through cooperation with LRSGUs, and especially obligated parties of planning and large cities and counties, coordinates activities and actively involves LRSGUs.</li> </ul> <p>EPEEF:</p> <ul style="list-style-type: none"> <li>• Drafts and published tender documentation in cooperation with MGIPU.</li> <li>• Collects the tenders for projects of energy renovation of family homes</li> <li>• Performs the selection of projects that meet the criteria of the public call for tenders</li> <li>• Controls the fulfilment of contractual obligations MGIPU:</li> <li>• Plans funds</li> <li>• Prepares the tender documentation</li> <li>• Confirms the selection of projects</li> <li>• Signs the co-financing contract</li> </ul> <p>Approximately 4000 family homes are expected to be renovated on an annual basis, i.e. 200 houses per county.</p> <p>Additionally: depending on the availability of financial resources acquired through the sale of emission units at the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14), the EPPEF shall implement the measures of installation of thermal-technical systems and the transition from conventional to alternative energy sources (RES), such as: photovoltaic systems for own consumption, biomass boilers, solar collectors, heat pumps, etc. This complements the Programme and represents a sort of upgrade of the Programme. The effects will be added to the savings achieved under the Programme and the effects will be divided via SMIV depending on energy sources (OPCC and ETS).</p>
	Funds and sources of financing	<p>Planned funds by the end of 2020:</p> <p>The annual investment for the energy renovation of 2000 family houses (100 houses per county) amounts to HRK 207.5 million:</p> <ol style="list-style-type: none"> <li>1. renovation of building envelope - HRK 87.5 million</li> <li>2. replacement of the heating system - HRK 40 million</li> <li>3. fostering the use of RES - HRK 80 million</li> </ol> <p>By increasing the plan to the renovation of 4000 family houses in Croatia annually, the investment would amount to HRK 415 million, of which no less than 40 % or HRK 166 million or EUR 21.8 million would be co-financed to the citizens.</p> <p>The increase of the target of energy renovation to 4000 family houses</p>



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		annually (200 houses per county) is financially achievable via approved allocation for this sector from the ERDF under the OPCC.
		<p>Sources of financing:</p> <ul style="list-style-type: none"> <li>• Resources from European Union (EU) structural funds.</li> </ul> <p>Approximately EUR 30 million (HRK 228,000,000) has been earmarked for the renovation of this sector by 2020 under the OPCC:</p> <ul style="list-style-type: none"> <li>• Sources of financing for citizens (citizens' funds from home savings accounts etc.)</li> <li>• Citizens' loans</li> <li>• LRSGU budgets</li> </ul>
	Executive body	<p>MGIPU – as the first level intermediary body in the system of managing and monitoring the Operational Programme Competitiveness and Cohesion, under which it plans EU funds and drafts the co-financing contract.</p> <p>MGIPU - operative monitoring of the implementation of the programme</p> <p>MRRFEU – as the managing body managing the OPCC and responsible for its overall implementation. IB2 - verifies the fulfilment of contractual obligations</p>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effects of the measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV)
	Expected energy savings by the end of 2019	1.21 PJ (403 TJ a year)
	Expected energy savings by the end of 2020	1.61 PJ
	Assumptions	<p>It is assumed that 200 family homes per county, or approximately 4 000 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<sup>2</sup> of surface area of walls. It is also assumed that, on average, 35 m<sup>2</sup> of windows will be replaced per house. That would achieve unit savings of 195.2 kWh/m<sup>2</sup> of surface area of windows. 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 200 000 m<sup>2</sup> of the outer structure (wall) area will be thermally insulated per year, or 70 000 m<sup>2</sup> of windows will be installed per year.</p> <p>The replacement of existent gas-powered condensing boilers with new ones typically reduces energy consumption by 97.5 kWh/m<sup>2</sup> of building surface 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</p>

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		675 kWh/m <sup>2</sup> of collector surface area. The programme is expected to be implemented with the same intensity by 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. This measure builds upon the Programme for combating energy poverty measure and the measures complement each other.

### 3.2.3 Other energy efficiency measures in the construction sector

Title of the measure		Energy renovation of buildings and replacement of lighting within the
Measure index		B.6
Description	Category	
	Time frame	Start: 2017 End: 2019
	Objective / outline	Implementation of measures of energy efficiency of buildings and the replacement of lighting with more energy efficient lighting (LED).
	Target contribution to more efficient production of electricity	Proposals of economically justified measures encompassing reports on energy audit of buildings point to projects that will lead to an improvement of thermal performance of existing buildings and would meet the basic requirements of energy management and preservation of heat during exploitation of buildings.  Reduction in consumption of energy for lighting by replacing the existing system with an efficient system of LED lighting and a reconstruction of the lighting management system. Promotion of energy efficiency, savings in electricity, preservation of the environment-reduction in emissions of CO <sub>2</sub> and reduction in maintenance costs.
	Target group	HEP Group
	Regional application	National
List and description of activities for implementation of measure	<p><b>1 Energy renovation of buildings of the CTPP Jertovec plant</b></p> <p>1) Administrative building: - thermal insulation of flat roof - thermal insulation of exterior façade - replacement of the heating system</p> <p>2) Plant building: - thermal insulation of flat roof - thermal insulation of exterior façade</p> <p><b>2. Replacement of worn out joinery on the administrative building of TPP Rijeka</b></p> <p>Replacement of the administrative building joinery with aluminium double-glazed joinery <math>U_w = 1.1 \text{ W/m}^2</math>.</p> <p><b>3. Energy renovation of the guardhouse of CHPP Osijek</b></p> <p>1) Prepare the project of building renovation. The service provider will be selected in accordance with the Public Procurement Act. The launch of the procurement process is predicted for 2018</p> <p>Performance of works on the comprehensive renovation of the building Pursuant to the prepared project of building renovation and the tendering documentation, a public procurement process will be launched for the purpose of selecting a contractor in accordance with the Public Procurement Act. The launch of the procurement process is predicted for</p>	

		<p>2019, after which the beginning of works is planned.</p> <p><b>4 Implementation of measures of improving energy efficiency of the administrative building, equipment warehouse and workshops of CHPP Zagreb</b></p> <p>Necessary scope of works:</p> <ul style="list-style-type: none"> <li>- reconstruction of flat roofs, installation of thermal and hydroinsulation</li> <li>- replacement of old steel joinery with single-glazed glassed with new aluminium joinery</li> <li>- installation of thermal façade</li> <li>- beginning of works in 2017, completion in 2018</li> </ul> <p><b>5 Replacement of old lighting fixtures in the CHPP Osijek plant with new, LED-based ones</b></p> <ol style="list-style-type: none"> <li>1) Procurement of new lighting fixtures</li> <li>2) Removal of old and installation of new lighting fixtures</li> </ol> <p><b>6. Reconstruction of exterior lighting in CHPP Sisak</b></p> <p>Energy efficient lighting fixtures (LED-based) have already been installed in one part during the repair of faults on the existing systems. On a part of exterior lighting system where this has not yet been performed, the replacement of existing lighting fixtures with energy efficient ones is planned during 2017.</p> <p><b>7. Reconstruction of lighting by applying energy efficiency measures within CHPP Zagreb</b></p> <p>In accordance with the proposal, the modernisation of lighting is performed with highly efficient LED lamps. The project would encompass:</p> <ul style="list-style-type: none"> <li>- the C block: 559 lamps and the replacement of the existing electrical installations for purpose of lighting</li> <li>- the K block: 535 lamps and the replacement of the existing electrical installations for purpose of lighting</li> <li>- exterior lighting: 132 lamps and the replacement of the existing electrical installations for purpose of lighting</li> <li>- the period of return of investment: between 5 and 7 years in energy savings only</li> </ul> <p>Implementation during 2017 and 2018.</p> <p><b>8. Programme Energy efficient lighting in TPP Plomin</b></p> <p>Installation of highly efficient lighting (LED lighting) (2017) The project of replacement of the existing lighting with high-efficient LED lighting in 2015 comprised the lighting on the dock, coal transport and coal depot. All lighting fixtures were replaced and lighting management was reconstructed. The second stage of implementation of lighting has been contracted and will be carried out by mid-2017; it comprises the boiler room, auxiliary boiler room, electric filter, the de-sulphurisation plant and wastewater treatment plant. The third stage comprises the block 2 boiler room and is in the stage of drafting the tender; the implementation will start after contracting.</p> <p><b>9. Replacement of interior and exterior lighting in HPP facilities (2017 -2018)</b></p> <p>The replacement of the existing lighting is planned: interior and exterior lighting in HPP facilities with the purpose of using energy efficient lighting and, indirectly,</p>
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		reducing total own consumption of electricity. The facilities where the replacement of lighting is planned are the following: HPP Varaždin, HPP Čakovec, HPP Dubrava, HPP Senj, HPP Gojak, Services of PF North.
	Funds and sources of financing	<p><b>1 Energy renovation of buildings of the CTPP Jertovec plant</b></p> <p>1) Administrative building:</p> <ul style="list-style-type: none"> <li>- Thermal insulation of flat roof HRK 191 202</li> <li>- Thermal insulation of exterior façade HRK 263 235</li> <li>- Replacement of the heating system HRK 80 000</li> </ul> <p>2) Plant building:</p> <ul style="list-style-type: none"> <li>- Thermal insulation of flat roof HRK 60 723</li> <li>- Thermal insulation of exterior façade HRK 82 558</li> </ul> <p><b>2. Replacement of worn out joinery on the administrative building of TPP Rijeka</b></p> <p>Value of the investment: HRK 1 422 640.00</p> <p><b>3. Energy renovation of the guardhouse of CHPP Osijek</b></p> <p>Planned funds: HRK 200 000.00 by the end of 2019</p> <p><b>4. Implementation of measures of improving energy efficiency of the administrative building, equipment warehouse and workshops of CHPP Zagreb</b></p> <p>Investment plan for CHPP Zagreb, estimate: HRK 4 600 000</p> <p><b>5. Replacement of old lighting fixtures in the CHPP Osijek plant with new, LED-based ones</b></p> <p>Planned funds: HRK 800 000.00 by July 2017</p> <p><b>6. Reconstruction of exterior lighting in CHPP Sisak</b></p> <p>Planned funds: HRK 50 000.00 by the end of 2017</p> <p><b>7. Reconstruction of lighting by applying energy efficiency measures within CHPP Zagreb</b></p> <p>Investment plan for CHPP Zagreb, estimate: HRK 12 000 000</p> <p><b>8. Programme Energy efficient lighting in TPP Plomin</b></p> <p>For 2017, the planned funds amount to HRK 2 000 000</p> <p><b>9. Replacement of interior and exterior lighting in HPP facilities (2017 2018)</b></p> <ul style="list-style-type: none"> <li>- HEP: HPP Varaždin – HRK 50 000 2017</li> <li>- HEP: HPP Čakovec – HRK 50 000 2017</li> <li>- HEP: HPP Dubrava – HRK 50 000 2017</li> <li>- HEP: HPP Senj– HRK 100 000 2017</li> <li>- HEP: HPP Gojak – HRK 200 000 2017 – HRK 270 000 2018</li> <li>- HEP: Services of PF North - HRK 180 000 2017</li> </ul> <p>Total: Replacement of interior and exterior lighting in the HPP facilities: HRK 900 000</p>
	Executive body	HEP – Proizvodnja d.o.o
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	Analysis of the calculation of consumption of energy sources before and after reconstruction of the building and analysis of the calculation of consumption of electricity before and after replacement of lighting fixtures. HEP - SGE Programme by company HEP-ESCO d.o.o. Verification by an expert and authorized company.

	<p>Expected energy savings by the end of 2019</p>	<p><b>1 Energy renovation of buildings of the CTPP Jertovec plant</b></p> <p>1) Administrative building:</p> <ul style="list-style-type: none"> <li>- Thermal insulation of flat roof 122 080.00 kWh/year</li> <li>- Thermal insulation of the exterior façade 55 396.00 kWh/year</li> <li>- Replacement of the heating system 9 000.00 kWh/year</li> </ul> <p>2) Plant building:</p> <ul style="list-style-type: none"> <li>- Thermal insulation of flat roof 41 082.00 kWh/year</li> <li>- Thermal insulation of the exterior façade 18 345.00 kWh/year</li> </ul> <p>Total: 491 806.00 kWh</p> <p><b>2. Replacement of worn out joinery on the administrative building of TPP Rijeka</b> Estimated savings of heat energy amounts to 83 248 kWh/year Total: 81 118.00 kWh</p> <p><b>3. Energy renovation of the guardhouse of CHPP Osijek</b> The proposed construction measures under the energy report are the following: 1 insulation of the ceiling with gypsum board and mineral wool d=10 cm and</p> <p>2. Installation of PVC joinery with a heat transfer coefficient of 1.1 kW/m<sup>2</sup>.</p> <p>The application of these measures will yield savings greater than 1,861.09 kWh, with a reduction of CO<sub>2</sub> emissions by more than 0,45 t. Seeing as how, in addition to the proposed measures, a detailed and extensive renovation of the facility is planned, it is assumed that the planned savings will be increased by another 20 %, so that the total savings of more than 2,233,308 kWh may be achieved by 2020, with annual savings of 558.327 kWh.</p> <p>Total: 1,116.654 kWh</p> <p><b>4. Implementation of measures of improving energy efficiency of the administrative building, equipment warehouse and workshops of CHPP Zagreb</b></p> <p>The proposed energy efficiency measures are the introduction of systematic energy management, replacement of joinery and insulation of exterior envelopes. Based on the proposed measures of energy certificates for these facilities, it is estimated that annual savings will amount to 942,774 kWh.</p> <p>Total: 1,885,548.00 kWh.</p> <p><b>5. Replacement of old lighting fixtures in the CHPP Osijek plant with new, LED-based ones</b></p> <p>Expected savings according to the current scope of replacement and the price of electricity on the market would be 300,000.00 kWh/year over two years, by 2020. 750,000 kWh.</p> <p>Total cca. 600,000.00 kWh</p> <p><b>6. Reconstruction of exterior lighting in CHPP Sisak</b></p> <p>The lighting is replaced successively; therefore, it is not possible to determine the expected savings.</p> <p><b>7. Reconstruction of lighting by applying energy efficiency measures within CHPP Zagreb</b></p> <p>It is assumed that the installation of energy efficient LED lighting will yield a reduction in electricity of 1,869,338/year.</p> <p>Total: 3,738,676.00 kWh.</p>
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		<p>Total: 2,000,000.00 kWh.</p> <p><b>9. Replacement of interior and exterior lighting in HPP facilities (2017 -2018)</b></p> <p>It is expected that the replacement of classic lighting with energy efficient LED lighting will yield savings in the amount of 200,00 kWh/year compare to previous energy consumption, which should be determined by measurements. Total: 300,000.00 kWh.</p> <p><b>Total savings by 2019: 9,098,264.654 kWh = 32.75 TJ</b></p>
	Expected energy savings by the end of 2020	<p><b>1. Energy renovation of buildings of the CTPP Jertovec plant</b> Total: 737,709.00 kWh</p> <p><b>2. Replacement of worn out joinery on the administrative building of TPP Rijeka</b> Total: 332,992 kWh</p> <p><b>3. Energy renovation of the guardhouse of CHPP Osijek</b> Total: 2,233.308 kWh</p> <p><b>4. Implementation of measures of improving energy efficiency of the administrative building, equipment warehouse and workshops of CHPP Zagreb</b> Total: 2,828,322.00 kWh</p> <p><b>5. Replacement of old lighting fixtures in the CHPP Osijek plant with new, LED-based ones</b> Total cca. 750,000.00 kWh</p> <p><b>6. Reconstruction of exterior lighting in CHPP Sisak</b> The lighting is replaced successively; therefore, it is not possible to determine the expected savings.</p> <p><b>7. Reconstruction of lighting by applying energy efficiency measures within CHPP Zagreb</b> Total: 5,608,014.00 kWh</p> <p><b>8. Programme Energy efficient lighting in TPP Plomin</b> Total: 3,000,000.00 kWh.</p> <p><b>9. Replacement of interior and exterior lighting in HPP facilities (2017 -2018)</b> Total: 500,000.00 kWh.</p>
	Assumptions	Securing sufficient financial resources under the Annual plan of investment of HEP Proizvodnja and performance of activities of the contractor according to the planned/contracted scope of procurement of equipment and other necessary works within mandatory works.
	Overlapping, multiplication effect, synergy	/

***3.2.4 Savings resulting from measures for increasing energy efficiency in the buildings sector***

Described above, individually for each measure.

***3.2.5 Financing measures for increasing energy efficiency in the buildings sector***

Described above, individually for each measure.

### 3.3 Energy efficiency in the public sector

#### 3.3.1 Central government buildings (Article 5 of the EED)

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 was registered in 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.

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. The measures are presented below. Although the Programme of energy renovation of public sector buildings 2014-2015 is over, it continues in 2017 because there is a part of contracted renovations that have not been completed.

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. Croatia is successful in the achievement of the renovation target of 3 % of public buildings between 2014-2016, and the data on savings has been verified through the System for monitoring, measuring and verifying energy savings. The results on achieved targets on an annual level are given in Table 3-10:

**Table 3-10** Results of renovation of public buildings (Source: National energy efficiency coordinating body, CEI)

<b>3 % of renovation of central government buildings</b>		
	Planned target	Achieved savings
2014	0.00489 PJ	0.01099 PJ
2015	0.00489 PJ	0.06136 PJ
2016	0.00489 PJ	0.02942 PJ



Title of the measure		Continuation of funding of the Programme of energy renovation of public sector buildings 2014-2015
Measure index		P.1
Description	Category	Financial instruments
	Time frame	Duration of the measure: 2014 - 31.12.2018
	Objective / outline	<p>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.</p> <p>The extension of financing of the Programme will ensure the continuation of energy renovation of public sector buildings which are underway or are currently being contracted, and allows for fulfilment of energy efficiency targets and continuation of the development of the ESCO market, all in accordance with Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.</p>
	Target final consumption	Services sector - project initiated under the Programme of energy renovation of public sector buildings 2014-2015 by 31 December 2016.
	Target group	Public sector buildings
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>During 2016, 11 contracts were in the realization stage, which means that the renovation of 45 buildings, occupying a surface area of 111,988.73 m<sup>2</sup>, is currently underway.</p> <p>Another 6 contracts are in the process of being contracted, which will cover the renovation of 42 buildings occupying a net surface area of app. 149,891.83 m<sup>2</sup>.</p>
	Funds and sources of financing	The Environmental Protection and Energy Efficiency Fund will secure funds for co-financing the implementation of the Programme of energy renovation of public sector buildings of Croatia for the period 2014-2015 in the part of the Programme concerning the implementation of energy renovation based on energy efficiency contracts, by granting financial assistance in the total amount of up to HRK 195,000,000.00 or 40 % of eligible costs for the period until 31 December 2018. These funds are obtained from selling emission units at the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14).
	Executive body	MGIPU - prepares the Programme and supervises its implementation APN – implements the Programme EPEEF - secures funds
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring/	The effects of the measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV)

	measuring energy savings	
	Expected energy savings by the end of 2019	0.2268 PJ
	Expected energy savings by the end of 2020	0.2268 PJ
	Assumptions	<p>It is assumed that this will overcome the financial gap between the Programme of energy efficiency of public sector buildings 2014-2015 and the Programme for energy renovation of public sector buildings 2016-2020, and that the renovations that are currently underway or in the contracting stage will not be suspended.</p> <p>(11 contracts are currently in the realization stage, which implies the renovation of 45 buildings occupying a surface area of app. 111,988.73 m<sup>2</sup>, in the total amount of contracted value of HRK 445,003,862.70, with co-financing from the Fund in the amount of HRK 140,826,534.44 (with VAT).</p> <p>6 contracts are currently in the contracting stage, which implies the renovation of 42 buildings occupying a surface area of app. 149,891.83 m<sup>2</sup>, in the estimated amount of contracted value of HRK 304,254,185.00 (with VAT), with co-financing from the Fund in the amount of HRK 105,450,000.00 (with VAT).</p>
	Overlapping, multiplication effect, synergy	Users of the buildings and the public should be regularly informed of completed projects and benefits that renovation has brought to the users and the savings brought to the owner, i.e. the state.

