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MINISTRY OF DEVELOPMENT

Energy Efficiency Action Plan

pursuant to Directive 2006/32/EC

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SUMMARY

Improved energy efficiency is a priority in the energy policy of the European Union and thus a priority for Greece as well. The European Union's energy policy is steered by three objectives which are also embraced at national level. The first objective is economic competitiveness, the second is security of energy supply and the third is protection of the environment. Improved energy end-use efficiency will make it possible to exploit potential cost-effective energy savings in an economically effective way. Energy efficiency improvement measures could realise these energy savings and thus help Greece reduce its dependence on energy imports. Furthermore, a move towards more energy-efficient technologies can boost Greece's innovativeness and competitiveness in accordance with the Community commitments and as underlined in the Lisbon strategy.

This report constitutes the first Energy Efficiency Action Plan (EEAP) in accordance with the requirements of Directive 2006/32/EC.

Energy savings target

Table 1 shows the energy savings target for 2016, calculated in accordance with the methodology set out in Directive 2006/32/EC, and also the intermediate target for 2010.

Table 1: Baseline energy consumption and the savings target

	2001		2002		2003		2004		2005		Average 2001-2005		
TWh	Conventional fuels and RES	Electric-ity	Convent-ional fuels and RES	Electric-ity	Convent-ional fuels and RES	Electric-ity	Convent-ional fuels and RES	Electric-ity	Convent-ional fuels and RES	Electric-ity	Convent-ional fuels and RES	Electric-ity	**Total**
Final inland consumption	154.9	44.5	158.6	46.6	167.9	48.6	162.7	49.7	167.9	50.9	162.4	48.1	**210.5**
Energy consumption in installations covered by the ETS Directive	22.4	7.1	21.7	7.4	19.9	7.1	19.8	6.9	18.7	6.7	20.5	7.0	**27.5**
Final inland consumption for ESD purposes	132.5	37.5	136.8	39.2	148.0	41.5	142.9	42.9	149.2	44.2	141.9	41.0	**182.9**
Residential sector	38.8	14.5	40.0	15.8	46.0	16.4	44.4	16.9	45.5	16.9	42.9	16.1	**59.0**
Tertiary sector	3.8	13.2	3.9	14.0	4.3	15.0	4.8	15.9	6.0	16.5	4.6	14.9	**19.5**
Industry (ESD purposes)	16.1	6.7	16.0	6.8	16.0	7.1	13.3	7.1	14.9	7.7	15.3	7.1	**22.3**
Transport	63.8	0.2	66.1	0.2	70.0	0.2	70.5	0.2	72.4	0.2	68.6	0.2	**68.8**
Agriculture	10.0	2.8	10.8	2.5	11.6	2.8	10.0	2.8	10.3	2.9	10.6	2.8	**13.3**
				National intermediate indicative annual energy savings target for 2010									**5.10**
				National indicative annual energy savings target for 2016									**16.46**

Savings per sector

Table 2 gives a summary of the optimum distribution of the savings target derived from the detailed analysis in Chapter 3 in which a reference scenario and a savings scenario are examined using the MARKAL model. The energy savings forecast is derived from current data and will improve as the implementation of the action plan proceeds.

Table 2: Savings per sector

	Savings required for achievement of the target (GWh)	
	2010	**2016**
Residential sector	1679	5533
Tertiary sector	1529	5715
Industry (outside the ETS)	127	680
Transport	1787	6731
Total	**5122**	**18659**

Overview table of the energy efficiency measures

The following table provides an overview of all the measures proposed for the purpose of achieving the action plan target and shows the anticipated annual savings for 2010 and 2016.

		Annual savings in 2010 (GWh)	Annual savings in 2016 (GWh)
Horizontal measures			
OP1.	Formation of a unit to collect energy data and forecasts.	Counted with the other measures.	Counted with the other measures.
OP2.	Targeted education campaigns, provision of information and rewarding of "good practices".	Counted with the other measures.	Counted with the other measures.
OP3.	Programmes to provide financial support for investment in energy-saving technologies and research.	300	1000
Cross-sectoral measures			
D1.	Energy performance of buildings.	Residential 210 Tertiary 375 Public 27	Residential 850 Tertiary 1125 Public 81
D2.	Further promotion of the integration of natural gas and LPG.	230	360
D3.	Energy labelling of appliances and minimum energy efficiency requirements.	995	2426
D4.	Implementation of an energy management system in the tertiary and public sectors.	150	1000
D5.	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV).	Depending on the scale and cost of the energy interventions.	Depending on the scale and cost of the energy interventions.

		Annual savings in 2010 (GWh)	Annual savings in 2016 (GWh)
D6.	Installation of electronic and intelligent metering of electricity and natural gas consumers.	80	800
D7.	Promotion of cogeneration of heat and power (CHP) and district heating systems.	180	823
Residential sector			
O1.	Energy upgrading of residential building shells.	200	2000
O2.	Financial aid for the upgrading of heating system boilers / burner units in existing buildings.	300	900
O3.	Compulsory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems in residential buildings.	180	540
O4.	Energy upgrading of social housing buildings.	Integrated study required.	Integrated study required.
Tertiary sector			
Private sector			
T1.	Compulsory installation of central solar thermal systems in tertiary sector buildings larger that 1 000m^2.	10	250
T2.	Promotion of voluntary agreements for energy upgrading interventions in tertiary sector buildings.	Dependent on the number of voluntary agreements concluded.	Dependent on the number of voluntary agreements concluded.
Public sector			
DM1.	Compulsory installation of central solar thermal systems to meet hot water requirements.	2	50
DM2.	Compulsory procurement procedures with respect to public buildings (green procurement – energy-efficient and RES technologies).	Study required.	Study required.
DM3.	Integrated energy planning by municipalities.	Study required.	Study required.
DM4.	Compulsory replacement of all lighting units with low energy efficiency in the public sector and the wider public sector.	98	298
Industry			
B1.	Incentives relating to the obligatory implementation of energy management systems in industry.	30	200
B2.	Creation of energy and environment management centres in business parks.	20	100
B3.	Programme of voluntary agreements in industry.	20	100
B4.	Energy services for energy savings.	50	400
Transport			

		Annual savings in 2010 (GWh)	Annual savings in 2016 (GWh)
M1.	Reshaping of the public transport system.	Requirement for implementation of a documented data collection and processing system.	Requirement for implementation of a documented data collection and processing system.
M2.	Transport infrastructure projects.	Requirement for implementation of a documented data collection and processing system.	Requirement for implementation of a documented data collection and processing system.
M3.	Development of urban mobility plans.	Requirement for implementation of a documented data collection and processing system.	Requirement for implementation of a documented data collection and processing system.
M4.	Promotion of economical, safe and eco-driving.	820	2014
M5.	Incentives for the replacement of old medium and heavy duty vehicles (over 3.5 tonnes and over 10 years old).	624	1738
M6.	Incentives for the replacement of private vehicles and to promote the use of energy-efficient vehicles (vehicles fuelled by natural gas and biofuels and hybrid vehicles).	768	1330
M7.	Eco-labelling – energy label for cars.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.
M8.	Compulsory quotas of vehicles with greater energy efficiency in the fleets of the public services and of public bodies.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.
M9.	Linking of vehicle taxation to energy efficiency and CO2 emissions.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.	The contribution of this measure has been included in the calculation of the energy saving from the vehicle replacement measures.

Conclusions

The energy efficiency improvement measures, coordinated in all the sectors, will lead to energy savings of at least 16.41 TWh in 2016 and meeting of the 9% target, and thus enable Greece to reduce its dependence on energy imports. Furthermore, the move towards more

energy-efficient technologies will boost innovativeness and competitiveness in Greece, help to improve the business environment and bring substantial direct development and job creation.

The energy savings scenario indicates that transport has the greatest savings potential, at about 36%. The tertiary sector and the residential sector come next, with potential savings of 30% and 29%, respectively.

Taken altogether these measures form a national integrated energy efficiency improvement programme the implementation of which will lead to achievement of the target of savings of large quantities of mineral fuels and electricity and further boost the penetration of natural gas and renewable energy sources.

INTRODUCTION

This is the final report of the energy efficiency action plan study in accordance with the requirements of the contract between the Ministry of Development and the Centre for Renewable Energy Sources (CRES).

This study is being implemented in the framework of Sub-Action 1.3.1.1. “Infrastructure studies and operations and modernisation of the institutional framework in the sectors of renewable energy sources (RES), cogeneration of heat and power and energy savings” of Action 1.3.1. “Simplification of the administrative procedures for energy investment” of the Ministry of Development's “Competitiveness” operational programme.

This report constitutes the first Energy Efficiency Action Plan (EEAP) in accordance with the requirements of Directive 2006/32/EC.

The EEAP study:

- provides a quantitative determination of the national energy savings target in GWh. The quantification is based on published official data of Eurostat on final energy consumption in Greece in the five-year period 2001-2005;
- analyses final energy consumption and gives a prediction of consumption per energy product, sector and use for the period of nine years in the reference scenario and the savings scenario determining the optimum distribution of the target on the basis of the MARKAL model;
- states the expected savings derived as the difference between the reference scenario and the savings scenario for the same period. This determines the optimum distribution of the energy end-use savings target for all sectors of activity on the basis of the technological measures of which the model takes account for the period from 2008 to 2016. The intermediate target for 2010 is also calculated;
- the proposed measures, which are already being implemented, constitute a decodification of the energy savings results, as derived with the help of the MARKAL calculation model, in the form of a selected mix of technologies which are technically and financially the best for each sector and use. The measures offer incentives and alternative financing mechanisms for achievement of the savings target through institutional, regulatory, management and technological provisions.

This shapes out an integrated national energy efficiency improvement programme the implementation of which will lead to achievement of the energy target. The measures of this programme have been arrived at additionally by taking account of the existing energy situation per sector of activity, national priorities (further penetration of natural gas and RES) and the policies and measures to which Greece is committed and which it is implementing at

the European and global levels in relation to selection of the energy mix, environmental commitments and obligations and employment and social cohesion.

1. DETERMINATION OF THE OVERALL NATIONAL INDICATIVE ENERGY SAVINGS TARGET

1.1. Calculation of the national target

Published official data of Eurostat on final energy consumption in Greece in the five years (2001-2005) prior to the implementation of the directive on energy end-use efficiency and energy services (Energy Services Directive – ESD) were collected for the purpose of determining the overall national energy savings target. The methodology used for calculating the national indicative energy savings target is specified in Article 4 of Directive 2006/32/EC. Use of the published official final energy data of EUROSTAT (Statistical Office of the European Communities - Energy statistics[1] August 2007, Annex A), specifically of the final energy consumption data for Greece in the most recent five-year period (2001-2005), ensured compatibility with the other Member States in the calculation of the target.

Table 1.1.1.: Final inland energy consumption in GWh in 2001 for the purposes of the Energy Services Directive (ESD)

YEAR 2001						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**129 465**	**10 490**	**3 687**	**11 281**	**44 535**	**199 458**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EU EMISSIONS TRADING DIRECTIVE (EU ETS)	8 823	10 106	2 953	503	7 057	29 442
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**120 642**	**384**	**734**	**10 778**	**37 478**	**170 016**
RESIDENTIAL SECTOR	29 982	233	58	8 502	14 546	53 320
TERTIARY SECTOR	3 675	0	140	12	13 233	17 059
INDUSTRY (ESD PURPOSES)	13 425	0	465	2 241	6 705	22 836
TRANSPORT	63 709	0	70	0	214	63 993
AGRICULTURE	9 851	151	0	23	2 780	12 805

[1] http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136239,0_45571447&_dad=portal&_schema=PORTAL

Table 1.1.2.: Final inland energy consumption in GWh in 2002 for the purposes of the Energy Services Directive (ESD)

YEAR 2002						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**134 478**	**8 676**	**4 012**	**11 386**	**46 564**	**205 116**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EMISSIONS TRADING DIRECTIVE (EU ETS)	9 443	8 386	3 368	518	7 375	29 090
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**125 035**	**290**	**644**	**10 868**	**39 189**	**176 026**
RESIDENTIAL SECTOR	31 168	279	105	8 490	15 775	55 817
TERTIARY SECTOR	3 663	0	198	12	13 954	17 827
INDUSTRY (ESD PURPOSES)	13 422	0	226	2 343	6 755	22 746
TRANSPORT	65 977	0	116	0	222	66 315
AGRICULTURE	10 804	12	0	23	2 483	13 322

Table 1.1.3.: Final inland energy consumption in GWh in 2003 for the purposes of the Energy Services Directive (ESD)

YEAR 2003						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**145 224**	**7 013**	**4 478**	**11 188**	**48 598**	**216 500**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EMISSIONS TRADING DIRECTIVE (EU ETS)	9 173	6 944	3 277	503	7 079	26 976
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**136 050**	**69**	**1 201**	**10 685**	**41 519**	**189 525**
RESIDENTIAL SECTOR	36 995	70	221	8 699	16 444	62 429
TERTIARY SECTOR	3 966	0	314	58	14 978	19 316
INDUSTRY (ESD PURPOSES)	13 621	0	538	1 845	7 077	23 081
TRANSPORT	69 908	0	128	0	237	70 273
AGRICULTURE	11 560	0	0	81	2 783	14 425

Table 1.1.4.: Final inland energy consumption in GWh in 2004 for the purposes of the Energy Services Directive (ESD)

YEAR 2004						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**139 572**	**6 513**	**5 361**	**11 223**	**49 738**	**212 407**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EMISSIONS TRADING DIRECTIVE (EU ETS)	9 743	6 443	3 179	401	6 878	26 644
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**129 828**	**70**	**2 183**	**10 822**	**42 860**	**185 763**
RESIDENTIAL SECTOR	35 227	70	407	8 664	16 852	61 220
TERTIARY SECTOR	4 210	0	488	58	15 872	20 629
INDUSTRY (ESD PURPOSES)	10 131	0	1 159	1 995	7 109	20 394
TRANSPORT	70 385	0	128	0	238	70 751
AGRICULTURE	9 874	0	0	105	2 789	12 768

Table 1.1.5.: Final inland energy consumption in GWh in 2005 for the purposes of the Energy Services Directive (ESD)

YEAR 2005						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**144 154**	**5 175**	**6 804**	**11 781**	**50 904**	**218 818**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EMISSIONS TRADING DIRECTIVE (EU ETS)	9 505	5 071	3 747	396	6 709	25 428
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**134 649**	**104**	**3 057**	**11 385**	**44 195**	**193 390**
RESIDENTIAL SECTOR	35 902	47	849	8 734	16 875	62 406
TERTIARY SECTOR	5 094	0	861	58	16 479	22 492
INDUSTRY (ESD PURPOSES)	11 277	0	1 208	2 441	7 710	22 636
TRANSPORT	72 280	0	140	0	199	72 619
AGRICULTURE	10 095	58	0	151	2 932	13 236

Table 1.1.6.: Average final inland energy consumption in GWh in the 2001-2005 period for the purposes of the Energy Services Directive (ESD)

AVERAGE FOR THE FIVE YEARS 2001-2005						
ENERGY PRODUCTS						
	LIQUID FUEL	SOLID FUEL	NATURAL GAS	RES + DISTRICT HEATING	ELECTRICITY	TOTAL
	GWH					
FINAL INLAND ENERGY CONSUMPTION	**138 578**	**7 573**	**4 868**	**11 372**	**48 068**	**210 460**
EXCLUDED: ENERGY CONSUMPTION IN INSTALLATIONS SUBJECT TO THE EMISSIONS TRADING DIRECTIVE (EU ETS)	9 337	7 390	3.305	464	7.020	27 516
FINAL INLAND ENERGY CONSUMPTION FOR ESD PURPOSES	**129 241**	**184**	**1 564**	**10 908**	**41 048**	**182 944**
RESIDENTIAL SECTOR	33 855	140	328	8 618	16 098	59 039
TERTIARY SECTOR	4 122	0	400	40	14 903	19 465
INDUSTRY (ESD PURPOSES)	12 375	0	719	2 173	7 071	22 339
TRANSPORT	68 452	0	116	0	222	68 790
AGRICULTURE	10 437	44	0	77	2 753	13 311

Average final consumption of the five-year period - TWh	**182.94**
Intermediate energy savings target for 2010 - TWh	**5.1**
Energy savings target of 9% - TWh	**16.46**

The presentation of the calculation of the national target is based on the template designed for the requirements of the EMEES[2] project the purpose of which is evaluation and monitoring of the Energy Services Directive.

Tables 1.1.1., 1.1.2., 1.1.3., 1.1.4., and 1.1.5. show the annual final inland energy consumption analytically per final consumption sector and the final inland consumption with exclusion of the energy consumed in the industrial installations which are obliged to implement the Emissions Trading Directive. Lastly, Table **1.1.6.** presents the calculation of the energy consumption averages per sector and fuel use in the five-year period (2001-2005). The overall average of consumption in the five years (2001-2005) multiplied by 9% gives the national energy savings target in TWh for the 2008-2016 period. The intermediate target shown in Table 1.1.6. is derived through the calculations analysed in Chapter 3.

[2] http://www.evaluate-energy-savings.eu/emeees/downloads/070514_NEEAP_template_final.doc

1.2. Clarifications about the procedure used to calculate the national target

Exclusions

In addition to the installations covered by the Emissions Trading Directive, the final inland energy consumption does not include the consumption of the armed forces. Consumption of aviation and maritime bunker fuels, which are exempted by Article 3(a) of Directive 2006/32/EC, is also excluded.

Participation of district heating plants and of units for the cogeneration of heat and power in the calculation of final inland energy consumption

District heating is not very common in Greece. It is used to a small extent in the cities of Ptolemaida, Kozani, Amyndaio and Megalopolis which have large thermo-electric stations of the Public Power Corporation (DEI). The quantity of heat averaged about 454 GWh in each of the five years (2001-2005) and is counted in final consumption. Most heat and power plants are within the installations of undertakings and used to meet own load; these are excluded because they are covered by the Emissions Trading Directive. There are a few low capacity cogeneration units in the tertiary sector, and those are taken into account for final consumption purposes.

2. ANALYSIS AND FORECAST OF THE DEVELOPMENT OF FINAL ENERGY DEMAND BY SECTOR AND USE

2.1. Analysis of average final energy consumption in the 2001-2005 period

The final energy consumption of the 2001-2005 period has been broken down per branch of economic activity, per sub-branch and per use. The presented result is the average for the period and is broken down into uses linked to electrical energy, on the one hand, and to heat (fuel consumption) on the other hand. Installations which have an obligation under the ETS and aviation and maritime bunker fuels have been excluded from the calculations. The most recently published official energy data of Eurostat (Statistical Office of the European Communities - Energy statistics[3] August 2007, Annex A), specifically the final energy consumption data in the five-year period (2001-2005), were used in the calculations. The Eurostat statistics contain a breakdown of energy consumption per branch of economic activity and fuel. Transport and the residential sector had the highest consumption at 38% and 32%, respectively, followed by industry, not including installations which are subject to emissions trading.

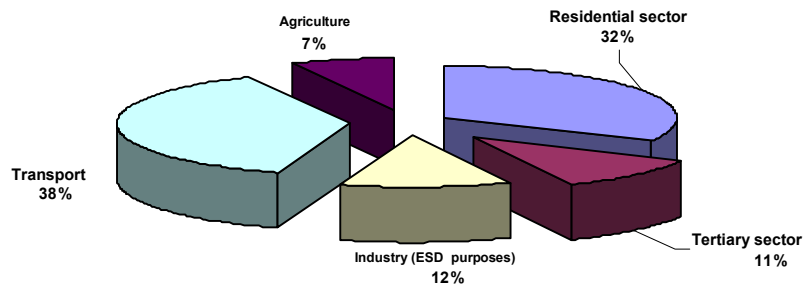


Figure 2.1.1.: Distribution of average final energy consumption in the 2001-2005 period in accordance with the ESD

The analysis of consumption per use in the tertiary sector in particular is based on a study of the subject by the CRES (Centre for Renewable Energy Sources)[4] which involved the

[3] http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136239,0_45571447&_dad=portal&_schema=PORTAL
[4] CRES: "Promotion of energy savings in the public sector through energy audits in selected public buildings", Ministry of Development programme, Athens, December 2004.

processing of data and results from other studies, which are mentioned below, concerning the five years 2001-2005.
The results of the calculations are discussed below.

Industry

The analysis of final energy consumption in industry is presented per branch and use linked to electrical energy and thermal energy uses (Table 2.1.1.). The chemical, food, clothing and leather, paper and final paper products industries and other industrial branches are examined. Branches subject to the ETS are excluded.

Tertiary sector

The analysis of average final energy consumption in the tertiary sector in the five year period 2001-2005 is presented per branch, use and fuel linked to electrical energy and thermal energy uses (Tables 2.1.2 - 2.1.7.).
A clear distinction is made between the private and public sectors per branch, and final energy consumption is calculated for each sector. Details of the methodology used are given in Annex I. The following were examined in the private sector: trade establishments, hotels, office buildings, hospitals and other private buildings. The following were examined in the public sector: office buildings, hospitals, education, sport facilities, street lighting, airports and other public buildings. The private sector accounts for 71% of the final energy consumption of the tertiary sector and the public sector accounts for 31%. Of the total final energy consumed in the private sector, 81% is consumed as electrical energy and 19% is consumed as thermal energy. In the public sector electrical energy accounts for 65% of total final energy and thermal energy for 35%.
Office buildings, with 43%, account for the largest portion of total public sector consumption, followed by hospitals with 20%. In the private sector trade establishments account for 45% of total final energy consumption, followed by hospitals at 29%. Figure 2.1.2. shows the final consumption of the two sectors per branch.

Residential sector

The analysis of final energy consumption per energy product and use in the residential sector is presented in Table 2.1.8. Heat consumption from solar thermal applications has been subtracted, as required by Directive 2006/32/EC. Electrical energy consumption accounts for 27% of average overall final consumption in the residential sector in the 2001-2005 period and heat requirements, chiefly for space heating and domestic hot water, account for the remaining 73%. The methodology described below was used for the calculation of end-use energy consumption in the residential sector.

In order to get the best possible approximation of the distribution of electrical energy consumption in the residential sector, data were selected from the integrated European EURECO [5] project. Specifically, the recorded indicators of the mean corrected annual electrical energy consumption per appliance and dwelling in Greece were obtained. Following that, the number of household appliances participating in the overall consumption of electrical energy was calculated. This was done by estimating, firstly, the mean percentage proportion of household appliances in the calculated average of total standard dwellings in the 2001-2005 period. The dwellings total was derived from the census of dwellings carried out by the National Statistical Service of Greece (NSSG) in 2001, with the addition of newly constructed dwellings up to 2005 (NSSG figures). Lastly, after estimation of the overall number of appliances per category, the consumption of electrical energy was calculated per category of appliance and use in the residential sector for 2005. The main thermal energy uses were space heating and domestic hot water, with cooking having a very small participation.[6]

Agriculture

The analysis of final energy consumption per energy product in the agriculture sector is presented in Table 2.1.9.

