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INTERLINKAGES AND SYNERGIES BETWEEN SELECTED OTHER POLICY AREAS AND ENERGY EFFICIENCY

D.1.3

PART OF WORK PACKAGE 1: MAPPING OF ENERGY EFFICIENCY POLICY INSTRUMENTS AND AVAILABLE TECHNOLOGIES IN BUILDINGS AND TRANSPORT

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Contents

Table of Tables

ACRONYMS

CHP	Combined Heat and Power
CRES	Center for Renewable Energy Sources and Saving
DSHWS	Domestic Solar Hot Water Systems
EC	European Commission
EE	Energy Efficiency
EU	European Union
GDP	Gross Domestic Product
GPP	Green Public Procurement
HEDNO S.A.	Hellenic Electricity Distribution Network Operator S.A.
HELAPCO	Hellenic Association of Photovoltaic Companies
ITS	Intelligent Transport Systems
KENAK	Greek abbreviation for Regulation for the Energy Efficiency of Buildings
LED	Light Emitting Diode
MEECC	Ministry of Environment, Energy and Climate Change
MEIST	Ministry of Economy, Infrastructure, Shipping and Tourism
NEEAP	National Energy Efficiency Action Plan
OASA	Athens Urban Transport Organisation
PPP	Public-Private-Partnerships
PV	Photovoltaic
RAE	Regulatory Authority for Energy
RES	Renewable Energy Sources
ROI	Return Of Investment
TISA	Traveller Information Services Association

EXECUTIVE SUMMARY

The policy interactions are an important parameter for the successful implementation of policies, measures and policy instruments. The parallel implementation of a number of policy instruments has the potential to create synergies or conflicts that maximize or prevent the achievement of their anticipated outcomes. This report presents cases of positive policy interactions between two policy instruments for promoting even more the energy efficiency outcomes in Greece for two sectors, buildings and transport. The case studies refer to existing policy instruments that are linked directly and indirectly with energy. There are no officially recorded outcomes or evaluations for the parallel implementation of these policy instruments.

These Hellenic case studies are:

- "Energy labelling" and "Green Public Procurement" (for the building and the transport sector) – Direct link with energy;
- "Regulation for the Energy Efficiency of Buildings (KENAK)" and the "*Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs"* (Only for the building sector) – Direct link with energy;
- "Planning policy instrument for Intelligent Transport Systems" and "Emission standards (Euro 5 and Euro 6)" (only for the transport sector) – Indirect link with energy.

CHAPTER 1: ACHIEVING ENERGY EFFICIENCY THROUGH INTEGRATION IN OTHER POLICY AREAS

In current debates the multiple benefits of energy efficiency are broadly discussed and available analyses are growing in number (e.g. IEA, 2014a - report on multiple benefits). However, in some cases energy savings can rather be seen as the co-benefit of other policies or measures, which do not target energy efficiency by design.

The aim of this task is to identify policy areas suitable for combination with energy efficiency policies and systematically analyse how they may contribute to improve energy efficiency, particularly if untapped energy saving potentials still exist.

1.1 POLICY INSTRUMENTS WITH A DIRECT LINK TO ENERGY

1.1.1 CASE STUDY FOR THE BUILDINGS SECTOR

Introduction

The first case study is about the policy Interactions between the policy instruments of "Energy labeling" and "Green Public Procurement". Both policy instruments concern **the building and the transport sector** and are presented analytically in *D.1.2 - Status Quo analysis of energy efficiency policies in 8 EU countries*.

They were selected as one of the few identified examples of policy interactions within the Hellenic framework and because of the amount of available information about them compared to other national policy instruments. They serve as an existing example of understanding the positive manner under which two policy instruments interact in achieving the outcomes for which they were designed and implemented for.

Relation to energy efficiency

Both policy instruments concern the policy area of energy efficiency. There are no official national assessments about their outcomes either individually or as a combination.

The outcomes of a survey regarding the implementation of the Green Public Procurement (GPP) in the EU27, showed that Greece had a below 20% GPP uptake performance (Centre for European Policy Studies and the College of Europe, 2012). This low percentage can be attributed to the fact that the "Green Public Procurement" has a short implementation period (set into force in 2005) compared to the "Energy labeling" (introduced in 1994). As described in *D.2.1 - Working paper on Social, Economic, Cultural and Educational Barriers in Buildings and Transport* the main barriers for the implementation of the "Green Public Procurement" in the country are linked with the public authorities (educational, informative and institutional barriers).