<b>Title of the measure</b>		<b>Programme of energy renovation of public sector buildings 2016-2020</b>
Measure index		P.2
Description	Category	Financial instruments
	Time frame	Start: July 2017 End: 31 December 2020
	Objective / outline	<p>The aim of the Programme is to raise the activity level in energy renovation to 3 % of the total public sector building fund per year, reduce the consumption of energy for cooling/heating renovated public sector buildings up to 70 %, or annual savings of app. 50 GWh and the achievement of target of energy savings of public sector buildings, including alternative policy measures set forth in the Third National Energy Efficiency Action Plan for the Period Between 2014 and 2016.</p> <p>The programme of energy renovation of public sector buildings concerns buildings of central state administration (ministries and state administration bodies) and buildings of local and regional self-government units, i.e. buildings owned by the public sector where social activities (education, science, culture, sport, health and social care), activities of state bodies and organizations, as well as bodies and organizations of local and regional self-government units, activities of legal persons with public</p>

		<p>authorities are performed, as well as buildings for community housing, buildings of citizens' associations and religious communities.</p> <p>The Programme ensures the continuity of fulfilment of requirements pursuant to Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, which stipulates that from 1 January 2014 Member States shall renovate 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government or use alternative means to achieve energy savings in central government buildings equal to the energy savings obtained by applying the 3 % rate of renovation.</p>
	Target final consumption	<p>All types and systems of energy and water consumption in public buildings. A total of 13.8 million square meters of usable floor area of public sector buildings was registered in Croatia in 2010, according to the data from the National Information System for Energy Management. 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<sup>2</sup>.</p> <p>According to analysed scenarios, which are not mutually exclusive, it is predicted that the intensity of energy renovation of buildings will increase to 327,000 to 473,000 m<sup>2</sup>, with expected cumulative savings in primary energy from 394 to 552 GWh by 2020.</p> <p>Building renovation means comprehensive renovation, or the renovation of the entire exterior envelope (thermal insulation of the façade, replacement of exterior joinery, renovation of the roof, etc.), and other works proposed by the first energy audit and certificate (replacement of thermal and technical systems, energy sources, etc.)</p>
	Target group	Public sector buildings, esp. buildings used for performing social activities of education, science, culture, sport, health care and social welfare.
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>It is planned that between 2017 and 2020 HRK 2,183,024,814 will be invested in energy renovation of public sector buildings. By the end of 2020, 9.46 % of the entire public sector building stock of Croatia, i.e. 1,305,169 m<sup>2</sup> of buildings, would be renovated. Savings in CO<sub>2</sub> emissions would amount to 80,269 tCO<sub>2</sub>, while the approximate financial savings would amount to HRK 142 million per year after comprehensive implementation of the programme.</p> <p>MGIPU (IB1) will prepare and publish a public call for tenders, in accordance with EU rules on co-financing with EU funds. The public call for tenders will define the criteria for allocation of funds.</p>
	Funds and sources of financing	<p>The programme is co-financed with funds of the European Fund for Regional Development under Priority axis 4. Promotion of energy efficiency and renewable energy sources, Investment priority 4c Promoting energy efficiency, smart energy management and use of RES in the public infrastructure, including public buildings in the housing sector, Specific objective 4c1 Reduction of energy consumption in public sector buildings, Operational Programme "Competitiveness and Cohesion 2014 -2020, for</p>

		<p>EUR 211,810,805.00 has been secured, which is given in the State budget of Croatia under source 563 - European Fund for Regional Development.</p> <p>In the 2017 state budget of Croatia and projections for 2018 and 2019, the following sums have been secured for activity T538072 Operational Programme Competitiveness and Cohesions 2014 -2020 (source 563):</p> <ul style="list-style-type: none"> <li>- for 2017: HRK 30,754,750.00,</li> <li>- for 2018: HRK 114,601,737.00,</li> <li>- for 2019: HRK 132,302,000.00-</li> </ul> <p>- An additional HRK 334,325,546.00 will be planned for 2020. The remaining funds will be paid by 2023.</p> <p>This funds ensure the allocation of grants to beneficiaries in the amount of 40 % of the value of investment in energy renovation.</p>
	Executive body	<p>MGIPU - as IB1</p> <ul style="list-style-type: none"> <li>- creates the programme;</li> <li>- prepares and publishes a public tender for grants</li> <li>- plans funds;</li> <li>- undertakes information measures;</li> <li>- prepares the tender documentation for the selection of projects;</li> <li>- initiates strategic projects;</li> <li>- concludes grant agreements</li> <li>- takes part in the processes of paying beneficiaries and return of funds in case of irregularities;</li> </ul> <p>APN - implementation body for energy renovation in accordance with the energy service model</p> <ul style="list-style-type: none"> <li>- determines which buildings will be renovated in accordance with the energy service model;</li> <li>- prepares and carries out public procurement;</li> <li>- together with MGIPU, controls energy renovations;</li> <li>- reports to competent bodies on the implementation of the Programme.</li> </ul> <p>EPEEF - as IB2:</p> <ul style="list-style-type: none"> <li>- participates in the process of allocating grants from the EPEEF in accordance with the regulations. MRREP - MB, managing body; manages and is responsible for the overall implementation</li> </ul>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effects of the measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	0.54 PJ

	Expected energy savings by the end of 2020	0.72 PJ
	Assumptions	<p>It is assumed that the implementation of the programme will lead to:</p> <ul style="list-style-type: none"> <li>- an increase in the absorption of European Union funds;</li> <li>- fostering investment with a positive effect on the state budget;</li> <li>- by investing private capital in public buildings under the ESCO model, which ensures that the measures of energy efficiency in public sector buildings are implemented without further spending of budget resources of the owner/beneficiary, increase total investment in the buildings sector;</li> <li>- encourage further development of the energy services market thanks to the need for installing materials and devices necessary for renovation;</li> <li>- in the long term, reduce the consumption of energy sources, fossil fuels and electricity;</li> <li>- contribute to an increased consumption of renewable energy sources.</li> </ul>
	Overlapping, multiplication effect, synergy	<ul style="list-style-type: none"> <li>- Improved standard of using public buildings, by establishing a more pleasant and healthier environment for the citizens and users of public space, will influence the improvement of productivity of employees and a drop in absenteeism.</li> <li>- There will be a need for employing more people, directly in the construction sector and indirectly in the accompanying construction material manufacturing industry, for manufacturing and installing energy systems and devices and employing highly qualified experts from the field of architecture, construction, engineering, automatics (contribution to the economy)</li> <li>- Renovation of buildings used for performing the educational activity will have a positive influence on the entire community, especially in demographically most vulnerable places, where renovated schools are also used as public space for other activities, such as cultural and social events.</li> </ul>

Title of the measure		Systematic energy management in the public sector
Measure index		P.3
Description	Category	Information and mandatory information measures
	Time frame	Start: 2014 End: 2019
	Objective / outline	<p>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, which encourages the development of new activities and entrepreneurship.</p> <p>The objective of the measure is to introduce, implement and verify measures of systematic energy management in public administration.</p> <p>Results of a successful implementation of SEM are the reduction of financial costs for energy and water through energy management and the application of energy efficiency measures, reduction of harmful influences on the environment, forming educated and competent EE teams capable for planning and managing energy consumption and the establishment of a system for managing facilities owned and used by the public sector via the national information system for energy management (ISEM).</p> <p>The important elements of systematic energy management are defined in the Energy Efficiency Act (OG 127/14), European Union Directive on energy efficiency (EED, 2012/27/EU), Ordinance on systematic energy management (OG 18/15) and the Methodology of systematic energy management (OG 18/15).</p> <p>Between 2017 and 2019 emphasis will be places on the automatization of collection of data on the consumption of energy sources and water, reporting and verifying savings measures and education energy partners and advisers pursuant to the Ordinance on systematic energy management OG 18/15)</p> <p>The entry of bills and meter readings is defined as a basic function and a legal obligation of ISEM 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.</p> <p>After achieving savings by monitoring consumption, a further direction for the development and intensification of ISEM 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 ISEM modules.</p> <p>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.</p> <p>Connecting the ISEM 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.</p> <p>The ultimate objective is connecting all major public sector consumers with the remote system for reading energy and water consumption in order to allow for a timely planning, analysis and, in the event of excess situations, reaction to energy and water consumption. In order to reduce the costs of installing the remote reading system, the connection of charging meters of energy and water distributors/suppliers equipped with a system for remote reading of consumption with ISEM is planned.</p>

		<p>Up to 130 000 readings are currently being entered in the ISEM database via the system for remote reading of consumption of energy and water, while the database contains more than 3,200,000 readings in total. The objective is to include all locations in the public sector with a consumption of energy and water greater than HRK 400,000.00/year.</p> <p>Remote reading of energy consumption is an efficient tool for establishing systematic energy management in the buildings sector. This is corroborated by energy efficiency measures conducted based on the information obtained from the remote reading system financed by UNDP. Potential energy savings that can be achieved taking into account actual energy and water consumption in the facilities and a conservative estimate that systematic energy management based on good information from the remote reading system can lead to a 5 % reduction in the consumption of energy and water. In the event of excess situations, the percentage of savings will grow.</p>
	Target final consumption	Existing buildings owned and used by the public sector of Croatia
	Target group	Public sector employees
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>Systematic energy management is carried out through four segments:</p> <ol style="list-style-type: none"> <li>1. Collection of relevant data on the consumption of facilities owned and used by the public sector and public lighting by designated persons and via the remote measurement system through the National energy management information system.</li> <li>2. Analysis of collected data, which indicates the potential for energy savings and related economic savings. This defines priorities and allows for strategic planning, the objective of which is, inter alia, adoption of legal acts. Based on these analyses, four National Programmes that the APN will implement with MGIPU have been proposed.</li> <li>3. Reporting and verification The purpose of collection of data is the possibility of reporting results obtained via analysis and valorization of energy efficiency measures through renovation (OJZ) and establishment of SGE.</li> <li>4. Technical support and education One of the segments of the SGE programme is the provision of technical assistance regarding EE measures in form of preparation of technical documentation and using ISEM, as well as educating public sector employees through specialized courses and workshops, such as: Course for energy advisers and partners (CEAP) and ISEM workshops – training course for using ISEM.</li> </ol> <p>Within the framework of technical assistance to the public sector 2017-2019, the implementation of five programmes in the field of systematic energy management has been planned. The programmes will be implemented by APN with MGIPU:</p> <ul style="list-style-type: none"> <li>• National project for contracting power in the take-over of electricity for the public sector: Preparation of studies for facilities which do not contract maximum monthly values of engaged power properly, which is why they are penalized by HEP ODS. The studies will contain recommendations on proper contracting of engaged power within the limits of 85 %-105 % for every facility individually. Based on the data of the ISEM database, over 150 facilities with incorrectly contracted engaged power has been discovered. The total charged engaged power for these facilities was over 580,000 kW, which amounts to more than HRK 21,000,000. Proper contracting of peak power, savings would amount to app. 20 % of the total cost for calculated power, i.e. over HRK 4,000,000.</li> </ul>

		<p>Consumers that take over electricity at medium voltage, white business tariff model, are obligated to contract maximum monthly values of engaged power with HEP ODS. In the event that measured maximum values differ significantly from the contracted ones, the distributor shall charge penalties. The allowed upper and lower limits are 105 % and 85 % of contracted power, respectively. If the measures (i.e. realized) engaged power is under the lower limit, the amount of lower limit is charged. If the measures engaged power is above the upper limit, the buyer pays the achieved power plus additional double price for every kW above the upper limit.</p> <ul style="list-style-type: none"> <li>• The national project for removing costs of excessive reactive energy for the public sector</li> </ul> <p>Determining which facilities generate the biggest costs for excessive reactive energy according to the ISEM database. Preparation of feasibility studies regarding the installation of reactive energy compensators for 500 facilities that generate the biggest costs.</p> <p>The objective is to remove the item of excessive reactive energy in the public sector to 500 facilities that generate the biggest costs.</p> <p>In the electricity system, there are consumers with an inductive component (they use reactive energy) or a capacitive component (they generate reactive energy). Increased consumption or production of reactive energy causes imbalances to the energy network; therefore, stakeholders of the electricity system penalize occurrences of excessive reactive energy.</p> <p>These costs can be avoided by compensating reactive energy, which is achieved by installing reactive energy compensators in the facilities that pay the highest reactive energy penalties. Studies on the rentability of installing reactive energy compensators would help identify and confirm such facilities.</p> <p>According to the ISEM data, it has been calculated that the public sector spends app. HRK 8,400,000 on the excessive reactive energy item. 500 biggest generators of cost cover app. 60 % of the total costs (27,300,00 kVarh, or HRK 5,000,000) for the excessive reactive energy item.</p> <ul style="list-style-type: none"> <li>• The national project of optimizing the costs of heat energy power lease</li> </ul> <p>Drafting a study by authorized engineers on facilities using heat energy, which would approach HEP Toplinarstvo with a demand for a change (reduced lease) of heat energy.</p> <p>The objective is to reduce the cost of heat energy power lease in the public sector by changing the previously leased heat power.</p> <p>Information on the facilities that use heat energy as the energy source for heating has been collected via the national energy management information system. After the analysis of this information, 260 facilities eligible for changing (reducing) leased heat power were selected. The costs of leased heat power would be reduced after the drafting of studies by an authorized engineer firm and harmonization with HEP Toplinarstvo.</p> <p>Together with the above described activities, a completion of the database of facilities entered in the national energy management information system that do not implement systematic energy management, would be performed.</p> <p>The expected savings amount to HRK 8,600,000.</p> <ul style="list-style-type: none"> <li>• The national project for optimization of energy inefficient boilers in the public sector</li> </ul> <p>The ISEM is ready for entering all information regarding the existing boilers in public sector buildings. First, the information will be collected by users. It is believed that, after the database has been properly established, it will be possible to prepare a quality analysis of the plan for replacing the boilers with more efficient ones. The ultimate objective is to achieve savings by implementing the measure.</p>
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	<p>Funds and sources of financing</p>	<p>Planned funds by the end of 2019: HRK 17,580,000</p> <p>Systematic energy management in the public sector HRK 3,550,000</p> <p>National project for contracting power in the take-over of electricity for the public sector: HRK 2,175,000</p> <p>National project for removing costs of excessive reactive energy for the public sector: HRK 2,175,000</p> <p>National project for optimizing costs of lease of heat energy power: HRK 2,175,000</p> <p>The national project for optimization of energy inefficient boilers in the public sector - HRK 2,175,000</p> <p>National programme for accumulation of cooling energy in the buildings sector - HRK 350,000</p> <p>Connecting the ISEM with systems for metering and charging of suppliers and distributors of energy sources and water - HRK 1,080,000</p> <p>Installation of remote consumption reading systems at metering points in public sector institutions - HRK 3,900,000</p>

Fourth National Energy Efficiency Action Plan of the Republic of Croatia for the Period from 2017 to 2019

		APN: HRK 17,580,000
	Executive body	APN - finances and implements Suppliers of energy sources and water, operators of distribution systems - connection with ISEM NCB - in the part referring to the connection of ISEM and SMIV
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	Until now, achieved energy savings could be monitored via ISEM 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. Direct hourly monitoring of water and energy consumption via ISEM provides quality indicators of energy needs, which allows for better planning and management of resources.
	Expected energy savings by the end of 2019	Total: 1,052 TJ 300 TJ (annually) Systematic energy management 35 TJ (annually) Installation of remote consumption reading systems at metering points in public sector institutions 47 TJ (in 2019) National programme for optimization of energy inefficient boilers in the public sector
	Expected energy savings by the end of 2020	1,387 TJ
	Assumptions	Currently, ISEM features over 38,000 ETC of the public sector, of which 20,000 public lighting , over 53,000 metering points, over 400 distributors of energy and water and over 5300 educated users. Taking into account that HEP Distribucija (and Opskrba) cover almost all facilities in the system, connection to their bases alone would cover almost the entire consumption of electricity in the public sector in the territory of the entire Republic of Croatia. Calculation based on actual consumption entered in ISEM would yield the information on energy savings in 2011 and 2012. These savings have led to the introduction of so-called "small measures", the implementation of which started on most facilities in 2011. Annual average savings amount to 300 TJ. According to the information in the ISEM database on charged engaged power for 2015, For public sector facilities, under the assumption that users contract maximum monthly values of engaged power in the same amount as achieved, the savings would be around 20 % of the total cost for the calculated power item. It is estimated that savings will amount to HRK 4,000,000. Over 7,500 facilities paying for excessive reactive energy use have been detected in the ISEM database. Under the assumption that the use/production of reactive energy varies slightly over the year, profitability studies show that the installation of reactive energy compensators would result in savings amounting to app. HRK 5,000,000. So far 630 facilities served by HEP Toplinarstvo have been detected in ISEM, of which 260 facilities are candidates for a new study and change in the amount of leased heat power. The implementation of the proposed measure would lead to savings in the amount of HRK 8,6000,000. It is assumed that there are over 10,000 boilers in public authority bodies. Calculation based on actual consumption entered in ISEM would yield the information on energy savings in 2019. ISEM currently has over 400 distributors of energy sources and water.

		At the moment, ISEM features over 100 locations in the public sector equipped with app. 787 individual meters connected to the system of remote reading of energy and water consumption. With 100 locations, we covered around 30 % of energy and water consumption in the public sector. By connecting 400 biggest consumers in the public sector, we would cover around 70 % of the consumption, taking into account that active monitoring of energy and water consumption can contribute to a 5 % reduction of costs, for remote reading we can influence 7 % of energy and water consumption in the public sector. By connecting metering points to the system for automatic monitoring of energy and water consumption with ISEM, it is possible to perform automated surveillance of consumption (hourly surveillance, analysis of consumption) and obtaining timely information on excess situations (increased consumption, ruptured water/gas pipes, heating). Average annual savings amount to 35 TJ.
	Overlapping, multiplication effect, synergy	The measure was launched under the 3rd NEEAP under the name: Connecting ISEM with the metering and charging systems of energy commodity and water suppliers

### 3.3.2 Buildings of other public bodies (Article 5 of the EED)

European Union practice sets forth the preparation of national and local energy efficiency action plans for the purpose of further developing the measures of achieving energy savings, taking into account local circumstances and possibilities. Energy efficiency plans are important planning documents, because they allow the local community to participate in the achievement of objectives and they respond to the needs of local authorities, instead of having the state imposing solutions.

So far, only counties were obligated to plan energy efficiency measures through three-year programmes and one-year plans. The entire planning procedure is defined in the Energy Efficiency Act (OG 127/14), which harmonizes national, local and regional planning. Three-year plans are adopted by the representative body, while annual plans are adopted by the executive body, which simplifies the procedure. Plans of sustainable development of cities (which most cities already have: “Sustainable energy efficiency action plans” - SEAP) complement these documents, so there is already experience in the preparation and implementation of these documents.

The Energy Efficiency Act (OG 127/14) provides that all counties and cities with a population of over 35,000 shall adopt three-year Energy Efficiency Action Plans, which are adopted for the time period in accordance with the National Energy Efficiency Action Plans. In addition to the Action Plan, cities and counties also prepare Annual Energy Efficiency Plans, which define the measures in detail, with clearly indicated amounts and sources of financing and calculated savings. The plans are delivered to the National Coordinating Body for Energy Efficiency (NCB) for approval, after which the plan is adopted by the representative, or the executive body of the city/county. Croatia has 37 obligated parties for planning: 20 counties and 17 large cities. By 1 March 2017, 112 energy efficiency plans were made, of which 42 Energy Efficiency Action Plans and 71 Annual Energy Efficiency Plan. An overview of all obligated parties and submitted plans is provided in Table 3-11.