Transport

The analysis of final energy consumption in the transport sector per sub-branch and energy product is presented in Table 2.1.10. The consumption profile per category of road transport means is also shown.

Aviation and maritime bunker fuels are not included in the calculations.

[5] EURECO (2002), End-use metering campaign in 400 households of the European Union, SAVE Programme Contract n° 4•1031/Z/98-267.

[6] Energy Efficiency Indicators NRDLINK 4.1 (SP1) ODYSSEE DATA BASE - 2006.

Table 2.1.1.: Analysis of final energy consumption in industry

	GWh	Natural gas	LPG	Diesel oil	Mazut	Biomass	Electricity	Total
Chemical industry	Industrial equipment and drives	0	0	0	0	0	648	648
	Thermal processes	69	781	28	275	0	0	1153
	Steam	275	0	112	1100	0	0	1487
Food and beverages	Industrial equipment and drives	0	0	0	0	0	2127	2127
	Thermal processes	29	438	65	175	384	0	1090
	Steam	117	0	258	701	1534	0	2610
Textiles	Industrial equipment and drives	0	0	0	0	0	804	804
	Thermal processes	25	0	14	125	0	0	164
	Steam	100	0	56	501	0	0	658
Paper and paper pulp	Industrial equipment and drives	0	0	0	0	0	295	295
	Thermal processes	0	0	4	2	0	0	6
	Steam	2	0	38	17	0	0	57
Other industry	Industrial equipment and drives	0	0	0	0	0	2877	2877
	Industrial equipment and drives	0	0	0	0	0	320	320
	Thermal processes	30	1875	2195	94	128	0	4323
	Steam	71	0	3293	227	128	0	3719
	Total	719	3094	6064	3218	2173	7071	22339

Table 2.1.2: Analysis of final energy consumption per branch, use and fuel in the tertiary sector

Aver. 2001-05	GWh	Natural gas	LPG	Diesel oil	Mazut	Electricity	Total
Hotels	Space cooling – mainland	4	-	-	-	366	370
	Space cooling – islands	-	-	-	-	330	330
	Space heating – mainland	109	-	281	68	239	697
	Space heating – islands	-	-	253	-	215	469
	Lighting – mainland	-	-	-	-	271	271
	Lighting – islands	-	-	-	-	244	244
	Other electrical – mainland	-	-	-	-	525	525
	Other electrical – islands	-	-	-	-	473	473
	Domestic hot water – mainland	14	-	70	-	111	195
	Domestic hot water – islands	-	-	63	-	100	164
	Cooking	10	141	-	-	151	302
	Total	136	141	668	68	3,027	4,040
Private hospitals	Space cooling	-	-	-	-	77	77
	Space heating	37	-	98	38	-	173
	Lighting	-	-	-	-	89	89
	Other electrical	-	-	-	-	200	200
	Domestic hot water	7	-	71	-	19	97
	Cooking	2	24	-	-	-	26
	Total	46	24	170	38	385	663
Public hospitals	Space cooling	-	-	-	-	137	137
	Space heating	62	-	142	65	-	269
	Lighting	-	-	-	-	158	158
	Other electrical	-	-	-	-	356	356
	Domestic hot water	12	-	102	-	34	148
	Cooking	4	36	-	-	-	40
	Total	78	36	244	65	685	1.108
Commercial sector	Space cooling	-	-	-	-	824	824
	Space heating	17	113	564	-	1,099	1,793
	Lighting	-	-	-	-	824	824
	Other electrical	-	-	-	-	2.198	2.198
	Domestic hot water	2	-	63	-	550	614
	Total	19	113	627	-	5,496	6,254
Education	Space cooling	-	-	-	-	54	54
	Space heating	4	0	255	-	36	295
	Lighting	-	-	-	-	249	249
	Other electrical	-	-	-	-	90	90
	Domestic hot water	0	0	13	-	23	37
	Total	4	0	269	-	452	725
Public office buildings	Space cooling	-	-	-	-	224	224
	Space heating	8	-	1,063	-	26	1,097
	Lighting	-	-	-	-	369	369
	Other electrical	-	-	-	-	685	685
	Domestic hot water	0	-	11	-	13	24

Aver. 2001-05	GWh	Natural gas	LPG	Diesel oil	Mazut	Electricity	Total
	Total	8	-	1,073	-	1,318	2,399
Office buildings	Space cooling	-	-	-	-	296	296
	Space heating	45	7	226	-	148	426
	Lighting	-	-	-	-	415	415
	Other electrical	-	-	-	-	593	593
	Domestic hot water	1	-	5	-	30	35
	Total	46	7	231	-	1,482	1,766
Sport centres	Space cooling	-	-	-	-	88	88
	Space heating	9	12	32	-	-	53
	Lighting	-	-	-	-	75	75
	Other electrical	-	-	-	-	57	57
	Domestic hot water	0	1	2	-	7	10
	Total	10	12	33	-	227	282
Airports	Space cooling	-	-	-	-	9	9
	Space heating	0	-	3	-	5	9
	Lighting	-	-	-	-	12	12
	Other electrical	-	-	-	-	11	11
	Domestic hot water	0	-	0	-	0	0
	Total	0	-	3	-	37	41
Other tertiary	Space cooling – mainland	-	-	-	-	113	113
	Space cooling – islands	-	-	-	-	20	20
	Space heating – mainland	24	14	136	37	151	362
	Space heating – islands	-	2	24	6	27	60
	Lighting – mainland	-	-	-	-	150	150
	Lighting – islands	-	-	-	-	26	26
	Other electrical – mainland	-	-	-	-	302	302
	Other electrical – islands	-	-	-	-	53	53
	Domestic hot water – mainland	0	-	-	-	38	39
	Domestic hot water – islands	-	-	-	-	7	7
	Total	25	17	160	43	888	1,132
Other public sector	Space cooling	-	-	-	-	31	31
	Space heating	28	42	37	-	40	148
	Lighting	-	-	-	-	53	53
	Other electrical	-	-	-	-	155	155
	Domestic hot water	-	-	-	-	31	31
	Total	28	42	37	-	309	417
Street lighting	Lighting	-	-	-	-	597	597
	Total	400	391	3,516	215	14,903	19,425

Table 2.1.3.: Analysis of final energy consumption in the tertiary sector

Average 2001-2005 [GWh]		
Sector		
Private	13894	71%
Public	5571	29%
Total	19465	

Table 2.1.4.: Analysis of final energy consumption per fuel in the tertiary sector

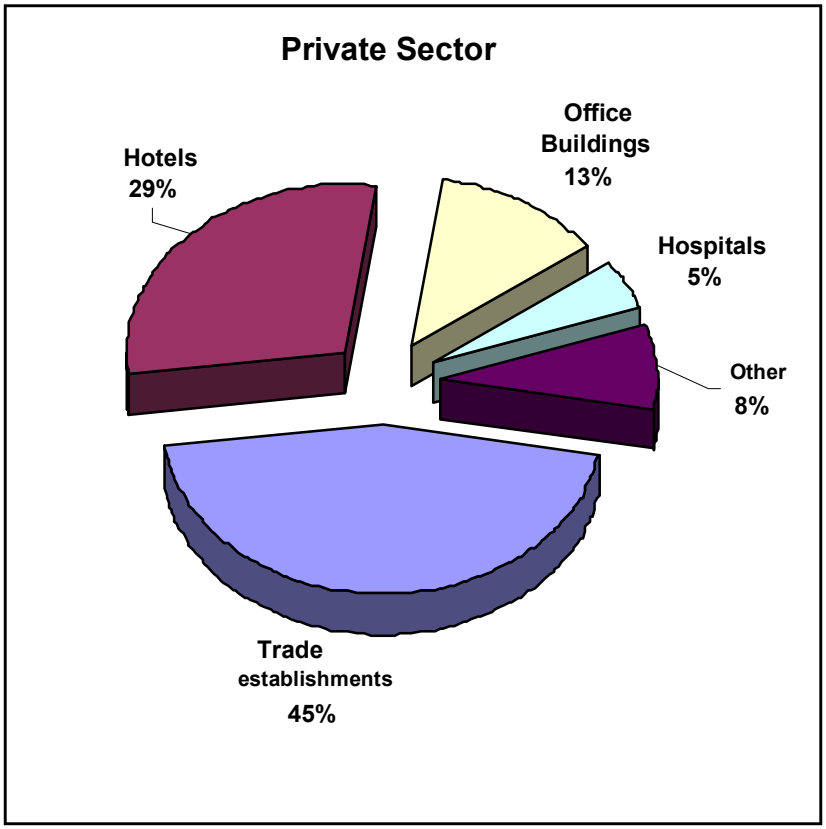
Average 2001-2005 [GWh]				
Sector	**Electrical energy**	**Liquid fuel**	**Natural gas**	**District heating**
Private	11278	2306	271	39
Public	3625	1816	129	1
Total	14903	4122	400	40

Table 2.1.5.: Analysis of final energy consumption per use and fuel in the private and public sectors

Average 2001-2005 [GWh]					
Sector	**Use**	**Electrical energy**	**Liquid fuel**	**Natural gas**	**District heating**
Private	Heating	1879	1870	232	39
	Air conditioning	2001	0	4	
	Lighting	2045	0	0	
	Domestic hot water	856	272	24	
	Cooking	151	164	12	
	Other electricity uses	4345	0	0	
Public	Heating	108	1652	112	1
	Air conditioning	543	0	0	
	Lighting	1512	0	0	
	Domestic hot water	109	129	12	
	Cooking	0	35	4	
	Other electricity uses	1354	0	0	

Table 2.1.6.: Analysis of final energy consumption per branch in the private and public sectors

Average 2001-2005 [GWh]			
Sector	**Branch**		
Private	Trade establishments	6283	45%
	Hotels	4044	29%
	Office buildings	1766	13%
	Hospitals	663	5%
	Other	1138	8%
	Total	13894	
Public	Office buildings	2400	43%
	Hospitals	1108	20%
	Education	726	13%
	Sport facilities	283	5%
	Street lighting	597	11%
	Airports	41	1%
	Other	416	7%
	Total	5571	



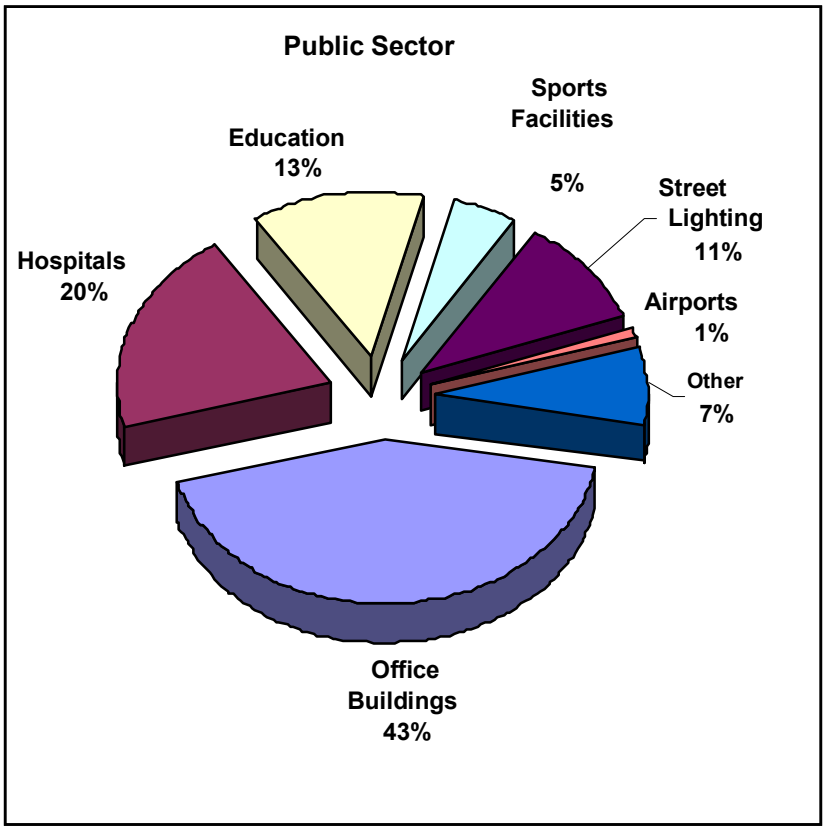


Figure 2.1.2.: Analysis of final energy consumption per branch in the tertiary sector

Table 2.1.7.: Analysis of final energy consumption per branch and use in the private and public sectors

Average 2001-2005 [GWh]							
Sector	**Branch**	**Heating**	**Lighting**	**Air conditioning**	**Domestic hot water**	**Cooking**	**Other electricity uses**
Private	Trade establishments	1822	850	798	614		2198
	Hotels	1170	515	700	359	301	999
	Office buildings	427	415	296	35		593
	Hospitals	173	89	77	97	26	200
	Other	428	177	133	46		355
	Total	4019	2045	2005	1152	327	4345
Public	Office buildings	1098	369	224	24		685
	Hospitals	269	158	137	149	39	356
	Education	296	249	54	37		90
	Sport facilities	53	75	88	10		57
	Street lighting		597				
	Airports	9	12	9	0		11
	Other	148	53	31	31		155
	Total	1873	1512	543	250	39	1354

Table 2.1.8.: Analysis of final consumption in the residential sector

	Solid fuel	Natural gas	LPG	Oil	Solar	Biomass	Heat	Electricity	Total
Domestic hot water - mainland	-	21	10	1 663	614	142	-	2 867	5 317
Domestic hot water - islands	-	-	-	-	409	-	-	284	693
Cooking - mainland	-	3	360	-	-	355	-	2 552	3 270
Cooking - islands	-	-	49	-	-	-	-	252	301
Space cooling - apartment blocks - mainland	-	-	-	-	-	-	-	359	359
Space cooling - apartment blocks - islands	-	-	-	-	-	-	-	51	51
Space cooling - single houses - mainland	-	-	-	-	-	-	-	460	460
Space cooling - single houses - islands	-	-	-	-	-	-	-	65	65
Dishwashers	-	-	-	-	-	-	-	452	452
Other electricity uses - mainland	-	-	-	-	-	-	-	1 934	1 934
Other electricity uses - islands	-	-	-	-	-	-	-	191	191
Space heating - apartment blocks - mainland	-	100	-	9 239	-	-	495	119	9 953
Space heating - apartment blocks - islands	-	-	-	1 307	-	-	-	17	1 324
Space heating - single houses - mainland	140	203	139	18 443	-	5 943	-	153	25 021
Space heating - single houses - islands	-	-	35	2 610	-	660	-	22	3 327
Lighting - mainland	-	-	-	-	-	-	-	2 001	2 001
Lighting - islands	-	-	-	-	-	-	-	198	198
Food cooling - mainland	-	-	-	-	-	-	-	3 006	3 006
Food cooling - islands	-	-	-	-	-	-	-	297	297
Washing machines - mainland	-	-	-	-	-	-	-	744	744
Washing machines - islands	-	-	-	-	-	-	-	74	74
Total	**140**	**328**	**593**	**33 262**	**1 023**	**7 100**	**495**	**16 098**	**59 039**

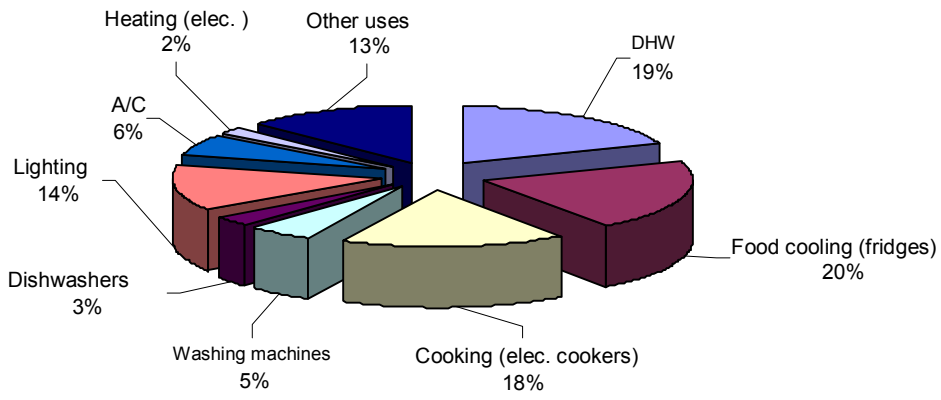


Figure 2.1.3.: Analysis of final electrical energy consumption in the residential sector

Table 2.1.9.: Analysis of final consumption in the agriculture sector

Agriculture sector	GWh
Electricity	2753
Solid fuel	42
Natural gas	0
Oil products	10437
RES	51

Table 2.1.10.: Analysis of final consumption in the transport sector

GWh	Natural gas	Oil products.	Electricity
Road transport / vans	-	6 558	-
Road transport / cars	-	41 823	-
Road transport / lorries	-	18 289	-
Road transport / buses	116	1 317	38
Railways	-	465	184
Total	116	68 452	222

2.2. The reference scenario

This study uses the MARKAL energy model to analyse the energy system of Greece. The MARKAL model determines the best mix of technologies that should be introduced into the country's energy system in the medium and long term, both on the energy supply side and on the consumption side, in order to meet the objectives of national energy policy (meeting of demand, security of supply, the environment, etc.) in the most cost/effective way. More specifically, on the consumption side, the model, after examining the competitiveness of the various technologies which service demand for useful energy (more expensive / more efficient as against less expensive / less efficiency) and taking account of constraints imposed by the supply system, determines the penetration that should be achieved for the various energy technologies in the various energy uses purely on the basis of financial criteria.

The development of demand for useful energy presented in the previous chapter is that which, in combination with the technologies in the MARKAL model and the policy constraints that are used, determines the final energy demand. The Reference scenario – Scenario 1 – includes only the energy policy measures and decisions that have already been incorporated in the energy system. This scenario includes the penetration rates of RES so far, relates to developments in global oil prices **according to the reference scenario of the International Energy Agency**[7] and does not include restrictions on emissions. The reference scenario is used to determine developments on a "business as usual" basis, but also constitutes a measure for comparison with energy-saving scenarios that will be developed later on for the creation of the Savings Action Plan.

Table 2.2.1.: Global oil prices scenario (US$ (2005) / barrel)

Scenario	2005	2010	2015	2020	2025
IEA Average prices[8]	51	57.47	49.87	52.04	56.37
IEA High prices	51	69.21	79.57	89	94
IEA Low prices	51	49.21	33.99	34.1	34.89
IEA (DOE)[12]	51	57.84	56.14	57.68	59.21

[7] "WORLD ENERGY OUTLOOK 2007, CHINA AND INDIA INSIGHTS", IEA, NOVEMBER 2007, TABLE 3, PAGE 64.

[8] http://www.eia.doe.gov/oiaf/aeo/forecast.html, http://www.eia.doe.gov/oiaf/aeo/pdf/tbl18_24.pdf.

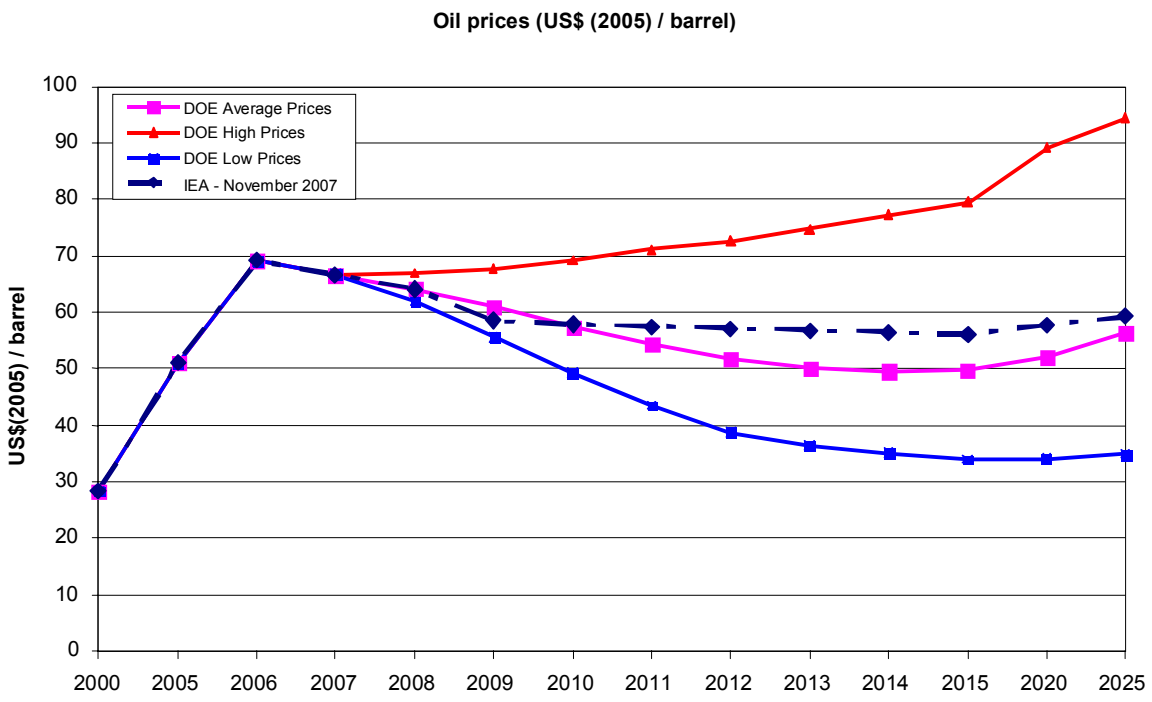


Figure 2.2.1.: Three scenarios of the development of global oil prices (Source: "Annual Energy Outlook 2007 with Projections to 2030", Energy Information Administration DOE, "World Energy Outlook 2007", IEA)

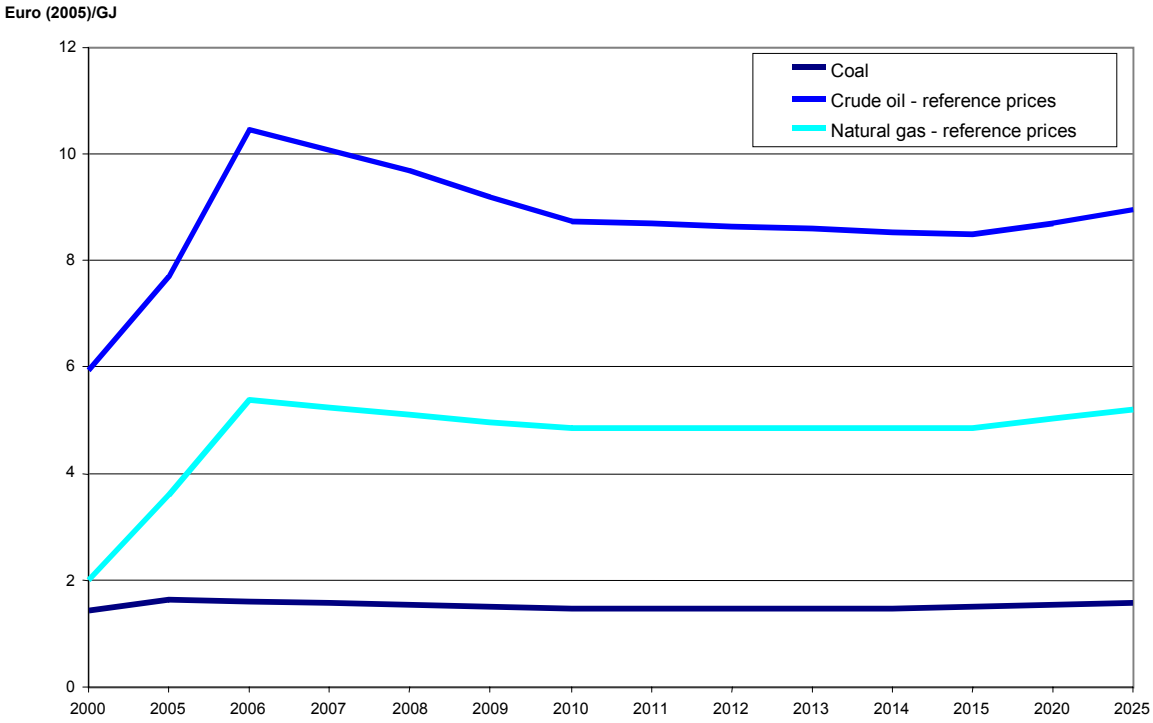


Figure 2.2.2.: Development of global fuel prices in the reference scenario

The programme of withdrawals of old electricity generation plants in accordance with the schedule of the Public Power Corporation DEI[9] has been incorporated in the energy supply sector in the reference scenario. Known scheduled integrations of new power stations have also been taken into account. The introduction of natural gas into the Greek energy system in 1997 has been a particular feature. The use of natural gas in the various sectors depends on development of the distribution network and consumer acceptance. In order to take account of those factors, a conservative penetration curve based on market analysis by the Public Gas Corporation (PGC)[10] and the gas corporations was used. These forecasts have therefore been used as an upper limit of overall natural gas consumption in the residential and tertiary sectors (Table 2.2.2.).