On the other hand for the "Energy-labelling" (referred also as a type of "Eco-labelling"), four out of ten people stated that the environmental impact of a product or service influences their purchasing decision (European Commission, 2015). Consumers mention frequently (along with price) that they trust the energy label and consider it when purchasing electrical household appliances (European Commission, 2015).

Out of the entities of the whole public sector, local authorities mainly were more active in implementing both policy instruments. The following cases are indicative:

- *Purchase of four multifunctional photocopiers - Municipality of Pilea-Hortiatis*[1]. The technical specifications of the tender included energy and environmental criteria (indicatively such as Energy Star Certification, Blue Angel Certification, environmentally friendly ingredients (percentage of recycled plastic), Recyclability after Lifecycle, Ecological packaging etc) (Buy Smart+Pilot project – Municipality of Pilea-Hortiatis, 2014). The estimated results for this procurement - when compared to conventional photocopiers without the required energy characteristics asked - were a total of 79MWh and 31 t CO_2 throughout the machines lifetime (7 years)[2] (Buy Smart+Pilot project – Municipality of Pilea-Hortiatis, 2014).
- *Replacement of old lighting in student dorms with LED lamps - Technological Educational Institute of Thessaly (Larisa).* The overall saving during lamp life (up to 15 years) will be 824 MWh, 342 tons of CO_2 and 29.780 EUR (Buy Smart+Pilot project – Technological Educational Institute of Thessaly (Larisa), 2014).
- *Replacement of four Euro 1 emission standard vehicles with four Euro 5 emissions vehicles – Municipality of Kalamaria*[3]*.* The annual savings are estimated to be 1,34tnCO_2, 0,29tn HC, 2,68tn NO_x, 0,26tn PM and 35MWh (Buy Smart+Pilot project – Municipality of Kalamaria, 2014).
- *Purchase of nine diesel ambulances for replacing old gasoline ones – Ministry of Health.* The diesel engines have a better fuel economy by 20 to 30% compared to the gasoline ones and 20,25 tonnes CO_2 less throughout the lifetime of the vehicle (250.000km). The total energy savings throughout the lifetime of the vehicles (250.000km) are estimated to be worth of 110.000 EUR according to fuel prices of the time of calculation (Buy Smart+Pilot project – Ministry of Health, 2014).

Interaction between objectives

The Energy Labelling Directive (and the Ecodesign Directive) aims to address the negative impact of products on the environment depending on how they are made, used and disposed of by 'pulling' the market towards more energy efficient products (European Commission, 2015).

Its objectives for fulfilling this aim are (European Commission, 2015): i) Increasing energy efficiency and the level of protection of the environment; ii) informing consumers about the energy efficiency and other resources use of products through an energy label, and encouraging them to buy more energy efficient ones; iii) Ensuring the free movement of energy-related products in the European Union.

In line with the aforementioned objectives, for the Hellenic case, the Ministerial Decision 12400/1108/29 (Government Gazette 2301 B, 14.10.2011[4]) defines as objective to enact a

[1] Suburn of the Thessaloniki urban area

[2] Assuming that conventional photocopiers today at full operating temperature may consume about 1600kWh per year whereas an energy star photocopiers consumes 900kWh per year.

[3] Second largest municipality in population in the regional unit of Thessaloniki

[4] http://www.google.gr/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=2&cad=rja&uact=8&ved=0CCkQFjABahUKEwjxv_GOz5HHAhUJORQKHdKrAX8&url=http%3A%2F%2Fwww.ydmed.gov.gr%2Fwp-content%2Fuploads%2F2011_09_10_diminiaio.doc&ei=4tXBVfHGEonyUNLXhvgH&usg=AFQjCNFSqq8d5JaYRHWaeMdvBaHCMGeA8Q&bvm=bv.99261572,d.d24 and http://www.et.gr/idocs-nph/search/pdfViewerForm.html?args=5C7QrtC22wFYAFdDx4L2G3dtvSoClrL8zS83ZvoDVVQtiDow6HlTE-JInJ48_97uHrMts-zFzeyCiBSQOpYnTy36MacmUFCx2ppFvBej56Mmc8Qdb8ZfRJqZnsIAdk8Lv_e6czmhEembNmZCMxLMtZqO3PZEZmZ4PAm4MxQaM4YkkPuOjFktfnSx0GKTOsdy

framework for: i) providing information to the end-users through the labeling and ii) quoting uniform information regarding the product (energy consumption and occasionally other basic resources during usage) and supplementary information about products related with energy. The aim is the end-users to be able to select more efficient products.