**Table 3-11** Overview of obligated parties of planning and submitted plans (Source: NCB)

City/county	Action Plan	2015 annual plan	2016 annual plan	2017 annual
Sisak-Moslavina County	+(2)	+	+	+
Varaždin County	+	+	+	+
Krapina – Zagorje County	+	+	+	+
Osijek-Baranja County	+	+	+	+

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Karlovac County	+(2)	+	+	+
Zagreb County	+	+	+	
Primorje-Gorski Kotar County	+	+	+	+
Međimurje County	+	+	+	+
Šibenik-Knin County	+(2)		+	
Split-Dalmatia County		+	+	
Brod-Posavina County	+	+	+	
Zadar County	+	+	+	+
Virovitica-Podravina County	+	+	+	
Istria County	+(2)	+	+	+
Bjelovar-Bilogora County			+	
Koprivnica-Križevci County	+		+	
Požega-Slavonia County	+			
Lika-Senj County	+		+	+
Vukovar-Srijem County	+			
City of Rijeka	+	+	+	
City of Bjelovar	+	+	+	+
City of Split		+	+	
City of Sisak		+	+	
City of Varaždin		+	+	
City of Karlovac	+(2)	+	+	+
City of Zadar	+	+	+	
City of Kaštela	+(2)		+	+
City of Velika Gorica	+		+	
City of Slavonski Brod	+		+	+
City of Zagreb	+		+	+
City of Vinkovci			+	+
City of Bakar	+		+	
City of Pula	+			+
City of Osijek	+		+	+
City of Šibenik	+			
City of Samobor		+		
Municipality of Šestanovac*	+			
Municipality of Antunovac*	+			
Municipality of Erdut*	+			
Municipality of Vladislavci*	+			
Town of Komiža*	+		+	
Town of Vis*	+		+	
Town of Novska*	+			

\* Not obligated parties

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: 2025 Planned major modifications, amendments, improvements: This measure amends and revises the measure from the 3rd NEEAP. It was designed based on the best experiences gained under various financial models of co-financing public lighting projects (EBRD, EPEEF, ESCO, service providers). The aim of the measure is to improve the ESCO market in Croatia.
	Objective / outline	Public lighting in Croatia spends around 450 GWh of electricity, which represents ca. 3 % of total final consumption of electricity (data from 2009). The projects of improvement of energy efficiency in public lighting are profitable depending on the price of electricity. However, previous practice has shown that savings are visible immediately and that they are easy to prove and verify through the application of the protocol for measuring and verifying savings via the national System for monitoring, measuring and verifying energy savings (SMIV). This is why these projects can be used for stimulating energy services market.  This measure comprises and develops innovative financial models of implementation of public lighting projects. The measure primarily includes the development of the Programme of energy renovation of public lighting, which shall stipulate target application of certain financial models depending on the demands of individual projects.
	Target final consumption	Consumption of electricity in public lighting
	Target group	Responsible persons in LRSGU, companies providing energy services, suppliers and manufacturers of equipment
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<u>Future activities:</u> 1. The MZOE and NCB must prepare a detailed Programme of energy renovation of public lighting by the end of 2017. The implementation shall start during 2018. The Programme shall cover and develop innovative components of various financial models: ESCO model, PPP model, using funds within EU programming (structural funds) via the EPEEF (consolidation of projects), "guarantee fund" for ESCO projects for public lighting and other appropriate innovative financing mechanisms. 2. The aim of the project is to achieve demonstrable savings in the public lighting system of over 30 GWh and cover over 50 % of the public lighting system every year until 2020. This amount represents additional savings compared to the achieved ones.
	Funds and sources of financing	Estimated funds in the period 2017 -2020: € 20 million from OPCC <ul style="list-style-type: none"> <li>Drafting the Programme of energy renovation of public lighting within the MZOE budget - HRK 200,000.00</li> <li>ESCO model and other financial mechanisms (PPP model, delivery of goods, etc.): co-financing in accordance with the financial plan pursuant to the Programme for energy renovation of public lighting</li> </ul> <p>The funds allocated to the thematic objective "Supporting transition to low CO<sub>2</sub> emissions economy in all sectors" are used since this is one of the selected targets to which funds within the</p>

		Operational Programme Competitiveness and Cohesion 2014 - 2020 are used, all with the cooperation with 1st level intermediary bodies with expert and technical cooperation with the Environmental Protection and Energy Efficiency Fund.
	Executive body	MZOE and NCB - preparation of programme and instructions for LRSGU NCB - collection and analysis of data LRSGU and ESCO companies - implementation EPEEF - co-financing under OPCC
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure will be monitored using the BU estimation method or ex-post analysis via the SMIV system.
	Expected energy savings by the end of 2019	270 TJ (75 GWh)
	Expected energy savings by the end of 2020	378 TJ (105 GWh)
	Assumptions	The target for 2020 was set on the basis of the following facts: electricity consumption for public lighting is 450 GWh; public lighting systems achieve savings of around 25 %, and even as high as 80 %, if LED technology and lighting regulation are used; the programme plans to cover 50 % of the overall electricity consumption for public lighting. It is assumed that the average achieved savings will amount to 50 % per system. The life cycle of technical measures is 15 years. It is assumed that during 2017, new savings will amount to 15 GWh, and in subsequent years 30 GWh.
	Overlapping, multiplication effect, synergy	NCB 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 is obtained from EPEEF and financial institutions - for co-financed projects, and from LRSGUs and ESCO companies for their projects.

3.3.3 Procurement by foreign public bodies (Article 6 DEU-a)

Title of the measure		'Green' public procurement
Measure index		P.5
Description	Category	Voluntary agreements and cooperative instruments
	Time frame	Start: 2014 End: 2019
	Objective / outline	<p>The aim of the measure is to include green procurement measures in regular public procurement procedures on the national and local level and to educate, train and build capacities of bodies directly implementing public procurement in terms of green public procurement.</p> <p>In 2017, the 1st National Action Plan for Green Public Procurement 2015-2017 with a 2020 perspective (NAP GPP) will continue being implemented; the Action Plan was adopted by Croatia at the session held on 26 August 2015. It recommends that obligated parties of public procurement include GPP measures in the technical documentation and the public procurement process; <a href="http://www.mzoip.hr/doc/nacionalni_akcijski_plan_za_zelenu_javnu_nabavu.pdf">http://www.mzoip.hr/doc/nacionalni_akcijski_plan_za_zelenu_javnu_nabavu.pdf</a></p> <p>The 1st NAP GPP contains, inter alia, instructions on how to use energy efficiency indicators in public procurement, as well as guidelines for calculating product life cycle costs. Standards are designed so that they can be easily used in public procurement procedures. All obligated parties of public procurement have been instructed to use GOO standards, inter alia, for products using energy (IT equipment, electricity, mobile phones). The national Green Public Procurement Committee has been formed, which monitors the implementation of GPP via a questionnaire and electronic public procurement classifieds (<a href="https://eojn.nn.hr/Oglasnik/">https://eojn.nn.hr/Oglasnik/</a>).</p> <p>The development of a 2nd NAP GPP is planned for late 2017; it will emphasize priority measures for the next 3-year period, from 2018 to 2020. The objective is that 50 % of implemented public procurement procedures be carried out applying the green public procurement standards by 2020. The NAP GPP fosters the development of the green products and services market. Buying green products and services contributes to the protection of the environment, energy efficiency, reduction in the consumption of resources and chemicals and reduction in GHG emissions.</p> <p>The energy efficiency requirements of energy-related products in public procurement procedures are laid down in the Ordinance on energy efficiency requirements of energy-related products in public procurement procedures (OG no. 70/15). The Act on the promotion of clean and energy-efficient road transport vehicles (OG No. 127/13), together with its by-laws, is also in force.</p> <p>The new Public Procurement Act (OG No. 120/16) sets forth the obligation of carrying out the most economically advantageous tender, which has opened the possibility of including other parameters in addition to the price, such as environmental and social considerations. A stronger implementation of green public procurement is therefore expected during the next period.</p>
	Target final consumption	Entities obligated to carry out public procurement when acquiring office and IT equipment, telecommunications services and mobile telephony services and household appliances, energy services, as well as all other products and services are instructed to use the GPP standards, which cover energy efficiency standards.

	Target group	Entities obligated to carry out public procurement pursuant to the Public Procurement Act.
	Regional application	National, LRSGUs and other entities obligated to carry out public procurement
Information on implementation	List and description of activities for implementation of measure	<p><u>Future activities:</u></p> <ol style="list-style-type: none"> <li>1. Continue with the implementation of educational and promotional activities and activities related to including GPP standards in public procurement procedures in accordance with 1st NAP GPP</li> <li>2. Continue monitoring green public procurement, as planned in 1. NAP GPP.</li> <li>3. Preparation of a proposal for the 2nd NAP GPP for the next 3-year period, 2018-2020, which shall include priority GPP standards including energy efficiency, where applicable. Here, the common EU GPP standards shall be used.</li> </ol>
	Funds and sources of financing	Implementation of activities and measures in accordance with the National Action Plan for Green Public Procurement 2015-2017 with a 2020 perspective (NAP GPP) will continue being implemented; the Action Plan was adopted by Croatia at the session held on 26 August 2015, and 2nd GPP NAP for the next 3-year period, 2018-2020, to be drafted.
	Executive body	MZOE in cooperation with MINGO and members of the Green Public Procurement Committee, Central Procurement Office, LRSGU and other obligated parties.
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	<p>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.</p> <p>The Central Procurement Office of the Government of Croatia monitors the data on the quantities and types of procured computer equipment and vehicles, and enters the implemented measures into the SMIV.</p>
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	Obligated parties shall, in the beginning of the year, publish their public procurement plans on the website; however, the statistical report on public procurement generated from the Electronic Public Procurement Classifieds contains information on whether GPP standards have been used, and will only be made in early 2018 for 2017, without giving any detail. Therefore, it is not possible to calculate energy savings without developing a method for monitoring GPP in the Electronic Public Procurement Classifieds.
	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 Other measures for energy efficiency in final consumption, including energy and transport

All measures from the 3rd NEEAP regarding the industry sector have been refined, whereby some have been suspended in accordance with amendments to the applicable regulations (obligation of energy audits of large companies), while others have been consolidated with the purpose of targeting resources to complementary activities.

#### 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 cooperative instruments
	Time frame	Start: 2017 End: 2025 Planned 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 and link the activities with EU sources of funding and facilitate the implementation of regulations. Also, IEEN activities will also promote measures regarding the increase of energy efficiency in industry I.2, as well as other projects of increasing energy efficiency in the economy and commercial buildings.
	Target final consumption	Consumption of all types of energy in industry and the commercial sector
	Target group	Economic operators
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>The key elements of IEEN are: connections with economic operators via existing HGK structures; establishing a list of experts competent for the field of energy efficiency in the commercial sector; proposing pilot projects; promotion of best practice projects; education and training. Implementation of these activities will be directed at funds available in the Operational Programme Competitiveness and Cohesion 2014 -2020 (OPCC).</p> <p>Future activities:</p> <ul style="list-style-type: none"> <li>• Institutional coordination: cooperation between state and professional bodies involved in the development of IEEN</li> <li>• development of tools: SEM, M&amp;T, energy audits, benchmarking, demo projects</li> <li>• determining financing: Developing aspects of financing, considering possible so-called “pipeline” projects, developing the possible application of the ESCO principle and OPCC in industry</li> <li>• promoting measures for increasing energy efficiency in industry I.2</li> <li>• informing and educating economic entities</li> </ul> <p>Implementing plans and monitoring the implementation on an annual level in terms of spent resources and achieved savings of energy and CO<sub>2</sub> emissions for NCB.</p>
	Funds and sources of financing	Source of financing: work activities IEEN: HGK budget and NCB Potential source of co-financing the measure: EU funds, OPCC programme for related measures (channelling the I.2 measure and energy efficiency projects in economy)

		Financing promotional and informative materials and workshops: EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14), HRK 30,000.00
	Executive body	HGK - implementation in cooperation with NCB MZOE - support
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effect of the measure will be monitored via the System for measuring and verifying energy savings, through individual projects or with the help of completed energy audits.
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	/
	Overlapping, multiplication effect, synergy	The activities of IEEN will promote measures regarding the increase of energy efficiency in industry I.2 and measure in the building sector B.4

Title of the measure		Increase of energy efficiency and use of RES in manufacturing industries
Measure index		I.2
Description	Category	Grants and financial instrument
	Time frame	Start: 2017 End: 2023
	Objective / outline	Achievement of energy savings through the increase of efficiency in using energy in the manufacturing industry (enabling equal or better amounts of results (production) by using less input energy and reduction of the share of conventional (fossil) fuels in total consumption of energy by introducing renewable energy sources in the products sector in the manufacturing industry.
	Target final consumption	Production and consumption of electricity and the production of heat energy in economic entities and industrial facilities
	Target group	steel and iron industry, non-ferrous metals industry, chemical industry, glass industry, ceramics and construction material industry, mining textile industry, leather and clothing industry, paper
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>Development of infrastructure for renewable energy sources in industrial production, including the transition from conventional to alternative energy sources (RES) such as: solar collectors, heat pumps, highly efficient co-generation, transition to more efficient fuels with less footprint. Implementation of measures for increasing energy efficiency in industrial production.</p> <p>Completed energy audit for MSPs.</p> <p>Completed main project on the level of an implementing project for energy cost centres for which the energy savings project is applied.</p> <p>Additionally: depending on the availability of financial resources acquired through the sale of emission units at the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14), the implementation of measures focused on tobacco and food industry will be encouraged. These activities are complementary with the activities of the measure, but differ regarding the source of financing. The effects will be added to the savings achieved under the measure and the effects will be divided via SMIV depending on energy sources (OPCC and ETS).</p> <p>Furthermore, co-financing via the EPEEF will encourage the introduction of the energy management system in accordance with the HRN EN ISO 50001 standard in companies and crafts, as well as energy audits of MSPs and crafts. This activity guarantees the support for estimating the potential for energy savings in companies, as well as continuous monitoring of energy consumption and identifying the possibilities for savings.</p>
	Financial resources and	Implementation of activities will be directed at funds available in the Operational Programme Competitiveness and Cohesion 2014 -2020 (OPCC) earmarked for the

	sources of financing	<p>thematic objective “Supporting transition to low CO<sub>2</sub> emissions economy in all sectors”. The funds will be allocated in two parts:</p> <ul style="list-style-type: none"> <li>• 1st part - EUR 20,000,000 in grants</li> <li>• 2nd part - EUR 40,000,000 in combination of grants and grants</li> </ul> <p>The amount of grants for the activities will be determined in accordance with Commission Regulation (EU) no. 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty. The amount of grants for project and preparatory documentation will be stipulated pursuant to the Commission Regulation (EU) no. 1407/2013 of 18 December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to <i>de minimis</i> aid.</p> <p>EPEEF: introduction of the energy management system in accordance with the HRN EN ISO 50001 standard: HRK 2,000,000.00 annually for 2018 and 2019.</p>
	Executive body	MZOE and EPEEF
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The measure will be monitored using the bottom-up method of estimated savings. The results of implemented measures shall be entered in the System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	806 TJ
	Expected effect on expected energy savings by the end of 2020	1,164 TJ
	Assumptions	The savings have been estimated concerning planned resources and indicators of achieved savings per unit of paid funds of the EPEEF in 2015 and 2016. A one-off lump sum of HRK 0.75 was paid for energy efficiency measures in industry for savings of 1 kWh/year within a measure’s life cycle. The life cycle of most measures is 15 years.
	Overlapping, multiplication effect, synergy	The activities of the measure will be promoted through measure I.1, Industrial energy efficiency network.

### 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.

### 3.4.4 Principal measures for increasing energy efficiency in transport

Transport has a large share in the total energy consumption and GHG emissions, as much as 30 % in EU. On the other hand, transport is the prerequisite for mobility and exchange of goods, and thus for further development. Energy efficiency measures in transport reduces the effect of transport on the environment, without curbing further development. All measures from the 3rd NEEAP in the transport sector have been revised: some have been suspended, and other added or consolidated.

Title of the measure		Eco-driving training
Measure index		T.1
Description	Category	Information and mandatory information measures
	Time frame	Start: 2011 End: 2020 The measure has been continued from the 3rd NEEAP
	Objective / outline	<p>Eco-driving has been recognised as one of the most efficient measures for promoting energy efficiency at EU level. Launching the <b>National Eco-driving Campaign</b> could achieve the maximum level of awareness of all citizens and drivers in Croatia on the advantages of this modern, intelligent and environmentally friendly style of driving, through active implementation of eco-driving training among <b>licensed (existing) drivers</b>. Special elements of the national campaign should be dedicated to eco-driving education for:</p> <ul style="list-style-type: none"> <li>• drivers of passenger cars;</li> <li>• bus drivers;</li> <li>• drivers of freight vehicles &gt; 3.5 tonnes</li> <li>• commercial vehicles</li> </ul> <p>Education on eco-driving elements is implemented through <b>short trainings</b> (in the duration of 60-120 minutes per learner) among the drivers who <b>obtained their driving licence prior to the entry into force</b> of the Ordinance on training learner drivers (OG 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 <b>does not pertain</b> to new drivers, who are trained in eco-driving in accordance with the legal obligations laid down in the aforementioned Ordinance.</p> <p>In 2015, almost 1000 drivers completed the eco-driving training. In 2015, this measure yielded savings in the amount of 17.513 TJ. The majority of trained drivers are truck and bus drivers (as much as 645 trained drivers), who are also the biggest consumers, which means their training has led to the biggest savings, 14.6 TJ.</p> <p>It is estimated that there are around 1,500,000 drivers who obtained their driver's licence prior to entry into force of the Ordinance on training learner drivers (OG No 13/09), or drivers who have not completed any eco-driving training or have completed insufficient training in Croatia.</p>
	Target final consumption	Personal, freight and commercial road vehicles and buses
	Target group	All drivers of passenger cars who obtained their driving licence <b>prior to the entry into force</b> of the Ordinance on training learner drivers (OG 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 implementation of measure	<p>Seeing as how the measure was continued from the 3rd NEEAP, the first step, i.e. the training of drivers and instructors, has been completed. Additional education on eco-driving of educators who carry out eco-driving training among existing drivers is possible.</p> <p>Education of drivers licensed before 2009</p> <ul style="list-style-type: none"> <li>education of ca. 4000 drivers by the end of 2019 It is expected that this time the majority of educated drivers will be drivers of freight vehicles and buses, app. 60 % of the total number of educated drivers.</li> </ul> <p>The National Coordinating Body (NCB) shall, on the website of the National Energy Efficiency Portal <a href="http://www.enu.hr">www.enu.hr</a>, publish educational material for target groups and interested public, and reports on the implementation of the national eco-driving campaign. Also, the NCB shall encourage obligated parties (LRSGUs, esp. large cities and counties) to conduct activities with drivers within their jurisdiction (communal companies) and citizens from their territory. This shall especially be carried out in coordination with the NCB, when drafting the Plans for energy efficiency of cities and counties.</p>
	Funds and sources of financing	<p>Total required funds: HRK 3,680,000.00 a year:</p> <ul style="list-style-type: none"> <li>EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): HRK 1,472,000.00</li> <li>Remainder: users' own funds</li> </ul>
	Executive body	<p>EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14)</p> <p>National Coordinating Body for energy efficiency (NCB) - educational campaigns via the <a href="http://enu.hr">enu.hr</a> web-portal, coordination with LRSGUs</p>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	52.5 TJ
	Expected energy savings by the end of 2020	70 TJ
	Assumptions	<p>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 %. 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. 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.</p>

	Overlapping, multiplication effect, synergy	/
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Title of the measure		Legislative adaptation to the provision on the deployment of alternative fuels infrastructure
Measure index		T.2
Description	Category	Regulations
	Time frame	Start: 2017 End: 2030 Planned major modifications, amendments, improvements: New measure
	Objective / outline	It is necessary to adopt legal and delegated acts to regulate the conditions for connecting to the electricity system for charging stations, requirements for distribution, charging and unit price of alternative energy sources used in transport, determining the conditions for charging station of liquefied natural gas and compressed natural gas (LNG and CNG) on the national level. The fulfilment of this requirement is the precondition for further development of the alternative fuels infrastructure.
	Target final consumption	Road, railway and maritime traffic and inland navigation
	Target group	Companies operating in the infrastructure sector and transport companies in the road, railway and maritime traffic and inland navigation
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	It is necessary to provide for amendments to the acts regulating traffic regulations by laying down the obligations of establishing an alternative fuels infrastructure for entities managing transport infrastructure, as well as amendments to the acts regulating the conditions for the reconstruction of parking spaces by introducing the obligation of alternative fuel charging stations.
	Funds and sources of financing	No additional financing is required; drafting of legislation is done by state administration bodies.
	Executive body	The NCB and other state administration bodies: ministry in charge of finance, ministry in charge of transport infrastructure, ministry in charge of energy, ministry in charge of internal affairs, ministry in charge of construction and physical planning and ministry in charge of the protection of the environment, as well as corresponding funds and regulatory bodies.
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	/
	Expected energy savings in 2019	Not estimated