Table 2.2.2.: Maximum permissible penetration levels for natural gas in the reference scenario for the residential and tertiary sectors.

GWh	2010	2015	2020
Tertiary sector	2634	5354	5915
Residential sector	2616	4340	5168
Total	5250	9694	11083

The reference scenario assumptions are summarised below.

Global fuel prices

The prices of diesel oil, natural gas and coal, as published in November 2007, of the reference scenario of the International Energy Association have been used (Table 2.2.1.).

Table 2.2.3. Global fuel prices for the reference scenario

€(2005)/GJ	2005	2010	2015	2020
Crude oil	7.71	7.95	7.71	7.93
Coal	1.64	1.47	1.48	1.52
Natural gas	3.61	4.84	4.86	5.04

Demographic characteristics

The population development of Greece is assumed to be that stated in the forecasts of the National Statistical Service of Greece (NSSG). The results of the population census conducted by the NSSG in 2001 show that the population increased by an average of 0.66%

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9 «1st Report on the long-term energy planning of Greece 2008-2020», SEES, July 2007.

10 S. Palaiogiannis, "The Development of the natural gas market in Greece", annual "Energy and Development Conference", 2000. S. Palaiogiannis, "The new role of the PGC in the liberalised natural gas market", annual "Energy and Development Conference", 2001.

annually in the 1991-2001 period. It is estimated that the average rate of increase will fall gradually in the 2000-2020 period, as indicated in the following table.

Table 2.2.4.: Annual rates of population change in Greece

2000	2005	2010	2015	2020
0.576%	0.326%	0.334%	0.214%	0.065%

It is estimated that average household size (number of persons per household) will fall at the average annual rates shown in the following table in the 2000-2015 period as a reflection of population ageing and changing lifestyles.

Table 2.2.5.: Average annual rates of change in the number of persons per household in Greece

2000-2005	2005-2010	2010-2015
-0.43%	-0.29%	-0.37%

Development of macroeconomic aggregates

The following table shows the average annual rates of increase in parameters on the basis of the forecasts of the GEM-E3 model for Greece.

Table 2.2.6.: Average annual rates of increase in the GEM-E3 results

	2005-10	2010-15	2015-20
GDP	3.26%	2.90%	2.78%
Disposable income	3.01%	2.61%	2.43%
Other industrial output	2.95%	2.64%	2.53%
Chemical industry output	2.99%	2.44%	2.29%
Tertiary sector activity	3.00%	2.81%	2.78%
Agriculture sector activity	2.45%	1.81%	1.79%
Transport activity	4.44%	4.58%	3.13%

The GEM-E3 (General Equilibrium Model for Energy-Economics-Environment)[11] is a general equilibrium model applied by the European Union which has been developed by an international group under the coordination of the National Technical University of Athens. The model computes the equilibrium prices of goods, services, labour and capital which lead to a general equilibrium in all the markets of the EU countries (Computable General Equilibrium Model). The results produced by the model ensure global consistency in the macroeconomic development of the aggregates of all the countries and of all sectors of

[11] The GEM-E3 model reference manual, Ntua: Energy-Economics-Environment Modelling Laboratory, http://www.e3mlab.ntua.gr/

economic activity. Of the many results produced by the model, the ones which are of interest for the purpose of forecasting the development of demand for useful energy are the average rate of growth of GDP, of the disposable income of households, of the output of branches of industry and of the activity of the tertiary, agriculture and transport sectors.

Discount rate

A common discount rate of 5% was used for all the sectors of activity, in order to have validity in terms of the national economy.

Penetration rates of new technologies

As has been said, MARKAL is an optimisation model. This means that new, more efficient technologies are introduced only on the basis of technical and economic criteria. There is the case, for example, of filament lamps, where the model for achievement of the optimum economic solution replaces all such lamps with efficient lamps within one year. This means that the replacement is warranted from the economic standpoint. In reality, however, the introduction of a technology depends on many other parameters (information, public acceptance, response time) and follows an S curve. The reference scenario expresses the development of the energy situation without a change in the behaviour of consumers. In order to do that in the model, exogenous rates of reduction of the installed power of the existing technologies which limit the withdrawal of those technologies were used. Additionally, exogenous rates of maximum penetration of new technologies, which limit the introduction of new technologies to rates that were considered acceptable for a reference scenario (in which there are no measures to promote new technologies) were used. The experience of the CRES and of the Athens National Observatory, which drew up the national plan for the reduction of greenhouse gas emissions, was used to determine those rates.

The computed development of final energy demand for the time horizon of the study is shown in Table 2.2.7.

In the tertiary sector there is penetration of natural gas and parallel substitution of oil products. A steady increase in electricity use of up to about 1.5 times the current level in the time horizon up to 2016 is noted. There is a rising trend also in the use of heat from district heating systems. In the residential sector there is almost a tripling of the penetration of natural gas in the period from 2008 to 2016, in particular for heating, and a parallel increase in electricity consumption. The contribution of biomass remains almost constant in the 2008-2016 period, and that of district heating doubles.

Substantial penetration of natural gas as a substitute for oil products, an increase in the use of biomass and a stabilisation of solid fuel use are noted in industry.

In transport there is a steady rise in the consumption of petrol, participation of biofuels (in a mixture in accordance with the Biofuels Directive) and penetration of natural gas.

Table 2.2.7.: Development of final energy demand in the reference scenario

GWh		*2005*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Agriculture	Oil products	***10095***	10222	10265	10308	10301	10295	10290	10287	10283	10260
	Electricity	***2932***	3049	3087	3127	3156	3185	3215	3245	3275	3293
	Biomass	***140***	230	261	292	364	435	505	574	643	701
	Total	***13167***	**13501**	**13613**	**13727**	**13820**	**13915**	**14009**	**14105**	**14200**	**14254**
Transport	Diesel + LPG	32233	34409	35524	36679	37639	38406	39150	39751	40354	40759
	Petrol	47520	52859	54342	54194	55552	56887	58256	59609	60998	61848
	Biofuels	0	1734	2533	4969	5502	6034	6598	7162	7758	8305
	Aviation fuel	13736	16113	16994	17923	18573	19246	19945	20668	21419	21954
	Natural gas	138	215	242	242	242	242	242	242	243	255
	Electricity	179	287	318	350	377	405	433	462	492	516
	Total	***93826***	**105617**	**109953**	**114357**	**117886**	**121220**	**124625**	**127894**	**131264**	**133637**
Residential	Oil products	***35902***	37637	38351	39092	39538	39953	40414	40840	41009	40910
	Natural gas	***851***	2069	2343	2617	2962	3306	3651	3995	4340	4506
	Electricity	***16875***	18133	18995	20073	20600	21211	21631	22117	22657	22977
	Biomass	***8164***	8174	8174	8174	8166	8158	8150	8143	8443	8435
	Heat	***570***	489	489	489	489	489	550	611	672	733
	Total	***62362***	**66502**	**68352**	**70445**	**71755**	**73117**	**74397**	**75706**	**77121**	**77562**
Tertiary	Oil products	***5106***	6143	6629	7121	7369	7484	7767	7988	8179	8150
	Natural gas	***858***	1962	2298	2634	3178	3723	4259	4789	5308	5468
	Electricity	***16479***	18189	18929	19723	20418	21190	21922	22741	23613	23840
	Heat	***0***	0	0	0	28	122	138	153	168	183
	Total	***22443***	**26294**	**27856**	**29478**	**30993**	**32519**	**34086**	**35671**	**37268**	**37641**
Industry	Electricity	***14 419***	15339	15638	15945	16132	16334	16539	16748	16964	17160
	Natural gas	***4 950***	6232	7026	7647	7715	7836	8672	9385	9618	10086
	Petroleum products	***20 734***	23338	23536	23734	24106	24463	24193	24068	24184	24165
	Solid fuel	***5 063***	3189	3235	3282	3302	3322	3341	3361	3381	3414
	Biomass	***2 830***	4656	4929	4948	5151	5399	5502	5735	5972	6139
	Total	***47 996***	**52754**	**54365**	**55557**	**56406**	**57353**	**58248**	**59297**	**60119**	**60964**
Final energy consumption											
	Solid fuel	***5 063***	3189	3235	3282	3302	3322	3341	3361	3381	3414
	Oil products	***165 326***	180721	185641	189051	193078	196734	200016	203210	206425	208047
	Natural gas	***6 797***	10477	11908	13140	14097	15107	16824	18411	19509	20316
	Electricity	***50 904***	54997	56967	59218	60683	62325	63740	65313	67001	67786
	Biomass	***11 134***	14795	15898	18384	19183	20026	20756	21613	22816	23580
	Heat	***570***	489	489	489	517	611	688	764	840	917
	Total	***239794***	**264668**	**274138**	**283564**	**290860**	**298125**	**305365**	**312672**	**319972**	**324060**

2.3. The energy savings scenario

Basic assumptions

This chapter summarises the basic assumptions that have been adopted in the present analysis for the formation of the energy savings scenario. This scenario examines the optimum distribution of the end-use energy savings target in all sectors of economic activity on the basis of **technological measures** taken in Greece for the period from the reference year of 2005 up to 2016.

The following basic assumptions were used for the scenario.

Penetration of natural gas

The forecasts used as the upper limits of total natural gas consumption in the residential and tertiary sectors agree with the forecasts of the PGC (Table 2.3.1.).

With regard to the public sector in particular, it was decided that 60% of the thermal requirements of the buildings of the sector in 2016 would be met from natural gas or LPG.

Table 2.3.1.: Maximum permissible levels of natural gas penetration in the savings scenario for the residential and tertiary sectors

GWh	2010	2015	2020
Tertiary sector	2634	5354	5915
Residential sector	2616	4340	5168
Total	5250	9694	11083

Insulation of buildings

Certain limits were set for penetration of the insulation of buildings. Thus it was assumed that insulation technologies to improve thermal behaviour will be applied in 2% of dwellings and in 2% of tertiary sector buildings in 2010, rising to 15% of dwellings and 10% of tertiary sector buildings in 2016.

Global fuel prices

The prices of oil, natural gas and coal from the reference scenario of the International Energy Agency, as they were published in November 2007 in "World Energy Outlook 2007, China and India Insights", were used. According to the analysis of the IEA, the main underlying hypothesis for this development of prices is that the rate of increase of extraction potential and oil refining capacity will be marginally higher than the rate of increase in demand as investments currently being made culminate in production. Those prices are higher than the prices in WEO 2006 and reflect the existing trend of rising oil prices on account of rising demand, and they are higher than those of the reference scenario of the Department of

Energy in its report "Annual Energy Outlook 2007 with Projections to 2030". The IEA forecast for 2030 is 62 USD (2006) / barrel, which corresponds to current prices of $110/barrel.

Table 2.3.2. : Global fuel prices for the reference scenario.

(2005)/GJ	2005	2010	2015	2020
Crude oil	7.71	7.95	7.71	7.93
Coal	1.64	1.47	1.48	1.52
Natural gas	3.61	4.84	4.86	5.04

Demographic characteristics

The population development of Greece is assumed to be that stated in the forecasts of the National Statistical Service of Greece (NSSG). The results of the population census conducted by the NSSG in 2001 show that the population increased by an average of 0.66% annually in the 1991-2001 period. It is estimated that the average rate of increase will fall gradually in the 2000-2020 period, as indicated in the following table.

Table 2.3.3.: Annual rates of population change in Greece

2000	2005	2010	2015	2020
0.576%	0.326%	0.334%	0.214%	0.065%

It is estimated that average household size (number of persons per household) will fall at the average annual rates shown in the following table in the 2000-2015 period, as a reflection of population ageing and changing lifestyles.

Table 2.3.4.: Average annual rates of change in the number of persons per household in Greece.

2000-2005	2005-2010	2010-2015
-0.43%	-0.29%	-0.37%

Development of macroeconomic aggregates

The following table shows the average annual rates of increase in parameters on the basis of the forecasts of the GEM-E3 model for Greece.

Table 2.3.5.: Average annual rates of increase in the GEM-E3 results

	2005-10	2010-15	2015-20
GDP	3.26%	2.90%	2.78%
Disposable income	3.01%	2.61%	2.43%
Other industrial output	2.95%	2.64%	2.53%
Chemical industry output	2.99%	2.44%	2.29%
Tertiary sector activity	3.00%	2.81%	2.78%
Agriculture sector activity	2.45%	1.81%	1.79%

Transport activity	4.44%	4.58%	3.13%

The GEM-E3 (General Equilibrium Model for Energy-Economics-Environment)[12] is a general equilibrium model applied by the European Union which has been developed by an international group under the coordination of the National Technical University of Athens. The model computes the equilibrium prices of goods, services, labour and capital which lead to a general equilibrium in all the markets of the EU countries (Computable General Equilibrium Model). The results produced by the model ensure global consistency in the long-term development of the aggregates of all the countries and sectors of economic activity. The results which are of interest for the purpose of forecasting the development of demand for useful energy are the average rate of growth of GDP, of the disposable income of households, of the output of branches of industry and of the activity of the tertiary, agriculture and transport sectors. Those aggregates are then used to forecast the development of useful energy.

Discount rate

A common discount rate of 5% was used for all the sectors of activity, in order to have validity in terms of the national economy.

Policies and measures

The energy savings scenario takes account of a set of effects stemming from the following existing policies and actions.

Directive 2002/91/EC on the energy performance of buildings. The energy savings scenario takes account of the improved performance of new buildings and of improvements in existing buildings.

Directive 2003/30/EC on the promotion of the use of biofuels or of other renewable fuels for transport. Account is taken of the Directive with regard to the use of biofuels for transport.

The voluntary agreement between the Commission and the motor manufacturers (ACEA, KAMA, JAMA) on market penetration of cars with better efficiency and lower emissions. This voluntary agreement has been incorporated in the characteristics of the technologies used.

[12] The GEM-E3 model reference manual, Ntua: Energy-Economics-Environment Modelling Laboratory, http://www.e3mlab.ntua.gr/

Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources. The penetration of RES in electricity generation has been adopted in the scenario through the third national report on electricity generation from RES.

Continuation of infrastructure projects for the penetration of natural gas in the residential and tertiary sectors. expansion of the network to cover additional industrial consumers and the implementation of projects to connect the network to the networks of neighbouring countries.

ESKDE – 2 (National Plan for the Allocation of Emission Rights) concerning installations covered by the emissions trading mechanism.

Ministerial Decision D5-HL/B/ OIK.20168/2006 (Government Gazette II/1554/24.10.2006) “Replacement of lamps in public sector buildings”.

Penetration rates of new technologies

As was said in connection with the formation of the reference scenario, in order to simulate the actual operation of the market in an optimisation model like MARKAL we use exogenous rates of reduction of the installed power from existing technologies and exogenous rates of maximum possible penetration of new technologies. In the formation of Scenario III the values of those rates were used as a control parameter, such that the value of the overall saving approximates to the computed target. This was followed by an iterative process in which differing percentages for the penetration ceiling of new technologies and for the maximum withdrawal of existing technologies were used to derive a set of solutions of the problem which minimised the overall cost of the energy sector. Those percentages were derived after an analysis of the experience of the CRES and of the Athens National Observatory. The computed saving in relation to the target was checked for each of those solutions.

2.4. The results of the energy savings scenario

The final energy consumption per branch and fuel in the results of the energy savings scenario from the MARKAL model are shown in Table 2.4.1.

Table 2.4.1. : Development of final energy demand in the energy savings scenario

GWh		*2005*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Agriculture	Oil products	***10095***	10222	10202	10184	10148	10114	10081	10050	10018	9968
	Electricity	***2932***	3049	3088	3128	3158	3189	3219	3250	3267	3285
	Biomass	***140***	230	309	387	457	526	594	662	729	785
	Total	***13167***	**13501**	**13599**	**13700**	**13764**	**13829**	**13894**	**13961**	**14014**	**14038**
Transport	Diesel +LPG	32233	34338	35228	36071	36654	37259	37883	38558	39231	39555
	Petrol	47520	52886	53938	53126	53835	54535	55268	56048	56866	56635
	Biofuels	0	1731	2509	4867	5325	5788	6277	6779	7309	7900
	Aviation fuel	13736	16113	16994	17923	18573	19246	19945	20668	21419	21954
	Natural gas	138	215	232	233	256	267	278	290	301	310
	Electricity	179	287	318	350	377	405	433	462	492	551
	Total	***93826***	**105572**	**109219**	**112570**	**115020**	**117500**	**120085**	**122806**	**125619**	**126906**
Residential	Oil products	***35902***	36723	36653	36643	36533	36123	35724	35336	34961	34559
	Natural gas	***851***	2591	3388	4185	4737	5290	5842	6394	6946	6956
	Electricity	***16875***	18065	18498	18927	19177	19466	19778	20113	20473	20768
	Biomass	***8164***	8392	8377	8344	8313	8284	8256	8231	8207	8192
	Heat	***570***	578	622	667	824	981	1138	1295	1452	1553
	Total	***62362***	**66350**	**67538**	**68766**	**69585**	**70143**	**70738**	**71369**	**72038**	**72029**
Tertiary	Oil products	***5106***	4911	4862	4817	4750	4618	4555	4400	4251	4109
	Natural gas	***858***	2191	2905	3318	3513	3619	3748	3887	3942	3982
	Electricity	***16479***	18302	18948	19701	20386	21126	21832	22594	23427	23539
	Heat	***0***	144	156	167	206	245	285	324	363	388
	Total	***22443***	**25548**	**26871**	**28003**	**28855**	**29608**	**30420**	**31205**	**31983**	**32018**
Industry	Electricity	***14419***	15309	15601	15895	16072	16241	16400	16540	16653	16739
	Natural gas	***4950***	7550	9042	9959	10492	10596	11162	11687	12190	12710
	Oil products	***20734***	22113	22332	22309	22215	21871	21795	21691	21559	21259
	Solid fuel	***5063***	3643	3235	3282	3302	3378	3398	3418	3438	3471
	Biomass	***2830***	4591	4804	5037	5264	5490	5715	5939	6161	6414
	Total	***47996***	**53205**	**55015**	**56483**	**57345**	**57578**	**58471**	**59274**	**60001**	**60593**
Final energy consumption											
	Solid fuel	***5063***	3643	3235	3282	3302	3378	3398	3418	3438	3471
	Oil products	***165326***	177306	180208	181074	182709	183766	185250	186751	188305	188039
	Natural gas	***6797***	12547	15568	17695	18998	19772	21030	22258	23379	23959
	Electricity	***50904***	55012	56453	58001	59170	60427	61662	62959	64312	64882
	Biomass	***11134***	14944	16000	18636	19359	20088	20843	21611	22407	23291
	Heat	***570***	722	778	833	1030	1226	1423	1619	1815	1941
	Total	***239794***	**264174**	**272242**	**279521**	**284568**	**288657**	**293606**	**298616**	**303656**	**305583**

3. ENERGY SAVINGS PER SECTOR AND USE

3.1. Calculation of energy savings

The total saving per sector is expressed as the difference between the two scenarios (reference and energy savings) and is shown in Table 3.1.

Table 3.1.: Saving per sector

GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016
Residential sector	-152	-814	-1679	-2171	-2974	-3659	-4337	-5082	-5533
Tertiary sector	-755	-1044	-1529	-2192	-2986	-3743	-4543	-5365	-5715
Industry	-45	-72	-127	-171	-302	-323	-433	-557	-680
Transport	-46	-734	-1787	-2865	-3720	-4540	-5088	-5646	-6731
Total	**-998**	**-2664**	**-5122**	**-7399**	**-9982**	**-12265**	**-14401**	**-16650**	**-18659**

The intermediate target for 2010 is calculated on the above basis.

Table 3.2. : Intermediate target for 2010

Intermediate target for 2010	**5.1** TWh
Saving for 2016	**18.6** TWh (calculated target using the methodology of the Directive: **16.46** TWh)

Table 3.1. shows that the transport, residential and tertiary sectors have the greatest savings potential. The difference in the figures for industry in the two scenarios is small because it is considered that industry pursues actions to achieve savings also in the reference scenario.