	Expected impact on energy savings for 2020	Not estimated
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

<b>Title of the measure</b>		<b>Fostering integrated and intelligent transport and development of alternative fuels infrastructure on a local and regional level</b>
<b>Measure index</b>		<b>T.3</b>
Description	Category	Information and organizational measure, infrastructure
	Time frame	Start: 2014 End: 2030 The measure is a consolidation of measures T.4 and T.8 from the 3rd NEEAP and a new measure, with larger amendments and improvements.
	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: <ul style="list-style-type: none"> <li>• optimising city logistics of freight transport and intelligent management of public parking spaces (ICT technology)</li> <li>• introducing integrated passenger transport</li> <li>• introducing car-sharing schemes in cities</li> <li>• introducing public city bicycles and the construction of the corresponding cycling infrastructure</li> <li>• intelligent transport management</li> </ul> In addition to the measures for promoting alternative fuels infrastructure on a national level, a series of measures has been recommended on a local level:
	Target final consumption	Road vehicles
	Target group	Drivers
	Regional application	Urban/National
	Information on implementation	List and description of activities for implementation of measure

		<p>The EPEEF shall ensure funds in the form of grants (from allocated funds from emission units) for 10 large cities of Croatia. Cities may use these funds for the preparation of expert analyses for the purpose of optimizing city logistics of freight transport.</p> <ul style="list-style-type: none"> <li>• <b>introducing integrated and sustainable passenger transport</b></li> </ul> <p>It is necessary to motivate LRSGUs (with an emphasis on large cities) to encourage passengers to use public city transport and combine various means/modules of public city transport. The aim is to encourage as much passengers in urban and suburban transport to switch from personal vehicles to combines public transport systems. The national coordinating body for energy efficiency encourages cities to promote and actively work on solving this problem when drafting and implementing planning documents for energy efficiency.</p> <p>Through Annual Plans, Action Plans and reports, cities independently develop and improve public transport services and infrastructure in cooperation with the NCB.</p> <p>Examples of activities aimed an integrated and sustainable passenger transport:</p> <ul style="list-style-type: none"> <li>○ introducing the option of purchasing a cheaper ticket to use for all public transport and other urban passenger transport services</li> <li>○ provide information on the status of available public transport services using ICT technologies and/or on site (bus stops, tram stops, bicycle parking spots, etc.)</li> <li>○ further development of the urban and suburban network available to a wider circle of users (bus, tram, railway lines and cycling lines and bicycle parking spots)</li> <li>○ other measures contributing to motivating users to switch from personal vehicles to public transport systems (enabling cheaper, faster, easier and more efficient public transport)</li> </ul> <p>Cities may request/contract direct aid from the EPEEF for certain projects if it is shown to be justified (through provable energy and CO<sub>2</sub> savings). For this measure, the EPEEF will ensure app. HRK 1,000,000 for the period of 4th NEEAP.</p> <ul style="list-style-type: none"> <li>• <b>intelligent transport management</b></li> </ul> <p>Introducing advanced technologies in regulation and management of transport contributes to the reduction of primary energy consumption, as well as the emissions of carbon dioxide and other harmful gases. Some of the proposed activities for introducing intelligent transport management include the following:</p> <ul style="list-style-type: none"> <li>○ upgrading, adapting and replacing obsolete signalling devices and equipment,</li> <li>○ installing advanced traffic equipment and intelligent traffic lights with an autonomous system of energy supply from renewable sources (the Sun, the wind),</li> <li>○ constructing and equipping central operational centres for the surveillance and management of intersections with traffic lights,</li> <li>○ connecting existing and future systems of advanced regulation of intersections with intelligent</li> </ul>
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		<p>traffic lights in cities (systems of advanced regulation of intersections with intelligent traffic lights).</p> <ul style="list-style-type: none"> <li>○ intelligent management of public parking spaces (ICT technologies) establishment of simple tracking of current availability of parking spots on public parking spaces and in garages.</li> </ul> <p>The implementation of this measure shall result in the increase of individual traffic flow, acceleration of public transport, reduction in fuel consumption and accompanying CO<sub>2</sub> emissions and will considerably unburden the roads. This can significantly reduce the consumption of fuel, e.g. 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, while the construction and equipping of an operational surveillance centre or introduction of automatic and intelligent traffic management in the event of an accident and daily requests will easily divert traffic, thus reducing congestion and consumption.</p> <ul style="list-style-type: none"> <li>● <b>Introducing a car sharing scheme</b></li> </ul> <p>Based on the experiences of Member States of the EU, practice has shown that one vehicle in a car sharing scheme substitutes 4–8 regular (personal) vehicles on roads. 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 electric and/or plug-in hybrid cars a year into the scheme in the largest cities is proposed by 2020. The EPEEF shall co-finance the car sharing schemes featuring only electric and plug-in hybrid vehicles. This measure also has an indirect effect on the environment: it shall lead to a reduction in the number of cars on roads, unburdening of parking spaces in city centres, reduction of the emission of pollutants and in fuel consumption (esp. fossil fuels).</p> <ul style="list-style-type: none"> <li>● <b>Introducing public city bicycles and acquiring cycling parking infrastructure</b></li> </ul> <p>The objective of introducing the public city bicycles scheme, 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. During the previous period, the infrastructure of the public city bicycles scheme was established in 10 cities of Croatia. A total of 283 bicycles and 44 terminals are available in the following cities: Zagreb, Ivanić Grad, Slavonski Brod, Karlovac, Brinje, Gospić, Zadar, Šibenik, Makarska, Lastovo.</p> <p>The plan is to have app. 700 bicycles and 100 terminals available on the territory of Croatia by 2019. The public bicycles scheme shall be further developed in terms of opening and constructing additional terminals/locations, primarily in larger cities of Croatia, or as a supplement to the public transport, and not as an additional tourist service. These systems are the most usable and have the most significant effect on consumption and reduction of pollution in larger urban areas, where they replace personal vehicles and complement other public transport systems. During the period of the implementation of the 4th NEEAP, 400 new public bicycles must be introduced on around 70 new locations.</p>
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		<ul style="list-style-type: none"> <li>• <b>Development of alternative fuels infrastructure on a local and regional level</b></li> </ul> <p>LRSUGs should be encouraged to include measures for the development of the alternative fuels infrastructure in their action and annual energy efficiency plans.</p> <p>Some of the proposed activities for the development of alternative fuels infrastructure on a local and regional level:</p> <ul style="list-style-type: none"> <li>○ Parking spots</li> </ul> <p>It is necessary to introduce the possibility of privileged parking for zero emission vehicles or of limiting the access to a parking spot for vehicles with internal combustion engines. For the purpose of implementing the measure, it will be necessary to define guidelines based on which decisions can be made on exemptions or discounts for using the public parking service for eco-friendly vehicles.</p> <ul style="list-style-type: none"> <li>○ Clean traffic zones</li> </ul> <p>Similarly to the introduction of privileged parking for zero emission vehicles, it is suggested that a ban be introduced on traffic of all vehicles other than zero emission vehicles through the central parts of cities and that zero emission vehicles be allowed in parts of cities which currently have a ban on all vehicles other than public transport vehicles.</p>
	Funds and sources of financing	<p>LRSUGs budgets of LRSUGs, EU funds - depending on plans and projects of LRSUGs</p> <p>EPEEF - financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): HRK 21,500,000.00 for the period 2017-2019, according to the following estimate:</p> <ul style="list-style-type: none"> <li>• HRK 3,500,000 for Optimising city logistics of freight transport</li> <li>• HRK 1,000,000 for Introducing integrated and sustainable passenger transport (for equipment, devices, establishing the system and preparing projects)</li> <li>• HRK 1,500,000 for Intelligent transport management</li> <li>• HRK 9,000,000 for Introducing a car sharing scheme (subsidising vehicles)</li> <li>• HRK 5,000,000 for Introducing public city bicycles and acquiring cycling parking infrastructure (bicycles and stops)</li> <li>• HRK 1,500,000 for Development of alternative fuels infrastructure on a local and regional level (for drafting guidelines and expert analyses for introducing privileged parking and clean traffic zones)</li> </ul>
	Executive body	EPPEF (co-financing and publishing the tender) LRSUGs - planning via annual and action plans and implementation
	Body for monitoring	NCB in coordination with MMPI
Energy savings	Method of monitoring / measuring energy savings	The effects of this measure will be recoded individually by projects, using the proscribed TD methodology with supplement/developing new BU methodology, if necessary
	Expected energy savings by the end of 2019	intelligent transport management: 201 TJ Introducing a car sharing scheme: 9.3 TJ Introducing public city bicycles and acquiring cycling parking infrastructure: 0.5 TJ
	Expected energy savings by the end of 2020	intelligent transport management: 402 TJ Introducing a car sharing scheme: 12.4 TJ Introducing public city bicycles and acquiring cycling parking infrastructure: 0.7 TJ

	Assumptions	<ul style="list-style-type: none"> <li>• <b>Optimising logistics of freight transport</b> Not estimated.</li> <li>• <b>Introducing integrated and sustainable passenger transport</b> Not estimated.</li> <li>• <b>Intelligent transport management</b> 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 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: 20 lights in 2017, 30 lights in 2018, 50 lights in 2019 and 100 lights in 2020. In such circumstances, the measure could reduce fuel consumption at busy intersections by up to 201 TJ in 2019 and by 402 TJ in 2020.</li> <li>• <b>Introducing a car sharing scheme</b> It is estimated that the introduction of most efficient vehicles in this scheme could achieve a difference in the amount of over 3 L/km compared to the existing vehicles. On the other hand, average annual mileage by vehicle in a car sharing scheme is estimated as 30,000 km. Considering the above, new annual savings would amount to 860 MWh, or a total of 9.3 TJ in 2009 and 12.4 TJ in 2020.</li> <li>• <b>Introducing public city bicycles and acquiring cycling parking infrastructure</b> So far it has been established that the annual daily mileage of a bicycle is 1.5 km, taking into account the period when the public bicycles system is not available due to the winter. With about 140 new bicycles annually, app. 76,650 km of driving can be avoided per year. Considering these assumptions, new annual savings would amount to 52 MWh, or a total of 0.5 TJ in 2009 and 0.7 TJ in 2020 (not including the savings based on previously implemented measures).</li> <li>• <b>Development of alternative fuels infrastructure on a local and regional level</b> Not estimated.</li> </ul>
	Overlapping, multiplication effect, synergy	/

Title of the measure		Financial incentives for energy efficient vehicles
Measure index		T.4
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020 The measure has been continued from the 3rd NEEAP, with major amendments and improvements.
	Objective / outline	In its work, the EPEEF co-finances cleaner traffic projects. This programme should be upgraded by developing special co-financing lines for specific purposes, as follows: <ul style="list-style-type: none"> <li>• purchasing electric and “plug-in” hybrid vehicles of lower and medium size (city and compact vehicles)</li> <li>• purchasing new energy efficient vehicles: L, M and N categories: <ul style="list-style-type: none"> <li>○ Diesel EURO6 standard with submitting proof of putting existing lower norm vehicles out of traffic</li> <li>○ With CNG and LNG drive</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ with electric and plug-in hybrid drive</li> <li>● Co-financing the purchase of electric bicycles, mopeds and motorcycles.</li> </ul> <p>In 2015 and 2016, the Environmental Protection and Energy Efficiency Fund co-financed the purchase of 528 and 198 electric, hybrid and plug-in hybrid vehicles, respectively.</p> <p>The majority of vehicles, over 80 %, were from the personal vehicles category; electric motorcycles and two electric trucks were also co-financed.</p> <p>This measure yielded energy savings in the amount of 2,069,350 kWh or 502 tCO<sub>2</sub> in 2015 and 962,838 kWh or 230 tCO<sub>2</sub> in 2016.</p>
	Target final consumption	Road vehicles
	Target group	Legal and natural persons
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	The Fund shall establish schemes for co-financing and purchasing electric and “plug-in” hybrid personal vehicles (L, M and N categories).
	Funds and sources of financing	EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): HRK 20 000 000.00
	Executive body	EPEEF (co-financing and launching the tender)
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	17 TJ
	Expected energy savings by the end of 2020	23 TJ
	Assumptions	It is assumed that the trend from the 3rd NEEAP shall not change drastically and that during the 4th NEEAP app. 1,200 vehicles will be co-financed. 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.
	Overlapping, multiplication effect, synergy	/

Title of the measure		Development of alternative fuels infrastructure
Measure index		T.5
Description	Category	Infrastructure, strategic planning
	Time frame	Start: 2014 End: 2030 Planned major modifications, amendments, improvements: The measure has been continued
	Objective / outline	<p>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.</p> <p>The measure follows the Directive on the deployment of alternative fuels infrastructure, the Act on the deployment of alternative fuels infrastructure and the draft National policy framework (NPF) and fosters the construction of charging stations in accordance with these documents. This infrastructure measure shall not have a direct effect on the reduction of consumption of fuel in traffic, but the development of infrastructure is a prerequisite for the development of market for vehicles using electricity, CNG and LNG in Croatia.</p>
	Target final consumption	Road vehicles, vessels in inland navigation, maritime ships
	Target group	
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>The following objectives have been established pursuant to the draft National policy framework (developed in accordance with the Directive):</p> <ul style="list-style-type: none"> <li>• Electricity In 2016, 856 vehicles using electrical power were registered in Croatia, of which 299 personal vehicles, 55 freight vehicles, 250 mopeds, 183 motorcycles, 3 buses, 66 tractors and non-road vehicles. 126 publicly available charging stations are registered. For the purpose of covering the minimum needs for functioning of electrical mobility, the proposal on the number of charging stations and plug-in spots was based on the scenario of low share of energy transmission in the public charging stations network. In order to follow the growth of the electric vehicles market, a minimum of 296 plug-in spots (222 AC with a minimum power of 22/(11)kw, 74 DC with a minimum power of 50 KW) in 164 charging stations must be ensured by 2020.</li> <li>• Liquefied natural gas (LNG) Croatia does not have LNG infrastructure and no vehicles or vessels using this energy source have been registered.                             <ul style="list-style-type: none"> <li>○ LNG in maritime navigation In accordance with the preliminary analysis of possible economically efficient locations for establishing the LNG infrastructure and taking into account the unreliability of predictions on market development, the need for the construction of infrastructure for reloading and supply of LNG in Rijeka by 2025 and in Pula, Zadar, Šibenik, Split, Ploče and Dubrovnik by 2030 was predicted. During the period of the 4th NEEAP, the construction of LNG infrastructure in maritime traffic has not been planned.                                     <ul style="list-style-type: none"> <li>○ LNG in inland navigation It is not possible to reliably predict the number of LNG-driven vessels in inland navigation</li> </ul> </li> </ul> </li> </ul>

		<p>over the next decade.</p> <ul style="list-style-type: none"> <li>○ LNG in road traffic</li> </ul> <p>It is estimated that charging stations will have to be installed on the periphery of Zagreb and Rijeka by 2025, and on the periphery of Zadar, Split, Ploče, Slavonski Brod and Osijek by 2030.</p> <p>During the period of the 4th NEEAP, the construction of LNG infrastructure in road traffic has not been planned.</p> <ul style="list-style-type: none"> <li>● Compressed natural gas (CNG)</li> </ul> <p>In terms of CNG-fuelled vehicles, in 2016, 208 personal vehicles, 84 freight vehicles, 10 mopeds, 6 motorcycles, 108 buses and 11 tractors were registered in Croatia. Croatia currently has 2 publicly available CNG charging stations (in Zagreb and Rijeka).</p> <p>Pursuant to the draft NFP, the opening of charging stations on 11 locations is planned by 2020, as follows: in Pula, Zadar, Šibenik, Split, Dubrovnik, Karlovac, Sisak, Osijek, Varaždin, Čakovec and Zagreb. It is assumed that during the 4th NEEAP 9 charging stations will be constructed. Furthermore, it is predicted that during 2017 study analyses be made for all cities where charging stations are predicted.</p>
	Funds and sources of financing	<p>EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14):</p> <ul style="list-style-type: none"> <li>● Electricity: HRK 4,700,000.00 a year or HRK 14,100,009.00 by 2019 for the installation of charging stations for electric vehicles in accordance with draft National policy framework.</li> <li>● Compressed natural gas (CNG): HRK 10,000,000.00 by 2019 for opening 9 charging stations and preparing study analyses for the cities in which CNG charging stations are predicted (Pula, Zadar, Šibenik, Split, Dubrovnik, Karlovac, Sisak, Osijek, Varaždin, Čakovec and Zagreb). The funds are allocated in the amount of app. HRK 1,000,000 for grants by charging stations and app. HRK 100,000 for grant earmarked for drafting of the study.</li> </ul>
	Executive body	EPEEF (co-financing and launching the tender) LRSGUs
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	TBD
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	The development of the infrastructure encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions
	Overlapping, multiplication effect, synergy	This measure shall have an effect on many industrial branches/sectors; TBD



Title of the measure		Introduction of a special motor vehicle tax based on CO <sub>2</sub> emissions
Measure index		T.6
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020 The measure has been continued from the 3rd NEEAP
	Objective / outline	<p>A special motor vehicle tax is introduced under this measure with the aim of reducing emissions from transport. Based on the “polluter pays” principle, the model is calculated on the basis of CO<sub>2</sub> emissions from motor vehicles.</p> <p>The special tax is determined on the basis of the sales price or market value of a motor vehicle, carbon dioxide (CO<sub>2</sub>) emissions expressed in grams per kilometre, engine volume in cubic centimetres and greenhouse gas emission levels.</p> <p>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.</p> <p>This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. For the purpose of determining the achieved and revising the expected future savings, a study on the effect of the special tax on consumer behaviour when purchasing a vehicle will be conducted.</p>
	Target final consumption	Motor vehicles
	Target group	Buyers of vehicles
	Regional application	National
	Information on implementation	List and description of activities for implementation of measure
Funds and sources of financing		Buyers of vehicles
Executive body		Ministry of Finance
Body for monitoring, measuring and verifying savings		NCB
Energy savings	Method of monitoring / measuring energy savings	This measure shall be monitored based on research; Questionnaires completed by buyers of vehicles
	Expected energy savings by the end of 2019	132 TJ
	Expected energy savings by the end of 2020	176 TJ

	Assumptions	The introduction of the tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. The used assumptions are as follows: 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 <sub>2</sub> /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 <sub>2</sub> /km lower. The duration of the measure is 8 years.
	Overlapping, multiplication effect, synergy	The encouragement for buying eco-friendly vehicles will lead to a reduction in the emissions from personal vehicles, and thus in the total emissions from the transport sector. This measure is connected to the measure of encouraging the purchase of energy efficient vehicles, which further stimulates the purchase of electric and hybrid vehicles.