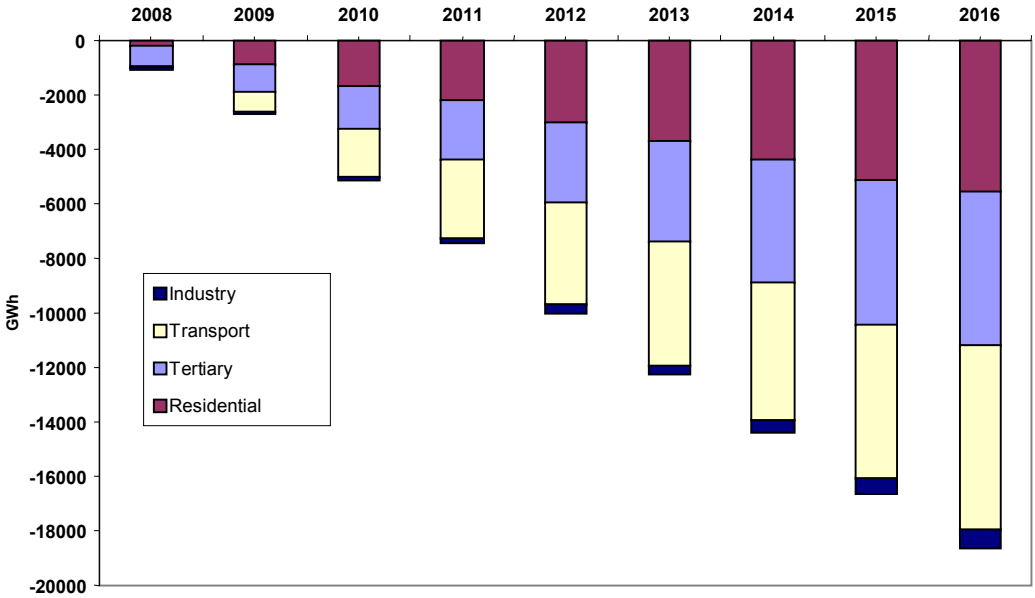

Figure 3.1. Energy savings per branch

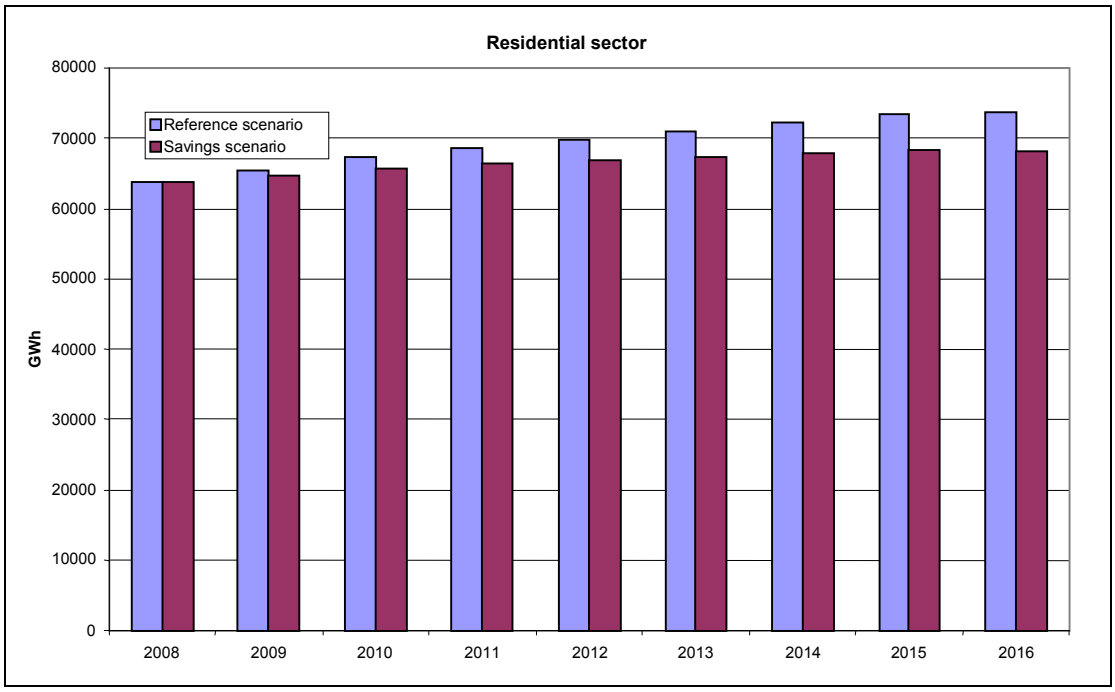

Figure 3.2. Development of final energy demand in the residential sector in both scenarios

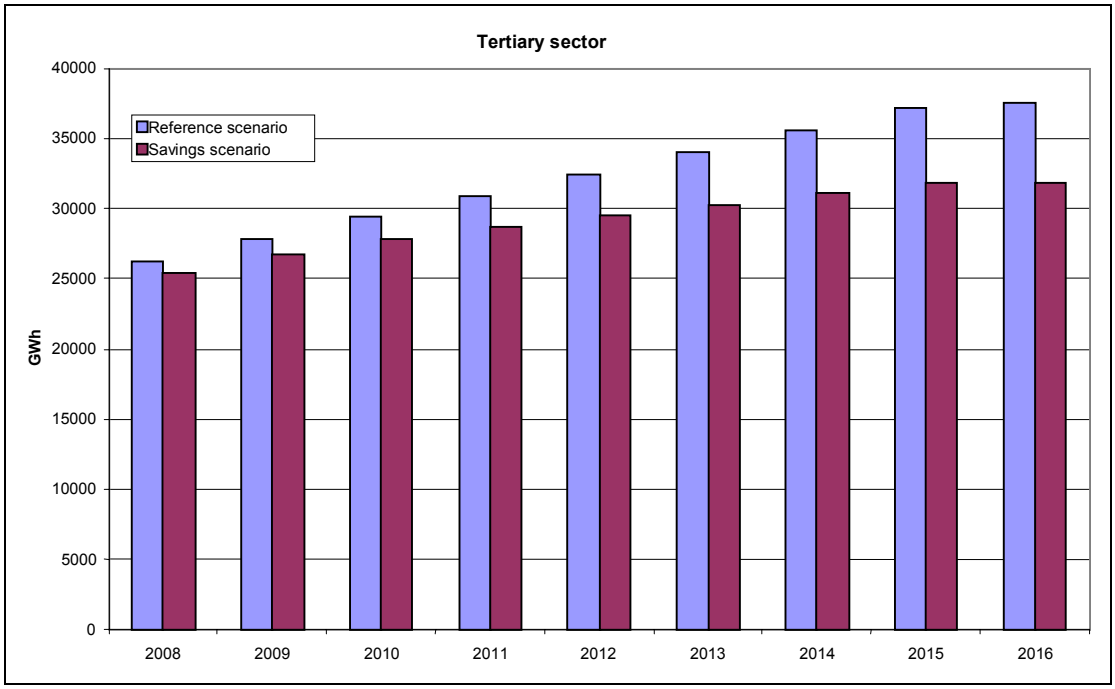

Figure 3.3. Development of final energy demand in the tertiary sector in both scenarios

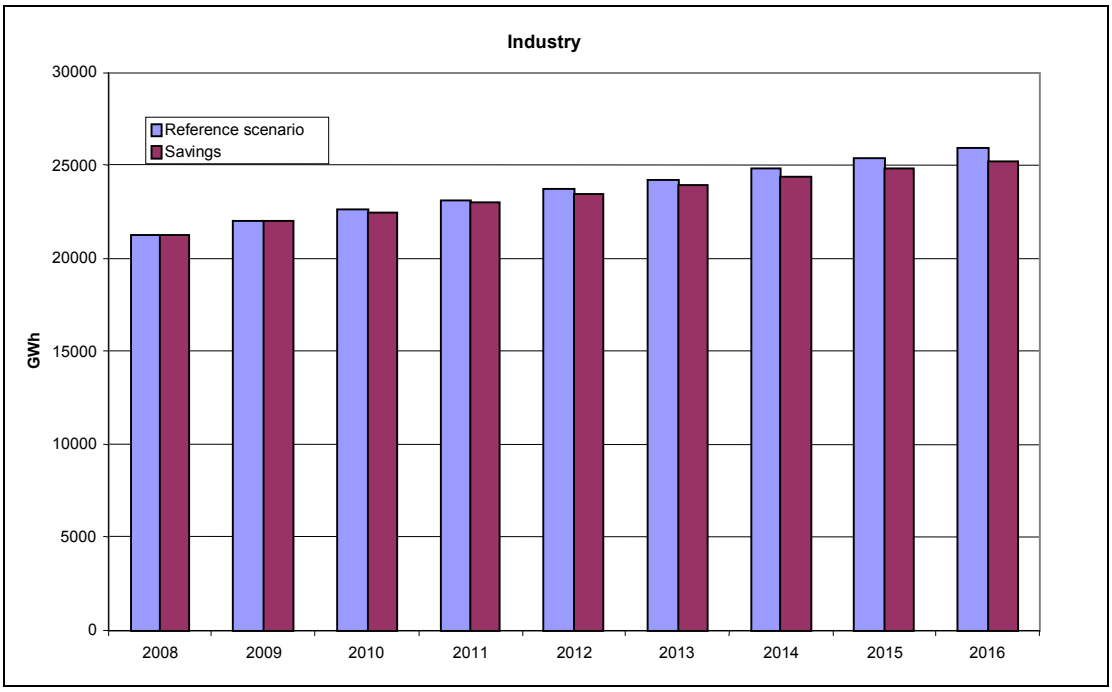

Figure 3.4. Development of final energy demand in industry for both scenarios

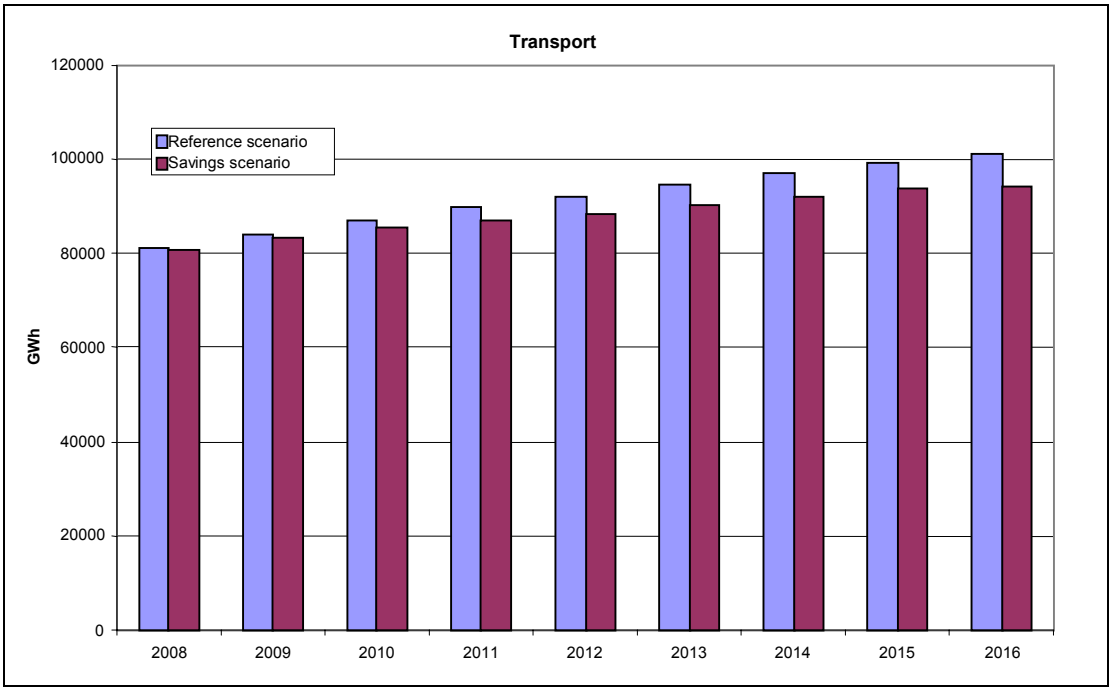

Figure 3.5. Development of final energy demand in transport in both scenarios

The energy saving per use in each branch is expressed as the difference between the two scenarios (reference scenario and savings scenario) and is analysed per sector and use in the following paragraphs.

Residential sector

The residential sector uses which offer the greatest saving potential are space heating, which accounts for 57% of the possible saving, domestic hot water (22%) and lighting (9%) (Table 3.3.).

The saving in space heating is achieved through a combination of heat insulation of building shells, double-glazing and penetration of natural gas boilers and of district heating. The overall saving is approximately 3.2 TWh in 2016, and about 60% of that will come from envelope improvement actions (heat insulation, double-glazing).

The domestic hot water saving is in the order of 1.2 TWh and comes mainly from the penetration of electrical resistance solar collectors, the move away from electric immersion (99% of the saving) and the penetration of natural gas as an alternative source. Penetration of district heating and the use of natural gas for the production of hot water in combination with space heating contribute to the rest of the saving.

The saving in lighting comes mainly from the replacement of filament lamps by fluorescent lamps and is 0.5T Wh in 2016.

The saving in cooking comes mainly from the penetration of more efficient technologies. The saving in dishwasher use is due mainly to the penetration of hot-fill technology – hot water straight into the machine. In washing machine use also the saving is due mainly to hot-fill technology – hot water straight into the washer. In food cooling the penetration of appliances with a higher degree of efficiency (energy class A+) is the main source of the saving. Lastly, the saving in space cooling is achieved through the penetration of more efficient air-conditioning appliances (energy class A+).

Table 3.3.: Consumption difference per use in the residential sector

GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cooking	0	0	-13	-20	-27	-33	-39	-44	-49
Dishwashers	0	-24	-52	-71	-76	-75	-74	-73	-73
DHW	-31	-253	-628	-690	-828	-964	-1116	-1276	-1298
Washing machines	0	-47	-98	-132	-144	-153	-152	-151	-149
Lighting	-18	-106	-207	-302	-392	-425	-453	-477	-499
Food cooling	-27	-67	-109	-153	-182	-177	-172	-167	-163
Space cooling	-20	-40	-69	-97	-126	-136	-146	-156	-161
Space heating	-56	-276	-503	-706	-1200	-1696	-2185	-2737	-3142
Total	**-152**	**-814**	**-1679**	**-2171**	**-2974**	**-3659**	**-4337**	**-5082**	**-5533**

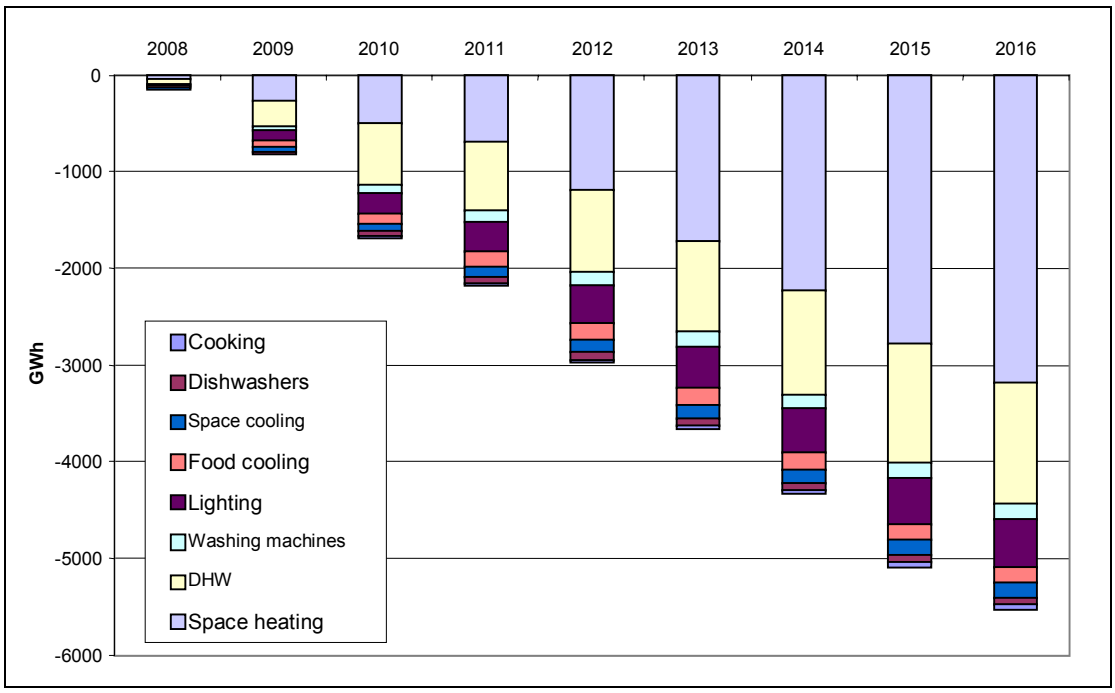

Figure 3.6.: Consumption difference per use in the residential sector

Transport

The biggest potential for energy saving in the transport sector appears to be offered by private cars (73% of the saving) and by trucks used for commercial transport (21% of the total saving in the sector) (Table 3.4.).

The saving in private car transport is achieved by the penetration of cars with more efficient petrol engines, which will account for 20% of the energy consumed in 2016, hybrid cars, which will account for 5% of the energy consumed in 2016, cars with new diesel engines and the use of natural gas to power cars (smaller percentages). In parallel, in Scenario III, it was considered that non-technological measures will lead to a reduction in demand for private car passenger / kilometres and to a corresponding 2% increase in demand for bus passenger / kilometres above the reference scenario of each year.

The saving in passenger transport will come from the penetration of buses which use natural gas (20% of consumption in 2016) and of new diesel buses with improved engines and superstructure.

In the case of large trucks (above 3.5tn) used for goods transport, replacement of the existing technologies at the rate of 2% a year from 2010 onwards, with penetration of more efficient trucks which will account for nearly 30% of the energy consumed in 2016, was considered the best course.

Lastly, in goods transport by small goods vehicles it was considered that savings will be achieved by the penetration of new vehicles with improved diesel engines.

Table 3.4.: Consumption difference per use in the transport sector

GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016
Buses	0	-18	-17	-17	-32	-49	-45	-43	-41
Private cars	0	-316	-983	-1615	-2235	-2866	-3435	-4014	-4957
Lorries	0	-283	-596	-980	-1171	-1345	-1330	-1313	-1459
Small goods vehicles	0	-116	-191	-255	-283	-280	-278	-276	-274
Total	**0**	**-734**	**-1787**	**-2865**	**-3720**	**-4540**	**-5088**	**-5646**	**-6731**

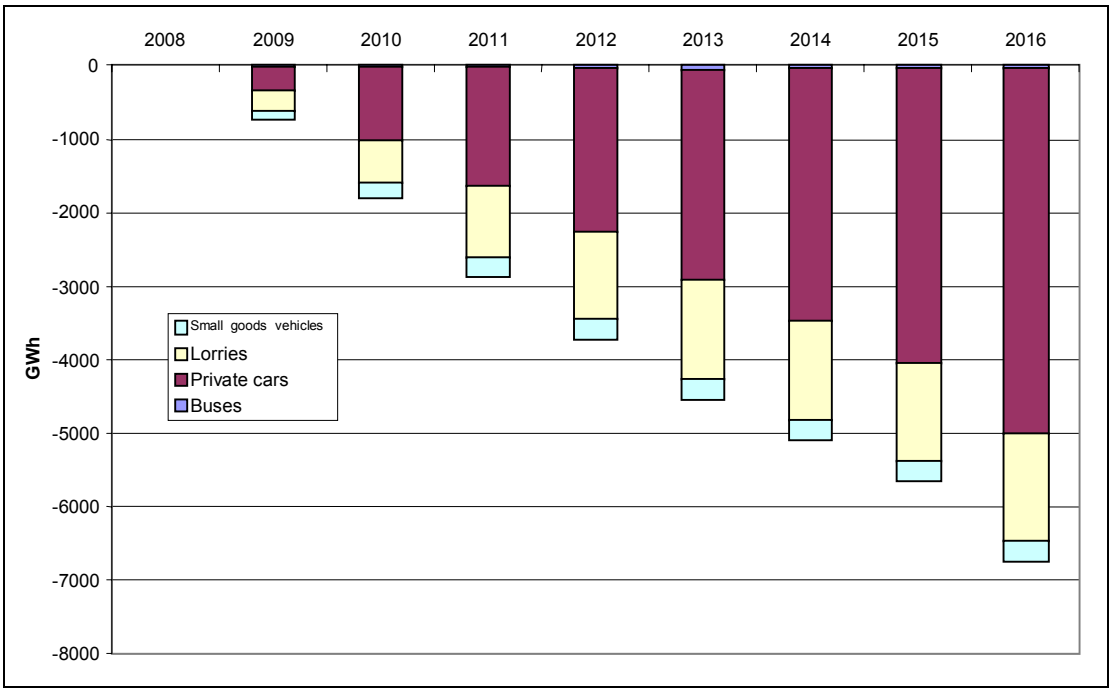

Figure 3.7.: Consumption difference per use in the transport sector.

Tertiary sector

Commercial buildings overall (44% of total tertiary sector savings) and hotels (24% of total savings) offer the greatest potential for saving.

In terms of uses, the greatest potential savings are in space heating (70% of the saving), lighting (15% of the saving) and space cooling (13% of the saving), as shown in Table 3.5.).

An overall tertiary sector saving in the order of 0.6 TWh in space heating will come from the use of shell improvement technologies (insulation, double-glazing) and from penetration of natural gas technologies and improved natural gas technologies, particularly in the public sector. There is substantial penetration of heat pump technologies providing space cooling and hot water at the same time and also penetration of district heating. Penetration of cogeneration with the use of natural gas and LPG to meet heating and electricity loads in hospitals, hotels, commercial buildings and other parts of the tertiary sector is another feature.

Public lighting offers the potential for an energy saving of 0.2 TWh by 2016. Of that saving, 54% will come from the replacement of almost all the filament lamps and old fluorescent lighting systems in public sector buildings. Hotels offer 16% of the saving potential in lighting and commercial buildings offer 14%.

The saving potential in space cooling comes from the penetration of new and more efficient electrical technologies and the use of heat pumps to provide heating / space cooling and hot water at the same time.

The saving in cooking is achieved through the penetration of more efficient appliances and from penetration of the use of natural gas in hospitals and hotels. Penetration of solar water heaters will provide the main saving in the production of domestic hot water in hospitals and hotels.

Table 3.5.: Consumption difference per use in the tertiary sector

GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cooking	0	0	0	-3	-3	-6	-6	-6	-6
Space cooling	-16	-52	-116	-232	-339	-450	-598	-793	-862
Lighting	-85	-179	-278	-391	-514	-608	-694	-771	-829
DHW	-43	-77	-107	-187	-288	-411	-540	-672	-745
Space heating (conventional systems)	-611	-800	-1096	-1450	-1919	-2350	-2794	-3209	-3369
Cogeneration	0	122	130	137	149	162	178	179	202
Production of electricity from cogeneration		-58	-62	-66	-72	-80	-89	-93	-106
Total	**-755**	**-1044**	**-1529**	**-2192**	**-2986**	**-3743**	**-4543**	**-5365**	**-5715**

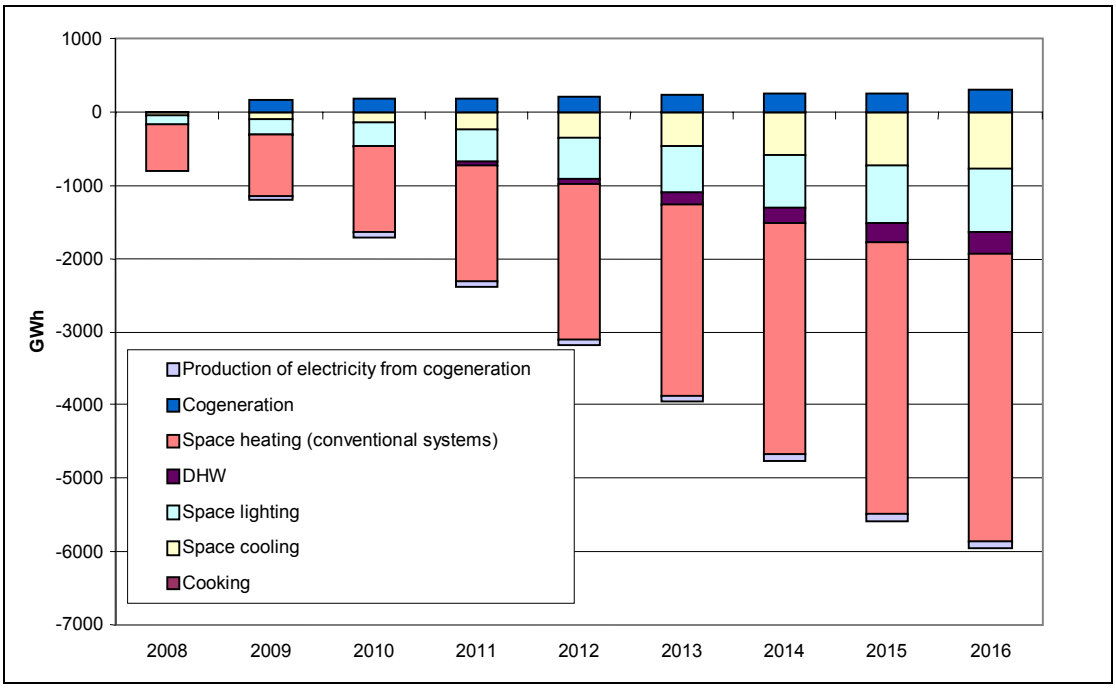

Figure 3.8.: Consumption difference per use in the tertiary sector

Industry

The saving in industry comes from the reduction of consumption in electricity uses and heat uses and from the cogeneration of heat and power.

Hence, as regards electricity uses, the use of more efficient appliances and lighting is viewed as a savings action. The gradual replacement of existing electrical motors by more efficient ones, which will reduce electricity consumption in this use by about 5% in relation to the reference scenario for 2016, will provide another saving.

In the area of thermal processes it is thought that there will be an increase in cogeneration, using natural gas in particular, and an increase also in the use of biomass and biogas in industries in which those fuels exist as by-products (the food and wood industries). Forty per cent of the savings in industry come from cogeneration. Of the installed cogeneratiion capacity, 56% is in the chemical industry and 26% is in the food and beverages industry, and the rest is in the wood industry, the clothing and leather industry and other industries.

Table 3.6. : Consumption difference per use in non-ETS industry

GWh	2008	2009	2010	2011	2012	2013	2014	2015	2016
Electrical appliances	-9	-11	-15	-20	-35	-59	-97	-154	-207
Electrical drives	-22	-27	-36	-41	-58	-81	-114	-159	-215
Thermal processes	-975	-1562	-1996	-2093	-1787	-1866	-1788	-1979	-2049
Cogeneration	1672	2487	3142	3278	2679	2854	2728	3021	3115
Production of electricity from cogeneration	-711	-959	-1222	-1295	-1101	-1171	-1163	-1286	-1323
Total	-45	-72	-127	-171	-302	-323	-433	-557	-680

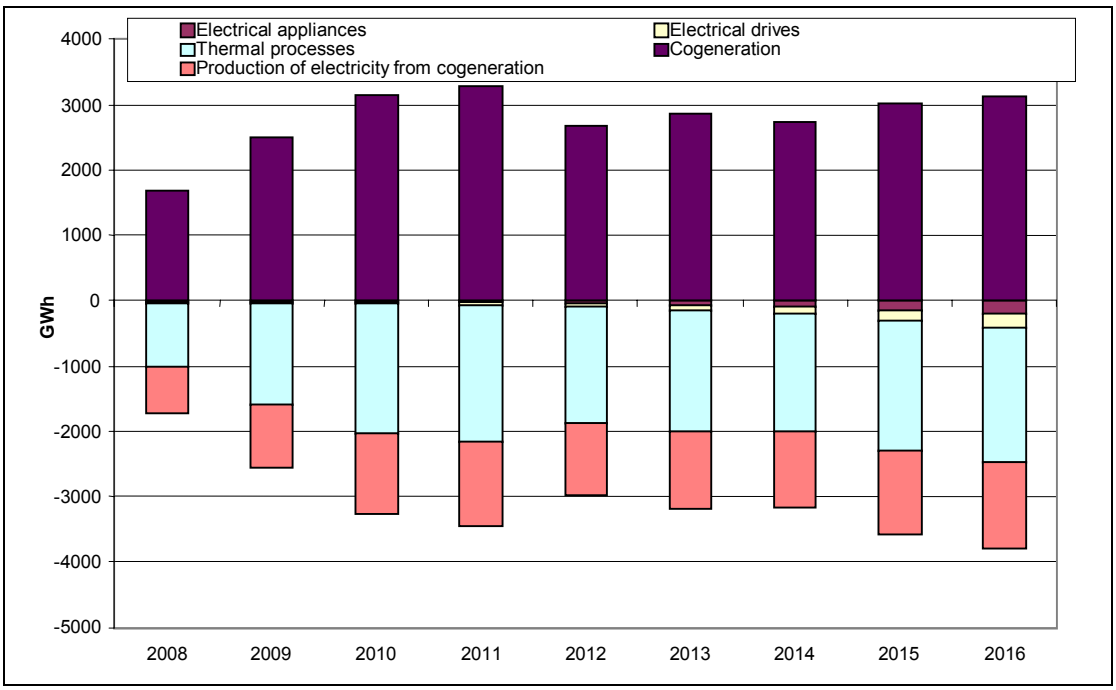

Figure 3.9.: Consumption difference per use in non-ETS industry

4. ENERGY EFFICIENCY IMPROVEMENT MEASURES

4.1. Energy efficiency improvement measures

The implementation of an energy efficiency action plan calls for the formation of measures which are mainly of an institutional, regulatory, management and technological nature and for the provision of incentives and alternative financing mechanisms at the end-use level in all sectors of consumption.

These measures, especially the technological ones, constitute a decodification of the energy savings results, as derived with the help of the MARKAL calculation model, in the form of a selected mix of technologies which are technically and financially the best for each sector and use. The institutional, regulatory and management measures and the incentives and alternative financing mechanisms encompass the savings percentage for achievement of the target that has been derived from the processing of data and particular studies and through the contractor's experience.

The selected measures are interventionist in nature and orientated towards actions for which there is a specific anticipated energy target for the entire 2008-2016 period which is being considered.

A key criterion for the selection of measures is immediate implementability, with particular emphasis on the overall cost of investment, always with a view to the anticipated annual saving on the basis of the target for 2016.

The energy efficiency improvement measures, coordinated in all the sectors, will lead to energy savings of at least 16.41 TWh in 2016 and meeting of the 9% target, and thus enable Greece to reduce its dependence on energy imports. Furthermore, the move towards more energy-efficient technologies will boost innovativeness and competitiveness in Greece, help to improve the business environment and bring substantial direct development and job creation.

The energy-savings scenario indicates that transport has the greatest savings potential, at about 36%. The tertiary sector and the residential sector come next, with potential savings of 30% and 29%, respectively.

Taken altogether these measures form a national integrated energy efficiency improvement programme the implementation of which will lead to achievement of the target of savings of large quantities of mineral fuels and electricity and further boost the penetration of natural gas and renewable energy sources.

The measures, in six categories, are stated below.

1. Horizontal measures

OP4. Formation of a unit to collect energy data and forecasts.

OP5. Targeted education campaigns, provision of information and rewarding of "good practices".

OP6. Programmes to provide financial support for investment in energy-saving technologies and research.

2. Cross-sectoral measures

D8. Energy performance of buildings.

D9. Further promotion of the integration of natural gas and LPG.

D10. Energy labelling of appliances and minimum energy efficiency requirements.

D11. Implementation of an energy management system (EMS) in the tertiary and public sectors.

D12. Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting (EPC) and public and private sector joint ventures (PPJV).

D13. Installation of electronic and intelligent metering of electricity and natural gas consumers.

D14. Promotion of cogeneration of heat and power (CHP) and district heating systems.

3. Household sector

O5. Energy upgrading of residential building shells.

O6. Financial aid for the upgrading of heating system boilers / burner units in existing buildings.

O7. Compulsory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems (STS) in residential buildings.

O8. Energy upgrading of social housing buildings.

4. Tertiary sector

Private sector

T3. Compulsory installation of central solar thermal systems in tertiary sector buildings larger that 1 000m^2.

T4. Promotion of voluntary agreements for energy upgrading interventions in tertiary sector buildings.

4.2. Public sector

DM5. Compulsory installation of central solar thermal systems to meet hot water requirements.

DM6. Compulsory procurement procedures with respect to public buildings (green procurement – energy-efficient and RES technologies).

DM7. Integrated energy planning by municipalities.

DM8. Compulsory replacement of all lighting units with low energy efficiency in the public sector and the wider public sector.

5. Industry

B5. Incentives relating to the obligatory implementation of energy management systems (EMS) in industry.

B6. Creation of energy and environment management centres in business parks.

B7. Programme of voluntary agreements in industry.

B8. Energy services for energy savings.

6. Transport

M10. Reshaping of the public transport system.

M11. Transport infrastructure projects.

M12. Development of urban mobility plans.

M13. Promotion of economical, safe and eco-driving.

M14. Incentives for the replacement of old medium and heavy duty vehicles (over 3.5 tonnes and over 10 years old).

M15. Incentives for the replacement of private vehicles and to promote the use of energy-efficient vehicles (vehicles fuelled by natural gas and biofuels and hybrid vehicles).

M16. Eco-labelling – energy label for cars.

M17. Compulsory quotas of vehicles with greater energy efficiency in the fleets of the public services and of public bodies.

M18. Linking of vehicle taxation to energy efficiency and CO2 emissions.

Horizontal measures

The measures are horizontal and their actions are not closely linked to a specific sector or branch. Some of the measures are considered essential for the implementation and monitoring of all of the supported actions in all the sectors. Their implementation is considered necessary for the success of an integrated programme of energy savings and achievement of the target. They centre principally on the collection and evaluation of relevant information and on the provision of education and information to all the parties involved, as well as on the provision of financial support through the operational programmes.

Title of Measure OP1.	**Formation of a unit to collect energy data and forecasts**
Category	Energy efficiency improvement.
Regional application	The authority or service with responsibility for supervising the EEAP (Article 4(4) of Directive 2006/32/EC)
Target group	• Public bodies. • Local authorities. • Local energy centres. • Non-governmental organisations which implement or support energy efficiency improvement and energy policy actions. • Companies and persons responsible for energy planning studies and projects at the branch, regional and international levels. • International bodies. • Bodies of the governments of third countries.
EEI actions targeted	• Formation and establishment of a unit or office in an existing or new body to be responsible for monitoring achievement of the target of the EEAP. The unit will cooperate directly with the NSSG, Eurostat, competent ministries (environment, finance, transport, the interior) and relevant bodies (CRES, RAE, institutes of technical vocational education, universities, etc.). • Collection, processing and filing of primary information such as energy data, generation data and figures for the volume of activities of the final energy consumption sectors in Greece. • Energy documentation, energy statistical surveys and development of energy information tools. • Preparation of sectoral and branch energy and environmental studies. • Forecasting of energy demand.
Effectiveness	The formation of the energy information collection unit will provide an effective infrastructure tool for strengthening and supporting the implementation, monitoring and evaluation of the integrated energy efficiency improvement programme and be based on the principles set out in the Directive and in the relevant national legislation. The establishment of the unit is an investment in the energy future of the country in that it promotes the national information system.
Anticipated annual energy savings in 2010 and 2016	• The anticipated saving is indirect and counted in with the other measures per sector of economic activity that are described below. • The total cost of implementation is estimated at about EUR 60m.
Status of implementation and exact timeframe	Immediate implementation – 2008 - 2016.

Title of Measure OP2.	**Targeted education campaigns, provision of information and rewarding of "good practices"**
Category	**Information provision** • Education and training; • Ministry of Development – Energy Sector in Action 2.1.1. – "Information, support, promotion and dissemination of cogeneration, RES and energy-saving" – of the "Competitiveness" OP.
Regional application	All of Greece.
Target group	• The general public. • All sectors of the economy. • The public sector.
EEI actions targeted	Targeted education campaigns, provision of information and rewarding of "good practices" in order to spread the message to the general public about the benefits and the prospects for the entire development effort of Greece, the reduction of air pollution and the long-term conservation and rehabilitation of the environment that can flow from the adoption of energy-saving measures. At the same, making people aware of the direct financial benefit to be gained by the application of simple energy-saving measures, thus encouraging them to adopt those measures. The Ministry of Development is responsible for coordinating the measure and will set up a team of experts in the fields of energy saving per sector of activity, publicity and education. Advertising agencies, consultants and bodies with proven ability to undertake the actions stated below will be chosen for the implementation of the measure, and the energy providers will also have to play a substantive role. The Ministry of Transport will be responsible for the transport measures and will seek to maximise the use of public transport by the travelling public, with the main focus on transport by track-guided vehicles and road. <u>Actions</u> • Focused information campaigns at the local and national levels providing practical instruction and advice, awareness-raising messages, incentives and promotion of the institutional framework. • Organised forums for local consultation on energy and environmental plans to promote rational energy use. • Training and education at e-learning seminars in cooperation with education bodies, institutes and research establishments. • Publicising of demonstration projects that have been implemented at the local and European levels. • Introduction of best practice awards to encourage and support local energy programming and viable development initiatives. • Establishment of annual actions, e.g. sustainable energy, annual meetings, conferences.

Title of Measure OP2.	**Targeted education campaigns, provision of information and rewarding of "good practices"**
Effectiveness	• According to studies of Community projects, energy savings of up to 30% can be achieved by following specific strategies. In general, the implementation of the measure will contribute positively to the sensitisation, level of knowledge, alertness, training and education of the public. It will also foster greater purchasing discernment among the public. • In transport the target is to increase the use of public transport from the present 26.6%[13] to 35% in 2016.
Anticipated annual energy savings in 2010 and 2016	The anticipated saving is indirect and counted in with the other measures per sector of economic activity that are described below. The total cost of implementation is estimated at approximately EUR 60m.
Status of implementation and exact timeframe	• The Ministry of Development has declared the years from 2005 to 2010 as a single energy-saving period. In that context it will cooperate with the Centre for Renewable Energy Sources (CRES) and has started an information campaign, with leaflets, participation in exhibitions and website[14] information with the aim of sensitising public opinion about energy-saving and changing consumer behaviour. • Currently, also, information actions which will be completed at the end of 2008, such as Action 2.1.1. "Information and awareness-raising actions to promote cogeneration of heat and power (CHP) and renewable energy sources (RES)" and "Strategy and implementation of an RES communications policy to inform energy consumers", are being financed through the "Competitiveness" operational programme of the European Regional Development Fund and the Greek State. • The measure must be systematic, continuous and coordinated over time and have measurable results. • The measure will run from 2008 to 2016.

[13] EUROSTAT: PANORAMA OR TRANSPORT 2007, TABLE 5.25 DGTREN PG 106

[14] HTTP://WWW.CRES.GR/ENERGY-SAVING

Title of Measure OP3.	**Programmes to provide financial support for investment in energy-saving technologies and research**
Category	**State aid** Grants of aid through: • the "Competitiveness" operational programme (Ministry of Development measures 2.1.3. & 6.5.) of CSF III 2000-2006, financing of investment projects – Ministry of Development; • the "Competitiveness" operational programme (Ministry of Development Measure 4.5) financing of research and demonstration projects – Ministry of Development, Secretariat-General for Research and Technology; • the "Entrepreneurship and Competitiveness" operational programme (ESPA) 2007-2013, Ministry of Development; • Development Law 3299/2004 of the Ministry of Economy and Finance, Gov. Gaz. I/261/23.12.2004.
Regional application	All of Greece.
Target group	• Industry • The tertiary sector • Transport • Research centres, institutes • Universities, institutes of technological education.
EEI actions targeted	• Public aid for private investment in renewable energy sources, cogeneration of heat / power / cooling, energy saving and the substitution of conventional fuels through the resources of the operational programmes and of the development law. • Public aid to promote cooperation between undertakings, research bodies and education establishments on technological development and demonstration research projects with long-term relevance to stimulate the production of innovative products and services with the objective of: - reducing cost and improving the effectiveness of renewable energy sources (RES); - developing new technological applications and structural materials to promote energy saving in buildings, industry and transport.
Effectiveness	It is estimated that the public aid will lead to 5-10% of the overall annual energy saving through the implementation of energy-saving investments.
Anticipated annual energy savings in 2010 and 2016	• 2010: 300 GWh • 2016: 1000 GWh. The total cost of implementation is estimated at approximately EUR 750m.
Status of implementation and exact timeframe	• The "Competitiveness" operational programme has provided grants for several hundred projects relating to energy saving, the cogeneration of heat and power and RES. Specifically: • through Measure 2.1.3. of the "Competitiveness" operational programme (Ministry of Development) of CSF III 2000-2006, with total public expenditure of EUR 100m on energy-saving projects; • through Measure 6.5. "Promotion of the penetration of RES systems in the country's energy system" of the "Competitiveness" operational programme (Ministry of Development) of CSF III 2000-2006, with total public expenditure of EUR 15m on energy-saving projects; • through Measure 4.5. of the "Competitiveness" operational programme (Ministry of Development) of CSF III 2000-2006, providing grants for research and demonstration projects in the fields of renewable energy sources and energy saving, with budgeted expenditure of EUR 15m, in the framework of the action "Research and technological development joint ventures in national priority sectors";

Title of Measure OP3.	**Programmes to provide financial support for investment in energy-saving technologies and research**
	• through grants for investment in RES, energy saving and cogeneration under Development Law 3299/2004.

Cross-sectoral measures

These measures are implemented in more than one sector and encompass institutional, strategic, management and technological aspects. In specific terms they concern standards and norms, such as, for example, the implementation of the Directive on the energy performance of buildings, energy labelling schemes, metering of consumption with intelligent metering systems and detailed billing and training and education leading to the application of energy-efficient technologies and techniques. In this way actions are selected which have high potential and maximised range. At the same time the conditions are established for economies of scale which contribute to stabilisation and job creation.

Title of Measure D1.	**Energy performance of buildings**
Category	• **Regulatory / institutional** - implementation of the new regulation on the energy performance of buildings and obligatory implementation of the regulation on the energy performance of buildings (KENAK).
Regional application	All of Greece.
Target group	• The residential sector • The public sector • The tertiary sector. Implementation is required: o in new buildings; o in existing buildings with useful surface area of more than 1 000m^2 when they undergo complete renovation; o in new social housing; o in building complexes of public bodies (Workers' Housing Organisation, Public Undertaking for Settlement and Housing Planning (DEPOS), etc.).
EEI actions targeted	• Immediate adoption of an institutional regulatory framework of harmonisation with Directive 2002/91/EC to provide for: o the fixing of energy performance requirements; o the energy performance certificate for buildings; o boiler inspection; o inspection of air conditioning systems; o energy audits; o focused information campaigns. The following are also proposed for the residential sector: • compulsory energy specifications (bioclimate planning) for all new social housing buildings and for the residential complexes of public bodies (Workers' Housing Organisation, Public Undertaking for Settlement and Housing Planning, etc.).
Effectiveness	It is estimated that implementation of the measure in every new and renovated building will produce a saving of 20% in relation to the conventional method of building construction of the last 50 years.
Anticipated annual energy savings in 2010 and 2016	The following savings are anticipated: o Residential sector: 2010: 210 GWh 2016: 850 GWh o Tertiary sector: 2010: 375 GWh 2016: 1125 GWh o Public sector: 2010: 27 GWh 2016: 81 GWh.
Status of implementation and exact timeframe	Implementation from the beginning of 2009 to the end of the target period in 2016.

Title of Measure D2.	**Further promotion of the integration of natural gas and LPG**
Category	• **Financial incentives** • **Information provision**
Regional application	All of Greece. (areas which have a natural gas distribution network).
Target group	• The general public • Buildings • Industry
EEI actions targeted	• Further integration of natural gas for heating, the production of domestic hot water and other uses (cooking, cooling, etc.) in the residential, tertiary and public sectors. • In areas in which immediate connection to a natural gas network is not foreseen, proposed use of liquefied gas in large buildings of the tertiary sector and in industry. Actions: • compulsory use of natural gas in the public sector (where there is a natural gas network); • provision of information about alternative means of financing (energy service companies (ESCO) and energy performance contracting (EPC); • incentives for low-income households which do not need to submit a tax return in the form of a subsidy for the integration of natural gas of an amount equal to the tax relief; • provision of information to consumers about the use and applications of liquefied gas; • public grants for the substitution of conventional fuels by natural gas and liquefied gas through operational programmes for the tertiary and industry sectors.
Effectiveness	The penetration of natural gas brings direct energy benefits through widening of the range of energy sources in Greece and indirect energy benefits through the replacement of old installations and appliances by more efficient natural gas installations. In cost terms natural gas is up to 30% cheaper than conventional fuels and provides big environmental benefits in the combating of emissions of suspended particulates and volatile organic compounds. In the EU Green Paper natural gas is listed as one of the alternative fuels for which the Member States are given a 20% target in 2020.
Anticipated annual energy savings in 2010 and 2016	The following savings are anticipated in the residential sector: 2010: 230 GWh, 2016: 360 GWh. The total cost of implementing the measure is estimated at EUR 90m.
Status of implementation and exact timeframe	• The use of natural gas in the public sector has already been made compulsory. • Demand for natural gas is growing continuously in all the sectors. • Under Article 2 of Law 3296/2004 the amounts which are tax-deductible from income include: “Twenty per cent (20%) of the expenditure either on the alteration of a fuel-use installation from diesel to natural gas or on a new natural gas installation or solar thermal or photovoltaic system. The deductible amount may not exceed five hundred (500) euro.” • Immediate implementation from 2008 to 2016.