Title of the measure		ELEN strategic project for the HEP Group
Measure index		T.7
Description	Category	Infrastructure, strategic planning
	Time frame	Start: 2013 End: until the development of the complete network of publicly available
	Objective / outline	<p>Almost a quarter of GHG emissions in the EU occurs in the transport sector. Also, an additional problem is the dependency of European transport on oil (around 94 %), which is mostly imported (around 84.3 %). Seeing as how the oil is mostly imported from increasingly unstable areas of the world, this further increases the uncertainty of supply, thus endangering the regular functioning of transport.</p> <p>The clear necessity for diversification of energy sources in transport puts electricity high on the list of priorities because the existing electricity network represents an appropriate platform for further development.</p> <p>The project implies the development of publicly available infrastructure in cooperation with the cities and interested legal persons with four main objectives:</p> <ul style="list-style-type: none"> <li>• Promoting e-mobility</li> <li>• Development of innovative solutions</li> <li>• Development of the limited network of charging stations</li> <li>• Development of the complete infrastructure of charging stations</li> </ul> <p>The main objective is to enable city and intercity traffic for electric vehicles, thus reducing emissions of harmful gases (on the level of entire Croatia) and noise in urban areas.</p>
	Target final consumption	Personal and freight road vehicles and buses
	Target group	All drivers of personal vehicles, freight vehicles, public transport vehicles
	Regional application	National and regional

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Information on implementation	List and description of activities for implementation of measure	<p>Every public charging station must be installed and deployed so as to meet the provisions of Directive 94/2014/EU, which includes non-discriminatory access, the possibility of selecting a supplier or service provider (it is necessary to declare a separate and new activity), possibility of ad hoc charging, etc.</p> <p>Keeping this objective in mind, the activity for the development of accessible network includes leasing the necessary power on location (quick charging stations are those stations with a connecting power of no less than 22 kV), performance of the connection, installation of charging stations pursuant to all standards and information protocols and providing the service in an interoperable way.</p> <p>In order to achieve the development and interconnection of all service providers, it is necessary to meet the technical and protocol standards in order to enable the so-called roaming between all available charging stations installed as proscribed.</p> <p>On the user side, it is necessary to enable further penetration of electric vehicles onto the roads with further incentives by the EPEEF and to create further non-financial incentives, such as free parking, easy access to city centres (after ban for conventional vehicles) and removing the levies when buying and registering the vehicle.</p>
	Funds and sources of financing	Own funds and co-financing from EU funds
	Executive body	HEP Group
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure shall be monitored by researching and exchanging experiences on both sides of the market, from the aspect of public infrastructure and the users/consumers themselves. For the purpose of establishing systematic monitoring of savings, it is necessary to adopt clear rules for the implementation and development of publicly accessible infrastructure (from the technical, ownership and legal aspect) pursuant to Directive 94/2014/EU. The number of users of electric vehicles shall be monitored by state bodies, such as the Vehicle Centre of Croatia.
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	According to the available documents for transposing the Directive into Croatian legislation, there are several scenarios on the necessary publicly available infrastructure (low scenario provides for 479 charging stations in 269 locations), while the share of electric vehicles in the total number of registered vehicles is expected to amount to 1 %.
	Overlapping, multiplication effect, synergy	In the future, the public infrastructure through smart grid can be seen as support to the electricity network, where electric vehicles with their batteries serve as distributed energy sources.

### 3.4.5 Savings resulting from energy efficiency measures in transport

Described above, individually for each measure.

**3.4.6 *Financing measures for increasing energy efficiency in transport***

Described above, individually for each measure.

### **3.5 Promotion of efficient heating and cooling (Article 14 of the EED)**

#### **3.5.1 Detailed mapping of the energy system**

In November 2015, the Government of Croatia adopted the Programme for using the potential for efficiency in heating and cooling for the period between 2016 and 2030. This document provides for certain estimates of needs for heating and cooling on municipality level. Although this represents an important source of information, for the purpose of local planning and estimating the possibility of using the potential sources of waste and renewable energy it is necessary to conduct detailed mapping of needs and potential sources.

For that purpose, it is necessary to take the following steps:

1. Create a detailed list of buildings in GIS format, which shall include locations, gross and net surface areas, information on the existing connections (water, electricity, gas), year of construction, basic energy features and building categories (residential, non-residential, industrial, mixed);
2. Analyse the need for heat energy and cooling with a resolution of one square kilometre or higher;
3. Analyse the potential sources of renewable and waste energy for heating and cooling such as geothermal sources, waste biomass and agricultural waste, system for the treatment of wastewater and sewage, industrial plants, etc. The results should be given with as precise a resolution as possible, no less than one square kilometre for geothermal sources and biomass, line and point sources for wastewater treatment facilities and sewage and, where possible, point source for industry;
4. GIS (geographic information system) mapping of results obtained via the previous two steps. GIS maps and all data shall be made publicly available. They are published by the National coordinating body (NCB).

The examples of such practice on the European Union level may already be seen through the activities implemented under the four projects within the “Heat Roadmap Europe 2050”, which last two steps, the STRATEGO and HRE project financed by the European Commission via the “Intelligent Energy Europe” and Horizon 2020, included Croatia.

Data on the electricity system should be collected and given on at least the NUTS 3 level. This level of precision would allow for better comparisons of energy demand and production, local and regional energy planning, and thus a more precise and better planning on a national level. The key data that must be collected and published in this manner is the following:

- Energy consumption by types and sectors;
- Fuel consumption by types and sectors;
- Potential energy sources;
- Existing energy infrastructure (production, transmission and distribution);
- Potential biomass sources by types;
- Production of energy and fuel by types.

The implementation of this measure will allow for quality and precise planning of the development of electricity and thermal systems focusing on making optimum use of renewable and waste energy sources, which will result in a more efficient, cheaper and ecologically acceptable energy system. Also, this measure will facilitate the monitoring of urban development and the implementation of measures of energy renovation in the building sector. This measure will be implemented in two stages. During the first stage, the activities will be conducted on the pilot project of the city of Velika Gorica, which will establish a national base and application, thus creating the foundation for the second stage, which will see the developed method be implemented on a national level. It is possible to achieve a synergy, inter alia, between this measure and the measures of implementation of energy audits, ISEM and energy renovations of buildings and existing digital cadastres.

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Title of the measure		Detailed mapping of the energy system
Measure index		HC.1
Description	Category	
	Time frame	Start: 2017 End: 2019 Planned major modifications, amendments, improvements: Updating results according to the actual state and changes to the system
	Objective / outline	Access to information on the needs, consumption and production of energy (electricity, heat and cooling energy) is the key for quality energy planning of the future energy system of Croatia. For this purpose, it is necessary to develop a comprehensive database of geo-referenced information on the consumption of energy and energy sources, buildings, infrastructure, potential sources and production facilities on the NUTS 3 level or, where possible, spatially distributed with a resolution of 1X1 km or higher. During the first stage, these activities will be carried out on the pilot project of Velika Gorica, and during the second one on the level of the entire country. Activities: Collecting information of public and private buildings and the establishment of a database that shall at least include information on locations, gross and net surface areas, existing connections and building categories (residential, non-residential, industrial, mixed) and the year of construction; Collecting information on the consumption of energy and energy sources on the level of individual facilities; Calculating the need for heat energy and electricity and cooling at a resolution of 1X1 km or higher; Analysing potential sources of renewable or waste energy and spatial overview of the potentials with the resolution of 1X1 km or higher, or point sources for potential sources of waste energy; Analysis and spatial overview of energy infrastructure; Preparation of a comprehensive database and GIS overviews of all collected and calculated information; Connecting the database and GIS overviews with the existing databases in order to enable the updating of information in real time, whenever possible. GIS maps and all data shall be made publicly available and are the property of Croatia. They are published by the National coordinating body (NCB).
	Target final consumption	All energy consumption sectors
	Target group	National institutions, regional and local self-government, institutes and faculties dealing with urban and energy planning
	Regional application	National, regional and local
Information on implementation	List and description of activities for implementation of measure	Implemented activities: In November 2015, the Government of Croatia adopted the Programme for using the potential for efficiency in heating and cooling for the period between 2016 and 2030. This document provides for certain estimates of needs for heating and cooling on municipality level. This document represents the key first step in the process of establishing a comprehensive, geo-referenced database of buildings, demand for and consumption of energy and energy sources, potential sources, existing energy infrastructure and production facilities. Future activities: A method for calculating the need for heat energy and electricity and cooling pursuant to the available data will be based on the experience obtained through the STRATEGO, HRE and PlanHeat projects; all data necessary

		for the creation of a comprehensive and geo-referenced database will be collected. In this stage, the key will be the data and cooperation of the State Geodetic Administration, MZOE, MINGO and the Croatian Geological Survey; the energy needs will be calculated at a level of 1X1 km or higher; a database and GIS map of the obtained results, information on buildings, actual consumption, existing infrastructure, production facilities and potential sources will be established; where possible, the database will be connected to other relevant sources of information on order to enable automatic updating of the database and the map.
	Funds and sources of financing	The planned funds for the duration of implementation of the entire measure (implementation of the pilot project and the project on a national level) Existing activities: Faculty of Mechanical Engineering and Naval Architecture in Zagreb - development of methodology, collection and processing data via the PlanHeat and HRE projects - HRK 500,000 The City of Velika Gorica - implementation of mapping, collection and processing data via the PlanHeat Project - HRK 150,000 SDEWES Centre – collection and processing data on the bio-potential via the AgroCycle project – HRK 100,000 Planned actions: EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): <ul style="list-style-type: none"> <li>• by the end of 2018: preparation of a national network interface for the presentation of GIS data HRK 100,000</li> <li>• by the end of 2019 EPEEF - Collection of data for establishing the comprehensive database and GIS overview of all collected and calculated data on the level of Croatia HRK 1,000,000.</li> </ul>
	Executive body	Faculty of Mechanical Engineering and Naval Architecture in Zagreb State Geodetic Administration - delivery of the digital cadastre to serve as a basis for presentation of buildings, delivery of available digital data on the features of buildings MZOE - delivery of digital data on the consumption of energy and energy sources by facilities and the existing infrastructure MGiPU - delivery of the digital database of energy audits Croatian Geological Survey - delivery of digital data on the potentials of geo-thermal energy
	Body for monitoring	NCB
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 pre-requisite for informing all stakeholders and implementing other energy efficiency measures.
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	Access to digital cadastre, information on the consumption of energy and energy sources by facilities

	Overlapping, multiplication effect, synergy	Initial mapping of needs for heat energy and cooling on the level of municipalities has been performed under the measure I.2 High efficiency co-generation from the 3rd NEEAP.
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### 3.5.2 Comprehensive evaluation (Article 14 of the EED)

The analysis of overall energy consumption in 2013 has shown the following:

- In 2013, total consumption of energy in the households sector amounted to 103.7 PJ. In the final energy sources structure, firewood had the biggest share in the consumption (48 %), followed by electricity (21 %), natural gas (19 %), heat (5 %), and fuel oil and liquefied petroleum gas with 4 % and 3 %, respectively.
- The total consumption of energy in the services sector amounted to 29118 TJ. The share of heat energy in total consumption was 48 %, while cooling energy participated with a share of 15 %. In the structure of heat energy consumption, natural gas had the biggest share (42 %), followed by electricity (24 %), extra light fuel oil (18 %), heat (12 %) and liquefied petroleum gas with 4 %.
- The total consumption of energy in industrial facilities amounted to 22.73 PJ, of which 12.28 PJ of direct heat energy and 14.45 PJ of indirect heat energy.

The results of modelling projections of future needs for heat energy indicate the following:

- In the households sector, on the level of entire Croatia, with the exception of coastal Croatia, a reduction in the consumption of heat energy is expected, mostly due to the expected reduction in the number of population in these part of Croatia, and also expected improvement of energy performances of buildings. In the coastal part of Croatia, i.e., the south zone, in addition to an expected rise in population, a slight rise in the needs for heat energy due to improvement in the standard of life and an increase in the need for cooling energy, is expected.
- In the services sector, a slight increase in useful heat energy and a much more significant increase in cooling energy is expected thanks to the development of the economy. • In the industry sector, an increase in the required heat energy of up to 30 PJ is expected, whereby it is important to make a difference between direct heat energy (generated by direct incineration of energy sources and used in the production process) and indirect heat energy (heat generated in boiler rooms and heating plants) because only indirect heat energy can be substituted with heat from high efficiency co-generation.

The analysis of existing heat energy plants, which covered four existing co-generation plants of Hrvatska elektroprivreda and three industrial co-generation plants with heat power over 20 MWt, has shown that, in certain circumstances, individual blocks of co-generation plants of HEP can meet the criteria for high-efficient co-generation, but that none analysed industrial co-generation plants is a legitimate candidate for meeting the requirements for high efficiency co-generation.

Analysis of potential new locations of heat energy consumption has identified 18 locations that, thanks to their theoretical potential of needs for heat energy and the possibility of construction of the necessary infrastructure for the distribution of heat energy, have a legitimate potential for the construction of new high efficiency co-generation plants. The associated heat potential of these 18 locations is 29,982,128 GJ, or 8,328,369 MWh a year until 2030.

The conservative scenario of the share of consumers in the centralized heat system, assumed based on the established existing trends for each of the potential new locations, has found six (6) potential new locations for high efficiency co-generation. Their total equivalent thermal potential amounts to 5,506,528 GJ, or 1,529,591 MWh a year, until 2030. The associated equivalent potential of the electrical component of high efficiency co-generation, based on the modern CCCGT technology, for the conservative scenario amounts to 8,653,115 GJ, or 2,403,643 MWh.

The optimistic scenario of the share of consumers in the centralized heat system, calculated based on a more optimistic assumption of trends in the energy sector, has singled out eighteen (18) potential new locations for high efficiency co-generation. Their total equivalent thermal potential amounts to 16,625,599 GJ, or 4,618,222 MWh a year, until 2030. The associated equivalent potential of the electrical component of high-efficiency co-generation for the optimistic scenario is 26,125,941 GJ, or 7,257,206 MWh.

The potential for primary energy savings by 2030, with the assumption of high-efficiency co-generation, amounts to 4,849,053 GJ for the conservative scenario, or 14,634,591 GJ for the optimistic scenario of the share of future consumers in the centralized heating system.

Despite the long tradition of supply from the CTS system in Croatia, the state in the existing centralized system is not satisfying; there are many reasons for this, such as: the age of plants and their low efficiency, the age of networks, high prices of fuels, poor insulation of buildings using centralized systems, poor manageability of heat consumption and inadequate policy of heat prices, which did not cover the costs of production.

The development of new centralized systems will depend on the success of the existing ones, which is why the first priority is the upgrade of the existing centralized systems. If wholesale prices of energy sources are expected as unmanageable, because they depend on the market, there are still four important components that must be considered when determining the priority of activities of increasing the efficiency of the CTS system:

- construction of efficient co-generations where there are none and substitution of regional boiler rooms with CTS and the construction of adequate highly efficient co-generations;
- Choice of fuel, especially taking into account the need to reduce CO<sub>2</sub> emissions;
- Replacement of obsolete thermal network and connecting regional boiler rooms in the CTS network;
- Priority programme of energy renovation of buildings in the areas covered by the CTS.

When planning the development of CTS, it is necessary to take into account the fact that the beginning of preparation and realization of the construction of plants requires not only the preparation of planning and expert bases by the competent institutions, but also obtaining a large number of administrative acts and concluding contracts provided for by the complex legal framework in the field of energy, spatial planning and construction, protection of the environment, etc. However, if the competent state bodies, local and regional self-government units and legal persons with public authorities (agencies, operators, etc.) act in accordance with the stipulated deadlines and taking into account the principles of administrative procedure, and if energy entities meet their obligations set forth in approvals and authorizations, the administrative procedure that must be carried out should not slow down the realization of such projects.

The new Act on Renewable Energy Sources and Highly Effective Co-generation, which entered into force on 1 January 2016, did not cover the problem of stimulating the production of energy for heating and cooling from renewable energy sources. Seeing as how the thermal market has significant potential for meeting energy objectives of using renewable energy sources, the absence of systematic consideration of this area is recognized as a significant deficiency of the existing legal framework.

State aid for centralized heating and cooling may be allocated in accordance with the rules set forth in the Block Exemption Regulation (651/2014). The condition is that all requirements from Regulation 651/2014 be met. There are three ways of granting state aid. 1 First is to allocate state aid in accordance with the de minimis rule; these are state aids for a company in an amount under EUR 200,000 in any 3-year period. The measures for supporting centralized heating and cooling can be in accordance with de minimis rules if the limit of EUR 200,000

over three years is respected. 2. The second way of granting state aid is the aid in accordance with Regulation 651/2014, which stipulates the categories of aid compatible with the interior market of the EU. This block exemption enables Member States to adopt certain programmes of state aid without prior notification to the European Commission; measures supporting centralized heating and cooling can be included in the block exemption if they meet the requirements of Regulation 651/2014. 3. The third way of granting state aid is by applying the plan for state aid to the Commission. This can be a long and uncertain procedure, and state aid may not be granted before the Commission's final approval.

For the purpose of monitoring the implementation of the programme and evaluating the achieved results and reporting to the Government of Croatia on achieved results and recommendations, the Ministry of the Economy (since October 2016 MZOE) should establish a system for evaluating and monitoring the implementation of the Programme via regular cooperation and reporting by HERA, which supervises the performance of energy-related activities and the functioning of energy markets, and local self-government units, which must, inter alia, encourage, plan and approve the construction of thermal systems.

3.6 Transforming, transferring and distributing energy and responding to demand

<b>Title of the measure</b>		<b>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</b>
Measure index		E.1
Description	Category	Production of electricity and/or heat energy – in HPP, TPP and CHPP of the
	Time frame	Start: 2017 End: 2019 Reduction of own consumption by way of replacements and reconstructions in HEP Group power plants
	Objective / outline	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>

		Seeing as how 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 plants' own consumption.
	Target contribution to the improvement of efficiency by reducing own consumption in the production activity	<p>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 network, as well as fuel procurement costs, costs of purchasing emission units and other variable costs of HPPs, TPPs and CHPPs.</p> <p>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 2015- 2019 period.</p>
	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	<p>Planned actions:</p> <ol style="list-style-type: none"> <li><b>Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b> After the completion of the open public procurement procedure (2016) for the construction of a steam boiler room, March 2017 saw the conclusion of a contract encompassing all tasks, from drafting the main project to the takeover of the facility, organization of technical audit and obtaining a certificate of occupancy for the facility. The deadline for the performance of works is 18 months from the signing of the contract.</li> <li><b>Reconstruction of the plant and management of pumps for well, drinking and technological water</b> The chemical treatment of the water of the Facility of CHPP Zagreb is supplied with raw (technological) water from own wells. The current regulation of the necessary pressure/amount of water is regulated by turning on a certain number of pumps. This work causes sudden changes in the pressure on the entrance into new de-mineralization and interrupts the facility's automatic operation. The reconstruction of the facility and management of the operation of well pumps will lead to the establishment of a balance in the operation of hydrant and drinking water, and there will be no need to unburden both systems due to an increase in the pressure by washing the sieve for the mechanic cleaning of cooling water on the Sava pumping station. In this part of the facility, an average of 50 m3/h of well water is used for cleaning the sieve.</li> </ol> <p>Action required:</p>

		<ul style="list-style-type: none"> <li>- performance of necessary works</li> <li>- functional tests</li> <li>- test drive</li> </ul> <p>The project would be carried out in 2017, 2018 and a part of 2019.</p> <p style="text-align: center;"><b>3 Reconstruction of the cooling water pumping station Sava</b></p> <p>Due to the low water level of Sava present for most of the year, failures on pumping aggregates are becoming more frequent because of the occurrence of cavitation and inadequate bearings, so-called self-lubricating bearings made of Thordon material. Failures are most often at the limit of a breakdown (blade fractures, suction ring damages, bearings damage). By investing in pumping aggregates that can function during low water levels and with bearings resistant to the abrasive effect of the working medium, the work of pumping aggregates between two overhauls would be extended, up to 50,000 working hours, which, in current circumstances of work of the pumping station, is equivalent to 10 years of work per pumping aggregate. An analysis of the operation of the pumping station with existing pumps and a proposal for the overhaul of the suction pool/replacement of pumping aggregates with aggregates with different hydraulic features adapted to the hydrological conditions of the river of Sava with an increase in efficiency have been prepared. Preference is given to pumps with a longer period between two planned overhaul procedures.</p> <p>The analysis of the work of the pumping station resulted in the type, size and number of required new, more modern pumping aggregates.</p> <p>In July 2016 the CHPP Zagreb facility obtained the Decision on integrated conditions for the protection of the environment. In point 4.4 of the book on integrated conditions for the protection of the environment with technical and technological solutions for the existing CHPP Zagreb, it is stated that by 01 January 2018 CHPP Zagreb will make the process of the cooling water pumping station automatic in order to ensure a reliable supply of cooling water for the entire facility. In addition to new pumping aggregates, which will solve the current problem of hydraulics and failures due to whirlpool and cavitation, electric motors with frequency speed regulation will be acquired, which will result in automatic operation, optimize the operation of pumping aggregates and achieve electricity savings, which is the consequence of the programme of improvements stated in the Decision on integrated conditions for the protection of the environment.</p> <p>The next stage of the project would include the following:</p> <ul style="list-style-type: none"> <li>- Selection of contractors for the preparation, procurement and delivery of pumping aggregates. Pursuant to the Decision on integrated conditions for the protection of the environment and the terms that the CHPP Zagreb facility must meet under the programme of improvements, new tender documentation will be published for the purpose of acquiring additional equipment, thus increasing the value of the investment.</li> <li>- Preparation and delivery of pumping aggregates</li> <li>- Deconstruction of existing aggregates</li> <li>- Assembly of new aggregates, commissioning, functional testing and release.</li> </ul> <p>Implementation during 2017 and 2018.</p>
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		<p>PK35 boilers. This scenario in conditions of low cost of electricity and high prices of fuel is economically efficient.</p> <p>The construction of two steam blocks (30 t/h of net steam each) would create the possibility of reliable wide-scale generation of industrial steam (between 7 t/h and 60 t/h). The reason for this is the construction of a steam block boiler room with flexible workload without negative consequences for the boiler's pipe system. This would meet the need for heat/industrial steam of the eastern part of the city during the summer.</p> <p>The CHPP has an informative offer for the revitalization of the existing auxiliary PK3 steam boiler (app. HRK 40,000.00); the estimated cost of construction of two new steam block boilers is app. HRK 30,000,000, which is the reason for this capital investment.</p> <p>The project is underway and the completion is planned by the end of 2018.</p> <p><b>5. Reconstruction of PSHPP Fužine (2013-2018)</b></p> <p>Further activities within the framework of the reconstruction of PSHPP Fužine include the completion of the preparation of the main revitalization project. During 2017, the motor-generator, the intake hydraulic section, and the shafts of the pump-turbine generator of PSHPP Fužine are expected to be installed. The beginning of test operation of the reconstructed PSHPP Fužine is expected in early 2018.</p> <p><b>6. Installation of additional exchangers in exhaust-gas boilers in gas thermal power plant Zagreb</b></p> <p>The installation of additional heaters of network water ZMV1B and ZMV2B at the point of exit of gases from exhaust-gas boilers UT1 and UT2 for the purpose of maximising the utilization of waste heat of flue gases. The installation of additional heaters will lead to a higher firepower of H and J blocks with the same consumption of natural gas as fuel. The completion of activities is planned by the end of 2017.</p> <p>Action required:</p> <ul style="list-style-type: none"> <li>- Tender documentation for the delivery of equipment, performance of works, testing and trial operation</li> <li>- contracting</li> <li>- delivery of equipment</li> <li>- performance of necessary works</li> <li>- functional testing and trial run</li> </ul> <p><b>7 Relocation of sludge pit for using pure condensate in the CHPP Zagreb heat station</b></p> <p>Both wanted and unwanted condensate and sewage are mixed in the existing sludge pit of the heat station. The possibility of collecting pure condensate in the collection pit represents the potential for achieving savings by its return to the hot water system. In addition to the fact that it is impossible to use the wanted condensate and sewage, the existing solution presents a problem for the nearby measuring and regulating electrical equipment due to pairing. The completion of activities is planned by the end of 2017.</p> <p>Action required:</p> <ul style="list-style-type: none"> <li>- Tender documentation for the delivery of equipment, performance of works, testing and trial operation</li> <li>- contracting</li> <li>- delivery of equipment and measuring and regulating devices</li> </ul>
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		<p>- performance of necessary works on the construction of new and renovation of the existing pit</p> <p>- testing and trial run</p>
	Funds and sources of financing	<ol style="list-style-type: none"> <li><b>1. Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b> Planned funds (2017-2018) HEP: HRK 6,192,196.00 2017 HEP: HRK 4,387,165.33 2018 Total: Construction of a 12.5 t/h steam boiler room in CHPP Sisak HRK 10,579,361.33</li> <li><b>2. Reconstruction of the plant and management of pumps for well, drinking and technological water</b> Own funds, estimated HRK 2,500,000</li> <li><b>3. Reconstruction of the cooling water pumping station Sava</b> Own funds, estimated HRK 18,000,000</li> <li><b>4. CONSTRUCTION OF THE STEAM BLOCK BOILER ROOM 2 X 35 t/h</b> Contracted for HRK 29,297,845, own funds</li> <li><b>5. Reconstruction of PSHP Fužine (2013-2018)</b> <ul style="list-style-type: none"> <li>- HEP: HRK 7.564.905 by 31 December 2016                             <ul style="list-style-type: none"> <li>- HEP: HRK 13,600,000 2017</li> <li>- HEP: HRK 5,835,095 2018</li> </ul> </li> </ul>                     Total: Reconstruction of PSHP Fužine: HRK 27,000,000                 </li> <li><b>6. Installation of additional exchangers in exhaust-gas boilers in gas thermal power plant</b> Own funds, estimated HRK 12,000,000.00</li> <li><b>7. Relocation of sludge pit for using pure condensate in the CHPP heat station.</b></li> </ol>
	Executive body	<ol style="list-style-type: none"> <li><b>1. Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b></li> <li><b>2. Reconstruction of the plant and management of pumps for well, drinking and technological water</b></li> <li><b>3. Reconstruction of the cooling water pumping station Sava</b> HEP-Proizvodnja d.o.o., Thermal power plant sector</li> <li><b>4. CONSTRUCTION OF THE STEAM BLOCK BOILER ROOM 2 X 35 t/h</b> HEP-Proizvodnja d.o.o., Thermal power plant sector</li> <li><b>5. Reconstruction of PSHP Fužine (2013 -2018)</b> HEP-Proizvodnja d.o.o., Hydroelectric power plant sector</li> <li><b>6. Installation of additional exchangers in exhaust-gas boilers in gas thermal power plant</b> HEP-Proizvodnja d.o.o., Thermal power plant sector</li> <li><b>7. Relocation of sludge pit for using pure condensate in the CHPP heat station.</b> HEP-Proizvodnja d.o.o., Thermal power plant sector</li> </ol>
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	<ol style="list-style-type: none"> <li><b>1. Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b> Analysis of fuel consumption and generated heat energy will provide the data on savings.</li> <li><b>2. Reconstruction of the plant and management of pumps for well, drinking and technological water</b></li> </ol>



		<p>Measuring the amount of affected water.</p> <p><b>3. Reconstruction of the cooling water pumping station Sava</b> Measuring the consumption of electricity and the corresponding amount of cooling river water.</p> <p><b>4. CONSTRUCTION OF THE STEAM BLOCK BOILER ROOM 2 X 35 t/h</b> Measuring of the consumption of natural gas on the entire location by calculating the amount of CO<sub>2</sub> emissions resulting from less consumption of natural gas Measuring fuel oil with a share of sulphur under 1 % of reduced consumption of alternative gas oil.</p> <p><b>5. Reconstruction of PSHPP Fužine (2013 -2018)</b> 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<sup>3</sup> 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 15.8 GWh. It is assumed that the reconstructed PSHPP Fužine will contribute to the increase in the production of the hydroenergy system of HPP Vinodol by app. 11 GWh.</p> <p><b>6. Installation of additional exchanged in exhaust-gas boilers in gas thermal power plant</b> Guarantee measurements to follow the installation of the equipment. After the equipment has been installed, measurement will be conducted via the system for monitoring and supervising process parameters</p>
	<p>Expected energy savings by the end of 2019</p>	<p><b>1. Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b> Very rough overview of the calculation of consumption app. 70 m<sup>3</sup> of gas for 1 tonne of steam (16 bar and 300°C) gives daily savings of app. 10,000 m<sup>3</sup> of gas, which, taking into account the minimum summer period of 120 days, gives summertime savings of app. 1,200.000 m<sup>3</sup>, or 11,520 MWh.</p> <p><b>2. Reconstruction of the plant and management of pumps for well, drinking and technological water</b> By using frequency converters for operation and regulation, the savings in electricity based on the operation of pumps for well, drinking and technological water in 2016 amounted to ≈ 97 MWh a year, i.e. 145.5 MWh by the end of 2019.</p> <p><b>3. Reconstruction of the cooling water pumping station Sava</b> By using frequency converters for operation and regulation, the savings in electricity based on the operation of pumps for well, drinking and technological water in 2016 amounted to ≈ 402 MWh a year, i.e. 804 MWh by the end of 2019.</p> <p><b>4. THE CONSTRUCTION OF A STEAM BLOCK BOILER ROOM 2 X 35 t/h will begin in late 2017</b> Exploitation of auxiliary steam boiler room during the winter will allow for the production of additional 40 MWt in the so-called C6 heater, over 120 days a year, which amounts to HRK 864,000 a year, or HRK 1,728,000 by the end of 2019.</p> <p><b>5. Reconstruction of PSHPP Fužine (2013 -2018)</b> The beginning of trial operation of PSHPP Fužine is planned for 2018, so that the estimated additional production of the hydroenergetic system of HPP Vinodol for 2019 amounts to ≈ 11,000 MWh.</p>

		<p><b>7 Relocation of sludge pit for using pure condensate in the CHPP heat station.</b></p> <p>N/A Total: 23,469,5 MWh ≈ 84.6 TJ</p>
Expected energy savings by the end of 2020		<p><b>1. Construction of a 12.5 t/h steam boiler room in CHPP Sisak</b> Very rough overview of the calculation of consumption app. 70 m<sup>3</sup> of gas for 1 tonne of steam (16 bar and 300°C) gives daily savings of app. 10,000 m<sup>3</sup> of gas, which, taking into account the minimum summer period of 120 days, gives summertime savings of app. 1,200,000 m<sup>3</sup>, or 11,520 MWh. The expected savings for the given period amount to 23,040 MWh.</p> <p><b>2. Reconstruction of the plant and management of pumps for well, drinking and technological water</b> By using frequency converters for operation and regulation, the savings in electricity based on the operation of pumps for well, drinking and technological water in 2016 amounted to ≈ 97 MWh a year. The expected savings for the given period amount to 242.5 MWh.</p> <p><b>3. Reconstruction of the cooling water pumping station Sava</b> By using frequency converters for operation and regulation, the savings in electricity based on the operation of pumps for well, drinking and technological water in 2016 amounted to ≈ 402 MWh a year. The expected savings for the given period amount to app. 1.206 MWh.</p> <p><b>4. THE CONSTRUCTION OF A STEAM BLOCK BOILER ROOM 2 X 35 t/h will begin in late 2017</b> Exploitation of auxiliary steam boiler room during the winter will allow for the production of additional 40 MWt in the so-called C6 heater, over 120 days a year, which amounts to HRK 864,000 a year, or HRK 2,592,000 by the end of 2020.</p> <p><b>5. Reconstruction of PSHPP Fužine</b> The expected savings amount to 11.,000 MWh/year, or app. 22,000 MWh for the given period.</p> <p><b>6. Installation of additional exchangers in exhaust-gas boilers in PSHPP</b> HRK 25,039,598.00 (in accordance with the study entitled Analysis of the possibility of additional cooling of flue gases in PSHPP by Elektroprojekt Zagreb)</p> <p><b>7. Relocation of sludge pit for using pure condensate in the CHPP heat station.</b></p>
Assumptions		Securing sufficient financial resources under the Annual plan of investment of HEP Proizvodnja and performance of activities of the contractor according to the planned/contracted scope of procurement of equipment and other necessary works within mandatory works.
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	Production of electricity - hydroelectric power plants
	Time frame	Start: 2017 End: 2019 Multi-annual stages of revitalising existent HPPs and SHPPs
	Objective / outline	<p>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. By increasing power, some of the night-time production can be shifted to daytime production.</p> <p>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.</p> <p>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.</p>
	Target contribution to more efficient production of electricity	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
	Regional application	National
	Information on implementation	<p>List and description of activities for implementation of measure</p> <p>Future activities:</p> <ol style="list-style-type: none"> <li><b>Centre of production of the HPP Zapad (West) production area (2015-2018)</b> Equipping/automating hydrological and piezometric stations and introducing hydrological measurements for all HPPs in CPZ, automating and process communication nodes for all HPP PAs of HPP Zapad, S/H equipping of CPZ, equipping the Administrative building in HPP Senj for CPZ</li> <li><b>Stage revitalisation of HPP Ozalj 1 (2013-2020)</b> Revitalisation of HPP Ozalj 1: revitalisation of A, B and C generators. The preparation of detailed design and production of equipment is underway. The production, delivery and assembly of A, B and C generators with the corresponding excitation and turbine regulation, SN equipment, network transformer and USZMR equipment is planned for the 2017-2020 period.</li> <li><b>Stage revitalisation of HPP Gojak (2015-2020)</b> Design, production, delivery and installation, commissioning of 3 synchronous generators, 25 MVA each, design, production, delivery, installation and commissioning of the aggregate monitoring and the adaptation of other systems of the PP (USZMR and PROCIS, excitation system, turbine regulation system, intake of air under the turbine working torque through the new generator shaft). Current activities: 2016 contracting, design and procurement of material; production, delivery and installation of A, B and C generators is planned for the 2017-2020 period, and the delivery of contracted documentation and final calculation is planned for 2020.</li> </ol>

	Funds and sources of financing	<p><b>1. Planned funds for the HPP Zapad PA</b></p> <ul style="list-style-type: none"> <li>- HEP: HRK 12.346.138 by 31 December 2016</li> <li>- HEP: HRK 11,808,900 2017</li> <li>- HEP: HRK 10,330,762 2018</li> </ul> <p>Total: HPP Zapad PA: HRK 34,485,800</p> <p><b>2. Planned funds for the revitalisation of HPP Ozalj 1 (4 MW)</b></p> <ul style="list-style-type: none"> <li>- HEP: HRK 6.980.000 by 31 December 2016</li> <li>- HEP: HRK 16,290,000 2017 2018</li> <li>- HEP: HRK 18,000,000 2018</li> <li>- HEP: HRK 9,300,000 2019 2018</li> <li>- HEP: HRK 202,056 2020 2018</li> </ul> <p>Total: Revitalisation of HPP Ozalj 1 with investment documentation: HRK 50,772,056</p> <p><b>3. Planned funds for the revitalisation of HPP Gojak (72.3 MW)</b></p> <ul style="list-style-type: none"> <li>- HEP: HRK 10.850.000 by 31 December 2016</li> <li>- HEP: HRK 23,220,000 2018</li> <li>- HEP: HRK 37,820,000 2018</li> <li>- HEP: HRK 17,970,000 2019</li> <li>- HEP: HRK 4,445,102 2020</li> </ul>
	Executive body	HEP-Proizvodnja d.o.o., Hydroelectric power plant sector
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	<p>1. Comparison of annual production in similar hydrological circumstances at annual level for periods before and after establishing the HPP Zapad PA Production Centre.</p> <p>2. Comparison of increased engaged power and electricity produced before and after the revitalisation of HPP Ozalj 1, 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.</p> <p>3. Comparison of increased engaged power and electricity produced before and after the revitalisation of HPP Gojak, 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.</p>
	Expected energy savings by the end of 2019	<p><b>1. HPP Zapad PA Production Centre</b>, indirect effect of plant optimisation on increased production at the HPP by 60 GWh/year.</p> <p><b>2. The revitalisation of HPP Ozalj 1</b> is expected to increase production by 1 GWh/year in average hydrological years; increase of the power of the plant by 0.72 MW in late 2020.</p> <p><b>3. The revitalisation of HPP Gojak</b> is expected to increase production by 9 GWh/year in average hydrological years; increase of the power of the plant by 16.5 MW in late 2020.</p> <p>Total: 70 GWh</p>

		Total: 252 TJ
Expected energy savings by the end of 2020		<b>1. Centre of production of the HPP Zapad (West) production area</b> 120 GWh <b>2. Revitalisation of HPP Ozalj 1</b> - 1 GWh <b>3. Revitalisation of HPP Gojak</b> - 9 GWh Total: 130 GWh
Assumptions		Achievement of 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		Programme "Reduction of specific heat consumption of turbine 210 MW TE PLOMIN"
Measure index		E.3
Description	Category	Electricity generation from thermal power plants
	Time frame	2017 2018
	Objective / outline	Reduction of specific consumption of turbine heat by modernizing the low pressure turbine
	Target contribution to more efficient production of	Increasing the technical and economic efficiency of production, reduction of fuel consumption, increasing reliability and safety of operation.
	Target group	TPP Plomin plant
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	The modernization of LP turbine includes the replacement of the following: <ul style="list-style-type: none"> <li>• rotor (with blades),</li> <li>• welded interior housing,</li> <li>• blade pulleys with static blades</li> <li>• end sealing.</li> </ul>
	Funds and sources of financing	HRK 53,541,296.00
	Executive body	HEP-Proizvodnja d.o.o., Thermal power plant sector
	Body for monitoring, measuring and verifying savings	NCB

Energy savings	Method of monitoring / measuring energy savings	Guarantee measurements after the completion of the measure
	Expected energy savings by the end of	Not estimated
	Expected energy savings by the end of 2020	Reduction of specific consumption of heat from the current 7991.29 kJ/kWh to 7770 kJ/kWh, with an increase in nominal power by 7 MW. After the investment, the achieved production will be increased by 56,000 MWh /year, with a reduction of specific consumption, which will lower the price of electricity by 0.95 EUR/MWh. Reduction of specific consumption affects the lower consumption of coal (annual average of 13,000 t), and thereby lower cost of purchasing CO <sub>2</sub> emission units.
	Assumptions	Securing sufficient financial resources under the Annual plan of investment of HEP Proizvodnja and performance of activities of the contractor according to the planned/contracted scope of procurement of equipment and other necessary works within mandatory works.
	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		Installation of new measurements of temperature and energy losses
Measure index		E.4
Description	Category	Production of electricity and heat energy
	Time frame	2017
	Objective /	Monitoring production parameters for the purpose of reducing losses
	Target contribution to more efficient production of electricity	Introduction of additional measurements of temperature on sewage drains of the PTA 1 and PTA2 and K6 expanders, measurements of heat losses and air flows on buildings and measurement of the temperature of flue gases on the 200 m chimney and flue gases in the smoke channel would establish the framework for analysis of losses and further actions with the aim of reducing the costs of the plant.
	Target group	CHPP Zagreb plant
	Regional application	-
Information on implementation	List and description of activities for implementation of measure	It is required to deliver the equipment, perform the installation and commission the following measuring circuits: measurement of temperature at the sewage drains of expanders PTA 1 and PTA 2 and K6 measurement of heat losses of buildings measurement of air flow on buildings (energy efficiency) measurement of the temperature of flue gases on the 200 m chimney and flue gases in the smoke canal

	Funds and sources of financing	Own funds, HRK 1,900,000.00
	Executive body	HEP-Proizvodnja d.o.o., Thermal power plant sector
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	After the equipment has been installed, measurement will be conducted via the system for monitoring process parameters
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of 2020	Not estimated
	Assumptions	/
	Overlapping, multiplication effect, synergy	N/A

<b>Title of the measure</b>		<b>Improving energy efficiency in researching and production of oil and gas</b>
Measure index		E.5
Description	Category	Researching and production of oil and gas
	Time frame	Start: 2017 End: 2019
	Objective / outline	The achievement of energy efficiency during the production of gas and oil requires continuous improvements. The previous action plan defined activities that included the replacement of equipment with newer and more efficient equipment, while the aim of this Plan is to achieve savings on adjusting the parameters of this equipment in order to meet the parameters of the process of production of oil and gas with minimum consumption of energy. These savings are planned on new boiler rooms, the hot oil system on the process facility Objekti Frakcioniranje Ivanić Grad (OFIG). Furthermore, investments are planned for the automation of the work of oil wells, where the electric engine will be powered by frequency converters and work in accordance with the requirements of individual well. Also, investments for the purpose of improving energy efficiency of lighting fixtures on facilities have been planned.
	Target final consumption	Consumption of electricity, consumption of heat energy, consumption of gas
	Target group	INA d.d.
	Regional application	National

Information on implementation	List and description of activities for implementation of measure	<ul style="list-style-type: none"> <li>• Optimization of the operation of new boiler rooms</li> <li>• Automation and optimization of the operation of production wells by installing frequency converters</li> <li>• Replacement of existing light with LED lights</li> <li>• Using the MOS Đeletovci gas</li> <li>• The Žutica water filtration system</li> <li>• Optimization of the hot oil system on OFIG</li> <li>• Other</li> </ul> <p>Expected savings under these measures: 6 GWh</p>
	Funds and sources of financing	Planned funds: INA business plans
	Executive body	INA d.d.
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The projects are monitored in accordance with internal acts of monitoring project implementation, and savings will be visible on a lower consumption of energy sources at locations, as monitored via the newly introduced energy surveillance system in accordance with ISO 50001.
	Expected energy savings by the end of 2019	10.2 GWh = 36.72 TJ
	Expected energy savings by the end of 2020	15.5 GWh = 55.8 TJ
	Assumptions	Successfully completed projects with operation of the plant.
	Overlapping, multiplication effect, synergy	/

<b>Title of the measure</b>		<b>Improving energy efficiency in oil refining</b>
Measure index		E.6
Description	Category	Oil refining
	Time frame	Start: 2017 End: 2019
	Objective / outline	INA will continue activities aimed at improving energy efficiency and reducing emissions, and thus reducing the environmental impact. The refining process uses significant amounts of heat; experience has shown that this represents the greatest opportunities for achieving savings (The condensate collection and return system; Improvement of existing process furnaces and boilers; recovery of heat; metering of consumption, improvement of heat exchangers). In addition to consumers of heat energy, the process also uses a significant number of consumers of electricity; possibilities of additional savings have been observed in this area (Replacement of lighting, construction of a new substation, upgrade of existing equipment in plants, installation of remote centres for the management of the electrical network. Additional activities



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		have been planned in the area of reducing the losses of carbohydrates and optimizing the treatment process (recovery of gas from the torch system, advances management of the treatment process).
	Target final consumption	Consumption of electricity, consumption of heat energy, consumption of liquid fuels, consumption of gas
	Target group	INA d.d.
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<ul style="list-style-type: none"> <li>• Improvement of the condensate collection and return system</li> <li>• Recovery of gas from the flare system</li> <li>• Analysis and improvement of existing process furnaces and boilers</li> <li>• Replacement of lighting and installation of LED technology</li> <li>• Integration and improvement of heat recovery</li> <li>• Improvement of energy consumption metering, monitoring and control</li> <li>• Construction of a TS 110/35 kV substation</li> <li>• Analysis and upgrade of existing equipment (e.g. frequency regulator installations)</li> <li>• Construction of a system for advanced management of the refining process</li> <li>• Analysis and improvement of existent heat exchangers</li> <li>• Analysis of existent and installation of remote electric network management centres</li> <li>• Analysis and improvement of cooling towers</li> </ul>
	Funds and sources of financing	Planned funds: INA business plans
	Executive body	INA d.d.
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The measures are monitored using the internal acts for monitoring the implementation. Reporting: internal and NCB.
	Expected energy savings by the end of 2019	1980 TJ in 2017, 2018 and 2019
	Expected energy savings by the end of 2020	Additional measures in 2020 have not been determined. Total: 1980 TJ
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

### ***3.6.1 Energy efficiency criteria in network tariffs and regulation (Article 15 of the EED)***

In accordance with the Energy Act (OG No. 120/12), the Act on the Regulation of Energy Activities (OG No. 120/12), the Act on the Electricity Market (OG No. 22/13), and the Gas Market Act (OG 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.