Title of Measure D3.	**Energy labelling of appliances and minimum energy efficiency requirements**

Category	• **Provision of information and obligatory information measures**
	• **Institutional: application of:**
	  • Presidential Decree 180/1994 (Government Gazette I/114/1994) "General framework for energy labelling of household appliances";
	  • Joint Ministerial Decision D6/B/12915/21.7.04 (Government Gazette II/1144/2004) "Energy labelling of household refrigerators and freezers and of combinations of such appliances";
	  • Joint Ministerial Decision D6/B/7312/23.4.97 (Government Gazette II/386/1997) "Energy labelling of household washing machines";
	  • Joint Ministerial Decision D6/B/3972/2.4.96 (Government Gazette II/247/1996) "Energy labelling of household dryers";
	  • Joint Ministerial Decision D6/B/9142/23.4.97 (Government Gazette II/386/1997) Energy labelling of household washing machines and dryers";
	  • Joint Ministerial Decision D6/B/10200/29.5.98 (Government Gazette II/591/1998) "Energy labelling of household dishwashers";
	  • Joint Ministerial Decision D6/B/13897/15.9.99 (Government Gazette II/1792/1999) "Energy labelling of lamps";
	  • Joint Ministerial Decision D6/B/3155/24.2.03 (Government Gazette II/266/2003) "Energy labelling of air conditioners";
	  • Law. 1797/88 (Government Gazette I/164/88) "Public sector procurement and related matters";
	  • Presidential Decree173/90 (Government Gazette I/62/90) "Public Procurement Regulation".

Regional application	All of Greece.
Target group	• The general public • The residential sector • The public and tertiary sectors.

EEI actions targeted	Provision of information to consumers about the financial benefits of the labelling of electrical and electronic appliances and energy equipment.
	• Further actions to provide information to consumers with the aim of establishing the preponderance of appliances with maximum energy efficiency (A, A^{+}, A^{++}):
	  o electrical household appliances (residential sector);
	  o lamps (buildings of all sectors);
	  o computers, printers, etc. (tertiary / private, public sectors);
	  o aid conditioning appliances (all sectors);
	  o the electrical and mechanical systems of heating and cooling – minimum energy efficiency requirements (tertiary / private, public sectors).
	• Strengthening of the control mechanism for the implementation of the measure.

Effectiveness	The objective is to bring about the preponderance of appliances with high energy efficiency and to meet the following targets: 2010: 5% energy saving, 2016: 15% energy saving.
Anticipated annual energy savings in 2010 and 2016	• The savings will come from establishment of the preponderance of domestic appliances in higher energy efficiency classes and be: 2010: 340 GWh, 2016: 600 GWh. • The savings produced by the preponderance of higher energy class lamps in the residential sector will be: 2010: 200 GWh, 2016: 500 GWh. • The total cost of implementing the measure to achieve the preponderance of more efficient household appliances and lamps is estimated at approximately EUR 380m. • The savings produced by the preponderance of appliances of higher energy

Title of Measure D3.	**Energy labelling of appliances and minimum energy efficiency requirements**
	efficiency classes in the tertiary sector are as follows: 2010: 145 GWh, 2016: 760 GWh. • The savings produced by the dominance of higher energy class lamps in the tertiary sector are as follows: 2010: 310 GWh, 2016: 866 GWh. • The total cost of implementing the measure to achieve the preponderance of more efficient household appliances and lamps in the tertiary sector is estimated at approximately EUR 1.2 billion.

Title of Measure D3.	**Energy labelling of appliances and minimum energy efficiency requirements**
Status of implementation and exact timeframe	• The energy-labelling measure is being applied to all categories of appliances, equipment and lamps as provided for in the relevant national legislation. • The penetration of appliances and lamps with improved energy efficiency remains low. • Immediate implementation for the entire 2008-2016 period.

Title of Measure D4.	**Implementation of an energy management system (EMS) in the tertiary and public sectors**
Category	• **Institutional / regulatory** (legislation required): o energy efficiency improvement mechanism; o public sector: exemplary role of the public sector, Government Gazette 880/19, August 1998 /No. 21475/4707, Article 8.
Regional application	All of Greece.
Target group	• Compulsory implementation in all public sector buildings. • Buildings with overall surface area exceeding 1 000 m^2.
EEI actions targeted	• Issue of a procedural standard for the EMS. The energy management system is founded on the principle: plan, implement, control, act. • In general terms an EMS encompasses: • a documented manner of implementation of the ESM; • application of a ongoing planning process to determine crucial parameters / indicators relating to the energy performance of the building; • creation of the appropriate structure and selection of a person to be responsible for allocating obligations and competences in energy matters; • creation and keeping of a file of energy information, targets and indicators; • energy audit; • timeframe and financial programming of the interventions needed to promote rational energy use and savings and to secure resources; • training of and provision of information to workers in energy efficiency subjects; • evaluation of the processes and functions of the EMS; • review and implementation of actions to improve the EMS. • Compulsory implementation in the public sector and the wider public sector. <u>Incentives</u> • Grants; • Loans (low-interest and/or subsidised).
Effectiveness	It is expected that the measure will bring an average energy saving of up to 5% in the final consumption of electricity and thermal energy in each building.
Anticipated annual energy savings in 2010 and 2016	The anticipated energy savings are: 2010: 150 GWh, 2016: 1000 GWh. A study is needed to determine the total cost of implementing the measure.
Status of implementation and exact timeframe	• The body pursuant to Article 4(4) of Directive 2006/32/EC is responsible for monitoring and evaluating the measure. • The relevant legislation with regard to the public sector is that published in Government Gazette 880/19.08.1998, but there is no monitoring and evaluation because of the absence of a supervising body. • Environmental management systems such as ISO 14000, EMAS, Internal EMS and HACCP are being implemented in the private sector. Part of those systems may relate to the energy management of buildings. Focusing and further extension of that part could be applied directly to these buildings. • Immediate implementation.

Title of Measure D5.	**Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)**
Category	• **Institutional** (legislation required) • **Financing mechanisms:** o energy performance contracting (EPC); o joint ventures; o public procurement based on energy efficiency; o mass market/ technology procurement.
Regional application	All of Greece.
Target group	Local authority buildings
EEI actions targeted	• Creation of an institutional framework for third-party financing (TPF) and for operational matters pertaining to energy service companies (ESCO), and regulation of existing public / private joint ventures (PPJV). • Procedure for the implementation of EPCs: • recording of energy consumption and determination of a consumption reference base; • fixing of energy-saving amounts; • selection of interventions for upgrading of the building shell and of the electrical and mechanical installations and installation of RES technologies; • conclusion of a contract of guaranteed energy performance (savings and renewable energy sources) for the medium to long term (5-15 years); • implementation of energy measures / interventions; • maintenance and operation of energy interventions and monitoring of the performance of the energy performance contract; • handing over of equipment to the user at the end of the contract. • Financial incentives Grants for the state or stakeholders through energy service companies (ESCO) for the procurement of equipment.
Effectiveness	• Energy and financial benefits for both parties (the ESCO and the user / owner). • Reduction of energy consumption and recouping of the investment by the ESCO. • Benefit for the ESCO and the user from the high efficiency of the energy interventions. • Modernisation of equipment, optimisation of installation operations and incorporation of the maintenance cost in the energy performance contract (EPC). • Repeatability and aggregation of the proposed energy interventions.
Anticipated annual energy savings in 2010 and 2016	• Energy savings and RES penetration of 20-30% per energy performance contract and an amortisation period of 3-10 years, depending on scale and cost of the energy interventions. • The calculation of the annual energy saving and RES penetration will be based on the number of implemented contracts. The determination and certification of the energy result requires the application of Article 8 of the Directive. This falls within the competence of the body to be formed pursuant to Article 4(4) of Directive 2006/32/EC.
Status of implementation and exact timeframe	• The operational framework of the ESCO has not been specified. • Immediate implementation when the legislation is ready. • Implementation for the full period covered by the Directive – 2008-2016.

Title of Measure D6.	**Installation of electronic and intelligent metering of electricity and natural gas consumers**
Category	• **Provision of information and obligatory information measures** • **Energy services for energy savings** • **Regulatory**: Government Gazette II/82/27.01.2006 “Manual on the management of measurements and on the periodic clearance of network 98

Title of Measure D6.	**Installation of electronic and intelligent metering of electricity and natural gas consumers**
	• Suppliers".
Regional application	All of Greece.
Target group	• Buildings (residential and tertiary sectors • Industry.
EEI actions targeted	• The use of electronic metering to measure hourly electricity consumption enables effective collection of necessary information about the consumption behaviour of industrial, commercial and residential consumers and facilitates the promotion of financial or other incentives to promote rational organisation of consumption behaviour. • Installation by the energy suppliers of electronic meters with time measuring and telemetric capability and direct charting of the energy behaviour of consumers in order to be able to give the consumers better information. • Installation of intelligent meters with the ability to monitor the energy consumed, the carbon dioxide emissions produced and the consumption of each appliance. The indications / information are provided through appliances sited next to the electronic meter or are sent to mobile phones or personal computers. Actions • Installation of electronic and/or intelligent meters and provision of informative billing by suppliers: - in all new buildings; - gradually in existing buildings. • Focused campaigns to provide information to consumers on energy saving and the rational use of energy through informative billing.
Effectiveness	The provision of information is expected to result in a saving of 2% of the total electricity consumption of the residential, tertiary and public sectors.
Anticipated annual energy savings in 2010 and 2016	Determination of the energy saving requires the application of a documented system for the collection and processing of information to permit monitoring and evaluation of the implementation of the measure. This falls within the responsibilities of the body to be formed pursuant to Article 4(4) of Directive 2006/32/EC. Estimated saving of 80 GWh in 2010. Estimated saving of 800 GWh in 2016.
Status of implementation and exact timeframe	The provisions published in Government Gazette II/82/27.01.2006 enable the electricity suppliers to replace analog meters by digital ones. Immediate implementation. All the digital meters will be installed by 2016.

Title of Measure D7.	**Promotion of cogeneration of heat and power (CHP) and district heating systems**
Category	• **Institutional** (legislation required) • **Funding mechanism** • Public and private sector joint ventures • Public procurement based on energy efficiency • Guarantee of energy savings contracts • Third-party financing • Energy performance contracting (EPC).
Regional application	All of Greece.
Target group	• The residential sector • The tertiary sector • The public sector • Industry.
EEI actions targeted	• Legislation to achieve harmonisation with Directive 2004/08/EC. • Legislation to determine the specifications for the integration of heat and power systems and district heating networks in the town plan areas which are being included. • Targeted information and incentive actions for CHP applications in

Title of Measure D7.	**Promotion of cogeneration of heat and power (CHP) and district heating systems**
	the tertiary, public and industrial sectors. • Targeted information and incentive actions for district heating applications from new cogeneration stations of independent producers which are fuelled by natural gas or liquefied gas. • Targeted information and incentive actions for small cogeneration applications in residential buildings, using natural gas as fuel. • Targeted information and incentive actions to promote CHP applications at locations where there are exploitable biomass products. • Provision of incentives for CHP applications using biogas. • Provision of incentives for CHP installations in combination with geothermal energy. • Provision of incentives for CHP installations in agriculture (greenhouses, drying plants, etc.). • Provision of incentives for CHP installations in combination with the operation of desalination plants, especially in island areas.
Effectiveness	The additional penetration of CHP is expected to produce energy savings equating to 10% of the total thermal energy consumption of Greece.
Anticipated annual energy savings in 2010 and 2016	The anticipated savings from district heating are: 2010: 180 GWh 2016: 823 GWh. The cost of implementation (district heating) is estimated at about EUR 240m.
Status of implementation and exact timeframe	• At present there are 25 CHP stations in Greece, mainly in large industrial plants, with total installed thermal power of 786.8MWth και 232 MWel[15]. • Most of the installations have received subsidisation from the energy operational programmes. • The integration of new and more CHP installations requires subsidisation through the new National Strategic Reference Framework (NSRF) for 2007-2113 of the fourth support framework and through the Development Law. • Immediate implementation for further penetration up to the end of period in 2016.

[15] Estimation of cogeneration of heat and power capacity in Greece: Ministry of Development and CRES study, August 2007.

Residential sector

The main measures in the residential sector relate in particular to the upgrading of building shells, the upgrading of heating systems and further penetration of solar thermal systems. Financial incentives, tax reliefs and management and regulatory provisions are proposed for the application of the measures.

Title of Measure O1.	**Energy upgrading of residential building shells**
Category	• **Financial incentives** • **Regulatory** - provision to speed up the procedures for issue of the relevant licences.
Regional application	All of Greece. Priority in municipalities with planning offices.
Target group	Existing residential buildings, with priority given to pre-1980 buildings.
EEI actions targeted	• Actions under Article 11 of Directive 2006/32/EC: • Grants through the licensing procedure (public aid) • Loans (low-interest and/or subsidised). Also: • tax breaks; • provision to speed up the procedures for issue of the relevant licences (one-stop shop procedures). The local authority will be responsible for management and for helping to speed up the procedures. The measure relates to the “energy facade”, namely to the energy upgrading of the shells of residential buildings, such as insulation of building shells (masonry, flat roofs, etc.) and replacement of single-glazing by double-glazing with better thermal behaviour.
Effectiveness	Energy savings of at least 30% are anticipated, according to energy studies carried out by the CRES.
Anticipated annual energy savings in 2010 and 2016	It is anticipated that the measure will have been implemented at 250 000 buildings by 2016. The anticipated annual energy savings are: 2010: 200 GWh 2016: 2000 GWh. Total cost of implementation: EUR 1.7 billion. Financial aid totalling EUR 340m (20% of the investment).
Status of implementation and exact timeframe	Staged implementation: beginning of 2009: buildings built before 1980; beginning of 2016: buildings built between 1980 and 1990.

Title of Measure O2.	**Financial aid for the upgrading of heating system boilers / burner units in existing buildings**
Category	**Financial incentives**
Regional application	All of Greece
Target group	Buildings of existing housing fitted with central heating systems.
EEI actions targeted	• Replacement of boilers which are more than 15 years' old and with an efficiency rating of less than 75%. • Installation of calorimeters and compensating systems. • Preference given to areas to which the natural gas network is not expected to be extended in the next five years. • Areas with a natural gas network are excluded. Actions: • information campaigns, • tax breaks, • loans (low-interest and/or subsidised).
Effectiveness	Anticipated energy saving of about 15%.
Anticipated annual energy savings in 2010 and 2016	2010: 300 GWh 2016: 900 GWh. Total cost of implementation: EUR 800m. The financial aid will total EUR 800m (20% of the investment).
Status of implementation and exact timeframe	Gradual implementation from 2009 to 2016.

Title of Measure O3.	**Compulsory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems in residential buildings**
Category	• **Legislation** • **Financial incentives**
Regional application	All of Greece.
Target group	• Compulsory in new residential buildings larger than 1 000 m^2 on the mainland and larger than 500 m^2 on the islands. • Optional for all residential sector buildings.
EEI actions targeted	• Legislation to provide for compulsory installation of central solar thermal systems in new residential buildings. Checking of the quality of the installation and of the efficiency of the system by an accredited body. • Incorporation of central solar thermal systems for the production of domestic hot water in new buildings larger than 1000 m^2, with coverage of at least 70% of the annual load in climate zones A and B and of at least 55% of the annual load in climate zones C and D, and additional examination to explore the possibility of a heating and/or cooling application. • Actions to promote further penetration of solar thermal systems for the production of domestic hot water and for heating / cooling in the residential sector. Financial incentives • Grants (public aid) Proposed subsidy of €15/MWh for classical solar energy installations for the production of domestic hot water. For the installation of solar air conditioning and/or space heating systems a subsidy of €30/MWh is proposed. The calculation of the MWh yielded by the solar system relates to a period equal to 15 years for the two cases. On that basis, a classical solar system yielding 0.5 MWh/m2 in a year will have a subsidy equal to 0.5 MWh/m2/year x 15 years x €15/MWh = €112.5/m2,

Title of Measure O3.	**Compulsory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems in residential buildings**
	which is about 30% of the cost of installing a solar system. • Reduction of VAT (from 19% to 10%) in a way similar to the natural gas and electricity markets (after 2010 this will apply to products and services connected with environmental and social criteria as recently announced by the EU). • Loans (low-interest and/or subsidised).
Effectiveness	Solar thermal systems will replace 50-100% of conventional fuels and electricity, depending on the climatic conditions in each area, the load and the position of the building.
Anticipated annual energy savings in 2010 and 2016	• The following energy savings are anticipated: • 2010: 180 GWh • 2016: 540 GWh. • Total cost of implementation: EUR 450m. • The financial aid will total EUR 135m.
Status of implementation and exact timeframe	• Solar thermal systems are installed in 27% of buildings (3 000 000 m2) at present. • The implementation of incentive measures from 2009 can lead to the extension of penetration in the residential sector to up to 80% of existing dwellings over time. • The compulsory installation of central solar thermal systems in new buildings will be imposed gradually as follows: • from 2009 to the end of 2010: buildings larger than 1 000 m2 on the mainland and larger than 500 m2 on the islands; • 2012: buildings larger than 500 m2 on the mainland and all buildings on the islands; • 2016: all buildings.

Title of Measure O4.	**Energy upgrading of social housing buildings**
Category	• **Institutional / regulatory** • **Financial incentives**
Regional application	All of Greece, wherever there are social housing settlements, of the Workers' Housing Organisation, for example, that were built before 1980.
Target group	Social housing buildings

EEI actions targeted	• Legislative measure to upgrade the building shells and the electrical and engineering installations, subject to acceptance by a majority of the tenants.
	• Financial incentives:
	  • funding through the establishment of a special fund (managed by the Workers' Housing Organisation which will monitor and implement the measure);
	  • loans (low-interest and/or subsidised).

Effectiveness	It is anticipated that the upgrading of shells (insulation of outer walls and of the bearing structure, fitting of double-glazing to provide better thermal behaviour, shading systems) and of the electrical and mechanical installations will produce an energy saving in the order of 50%.
Anticipated annual energy savings in 2010 and 2016	A study is needed for the calculation of the energy savings and investment cost on the basis of the existing social housing stock in the country as a whole.
Status of implementation and exact timeframe	The rate of building stock renovation is low at the present time. The timetable provides for: upgrading of 10% of the buildings by 2012; upgrading of 40% of the buildings by 2016.

TERTIARY SECTOR / PRIVATE AND PUBLIC

The tertiary sector is examined separately for the private and public sectors and the measures proposed for the sectors differ.

Tertiary / private sector

The tertiary sector, especially the private tertiary sector, is the fastest growing sector, and thus its energy consumption is also growing at a fast rate. There is great scope for energy improvement. The proposed measures are compulsory installation of solar thermal systems and the promotion of voluntary agreements.

Title of Measure T1.	**Compulsory installation of central solar thermal systems in tertiary sector buildings larger that 1 000m^2**
Category	**Financial incentives**
Regional application	All of Greece.
Target group	Tertiary sector building installations
EEI actions targeted	• Incorporation of central thermal solar systems in buildings larger than 1 000 m2 for the production of domestic hot water, and examination of the possibility of heating and/or cooling. • Legislation to provide for compulsory installation of central thermal solar systems in new residential buildings. • Checking of the quality of installation and of the efficiency of the system by an accredited body. • Incorporation of central solar thermal systems for the production of domestic hot water, with coverage of at least 70% of the annual load in climate zones A and B and of at least 55% of the annual load in climate zones C, and additional examination to explore the possibility of a heating and/or cooling application. <u>Financial incentives</u> • Grants (public aid) Proposed subsidy of €15/MWh for classical solar energy installations for the production of domestic hot water. For the installation of solar air conditioning and/or space heating systems a subsidy of €30/MWh is proposed. The calculation of the MWh yielded by the solar system relates to a period equal to 15 years for the two cases. On that basis, a classical solar system yielding 0.5 MWh/m2 in a year will have a subsidy equal to 0.5 MWh/m2/year x 15 years x €15/MWh = €112.5/m2, which is about 30% of the cost of installing a solar system. • Reduction of VAT (from 19% to 10%) in a way similar to the natural gas and electricity markets (after 2010 this will apply to products and services connected with environmental and social criteria as recently announced by the EU). • Loans (low-interest and subsidised).
Effectiveness	Solar thermal systems will replace 50-100% of conventional fuels and electricity, depending on the climatic conditions in each area, the load to be met and the position of the building.
Anticipated annual energy savings in 2010 and 2016	• The following energy savings are anticipated: • 2010: 10 GWh • 2016: 250 GWh • Total cost of implementation EUR 400m.
Status of implementation and exact timeframe	Gradual implementation of the measure from 2009 to 2016.

Title of Measure T2.	**Promotion of voluntary agreements for energy upgrading interventions in tertiary sector buildings**
Category	• **Energy efficiency improvement mechanisms** Voluntary agreements on energy savings.
Regional application	All of Greece.
Target group	Tertiary sector building installations.

EEI actions targeted	**Description of the programme of voluntary agreements** The core of the programme will be the action plan. This will specify the targets, the national management body, the procedures for the selection of members, the benefits and incentives (other than subsidies) in the framework of which the members will undertake to implement specific measures to reduce energy consumption. The participant will determine the production sectors and systems to which the programme will apply. The purpose of the commitment will be flexible and may be limited to a specific installation or extended to all of a company's production sectors. The members will receive assistance, advice and technical support from the national management body on the determination and implementation of the action plan. The participants must: • improve both the reliability and the quality of the services of the systems included in the action plan; • make most of the savings which are technically and financially feasible. • Additionally, the participants will receive public recognition of their contribution through the advertising campaigns of the programme. • Members will be able to use the programme logo as a means to making known the energy savings achieved by their company and their contribution to the environment, and thus to highlight the partnership stance and social responsibility adopted by the company. • A list of members of the programme providing a specific description of the endeavours will be widely publicised (brochures, Internet, etc.). • Members will be invited to present a publishable example of an intervention for dissemination nationally and in Europe. • It will be possible for the specific activities of members to be included in other promotional actions of the programme. • Particularly successful members in various categories will be given awards. <u>Actions</u> • Development of a voluntary agreements programme based on specific European programmes (GreenBuilding, GreenLight etc.). • Formation of a management body(ies) to determine the targets and to carry out monitoring and checks. • Voluntary agreements on energy saving with regard to air conditioning (heating / cooling / ventilation), lighting, boilers / burner units and office equipment et al. • Voluntary agreements for the reduction of electrical load at peak times and on the development of a mechanism of incentives and disincentives for buildings larger than 3 500 m2 in periods of increased demand for power.
Effectiveness	A reduction of 20-40% in energy use can be achieved.
Anticipated annual energy savings in 2010 and 2016	The annual energy saving will depend on how many voluntary agreements are implemented.

Status of implementation and exact timeframe	A pilot version of the measure is being implemented, with very encouraging results. The projects are co-financed by the Community through initiatives such as the voluntary GreenBuilding programme (GBP)[16], which began in 2005 and seeks to improve the energy performance of tertiary sector buildings in Europe, focusing on cost/effective energy interventions and providing information support and public recognition and publicity for bodies and undertakings which are interested in participating and are willing to commit to energy efficiency measures, and the voluntary GreenLight[17] programme. The GreenLight programme was adopted by the Directorate-General for Energy and Transport of the Commission in February 2000 for the 2000–2006 period. It seeks to sensitise the public and undertakings to the possibilities of reducing energy consumption on lighting. Under the programme, private undertakings and public bodies make a commitment to the Commission to reduce the use of electrical energy for lighting. Major European and Greek bodies, airlines, airports in Spain and Italy and Eleftherios Venizelos airport in Greece are participating in the GreenLight programme. In Greece GreenBuilding (GBP) and GreenLight are promoted and coordinated by the Centre for Renewable Energy Sources (CRES). Implementation from 2009 to 2016.

16 http://www.cres.gr/greenbuilding/index.htm

17 www.eu-greenlight.org, http://www.cres.gr/kape/news/deltia/forma_greenlight.htm

Tertiary / public sector

The public sector is to be the exemplar in the application of energy efficiency improvement measures, as the Directive states. In pursuit of that status the application of energy efficient technologies and RES systems is proposed. In parallel, the use of energy efficiency criteria in calls for tender and contests for public procurement is considered necessary.

Title of Measure DM1.	**Compulsory installation of central solar thermal systems to meet hot water requirements**
Category	• **Institutional** • **Exemplary role of the public sector**
Regional application	All of Greece.
Target group	• Existing and new buildings larger that 1 000 m^2. • Private buildings leased by public bodies.
EEI actions targeted	• Legislation to provide for compulsory incorporation of central solar thermal systems to meet the hot water requirement in public sector buildings such as, indicatively, o hospitals, o sports centres, o buildings of charities and buildings used for other purposes in which there is a high requirement for domestic hot water. • Monitoring of the quality of the installation and of the efficiency of the system by an accredited body.
Effectiveness	Solar thermal systems will replace 50-100% of conventional fuels and electricity, depending on the climatic conditions in each area, the load and the position of the building.
Anticipated annual energy savings in 2010 and 2016	• The following energy savings are anticipated: 2010: 10 GWh 2016: 250 GWh. • Total cost of implementation: EUR 100m.
Status of implementation and exact timeframe	Staged implementation: from 2009 to the end of 2012 – buildings larger than 1 000 m^2; from 2014 – buildings larger than m^2; 2016 – all buildings.

Title of Measure DM2.	**Compulsory procurement procedures with respect to public buildings (green procurement – energy-efficient and RES technologies)**
Category	• **Institutional** Application of the following legislation: • Law 1797/88 (Government Gazette I/164/88) "Public sector procurement and provisions on related matters"; • Presidential Decree173/90 (Government Gazette I/62/90) "Public Procurement Regulation". • **Exemplary role of the public sector**
Regional application	Public sector.
Target group	All public buildings, including private buildings leased by public bodies.
EEI actions targeted	Implementation procedure: • recording and determination of procurement needs in materials and equipment; • specification of products (materials and equipment) which contribute, directly or indirectly, to energy saving; • action programme to replace existing energy-intensive products; • implementation of procurement which is considered acceptable in financial and energy terms and based on mature technologies and RES.
Effectiveness	This will depend on the needs that emerge on the basis of the existing equipment. Account should be taken also of the fact that the public sector is responsible for 10-20% of expenditure on equipment procurement.
Anticipated annual energy savings in 2010 and 2016	A study is required.
Status of implementation and exact timeframe	Implementation from 2009 and for the entire duration up to 2016.

Title of Measure DM3.	**Integrated energy planning by municipalities**
Category	**Energy efficiency improvement mechanisms** • Energy audit • Plans (energy planning studies) • Provision of energy services to the public
Regional application	All municipalities
Target group	Central Union of Municipalities and Communes of Greece (coordinator) and municipal authorities.
EEI actions targeted	• Establishment of a municipal energy office. • Appointment of a responsible municipal energy officer. • Municipal energy recording: o recording of energy consumption and of consumption per fuel in municipal buildings; o recording of the energy characteristics of municipal buildings (old and new); o recording of other municipal energy consumption (municipal lighting, vehicle fuels, etc.); o recording of electrical consumption. • Targeted studies of the consumption and energy behaviour of the residential sector (questionnaire). • "Energy identity" (based on a specific methodology). <u>Municipal energy planning specifying:</u> • a targeted reduction in the consumption of electrical energy and fuel in municipal installations and procedures (on the basis of recorded figures); • technical and procedural solutions, with quantification of the reduction in energy

Title of Measure DM3.	**Integrated energy planning by municipalities**
	consumption; • implementation, monitoring and evaluation of actions; • creation of a public information office; • actions to sensitise and inform the public; • education of employees in energy behaviour subjects; • annual recording / reporting of energy interventions and recasting of the municipal "energy identity".
Effectiveness	The energy recording and monitoring will reinforce all the actions implemented by municipalities through other measures and make a significant contribution to monitoring of the effectiveness and re-examination of the EEAP in national terms.
Anticipated annual energy savings in 2010 and 2016	A study is required
Status of implementation and exact timeframe	Immediate implementation of the first phase and implementation for the whole duration up to 2016.

Title of Measure DM4.	**Compulsory replacement of all light fittings with low energy efficiency in the public sector and the wider public sector**
Category	• **Institutional / regulatory** Application of Joint Ministerial Decision D5-HL/B/oik.20168 (Government Gazette II/1554/24.10.2006): o energy efficiency improvement; o energy audit.
Regional application	All of Greece.
Target group	• All buildings of the public sector and the wider public sector. • Public facilities (sports centres, etc.). • Street lighting and public lighting.
EEI actions targeted	• Energy recording. • Compulsory replacement of all lighting units with low energy efficiency by units with higher efficiency (lamps, ballasts, reflectors, etc.). • annual recording / reporting of energy interventions and redetermination of the target for further improvement.
Effectiveness	The replacement of filament lamps by compact fluorescent lamps or by other low-consumption lamps which use 80% less energy and have a lifespan which is almost ten times longer will produce immediate substantial results.
Anticipated annual energy savings in 2010 and 2016	• The following energy savings are anticipated: • 2010: 98 GWh • 2016: 298 GWh. • Total cost of implementation: EUR 98m.
Status of implementation and exact timeframe	• Joint Ministerial Decision D5-HL/B/OIK.20168/2006 (Government Gazette II/1554/24.10.2006, which provides for the replacement of lamps in public sector buildings and in the buildings of local authorities and supervised bodies (owned or leased), is being implemented. The ministerial decision stipulates compulsory replacement of all lighting units consisting of filament lamps or of fluorescent lamps of an energy efficiency class lower than B by fluorescent lamps of energy efficiency class A or B with integral or external electronic ballast. • Immediate implementation for the entire 2008-2016 period with the target of achieving preponderance of lamps with the maximum energy efficiency (A, A+, A++).

Industry

The contribution of the industry sector to energy saving is small because the intensive-use industries are covered by the Emissions Trading Directive and are not included. Management measures covering voluntary agreements and measures relating to alternative methods of financing and the provision of energy services are proposed.

Title of Measure B1.	**Incentives relating to the obligatory implementation of energy management systems (EMS) in industry**
Category	• **Institutional** • **Financial aid** • **Energy efficiency improvement mechanisms** • **Information provision and education for energy managers**
Regional application	All of Greece.
Target group	All industries covered by the ESD.
EEI actions targeted	• Application of legislation which will provide for the obligatory implementation of energy management systems (EMS) and lay down the minimum requirements for the implementation. • State grant to each undertaking for the implementation of an EMS and an energy audit.
Effectiveness	The energy management system is founded on the principle: plan, implement, control, act. In general terms an EMS encompasses: • a documented method of implementation of the ESM; • application of a ongoing planning process to determine crucial parameters / indicators relating to the energy performance of the industrial undertaking; • creation of the appropriate structure and selection of a person to be responsible for allocating obligations and competences in energy matters; • creation and keeping of a file of energy information, production information targets and indicators; • energy audit; • training of and provision of information to workers in energy efficiency subjects; • evaluation of the processes and functions of the EMS; • review and implementation of actions to improve the EMS. The target is an energy saving of around 1% in industry as a whole.
Anticipated annual energy savings in 2010 and 2016	The following energy savings are anticipated: 2010: 30 GWh 2016: 200 GWh. Proposed budget: subsidy of EUR 10 000 per industrial undertaking – 10 000 * 1 000 undertakings = EUR 10 000 000. The benefit from full implementation of the measure will be about EUR 22m in 2016. The body to be appointed pursuant to Article 4(4) of Directive 2006/32/EC will be responsible for monitoring and evaluating the measure.
Status of implementation and exact timeframe	• Many industrial undertakings have implemented environmental management systems such as ISO 14000, EMAS, Internal EMS and HACCP. Part of those systems may relate to the energy management of the installation. Focusing and further extension of that part could be applied directly to these installations. • Implementation from the middle of 2008 to 2016.

Title of Measure B2.	**Creation of energy and environment management centres in business parks**
Category	• **Energy services** (outsourcing) • **Financial aid**
Regional application	All of Greece.
Target group	All business parks.
EEI actions targeted	• Creation of energy and environment management centres in business parks. The energy and environmental management centres in industry parks will facilitate systematic monitoring of the energy parameters of industrial premises and the compilation of energy balances and environmental impact charts. There will be on-line monitoring of operations and it will be possible to issue environmental impact control and energy management certificates. Feasibility studies will be carried out and support will be provided for energy investment at the industrial undertaking level and in business parks. Additional services provided by a centre[18]. • State grants for the formation of energy and environment management centres in business parks.
Effectiveness	An energy saving of 1% of the overall final consumption of industry is expected from the systematic monitoring and the implementation of targeted actions.
Anticipated annual energy savings in 2010 and 2016	• The following energy savings are anticipated: 2010: 20 GWh 2016: 100 GWh. • The cost of setting up a centre in a business park is estimated at EUR 600 000 and the cost of operating a centre is estimated at EUR 200 000.
Status of implementation and exact timeframe	• An integrated viability study was carried out for the establishment and formation of the Thessaloniki business park. • The measure can be implemented in stages. • The first implementations could be pilots. There are 25 business parks in Greece at present. • The measure will be implemented from the middle of 2008 and continue until 2016.

[18] "Establishment and formation of an energy and environment management centre in the Thessaloniki business park", Ministry of Development and CRES study, 2004.

Title of Measure B3.	**Programme of voluntary agreements in industry**
Category	• **Voluntary agreements**
Regional application	All of Greece. Implementation at industrial undertakings which are not subject to emissions trading.
Target group	All industrial undertakings which are not subject to emissions trading.
EEI actions targeted	• Development of a programme of voluntary agreements based on specific European projects (Motor Challenge, GreenLight, etc.). • Establishment of a management body to determine the targets. • Voluntary agreements for energy saving with regard to motors, lighting, boilers / burner units, industrial cooling and other industrial equipment. The core of the programme will be the action plan. This will specify the targets, the national management body, the procedures for the selection of members, the benefits and incentives (other than subsidies) in the framework of which the members will undertake to implement specific measures to reduce energy consumption. The participant will determine the production sectors and systems to which the programme will apply. The purpose of the commitment will be flexible and may be limited to a specific installation or extended to all of a company's production sectors. The members will receive assistance, advice and technical support from the national management body on the determination and implementation of the action plan. The participants must: • preserve or improve both the reliability and the quality of the services of the systems included in the action plan; • achieve the greater part of the savings which are technically and financially feasible. • Additionally, companies will receive public recognition of their contribution through the advertising campaigns of the programme. • The members will be able to use the programme logo as a means to making known the energy savings achieved by their company and their contribution to the environment, and thus to highlight the partnership stance and social responsibility adopted by the undertaking. • A list of members of the programme providing a specific description of the endeavour will be widely publicised (brochures, Internet, etc.). • Members will be invited to present a publishable example of an intervention for dissemination nationally and in Europe. • It will be possible for the specific activities of members to be included in other promotional actions of the programme. • Particularly successful members in various categories will be given awards. • Voluntary agreements on reduction of the electricity load at peak times and on the development of a mechanism of incentives and disincentives for periods of increased demand for power. • The incentives and disincentives for the compulsory limitation of demand for electrical power at 6 850 industrial consumers in the month of July are specified on the basis of Ministerial Decision D5/HL/B/F1B/715/8076.
Effectiveness	Electrical and thermal energy savings of around 0.5% of the total final consumption of industry. The objective is to conclude voluntary agreements for electrical and thermal energy savings through rational use of the existing production equipment, the use of more efficient technological equipment and the automation of industrial processes.
Anticipated annual energy savings in 2010	2010: 20 GWh 2016: 100 GWh.

Title of Measure B3.	**Programme of voluntary agreements in industry**
and 2016	The cost of implementing the programme until 2016 will be EUR 1m.
Status of implementation and exact timeframe	A pilot version of the measure is being implemented, with very encouraging results. The projects are co-financed by the Community through initiatives such as Motor Challenge[19] (a voluntary programme of the Commission which began in 2003 and through which industries receive help to improve the energy efficiency of their electrically powered systems) and GreenLight[20], a voluntary programme adopted in February 2000 by the Directorate-General for Energy and Transport of the Commission for the 2000-2006 period which seeks to sensitise the public and undertakings to the possibilities of reducing energy consumption on lighting. Under the programme, private undertakings and public bodies make a commitment to the Commission to reduce the use of electrical energy for lighting. Major European and Greek bodies, airlines, airports in Spain and Italy and Eleftherios Venizelos airport in Greece are participating in the GreenLight programme. In Greece Motor Challenge and GreenLight are promoted and coordinated by the Centre for Renewable Energy Sources (CRES). Implementation on a bigger scale may commence at the beginning of 2009 and continue up to 2016, which is the period of implementation of the EEAP for achievement of the target.

Title of Measure B4.	**Energy services for energy savings**

Category	• **Financing mechanism**
	  • Third-party financing
	  • Energy performance contracting (EPC) Energy services outsourcing.

Regional application	All of Greece.
Target group	Industry
EEI actions targeted	• Creation of an institutional framework for third-party financing and operational matters pertaining to energy service companies (ESCO). • Development of an appropriate system for the recognition of qualifications, certification and/or accreditation of ESCO. • EPC implementation procedure. • Recording of energy consumption and determination of a consumption reference base. • Fixing of energy-saving amounts. • Selection of interventions for the upgrading of production equipment and electrical and mechanical installations and installation of RES technologies. Conclusion of contracts guaranteeing efficiency (savings and renewable energy sources) with medium-term duration of 5-15 years. • Implementation of energy measures / interventions. • Maintenance and operation of energy interventions and monitoring of the efficiency of the EPC. • Financial incentives: grants for stakeholders through energy service companies (ESCO) for the procurement of equipment.

[19] www.cres.gr/motorchallenge

[20] www.eu-greenlight.org, http://www.cres.gr/kape/news/deltia/forma_greenlight.htm

Title of Measure B4.	**Energy services for energy savings**
Effectiveness	The implementation of specific energy-saving measures and third-party financing of energy investments is expected to result in a saving of 2% of the total consumption of the industry sector.
Anticipated annual energy savings in 2010 and 2016	• The following savings are anticipated: 2010: 50 GWh 2016: 400 GWh. • The determination and certification of the energy result requires the application of Article 8 of the Directive. This falls within the competence of the body to be formed pursuant to Article 4(4) of Directive 2006/32/EC.
Status of implementation and exact timeframe	• The operational framework of the energy service companies (ESCO) has not been specified. • Immediate implementation from 2008 to 2016 when the appropriate legislation is ready.

Transport

The proposed measures represent, on the one hand, the first adoption of regulatory / administrative measures which introduce binding actions, and, on the other hand, determine the extent and type of the actions. Indicatively, they encompass the development of urban mobility, passenger vehicle labelling, compulsory quotas for public bodies for the use of more energy efficient and cleaner vehicles, linking of vehicle taxes to CO2 emissions, measures to inform, sensitise and educate the public to encourage greater use of public transport and to promote eco-driving, energy efficiency improvement measures in transport, such as reshaping of the public transport system, transport infrastructure projects, incentives for the replacement of old medium and heavy duty vehicles and private vehicles by energy efficient vehicles (vehicles fuelled by natural gas, hybrids, biofuel vehicles).

Title of Measure M1.	**Reshaping of the public transport system**
Category	**Energy efficiency improvement mechanisms**
Regional application	All of Greece.
Target group	Experts specialising in transport subjects. The central administration. Local government. Transport project management bodies. The general public (as the recipient of the result).
EEI actions targeted	Facilitation of the task of public transport with the objective of increasing the share of passenger demand for fixed rail and road public transport. Actions: • improvement of public transport route planning; • improvement of the reliability of public transport by the use of smart control and management systems in transport networks; • Linking of new routes to existing ones; • promotion of cooperation and responsiveness between forms of public transport (e.g. between bus services and the metro); • facilitation of connection and functionality in existing transport networks (i.e. as between different means and different geographical areas); • creation of organised parking near to bus stops and metro stations; • smart ticket charging and cancelling systems; • information systems for the travelling public.
Effectiveness	The objective is to increase the percentage of public transport use from the present 26%[21] to 35% in 2016.
Anticipated annual energy savings in 2010 and 2016	The aim of this measure, like that of the previous one, is to get more people on to public transport. Determination of the energy saving requires the application of a documented system for the collection and processing of information to permit monitoring and evaluation of the implementation of the measure. This falls within the competence of the body to be formed pursuant to Article 4(4) of Directive 2006/32/EC. Proposed budget: EUR 300 000 000.
Status of implementation and exact timeframe	Many of the actions of the measure are under way in the Athens area and are at the planning stage for Thessaloniki. They must be incorporated immediately into the planning of other urban centres of Greece in which the functioning of public transport manifests organisational difficulties. This

[21] EUROSTAT: PANORAMA OR TRANSPORT 2007, TABLE 5.25 DGTREN PG 106

Title of Measure M1.	**Reshaping of the public transport system**
	should be continued until 2016.

Title of Measure M2.	**Transport infrastructure projects**
Category	**Energy efficiency improvement mechanisms**
Regional application	All of Greece.
Target group	The central administration Local government The general public.
EEI actions targeted	Infrastructure projects to improve the energy efficiency of road and fixed rail transport. Actions: • creation of new infrastructure (road improvements, new bus lanes, installation of smart traffic lights for public transport, modernisation and extension of the rail network, etc.); • metro extensions; • new metro in Thessaloniki; • new national and regional trunk routes; • quiet streets; • creation of pavements and cycling paths.
Effectiveness	The objective is to shorten travel time for cars and public transport means and thereby to improve transport quality and safety and achieve energy savings. Additionally, the construction of appropriate infrastructure will increase the possibility of moving around by alternative means (walking, cycling, etc.). Increased use of fixed rail transport will help to reduce private car use and bring energy savings.
Anticipated annual energy savings in 2010 and 2016	Determination of the energy saving requires the application of a documented system for the collection and processing of information to permit monitoring and evaluation of the implementation of the measure. This falls within the competence of the body to be formed pursuant to Article 4(4) of Directive 2006/32/EC. Proposed budget: EUR 3 billion.
Status of implementation and exact timeframe	Many of the construction projects are already under way or in the process of being planned. This implementation will continue at least until the end of 2016.

Title of Measure M3.	**Development of urban mobility plans**
Category	• **Regulatory** o Administrative / regulatory framework • **Voluntary agreements and joint ventures**
Regional application	Urban centres.
Target group	• The central administration • Local government • Hospitals, schools and public services • Companies • Leasing companies • Owners of parking areas • The general public.
EEI actions targeted	Implementation in the large municipalities of Athens and Thessaloniki and in other urban centres. Actions: • Optimisation of private car use (car-sharing). *Car-sharing has been implemented successfully in other European cities (Barcelona, Bremen, etc.) and is used by bodies or in company schemes which have a lot of vehicles for the travel of members / customers between specific pick-up points and parking areas. The body or company pays the costs of purchase, operational management and maintenance of the fleet and the customer / member is charged according to the usage time and the distance covered.* • Promotion of travel by foot and bicycle. • Development of mobility plans at large companies, schools, tourism sites, hospitals and event venues, etc. *The development of mobility plans involves actions which promote the avoidance of individual travel in separate cars by large numbers of people who have the same destination at a defined time; for example, free tickets for travel to and from the workplace by public transport, travel in buses of employers, access to park-and-ride and group car use*[22]*.*
Effectiveness	Improvement of mobility and of travel safety, curtailing of individual travel by private car, energy savings. An energy saving of from 5% to 35% is anticipated, depending on the scale of implementation and on how the actions are brought together.
Anticipated annual energy savings in 2010 and 2016	A study of the organisation, development and implementation of the measure is required. The anticipated annual energy saving will come from the reduction of private car use and be calculated indirectly. Proposed budget: EUR 100 000 000 annually.
Status of implementation and exact timeframe	Gradual implementation, with pilot demonstration actions which will be an example for further development and other areas.

[22] HTTP://TREATISE.EU.COM, WWW.EPOMMWEB.ORG AND WWW.OPTIMUM2.ORG

Title of Measure M4.	**Promotion of economical, safe and eco-driving**
Category	• **Regulatory** • **Information provision** • **Training and education**
Regional application	All of Greece.
Target group	• Driving instructors • Professional drivers • Private vehicle drivers • Vehicle fleet managers.
EEI actions targeted	Road transport (private vehicles, buses) and rail transport. Actions: • information campaigns, • training of professional drivers, • education of private vehicle drivers through seminars, • incorporation of eco-driving in the training for the driving licence.
Effectiveness	Eco-driving is a new way of driving which combines simple driving techniques with rules of maintenance. This leads to a fuel saving of 5-20%, cuts pollutant emissions, causes less noise pollution and reduces the number of accidents.
Anticipated annual energy savings in 2010 and 2016	The energy saving has been estimated from the actual results of pilot implementations in Greece (of a CRES and UBC project) and elsewhere in Europe. The total saving will be about 3514 GWh in 2016 (moderate scenario). The following additional savings are anticipated for 2010 and 2016: **2010**: 820 GWh **2016**: 2014 GWh. Anticipated annual budget: EUR 2 842 000 <u>Breakdown of the budget</u> Campaigns: EUR 100 000/year. Training of trainers: EUR 66 000/year Training of private vehicle and taxi drivers: EUR 1 836 000/year. Training of professional drivers (LDV, heavy duty vehicles, buses): EUR 840 000/year.
Status of implementation and exact timeframe	Implementation of the measure requires legislation and incorporation of the measure in the procedure for acquisition of the driving licence. In the case of professional drivers there is a need to incorporate the measure in the initial and periodic training procedures (a presidential decree based on Directive 59/2003/EC is anticipated). Immediate implementation from 2008 and continuation until 2016.