Pursuant to the provisions of the Energy Act and the Act on the Regulation of Energy Activities, one of the main tasks of HERA is issuing, extending and transferring licences for performing energy activities. The applicable legislative package, harmonized with the provisions of the Third package of energy regulations of the European Union, stipulates that HERA makes the decisions on the amounts of tariff items at the request of the energy entity or independently. The Energy Act and the Act on the Regulation of Energy Activities significantly alter the role of HERA in terms of determining prices or the amounts of tariff items for regulated energy activities. In that sense, HERA shall implement the processes regarding the adoption and publishing of decisions on the amounts of tariff items.

The Energy Efficiency Act (OG 127/14) sets forth significant additional obligations of HERA. HERA supervises the obligations of energy suppliers regarding the delivery of information on the calculation of electricity, heat energy or gas, and the previous consumption of the final energy buyer. HERA supervises the obligations of the energy distributor to ensure that, as far as technically feasible, financially justified and proportional to potential energy savings, end consumers of energy and domestic hot water are provided with individual meters at competitive prices that accurately reflect the actual consumption of energy of the end buyers, as well as that individual meters are secured at competitive prices when replacing the existing meter and setting up a new connection in a new building or if the building is undergoing reconstruction.

In carrying out regulatory tasks in accordance with the act regulating the electricity market and gas market, HERA shall take into account the energy efficiency in relation to its decisions on the operation of gas and electricity infrastructure. When adopting tariff methodologies for energy activities of distribution and transmission (network tariffs) and regulations in accordance with the act regulating the electricity market, HERA shall take into account the costs and benefits of each measure, incentives for network operators to make available system services to network users and thus enable them to implement measures to improve energy efficiency in the context of further deployment of smart networks. In the field of electricity, HERA shall ensure compliance with regulations on the network and network tariffs with the criteria from Article 16(3) of the Energy Efficiency Act, but also taking into account the guidelines and codes stipulated pursuant to Regulation (EC) no. 714/2009. HERA shall ensure that an assessment of the potential for increasing energy efficiency is conducted, in particular relating to transmission, i.e. transport, distribution, load management, interoperability and connection to power generation facilities, including access to energy generators, and set forth concrete measures and investment for introducing cost-efficient energy efficiency improvements to network infrastructure, including their implementation deadlines. HERA shall ensure the removal of those incentives in network tariffs that are detrimental to the overall efficiency (including energy efficiency) of the generation, transmission, distribution and supply of electricity or those that might hamper participation of demand response, in balancing markets and ancillary services procurement. HERA shall ensure that network operators provide incentives to improve efficiency in planning and operation of infrastructure, and that tariffs allow providers to improve customer participation in system efficiency, including response to demand, depending on the circumstances. HERA shall stimulate demand-side sources, such as the response to demand, in a way that, in addition to procurement, they also participate in wholesale and retail markets. The Energy Regulatory Act has significantly strengthened the role of HERA in controlling the electricity market and the gas market.

### ***3.6.2 Facilitating and stimulating demand response (Article 15 of the EED)***

HOPS and HEP-ODS have been continuously investing in the automation of electric power networks 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 network management centres (NMC), which also complies with the obligations on parallel operation in the synchronous network of continental Europe, with the aim of ensuring continuous balance between electricity consumption and production as the basic condition for supply security.

### ***3.6.3 Energy efficiency in designing networks and regulation (Article 15 of the EED)***

Every year, HOPS submits a **Ten-year plan for the development of the transmission network**, which includes investments, in accordance with the Plan's financial framework, to HERA for approval. In this Plan, HOPS must define the amount of annual energy savings as a percentage of the average total electricity supplied during the previous three years. These savings concern all planned investments. HERA monitors the implementation of the Plan and gives its approval to HOPS for the ten-year plan for purchasing energy to cover losses in the transmission network for the following year. The achieved level of losses in the transmission network of Croatia for 2015 was 2.3 % of transmitted electricity.

Every year, HEP-ODS submits a **Ten-year plan for the development of the distribution network**, which includes investments resulting in a reduction of losses of electricity, in accordance with the Plan's financial framework, to HERA for approval. In this Plan, HEP-ODS must define the amount of annual energy savings as a percentage of the average total electricity supplied during the previous three years. HERA monitors the implementation of the Plan and gives its approval to HEP-ODS for the ten-year plan for purchasing energy to cover losses in the distribution network for the following year. The achieved level of losses in the distribution network of Croatia for 2015 was 8.1 % of purchased electricity. In 2016, HERA commissioned a study entitled "Assessment of the potential for increasing energy efficiency of electricity infrastructure", which was completed in 2016 and is used for monitoring losses in the transmission and distribution networks.

Title of the measure		Replacements and reconstructions of the hot water and steam network
Measure index		E.7
Description	Category	
	Time frame	Start: 2017 End: 2019
	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 implementation of measure	<u>Future activities:</u> 1. Preparation of documentation for replacing worn out hot water and steam distribution systems. 2. Replacement of hot water pipelines and steam lines whose steel pipeline insulation has worn out with new pre-insulated pipes.
	Funds and sources of financing	Planned funds: <ul style="list-style-type: none"> <li>• 2017 – HRK 26,700,000 (own funds)</li> <li>• 2018-2019 - HRK 77,000,000 (own funds, commercial banks)</li> </ul>
	Executive body	Heat energy distributor – HEP-TOPLINARSTVO d.o.o.
	Body for monitoring, measuring and verifying savings	NCB
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.
	Expected energy savings by the end of 2019	15 GWh = 54 TJ
	Expected energy savings by the end of	20 GWh = 72 TJ
	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.
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Title of the measure		Measures for managing the energy power plants and short- and long-term development of the transport network
Measure index		E.8
Description	Category	Managing the energy power plants and short- and long-term development of the transport network
	Time frame	Start: 2017 End: 2019
	Objective / outline	Seeing as how HOPS does not influence the timetable of power plants, production of wind power plants and other RES, market transactions, including imports of electricity, or transits via the transmission network for the needs of third countries, any influence of HOPS on the amount of losses in the transmission network is limited with measures regarding the management of EPS and short- and long-term development of the transmission network (list of measures is given below).
	Target final consumption	Consumption / losses of electricity
	Target group	Croatian Transmission System Operator
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p><u>List of activities:</u></p> <p>1) Measures for managing EPS:</p> <ul style="list-style-type: none"> <li>• topological changes in the network depending on the current state,</li> <li>• change to the switching state of the 400/220 kV, 400/110 kV, 220/110 kV and 110 / x kV transformer under the ownership / competence of HOPS and optimization of the operation of the transformer with coarse control (TS Žerjavinec, TS-HPP Senj)</li> <li>• voltage management and optimization of power flows in the network,</li> <li>• optimization of generator operation (work point with power factor within limits 0.95-1).</li> </ul> <p>2) Measures related to the short-term and long-term development of the transmission network:</p> <ul style="list-style-type: none"> <li>• replacement of old energy transformers with new transformers with smaller losses,</li> <li>• revitalization of the old transmission lines with the replacement of the conductor, using HTLS conductors with a larger cross section of the aluminium sheath and smaller losses,</li> <li>• planned network reinforcements (construction of new lines),</li> </ul> <p><u>Description of activities for implementation of measure:</u></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• An important characteristic of Croatian transmission network, both from the point of view of security of the facility and supporting market activities and from the point of view of losses, is an extremely strong connection with neighbouring electricity systems (interconnections). On the one hand, it significantly increases the safety of the facility, but on the other hand, it increases the losses in the network.</li> </ul>

		<ul style="list-style-type: none"> <li>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.</li> <li>The replacement of existing cables with new cables with a larger cross-section will directly reduce the resistance of conductors, thus producing a positive impact on reducing technical losses due to loads (variable losses).</li> <li>The replacement of old equipment with new equipment with reduced losses will achieve a reduction in the total losses at the level of the system.</li> </ul> <p>Further reduction of losses in the future may be achieved by developing new, more energy efficient technologies, and by further revitalisation and construction of network, using conductors with less resistance and lower losses.</p>
	Funds and sources of financing	Planned funds by the end of 2019: <ul style="list-style-type: none"> <li>HOPS: HRK 300,000,000</li> <li>HBOR, commercial banks</li> <li>EU funds</li> </ul>
	Executive body	HOPS
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	The effects of this measure are monitored on the basis of the data on the losses of electricity before and after the implementation of measure with normalisation according to the amount and duration of load.
	Expected energy savings by the end of 2019	174.96 TJ
	Expected energy savings by the end of 2020	285.12 TJ
	Assumptions	Future estimates are based on indications of the growth in electricity consumption 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.

<b>Title of the measure</b>	<b>Reducing losses in the electric power distribution network</b>	
Measure index	E.9	
Category	Information and mandatory information measures; Financial instruments	

Description	Time frame	<p>Start: continuous End: continuous Planned major modifications, amendments, improvements: 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.</p>
	Objective / outline	<p>Electric power losses in the distribution network can be classified as technical and non-technical losses, and therefore the activities for reducing losses can also be divided into two categories</p> <ul style="list-style-type: none"> <li>• activities for reducing non-technical losses;</li> <li>• activities for reducing technical losses, or increasing energy efficiency.</li> </ul> <p>A detailed analysis of electric power losses in the distribution network 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 network elements.</p> <p>The objective of HEP- Operator distribucijskog sustava d.o.o. is to reduce losses of electricity (total technical and non-technical) by the end of 2019 to no more than 7.75 % (<math>\pm 0.25</math> %) of the achieved procurement in the distribution network for that year.</p>
	Target final consumption	Consumption of electricity
	Target group	Distribution system operator
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>HEP-Operator distribucijskog sustava d.o.o. will continue the systematic implementation of the measure for reducing losses in the electricity distribution network.</p> <p>A detailed analysis will determine the causes of increased losses in certain sections of the network, and priorities will be set for implementing activities for reducing technical and non-technical losses</p> <p>The activities for reducing technical losses will be conducted through the following:</p> <ul style="list-style-type: none"> <li>• optimising the operating state of the network</li> <li>• reconstructions of parts of the network with small conductor cross-sections and long sections</li> <li>• switching parts of the 10 kV network on the 20 kV voltage level</li> <li>• replacement of old transformers with major losses</li> <li>• installation of energy transformers with reduced losses</li> <li>• reducing own consumption.</li> </ul> <p>The activities for reducing non-technical losses will be conducted through the following:</p> <ul style="list-style-type: none"> <li>• further installation and introduction of as many advanced meters in the remote supervision and meter reading system as possible</li> <li>• further comprehensive implementation of connection and meter point controls (CMPC), with an emphasis on detecting unauthorised electric power consumption</li> </ul>

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		<ul style="list-style-type: none"> <li>continued reconstruction of existing connections and meter points installed on the premises of the customers.</li> </ul>
	Funds and sources of financing	Planned funds and own business plans
	Executive body	Distribution system operator
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	HEP- Operator distribucijskog sustava will draw up a balance for the previous year, specifying losses of electricity.
	Expected energy savings by the end of 2019	108 TJ
	Expected energy savings by the end of 2020	144 TJ
	Assumptions	The specified savings were given under the assumption that the electricity procurement in the electricity distribution network would be of an approximately equal amount and approximately equal consumption structure per voltage levels for 2010, 2016 and 2020.
	Overlapping, multiplication effect, synergy	This measure will primarily affect the electricity distribution network.

Title of the measure		Energy efficiency in the natural gas transmission system
Measure index		E.10
	Category	
	Time frame	Start: 2017 End: 2019
	Objective / outline	<p>JANAF's development plans are aimed at modernizing the oil pipeline and storage system, further inclusion into the European oil pipeline network, with the diversification of directions and sources of oil supply, i.e. increased security of oil supply to consumers, building storage capacities and especially at achieving business goals concerning the development and increasing the level of success and efficiency of the business.</p> <p>Over the past few years, the oil pipeline system has been modernized to the highest world technology standards with the aim of increasing the safety of oil transportation, storage of oil and petroleum products, protection of the environment, maintenance of the capacities of transport within the framework of installed or projected capacity, prolongation of oil pipeline and tank life and efficient use of energy. With regard to the above, the completion and ongoing upgrading of the JANAF Monitoring and Control System (SCADA), power and communication information system, GIS and ongoing testing and improvement of pipeline integrity, etc., are especially significant.</p> <p>By the end of 2016, the JANAF power system has been fully modernized: equipment and power supply systems at 48 VDC, 110 VDC, 400 VAC, 6000 VAC and 35000 VAC have been replaced at all locations of JANAF. The connection to the SCADA System, which is further modernized, has also been modernized. The modernization of 35 kV plants, which are partly</p>



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		<p>within the competence of HEP, the electricity distributor, is especially significant. The result of all these measures is safe and high-quality electricity supply, with no breakdowns and deadlocks in the transportation of oil.</p> <p>In order to fully meet the needs of customers for faster delivery of crude oil from the Omišalj Terminal to the refineries in Croatia, Hungary, Serbia and Bosnia and Herzegovina, oil transportation on the Omišalj-Melnice-Sisak and Omišalj-Urinj sections must be organized as much as possible in the night mode, i.e. in the period of lower electricity tariffs, when the main and auxiliary pump in the Omišalj terminal are in operation, as well as the pump at the Melnica Pump Station (PS). The direct consequence of such mode of operation are significant savings on electricity costs by not paying full staff (which is otherwise calculated in the daily tariff), which on the Omišalj terminal amount to 4,000 kW, and on PS Melnice 3,500 kW, which in total amounts to app. 7,500 kW. The indirect consequence of the night-time mode of operation, when consumption is low, is a major contribution to balancing and stability of the power system. However, a likely increase in oil transportation may limit the possibility of using a favourable night-time operating regime and savings in energy consumption.</p>
	Target final consumption	Up to 5 kWh/tonne of transported oil
	Target group	Oil transportation - electricity
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	<p>The plan for the optimization of the oil transport system in the upcoming three-year period provides for the modernization of the main power electric motors at the Omišalj and Sisak terminals.</p> <p>At the Omišalj Terminal, replacement of two existing 3,300 kW electric motors installed in 1979 with new ones, with better electrical features, is planned. After this replacement, the pump unit with new electric motor will transport the same amount of oil in a shorter time, which should result in savings in electricity costs at the Omišalj Terminal. At the same time, significant savings will also be achieved at PS Melnice, since the aggregates, working parallel to the pump aggregates at the Omišalj Terminal, will transport the same amount of oil in shorter time. During the life cycle of new electric motors at the Omišalj Terminal (estimated at 30 years), financial savings will significantly exceed investment costs.</p> <p>At the Sisak Terminal, it is planned to modernize two pumping units by changing the speed of rotation of the electric motor in a new technological way, using the frequency converter of the mains supply Variable Speed Drive - VSD). The direct consequence of the introduction of VSD will be significantly lower electricity consumption for the same amount of crude oil transported. In relation to the current pumping mode and the same amount of transported oil from the Sisak Terminal in the direction of Slavonski Brod or Virje, the expected savings of the cost of electricity would provide a return on investment in a period of less than five years.</p>
	Funds and sources of financing	Planned funds and own business plans
	Executive body	Jadranski naftovod d.d.
	Body for monitoring, measuring and verifying savings	NCB

Energy savings	Method of monitoring / measuring energy savings	Electricity consumption in kilowatts (kWh) per tonne of crude oil delivered
	Expected energy savings by the end of 2019	Due to market volatility, pipeline users do not publish reliable medium-term oil transportation plans, so savings cannot be calculated reliably.
	Expected energy savings by the end of 2020	Due to market volatility, pipeline users do not publish reliable medium-term oil transportation plans, so savings cannot be calculated reliably.
	Assumptions	Implementation of the modernization plan for the electric motors of main pumping stations at the terminals of Omišalj and Sisak.
	Overlapping, multiplication effect, synergy	In conclusion, projects that have already been completed, as well as those planned for the next three-year period, will significantly contribute to increased transport and oil security and protection of the environment. Furthermore, they will also contribute to the prolongation of the oil pipeline's life cycle, as well as retention of old and the acquisition of new markets.

#### ***3.6.4 Savings resulting from measures in the field of electricity supply***

Described above, individually for each measure.

#### ***3.6.5 Financing measures in the field of electricity supply***

Described above, individually for each measure.

**ANNEX 1 Overview of measures for establishing an alternative fuels infrastructure**

The measures for establishing an alternative fuels infrastructure have been developed within the Fourth National Action Plan, and are thus harmonized with the implementation of the policy for energy efficiency and mitigating climate change. An overview of measures for establishing an alternative fuels infrastructure is given below.