Title of Measure M5.	**Incentives for the replacement of old medium and heavy duty vehicles (over 3.5 tonnes and over 10 years old)**
Category	• **Pricing incentives for improvement of energy efficiency** • **Regulatory** • **Institutional**: o implementation of Law 3423/2005 "Introduction of biofuels and other renewable fuels into the Greek market"; o implementation of Directives 2003/30/EC and 2003/96/EC.
Regional application	All of Greece.
Target group	The central administration Policymakers Owners and managers of heavy vehicle fleets.
EEI actions targeted	Road transport (medium and heavy duty vehicles). Actions: • public grants; • tax incentives for alternative technology vehicles (natural gas vehicles, hybrids, biofuel vehicles), and vehicles with improved engine specifications (EuroV); • provision of information.
Effectiveness	• Medium and heavy duty vehicles account for 30% of the total energy consumption of road transport. Heavy duty vehicles which are more than ten years old use old technologies and emit more pollutants. • The European Union has set a target for the substitution of 20% of the conventional fuels used in transport by alternative fuels by 2020. • Directive 2003/96/EC proposes the creation of a framework for reduction of the excise duty paid on conventional liquid fuels for biofuels and other alternative fuels, such as natural gas and liquefied gas, or for exemption from the duty. • Under Directive 2003/30/EC, Greece and the other Member States are required to substitute biofuels for 5.75% of all petrol and diesel placed on their markets for transport purposes by 2010. Law 3423/2005 "Introduction of biofuels and other renewable fuels into the Greek market" harmonised the national legislation with the Directive. • The progress chart for renewable energy sources proposes the fixing of a minimum binding biofuels target of 10% of vehicle fuel by 2010. • Vehicle propulsion by natural gas is a mature technology and is applied successfully in many countries. Essentially, the only obstacle to the further spread of natural gas vehicles is the provision of financial incentives to users and the creation of a denser filling station network. Under the recent Ministerial Decision 13263/1043/2007 it will be possible to create natural gas filling stations for the implementation of pilot programmes for the use of CNG for motor vehicle propulsion.
Anticipated annual energy savings in 2010 and 2016	On the basis of calculations and alternative replacement scenarios for fleets the best annual rate of replacement of old vehicles is estimated at 3%. The total energy saving from 2008 to 2016 will be 1738 GWh. Additionally, the following savings for the years 2010 and 2016 are anticipated: **2010**: 624 GWh **2016**: 1 738 GWh. Proposed budget: Subsidy of EUR 30 000 per vehicle – 3 300 *30 000 = EUR 99 000 000/year.
The current Implementation situation and the precise timetable	• According to an estimate of the European Automobile Manufacturers' Association (ACEA), 173 351 vehicles were over 10 years old in 2005. • Staged implementation of the measure starting from 2008. • Market penetration of biofuels requires commensurate production of

Title of Measure M5.	**Incentives for the replacement of old medium and heavy duty vehicles (over 3.5 tonnes and over 10 years old)**
	those fuels. • The target of substituting biofuels for 5.75% of conventional fuel by 2010 will be met by 441 000 tonnes of biodiesel or by 400 000 tonnes of biodiesel and 57 500 tonnes of bioethanol. • The target of 8% (as an intermediate target for 2016) will be met by 565 000 tonnes of biodiesel and 180 000 tonnes of bioethanol. • There are biodiesel production plants in Kilkis, Thessaloniki, Patras, Fthiotida and Volos at present, and eight other plants are planned. • Hellenic Sugar Industries SA has expressed interest in converting two of its five factories into bioethanol production plants.

Title of Measure M6.	**Incentives for the replacement of private vehicles and to promote the use of energy-efficient vehicles (vehicles fuelled by natural gas and biofuels and hybrid vehicles)**
Category	• **Pricing incentives for the improvement of energy efficiency** • **Regulatory** • **Institutional**: o implementation of Law 3423/2005 "Introduction of biofuels and other renewable fuels into the Greek market"; o implementation of Directives 2003/30/EC and 2003/96/EC.
Regional application	All of Greece.
Target group	• The central administration • Policymakers • Owners of private vehicles • Taxis • Light vehicles (LDV) < 3.5 tonnes.
EEI actions targeted	Road transport. Actions: • public grants; • tax incentives for alternative technology vehicles (vehicles fuelled by natural gas, hybrid vehicles) and for vehicles with improved engine specifications (EuroVI); • provision of information.
Effectiveness	• Depending on the alternative technology selected, the fuel saving can reach 50% (in the case of hybrid vehicles, for instance). • The actions must be planned such that the national and European targets (replacement of 20% of conventional fuels by alternative fuels by 2020, 10% of which must be biofuels) are implemented. • The strategy of the EU regarding CO2 emissions by cars and light goods vehicles requires that new vehicles of those types have average CO2 emissions of 140 g/km by 2008/09 and of 120 g/km by 2012.
Anticipated annual energy savings in 2010 and 2016	The calculations and alternative fleet replacement scenarios give an optimum annual rate of replacement of old vehicles of 4%. The total energy saving from 2008 to 2016 will be 1330 GWh. The energy savings for 2010 and 2016 are: **2010**: 768 GWh **2016**: 1330 GWh. Proposed budget: subsidy of EUR 3 000 per vehicle, which is the cost differential for a natural gas vehicle (the cost differential for a hybrid vehicle is EUR 7 000). A subsidy of EUR 3 000 is proposed for both types, because the fuel supply situation is currently better for hybrid vehicles. 51 000*3000 = EUR 153 000 000/year.
The current Implementation situation and the precise timetable	• There are currently about 700 hybrid vehicles in use in Greece. They are exempt from vehicle duties, special registration tax and the alternate day driving restriction within the ring. • According to the European Automobile Manufacturers' Association (ACEA), there were 2 177 925 cars, 40 286 diesel taxis and about 820 000 LDVs in circulation in 2005. • Implementation from 2008.

Title of Measure M7.	**Eco-labelling – energy label for cars**
Category	• **Regulatory** • **Updating and obligatory provision of information** o Energy labelling of products.
Regional application	All of Greece.
Target group	• Distributors • Vehicle sellers • The general public.
EEI actions targeted	• Road transport – cars in particular. Sensitisation of the public about their contribution to the problems of climate change and environmental pollution, through: • further actions to provide consumers with systematic information with the objective of achieving preponderance of vehicles with lower fuel consumption and lower emissions; • strengthening of the control mechanism for application of the measure.
Effectiveness	The measure is being implemented with a view to achieving preponderance of vehicles with improved energy efficiency and lower emissions.
Anticipated annual energy savings in 2010 and 2016	This measure is regulatory. Its contribution has been included in the calculation of the energy saving from the vehicle replacement measures.
The current Implementation situation and the precise timetable	The measure has been implemented in Greece through Ministerial Decision 90364/31.01.2002 (harmonisation with Directive 1999/94/EC). The measure has not had the anticipated results because the responsible vehicle sellers have not publicised it appropriately at car shows. However, many companies highlight the label with the minimum requirements of the Directive. An amendment to Directive 1999/94/EC which will propose a uniform energy label for cars in all countries is expected in 2008. Immediate implementation from 2008 for the entire period of application of the Directive.

Title of Measure M8.	**Compulsory quotas of vehicles with greater energy efficiency in the fleets of the public services and of public bodies**
Category	• **Administrative / regulatory** • **Exemplary role of the public sector**
Regional application	The public sector (additional desired result or exemplary action as a marker for the private sector).
Target group	• Policymakers • Public services • Public bodies.
EEI actions targeted	Road transport.
Effectiveness	This measure is regulatory. • A study to determine the optimum quota is needed. • Direct legislative provision.
Anticipated annual energy savings in 2010 and 2016	The contribution of the measure has been included in the calculation of the energy saving from the vehicle replacement measures.
Status of implementation and exact timeframe	The Urban Transport Company (UTC) already has 415 natural gas buses, and the supply of 200 new natural gas buses and 320 EURO V is expected. It is proposed to implement the measure from before the end of 2008 until 2016. Connected with the proposal for a directive regarding the obligation on public bodies to allocate a quote of their procurement of heavy duty vehicles to clean vehicles (COM (2005) 634, 21.12.2005) and implementation of the Green Paper – Towards a new culture of urban mobility (COM (2007) 551, 25.09.2007).

Title of Measure M9.	**Linking of vehicle taxation to energy efficiency and CO2 emissions**
Category	**Regulatory**
Regional application	All of Greece.
Target group	Vehicles owners.
EEI actions targeted	• Road transport. • Preparation of a study into the appropriate categorisation[23]. • Development of a new institutional / regulatory framework.
Effectiveness	Promotion of vehicles with lower fuel consumption and lower emissions.
Anticipated annual energy savings in 2010 and 2016	This measure is regulatory. Its contribution has been included in the calculation of the energy saving from the vehicle replacement measures.
Status of implementation and exact timeframe	It is proposed to implement the measure from the beginning of 2009 to 2016. There is a proposal for a directive (COM (2005) 261,05.07.2005), and the system of taxation based on emissions is already being applied successfully in the United Kingdom and the Netherlands.

[23] Note: The basing of taxation categories on a simple correspondence of cubic capacity to CO2 emissions does not suffice for the success of the measure. A study to find the appropriate categorisation is required.

Title of Measure M9.	**Linking of vehicle taxation to energy efficiency and CO2 emissions**

Overview table for EEAP 1: 2008 – 2016
SECTORAL ENERGY EFFICIENCY IMPROVEMENT MEASURES

HORIZONTAL					
No	**EEI measure**	**Actions targeted**	**Duration**	**Anticipated annual energy saving in 2016 (GWh)**	**Investment cost in EUR**
OP1.	**Formation of a unit to collect energy data and forecasts**	1. Formation and establishment of a unit or office in an existing or new body to be responsible for monitoring achievement of the target of the EEAP. 2. Collection, processing and filing of primary data. 3. Energy documentation, energy statistical surveys and development of energy information tools. 4. Preparation of sectoral and branch energy and environmental studies. 5. Forecasting of energy demand.	**2008 - 2016**	The anticipated energy saving is indirect and counted in with the other measures.	€60m
OP2.	**Targeted education campaigns, provision of information and rewarding of "good practices"**	1. Targeted information campaigns at local and national level. 2. Organised forums for local consultation on energy and environmental plans to promote rational energy use. 3. Training and education at e-learning seminars. 4. Publicising of demonstration projects. 5. Introduction of best practice awards to encourage and support local energy programming and viable development initiatives. 6. Establishment of annual actions in relevant fields. 7. Information campaigns about the benefits of using public transport with the aim of maximising use.	**2008 - 2016**	The anticipated energy saving is indirect and counted in with the other measures.	€50m
OP3.	**Programmes to provide financial support for investment in energy-saving technologies and research**	1. Public aid for private investment in RES, CHP, energy saving and the substitution of conventional fuels. 2. Public aid to promote cooperation between undertakings and research bodies on technological development and demonstration research projects with long-term relevance to stimulate the production of innovative products and services.	**2000 - 2016**	1 TWh	€750m

CROSS-SECTORAL

No	EEI measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
D1.	**Energy performance of buildings**	1. Institutional regulatory framework of harmonisation with Directive 2002/91/EC. 2. Compulsory energy specifications for all new social housing buildings and for the residential complexes of public bodies.	**2009 - 2016**	**Residential sector:** 850 GWh **Tertiary:** 1125 GWh **Public:** 81 GWh	
D2.	**Further promotion of the integration of natural gas and LPG**	1. Compulsory use of natural gas in the public sector (where there is a natural gas network). 2. Provision of information about alternative means of financing. 3. Incentives for low-income households. 4. Provision of information to consumers about the use and applications of liquefied gas. 5. Public grants for the substitution of conventional fuels by natural gas and liquefied gas.	**2008 - 2016**	Residential 360 GWh	
D3.	**Energy labelling of appliances and minimum energy efficiency requirements**	1. Energy labelling of appliances and further provision of information to consumers with the aim of establishing the preponderance of appliances with maximum energy efficiency (A, A^{+}, A^{++}): a. electrical household appliances (residential sector); b. lamps (buildings of all sectors); c. computers, printers, etc. (tertiary / private, public sectors); d. aid conditioning (all sectors). 2. Minimum energy efficiency requirements (electrical and mechanical equipment of heating and cooling systems) in the tertiary / private and public sectors.	Until **2016**	Residential sector savings: appliances: 600 GWh Lighting: 500 GWh Tertiary sector savings: appliances: 760 GWh Lighting: (lighting units): 866 GWh	Residential sector: EUR 380m Tertiary sector: EUR 1.2 billion
D4.	**Implementation of an energy management system (EMS) in the tertiary and public sectors**	1. Issue of a procedural standard for the EMS. 2. Compulsory implementation in the public sector and the wider public sector. 3. Grants. 4. Loans (low-interest and/or subsidised).	Immediate implementation and continuation up to **2016**	Average energy saving of 5% in each building. Total saving: 1000 GWh	Determination of the total implementation cost requires a study.
D5.	**Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting (EPC) and public and private joint ventures (PPJV)**	1. Creation of an institutional framework and immediate implementation for the EPCs and the operation of ESCOs. 2. Development of an appropriate system for the recognition of qualifications, certification and/or accreditation of ESCO. 3. Taxation provisions (tax reliefs). 4. Grants for end-consumers through energy service companies (ESCO) for the energy interventions.	**2008 - 2016**	The yearly energy saving and RES generation will depend on the number of contracts implemented.	98
D6.	**Installation of electronic and intelligent metering of**	1. Installation by the energy suppliers of electronic and/ or smart meters in all new buildings and implementation gradually in existing buildings.	**2008 - 2016**	0.8 TWh	

RESIDENTIAL SECTOR

No	EEI measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
O1.	**Energy upgrading of residential building shells**	1. Grants through the licensing procedure (public aid). 2. Loans (low-interest and/or subsidised). 3. Tax breaks. 4. Provision to speed up the procedures for issue of the relevant licences by local government (one-stop shop procedures).	Gradual implementation from **2009 to 2016**	A saving of about 2000 GWh is anticipated from the implementation of the measure at 250.000 dwellings by 2016	EUR 1.7 billion
O2.	**Financial aid for the upgrading of heating system boilers / burner units in existing buildings**	1. Tax breaks. 2. Loans (low-interest and/or subsidised). 3. Information campaigns of boilers which are more than 15 years' old and with an efficiency rating of less than 75%. 4. Installation of calorimeters and compensating systems.	Gradual implementation from **2009 to 2016**	900 GWh	EUR 800m
O3.	**Compulsory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems in residential buildings**	1. 2. Legislation to provide for compulsory installation of central solar thermal systems in new residential buildings. 3. Checking of the quality of the installation and of the efficiency of the system by an accredited body. 4. Incorporation of central solar thermal systems for the production of domestic hot water in new buildings larger than 1000 m^2. 5. Grants (public aid). 6. Reduction of VAT (from 19% to 10%) after 2010. 7. Loans (low-interest and/or subsidised).	Implementation from **2009** until 80% of existing dwellings have been covered	540 GWh	450m
O4.	**Energy upgrading of social housing buildings**	1. Legislative measure to upgrade the building shells and the electrical and engineering installations, subject to acceptance by a majority of the tenants. 2. Financial incentives: - funding (the Workers' Housing Organisation will be the managing body and implement the measure). - loans (low-interest and/or subsidised).	**2012:** upgrading at 10% of buildings **2016:** upgrading at 40% of buildings	Requirement for an integrated study	Requirement for an integrated study

TERTIARY PRIVATE SECTOR

No	EEI measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
T1.	**Compulsory installation of central solar thermal systems in tertiary sector buildings larger that 1 000m^2**	1. Legislation to provide for compulsory installation of central thermal solar systems in new residential buildings. 2. Checking of the quality of installation and of the efficiency of the system by an accredited body. 3. Grants (public aid). 4. Reduction of VAT (from 19% to 10%) after 2010. 5. Loans (low-interest and/or subsidised).	Gradual implementation from **2009 to 2016**	250 GWh	400m
T2.	**Promotion of voluntary agreements for energy upgrading interventions in tertiary sector buildings**	1. Development of a voluntary agreements programme based on specific European programmes (GreenBuilding, GreenLight etc.). 2. Formation of a management body to determine the targets and to carry out monitoring and checks. 3. Voluntary agreements on energy saving with regard to air conditioning (heating / cooling / ventilation), lighting, boilers / burner units and office equipment et al. 4. Voluntary agreements for the reduction of electrical load at peak times and on the development of a mechanism of incentives and disincentives for buildings larger than 3 500 m2 in periods of increased demand for power.	**2009 - 2016**	Estimated reduction in energy use of from 20% to 40%. The energy saving will depend on the number of voluntary agreements that are implemented.	

TERTIARY PUBLIC SECTOR

No	EEI measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
DM1.	**Compulsory installation of central solar thermal systems to meet hot water requirements**	1. Legislation to provide for compulsory incorporation of central solar thermal systems to meet the hot water requirement in public sector buildings such as, indicatively, - hospitals, - sports centres, - buildings of charities and other buildings as considered advisable. 2. Monitoring of the quality of the installation and of the efficiency of the system by an accredited body.	Gradual implementation from **2009 to 2016**	50 GWh	100m
DM2.	**Compulsory procurement procedures with respect to public buildings (green procurement – energy-efficient and RES technologies)**	1. Specification of products (materials and equipment) which contribute (directly or indirectly) to energy saving. 2. Action programme to replace existing energy-intensive products. 3. implementation of procurement which is considered acceptable in financial and energy terms and based on mature technologies and RES.	**2009 - 2016**	Study required	--
DM3.	**Integrated energy planning by municipalities**	1. Establishment of a municipal energy office. 2. Appointment of a responsible municipal energy officer. 3. Municipal energy recording. 4. Municipal energy planning. 5. Implementation, monitoring and evaluation of actions. 6. Targeted studies of the consumption and energy behaviour of the residential sector. 7. “Energy identity” (based on a specific methodology). 8. Actions to sensitise and inform the public. 9. Education of employees in energy behaviour subjects. 10. annual recording / reporting of energy interventions and recasting of the municipal “energy identity”.	**2008 - 2016**	Study required	--
DM4.	**Compulsory replacement of all light fittings with low energy efficiency in the public sector and the wider public sector**	1. Energy recording. 2. Compulsory replacement of all lighting units with low energy efficiency by units with high efficiency (lamps, ballasts, reflectors, etc.). 3. annual recording / reporting of energy interventions and redetermination of the target in order to promote further improvement and the preponderance of high energy efficiency lamps.	**2008 - 2016**	298 GWh	98m[104]

INDUSTRY SECTOR

No.	EEI Measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
B1.	**Incentives relating to the obligatory implementation of energy management systems (EMS) in industry**	1. Application of legislation which will provide for the obligatory implementation of energy management systems (EMS) and lay down the minimum requirements for the implementation. 2. State grant to each undertaking for the implementation of an EMS and an energy audit.	**2008 - 2016**	200 GWh	EUR 22m
B2.	**Creation of energy and environment management centres in business parks**	State grants for the formation of energy and environment management centres in business parks.	**2009-2016**	100 GWh	EUR 6m
B3.	**Programme of voluntary agreements in industry**	1. Development of a programme of voluntary agreements based on specific European projects (Motor Challenge, GreenLight, etc.). 2. Establishment of a management body to determine the targets. 3. Voluntary agreements for energy saving with regard to motors, lighting, boilers / burner units, industrial cooling and other industrial equipment. 4. Voluntary agreements on reduction of the electricity load at peak times and on the development of a mechanism of incentives and disincentives for periods of increased demand for power.	**2009-2016**	100 GWh	EUR 1m
B4.	**Energy services for energy saving**	1. Creation of an institutional framework and immediate implementation for EPC and operation of ESCO. 2. Development of an appropriate system for the recognition of qualifications, certification and/or accreditation of ESCO. 3. EPC implementation procedure. 4. Taxation provisions (tax reliefs). 5. Grants for end-consumers through energy service companies (ESCO) for energy interventions.	**2008 - 2016**	400 GWh	

TRANSPORT SECTOR

No	EEI measure	Actions targeted	Duration	Anticipated annual energy saving in 2016 (GWh)	Investment cost in EUR
M1.	**Reshaping of the public transport system**	1. Improvement of public transport route planning. 2. improvement of the reliability of public transport by the use of smart control and management systems on transport networks. 3. Linking of new routes to existing ones. 4. Promotion of cooperation and responsiveness between forms of public transport (e.g. between bus services and the metro). 5. Facilitation of connection and functionality in existing transport networks (i.e. as between different means and different geographical areas). 6. Creation of organised parking near to bus stops and metro stations. 7. Smart ticket charging and cancelling systems. 8. Information systems for the travelling public.	**2008 - 2016**	Determination of the energy saving requires the implementation of a documented data collection and processing system	300m
M2.	**Transport infrastructure projects**	1. Creation of new infrastructure (road improvements, new bus lanes, installation of smart traffic lights for public transport, modernisation and extension of the rail network, etc.). 2. Metro extensions. 3. New metro in Thessaloniki. 4. New national and regional trunk routes. 5. Quiet streets. 6. Creation of pavements and cycling paths.	**2008 - 2016**	Determination of the energy saving requires the implementation of a documented data collection and processing system	3 billion
M3.	**Development of urban mobility plans**	1. Optimisation of private car use (car-sharing). 2. Promotion of travel by foot and bicycle. 3. Development of mobility plans at large companies, schools, tourism sites, hospitals and event venues, etc.	**2008 - 2016**	The anticipated annual energy saving will come from the reduction of private car use and be calculated indirectly	100m
M4.	**Promotion of economical, safe and eco-driving**[24]	1. Information campaigns. 2. Training of professional drivers. 3. Education of private vehicle drivers through seminars. 4. Incorporation of eco-driving in the training for the driving licence.	**2008 -2016**	2014	2.85m
M5.	**Incentives for the replacement of old medium and heavy duty vehicles (over 3.5 tonnes and over 10 years old)**	1. Public grants. 2. Tax incentives for alternative technology vehicles (natural gas vehicles, hybrid vehicles), and vehicles or improved engine specifications (EuroV).	**2008- 2016**	1738	99m110

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Abbreviations

Abbreviation	Full name or term
ACEA	European Automobile Manufacturers' Association
EPC	Energy Performance Contracting
ESD	Energy Services Directive
ETS	Emissions Trading Scheme
GEM-E3	General Equilibrium Model for Energy-Economy-Environment
GDP	Gross domestic product
RES	Renewable energy sources
BP	Business park
PGC	Public Gas Corporation
IEA	International Energy Agency
ESCO	Energy service company (ESCO)
UBC	Urban Transport Company
NPAER	National plan for the allocation of emission rights
NSRF	National Strategic Reference Framework
ERFD	European Regional Development Fund
DHW	Domestic hot water
STS	Solar thermal systems
CRES	Centre for Renewable Energy Sources
CUMCG	Central Union of Municipalities and Communes of Greece
PT	Public transport
RAE	Regulatory Authority for Energy
EEAP	Energy Efficiency Action Plan
PPJV	Public and private joint ventures
EPC	Energy performance contracting
EPC	Energy performance contracts
EMS	Energy management system
CHP	Cogeneration of heat and power
NG	Natural gas
TPF	Third-party financing