Title of the measure		Legislative adaptation to the provision on the deployment of alternative fuels infrastructure
Measure index		T.2
Description	Category	Regulations
	Time frame	Start: 2017 End: 2030 Planned major modifications, amendments, improvements: New measure
	Objective / outline	It is necessary to adopt legal and delegated acts to regulate the conditions for connecting to the electricity system for charging stations, requirements for distribution, charging and unit price of alternative energy sources used in transport, determining the conditions for charging station of liquefied natural gas and compressed natural gas (LNG and CNG) on the national level. The fulfilment of this requirement is the precondition for further development of the alternative fuels infrastructure.
	Target final consumption	Road, railway and maritime traffic and inland navigation
	Target group	Companies operating in the infrastructure sector and transport companies in the road, railway and maritime traffic and inland navigation
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	It is necessary to provide for amendments to the acts regulating traffic regulations by laying down the obligations of establishing an alternative fuels infrastructure for entities managing transport infrastructure, as well as amendments to the acts regulating the conditions for the reconstruction of parking spaces by introducing the obligation of alternative fuel charging stations.
Energy savings	Funds and sources of financing	No additional financing is required; drafting of legislation is done by state administration bodies.
	Executive body	The NCB and other state administration bodies: ministry in charge of finance, ministry in charge of transport infrastructure, ministry in charge of energy, ministry in charge of internal affairs, ministry in charge of construction and physical planning and ministry in charge of protection of the environment, as well as corresponding funds and regulatory bodies.
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	/

	Expected energy savings in 2019	Not estimated
	Expected impact on energy savings for 2020	Not estimated
	Assumptions	/
	Overlapping, multiplication effect, synergy	/

<b>Title of the measure</b>		<b>Fostering integrated and intelligent transport and development of alternative fuels infrastructure on a local and regional level</b>
<b>Measure index</b>		<b>T.3</b>
Description	Category	Information and organizational measure, infrastructure
	Time frame	Start: 2014 End: 2030 The measure is a consolidation of measures T.4 and T.8 from the 3rd NEEAP and a new measure, with larger amendments and improvements.
	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: <ul style="list-style-type: none"> <li>• optimising city logistics of freight transport and intelligent management of public parking spaces (ICT technology)</li> <li>• introducing integrated passenger transport</li> <li>• introducing car-sharing schemes in cities</li> <li>• introducing public city bicycles and the construction of the corresponding cycling infrastructure</li> <li>• Intelligent transport management</li> </ul> In addition to the measures for promoting alternative fuels infrastructure on a national level, a series of measures has been recommended on a local level:
	Target final consumption	Road transport vehicles
	Target group	Drivers
	Regional application	Urban/National
	Information on implementation	List and description of activities for implementation of measure

		<p>optimizing the time of entry of freight and delivery vehicles in city centres. This approach improves the capacity and reduces traffic congestion, especially in peak morning hours.</p> <p>The EPEEF shall ensure funds in the form of grants (from allocated funds from emission units) for 10 large cities of Croatia. Cities may use these funds for the preparation of expert analyses for the purpose of optimizing city logistics of freight transport.</p> <ul style="list-style-type: none"> <li>• <b>Introducing integrated and sustainable passenger transport</b></li> </ul> <p>It is necessary to motivate LRSUs (with an emphasis on large cities) to encourage passengers to use public city transport and combine various means/modules of public city transport. The aim is to encourage as much passengers in urban and suburban transport to switch from personal vehicles to combines public transport systems. The national coordinating body for energy efficiency encourages cities to promote and actively work on solving this problem when drafting and implementing planning documents for energy efficiency.</p> <p>Through Annual Plans, Action Plans and reports, cities independently develop and improve public transport services and infrastructure in cooperation with the NCB.</p> <p>Examples of activities aimed an integrated and sustainable passenger transport:</p> <ul style="list-style-type: none"> <li>○ introducing the option of purchasing a cheaper ticket to use for all public transport and other urban passenger transport services</li> <li>○ provide information on the status of available public transport services using ICT technologies and/or on site (bus stops, tram stops, bicycle parking spots, etc.)</li> <li>○ further development of the urban and suburban network available to a wider circle of users (bus, tram, railway lines and cycling lines and bicycle parking spots)</li> <li>○ other measures contributing to motivating users to switch from personal vehicles to public transport systems (enabling cheaper, faster, easier and more efficient public transport)</li> </ul> <p>Cities may request/contract direct aid from the EPEEF for certain projects if it is shown to be justified (through provable energy and CO<sub>2</sub> savings). For this measure, the EPEEF will ensure app. HRK 1,000,000 for the period of 4th NEEAP.</p> <ul style="list-style-type: none"> <li>• <b>Intelligent transport management</b></li> </ul> <p>Introducing advanced technologies in regulation and management of transport contributes to the reduction of primary energy consumption, as well as the emissions of carbon dioxide and other harmful gases. Some of the proposed activities for introducing intelligent transport management include the following:</p> <ul style="list-style-type: none"> <li>○ upgrading, adapting and replacing obsolete signalling devices and equipment,</li> <li>○ installing advanced traffic equipment and intelligent traffic lights with an autonomous system of energy supply from renewable sources (the Sun, the wind),</li> </ul>
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		<ul style="list-style-type: none"> <li>○ constructing and equipping central operational centres for the surveillance and management of intersections with traffic lights,</li> <li>○ Connecting existing and future systems of advanced regulation of intersections with intelligent traffic lights in cities (systems of advanced regulation of intersections with intelligent traffic lights).</li> <li>○ intelligent management of public parking spaces (ICT technologies) establishment of simple tracking of current availability of parking spots on public parking spaces and in garages.</li> </ul> <p>The implementation of this measure shall result in the increase of individual traffic flow, acceleration of public transport, reduction in fuel consumption and accompanying CO<sub>2</sub> emissions and will considerably unburden the roads. This can significantly reduce the consumption of fuel, e.g. 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, while the construction and equipping of an operational surveillance centre or introduction of automatic and intelligent traffic management in the event of an accident and daily requests will easily divert traffic, thus reducing congestion and consumption.</p> <ul style="list-style-type: none"> <li>● <b>Introducing a car sharing scheme</b></li> </ul> <p>Based on the experiences of Member States of the EU, practice has shown that one vehicle in a car sharing scheme substitutes 4–8 regular (personal) vehicles on roads. 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 electric and/or plug-in hybrid cars a year into the scheme in the largest cities is proposed by 2020. The EPEEF shall co-finance the car sharing schemes featuring only electric and plug-in hybrid vehicles. This measure also has an indirect effect on the environment: it shall lead to a reduction in the number of cars on roads, unburdening of parking spaces in city centres, reduction of the emission of pollutants and in fuel consumption (esp. fossil fuels).</p> <ul style="list-style-type: none"> <li>● <b>Introducing public city bicycles and acquiring cycling parking infrastructure</b></li> </ul> <p>The objective of introducing the public city bicycles scheme, 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. During the previous period, the infrastructure of the public city bicycles scheme was established in 10 cities of Croatia. A total of 283 bicycles and 44 terminals are available in the following cities: Zagreb, Ivanić Grad, Slavonski Brod, Karlovac, Brinje, Gospić, Zadar, Šibenik, Makarska, Lastovo.</p> <p>The plan is to have app. 700 bicycles and 100 terminals available on the territory of Croatia by 2019. The public bicycles scheme shall be further developed in terms of opening and constructing additional terminals/ locations, primarily in larger cities of Croatia, or as a supplement to the public transport, and not as an additional tourist service. These systems are the most useable and have the most significant effect on consumption and reduction of pollution in larger urban areas, where they replace personal vehicles</p>
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		<p>and complement other public transport systems. During the period of the implementation of the 4th NEEAP, app. 400 new public city bicycles must be introduced to around 70 new locations.</p> <ul style="list-style-type: none"> <li>• <b>Development of alternative fuels infrastructure on a local and regional level</b></li> </ul> <p>LRSUGs should be encouraged to include measures for the development of the alternative fuels infrastructure in their action and annual energy efficiency plans.</p> <p>Some of the proposed activities for the development of alternative fuels infrastructure on a local and regional level:</p> <ul style="list-style-type: none"> <li>○ Parking spots</li> </ul> <p>It is necessary to introduce the possibility of privileged parking for zero emission vehicles or of limiting the access to a parking spot for vehicles with internal combustion engines. For the purpose of implementing the measure, it will be necessary to define guidelines based on which decisions can be made on exemptions or discounts for using the public parking service for eco-friendly vehicles.</p> <ul style="list-style-type: none"> <li>○ Clean traffic zones</li> </ul> <p>Similarly to the introduction of privileged parking for zero emission vehicles, it is suggested that a ban be introduced on traffic of all vehicles other than zero emission vehicles through the central parts of cities and that zero emission vehicles be allowed in parts of cities which currently have a ban on all vehicles other than public transport vehicles.</p>
	Funds and sources of financing	<p>LRSUGs budgets of LRSUGs, EU funds - depending on plans and projects of LRSUGs</p> <p>EPEEF - financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): HRK 21,500,000.00 for the period 2017-2019, according to the following estimate:</p> <ul style="list-style-type: none"> <li>• HRK 3,500,000 for Optimising city logistics of freight transport</li> <li>• HRK 1,000,000 for Introducing integrated and sustainable passenger transport (for equipment, devices, establishing the system and preparing projects)</li> <li>• HRK 1,500,000 for Intelligent transport management</li> <li>• HRK 9,000,000 for Introducing a car sharing scheme (subsidising vehicles)</li> <li>• HRK 5,000,000 for Introducing public city bicycles and acquiring cycling parking infrastructure (bicycles and stops)</li> <li>• HRK 1,500,000 for Development of alternative fuels infrastructure on a local and regional level (for drafting guidelines and expert analyses for introducing privileged parking and clean traffic zones)</li> </ul>
	Executive body	EPPEF (co-financing and publishing the tender) LRSUGs - planning via annual and action plans and implementation
	Body for monitoring	NCB in coordination with MMPI
Energy savings	Method of monitoring / measuring energy savings	The effects of this measure will be recoded individually by projects, using the proscribed TD methodology with supplement/developing new BU methodology, if necessary
	Expected energy savings by the end of 2019	intelligent transport management: 201 TJ Introducing a car sharing scheme: 9.3 TJ Introducing public city bicycles and acquiring cycling parking infrastructure: 0.5 TJ

	Expected energy savings by the end of 2020	intelligent transport management: 402 TJ Introducing a car sharing scheme: 12.4 TJ Introducing public city bicycles and acquiring cycling parking infrastructure: 0.7 TJ
	Assumptions	<ul style="list-style-type: none"> <li>• <b>Optimising logistics of freight transport</b> Not estimated.</li> <li>• <b>Introducing integrated and sustainable passenger transport</b> Not estimated.</li> <li>• <b>Intelligent transport management</b> 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 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: 20 lights in 2017, 30 lights in 2018, 50 lights in 2019 and 100 lights in 2020. In such circumstances, the measure could reduce fuel consumption at busy intersections by up to 201 TJ in 2019 and by 402 TJ in 2020.</li> <li>• <b>Introducing a car sharing scheme</b> It is estimated that the introduction of most efficient vehicles in this scheme could achieve a difference in the amount of over 3 L/km compared to the existing vehicles. On the other hand, average annual mileage by vehicle in a car sharing scheme is estimated as 30,000 km. Considering the above, new annual savings would amount to 860 MWh, or a total of 9.3 TJ in 2009 and 12.4 TJ in 2020.</li> <li>• <b>Introducing public city bicycles and acquiring cycling parking infrastructure</b> So far it has been established that the annual daily mileage of a bicycle is 1.5 km, taking into account the period when the public bicycles system is not available due to the winter. With about 140 new bicycles annually, app. 76,650 km of driving can be avoided per year. Considering these assumptions, new annual savings would amount to 52 MWh, or a total of 0.5 TJ in 2009 and 0.7 TJ in 2020 (not including the savings based on previously implemented measures).</li> <li>• <b>Development of alternative fuels infrastructure on a local and regional level</b> Not estimated.</li> </ul>
	Overlapping, multiplication effect, synergy	/

Title of the measure		Financial incentives for energy efficient vehicles
Measure index		T.4
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020 The measure has been continued from the 3rd NEEAP, with major amendments and improvements.
	Objective / outline	In its work, the EPEEF co-finances cleaner traffic projects. This programme should be upgraded by developing special co-financing lines for specific purposes, as follows: <ul style="list-style-type: none"> <li>• purchasing electric and “plug-in” hybrid vehicles of lower and medium size (city and compact vehicles)</li> </ul>



		<ul style="list-style-type: none"> <li>• purchasing new energy efficient vehicles: L, M and N categories: <ul style="list-style-type: none"> <li>○ Diesel EURO6 standard with submitting proof of putting existing lower norm vehicles out of traffic</li> <li>○ With CNG and LNG drive</li> <li>○ With electric and plug-in hybrid drive</li> </ul> </li> <li>• Co-financing the purchase of electric bicycles, mopeds and motorcycles.</li> </ul> <p>In 2015 and 2016, the Environmental Protection and Energy Efficiency Fund co-financed the purchase of 528 and 198 electric, hybrid and plug-in hybrid vehicles, respectively.</p> <p>The majority of vehicles, over 80 %, were from the personal vehicles category; electric motorcycles and two electric trucks were also co-financed.</p> <p>This measure yielded energy savings in the amount of 2,069,350 kWh or 502 tCO<sub>2</sub> in 2015 and 962,838 kWh or 230 tCO<sub>2</sub> in 2016.</p>
	Target final consumption	Road vehicles
	Target group	Legal and natural persons
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	The Fund shall establish schemes for co-financing and purchasing electric and “plug-in” hybrid personal vehicles (L, M and N categories).
	Funds and sources of financing	EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14): HRK 20 000 000.00
	Executive body	EPEEF (co-financing and launching the tender)
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	This measure shall be monitored via the national System for monitoring, measuring and verifying energy savings (SMIV).
	Expected energy savings by the end of 2019	17 TJ
	Expected energy savings by the end of 2020	23 TJ
	Assumptions	It is assumed that the trend from the 3rd NEEAP shall not change drastically and that during the 4th NEEAP app. 1,200 vehicles will be co-financed. 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.

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	Overlapping, multiplication effect, synergy	/
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Title of the measure		Development of alternative fuels infrastructure
Measure index		T.5
Description	Category	Infrastructure, strategic planning
	Time frame	Start: 2014 End: 2030 Planned major modifications, amendments, improvements: The measure has been continued from the 3rd NEEAP.
	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 measure follows the Directive on the deployment of alternative fuels infrastructure, the Act on the deployment of alternative fuels infrastructure and the draft National policy framework (NPF) and fosters the construction of charging stations in accordance with these documents. This infrastructure measure shall not have a direct effect on the reduction of consumption of fuel in traffic, but the development of infrastructure is a prerequisite for the development of market for vehicles using electricity, CNG and LNG in Croatia.
	Target final consumption	Road vehicles, vessels in inland navigation, maritime ships
	Target group	
	Regional application	National
Information on implementation	List and description of activities for implementation of measure	The following objectives have been established pursuant to the draft National policy framework (developed in accordance with the Directive): <ul style="list-style-type: none"> <li>• Electricity In 2016, 856 vehicles using electrical power were registered in Croatia, of which 299 personal vehicles, 55 freight vehicles, 250 mopeds, 183 motorcycles, 3 buses, 66 tractors and non-road vehicles. 126 publicly available charging stations are registered. For the purpose of covering the minimum needs for functioning of electrical mobility, the proposal on the number of charging stations and plug-in spots was based on the scenario of low share of energy transmission in the public charging stations network. In order to follow the growth of the electric vehicles market, a minimum of 296 plug-in spots (222 AC with a minimum power of 22/(11)kw, 74 DC with a minimum power of 50 KW) in 164 charging stations must be ensured by 2020.</li> <li>• Liquefied natural gas (LNG) Croatia does not have LNG infrastructure and no vehicles or vessels using this energy source have been registered. <ul style="list-style-type: none"> <li>○ LNG in maritime navigation In accordance with the preliminary analysis of possible economically efficient locations for establishing the LNG infrastructure and taking into account the unreliability of predictions on market development, the need for the construction of infrastructure for reloading and supply of LNG in Rijeka by 2025 and in Pula, Zadar, Šibenik, Split, Ploče and Dubrovnik by 2030 was predicted.</li> </ul> </li> </ul>

		<p>During the period of the 4th NEEAP, the construction of LNG infrastructure in maritime traffic has not been planned.</p> <ul style="list-style-type: none"> <li>○ LNG in inland navigation</li> </ul> <p>It is not possible to reliably predict the number of LNG-driven vessels in inland navigation over the next decade.</p> <ul style="list-style-type: none"> <li>○ LNG in road traffic</li> </ul> <p>It is estimated that charging stations will have to be installed on the periphery of Zagreb and Rijeka by 2025, and on the periphery of Zadar, Split, Ploče, Slavonski Brod and Osijek by 2020.</p> <p>During the period of the 4th NEEAP, the construction of LNG infrastructure in road traffic has not been planned.</p> <ul style="list-style-type: none"> <li>• Compressed natural gas (CNG)</li> </ul> <p>In terms of CNG-fuelled vehicles, in 2016, 208 personal vehicles, 84 freight vehicles, 10 mopeds, 6 motorcycles, 108 buses and 11 tractors were registered in Croatia. Croatia currently has 2 publicly available CNG charging stations (in Zagreb and Rijeka).</p> <p>Pursuant to the draft NFP, the opening of charging stations on 11 locations is planned by 2020, as follows: in Pula, Zadar, Šibenik, Split, Dubrovnik, Karlovac, Sisak, Osijek, Varaždin, Čakovec and Zagreb. It is assumed that during the 4th NEEAP 9 charging stations will be constructed. Furthermore, it is predicted that during 2017 study analyses be made for all cities where charging stations are predicted.</p>
	Funds and sources of financing	<p>EPEEF - Financing energy efficiency programmes with funds obtained from the auction trade of greenhouse gas emission units of the EU pursuant to the Air Protection Act (OG 130/11, 47/14):</p> <ul style="list-style-type: none"> <li>• Electricity: HRK 4,700,000.00 a year or HRK 14,100,009.00 by 2019 for the installation of charging stations for electric vehicles in accordance with draft National policy framework.</li> <li>• Compressed natural gas (CNG): HRK 10,000,000.00 by 2019 for opening 9 charging stations and preparing study analyses for the cities in which CNG charging stations are predicted (Pula, Zadar, Šibenik, Split, Dubrovnik, Karlovac, Sisak, Osijek, Varaždin, Čakovec and Zagreb). The funds are allocated in the amount of app. HRK 1,000,000 for grants by charging stations and app. HRK 100,000 for grant earmarked for drafting of the study.</li> </ul>
	Executive body	EPEEF (co-financing and launching the tender) LRSGUs
	Body for monitoring, measuring and verifying savings	NCB
Energy savings	Method of monitoring / measuring energy savings	TBD
	Expected energy savings by the end of 2019	Not estimated
	Expected energy savings by the end of	Not estimated
	Assumptions	The development of the infrastructure encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions

	Overlapping, multiplication effect, synergy	This measure shall have an effect on many industrial branches/sectors; TBD
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Title of the measure		Introduction of a special motor vehicle tax based on CO <sub>2</sub> emissions
Measure index		T.6
Description	Category	Financial instruments
	Time frame	Start: 2014 End: 2020 The measure has been continued from the 3rd NEEAP
	Objective / outline	A special motor vehicle tax is introduced under this measure with the aim of reducing emissions from transport. Based on the "polluter pays" principle, the model is calculated on the basis of CO <sub>2</sub> emissions from motor The special tax is determined on the basis of the sales price or market value of a motor vehicle, carbon dioxide (CO <sub>2</sub> ) emissions expressed in grams per 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 This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. For the purpose of determining the achieved and revising the expected future savings, a study on the effect of the special tax on consumer behaviour when purchasing a vehicle will be conducted.
	Target final consumption	Motor vehicles
	Target group	Buyers of vehicles
	Regional application	National
	Information on implementation	List and description of activities for implementation
Funds and sources of financing		Buyers of vehicles
Executive body		Ministry of Finance
Body for monitoring, measuring and verifying savings		NCB
Energy savings	Method of monitoring/measuring energy savings	This measure shall be monitored based on research; Questionnaires completed by buyers of vehicles

	Expected energy savings by the end of 2019	132 TJ
	Expected energy savings by the end of 2020	176 TJ
	Assumptions	The introduction of the tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. The used assumptions are as follows: 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 <sub>2</sub> /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 <sub>2</sub> /km lower. The duration of the measure is 8 years.
	Overlapping, multiplication effect, synergy	The encouragement for buying eco-friendly vehicles will lead to a reduction in the emissions from personal vehicles, and thus in the total emissions from the transport sector. This measure is connected to the measure of encouraging the purchase of energy efficient vehicles, which further stimulates the purchase of electric and hybrid vehicles.