For the second policy instrument, the relevant information follows. The purpose of the EU Green Public Procurement (GPP) policy instrument is to use the purchasing power of the EU Member States governments to stimulate the markets for goods and services with lower impacts on the environment (BIO Intelligence Service, 2013). Energy efficient products and services are promoted for use by the public sector.

The policy interaction is positive since both policy instruments through their objectives (primary and secondary) aim to support energy efficient products and services.

Interaction between target groups

For the Hellenic case of "Energy labeling" the target groups include end-users in households and producers of the respective products. The energy labeling is applied to those products that have a significant direct or indirect effect on energy consumption and depending on the case of other resources during their use. It is not applied to: i) second hand products; ii) to transportation means of persons or merchandise; iii) on the indicative signal or the equivalent label for security reasons that is attached on the product.

For the GPP the target groups are public[5] and private entities that sign contracts covering: Energy efficient computers, Office furniture from sustainable timber, Low energy buildings, Recycled paper, Cleaning services using environmentally friendly cleaning products, Electric, hybrid or low-emission vehicles, Electricity from renewable energy sources (European Commission and ICLEI – Local governments for Sustainability, 2011).

The target groups of the two policy instruments are different. There is no direct policy interaction under the target groups of these policy instruments. For Energy Labelling the target group consists of end-users (citizens) coming from the building and the transport sector, while for GPP the target groups are public entities. Producers and manufacturers of such products and services – whose participation is optional, particularly for the GPP - are benefitted indirectly by the implementation of both policy instruments.

Interactions between rules - influencing mechanisms

The Energy Labelling (or Eco-labelling) standards can be used as preconditions for the tenders of the GPP. This option facilitates the implementation of the GPP and reinforces the implementation of the Energy labelling standards. The reasons are: i) energy or eco-labelling is characterized by a significant potential to contribute to an effective reduction of environmental impacts associated to economic activities due to its criteria which take into account the environmental impacts that products may have in their life-cycle (Domingues A.R. et al., 2015); ii) they provide consumers/users with the information to select products energy efficient or least harmful to the environment since independent third parties narrow the information gap by assuring consumers/users about which product meets those energy or environmental standards (Domingues A.R. et al., 2015).

The public sector is expected to lead in such efforts for the fulfillment of energy efficiency targets due to the significant number of human resources, the services that it provides, the consumption of resources, its size and influence, particularly at the local level (Domingues A.R. et al., 2015). When

[5] Public sector, first and second level of local authorities, companies whose stock share belongs to the public sector or local authorities - Public transport sector

public entities and specifically the local authorities, adopt the energy or eco-labelling criteria in the tenders of GPP they set out an example. If information about this example is accessible through web-sites, social media, etc then more end-users (citizens and companies of the private sector) are likely to be positively influenced. It is indicative that the majority of environmental related label initiatives for goods and services were produced by the private sector (Domingues A.R. et al., 2015). This is evident by the products that are covered by the EU ecolabel or by the overview provided by Ecolabel Index (Domingues A.R. et al., 2015).

The incorporation of sustainable development principles and practices (ie energy or eco-labelling and GPP) into processes of the multi-level governance structure, including policy formulation and operations is crucial since the public sector as a total represents an important part of international economic activities (Domingues A.R. et al., 2015).

This is a positive policy interaction between rules-influencing mechanisms of the two policy instruments.

Interactions between the implementation network/ governance structure

MEECC is responsible for the implementation of the "Energy labelling", and particularly, the General Secretariat of Industry at the Ministry of Reconstruction of Production, Environment and Energy (former Ministry of Environment, Energy and Climate Change (MEECC[6])). The Public Economic Services, the Service of Special Audits of the Ministry of Finance, Hellenic Police, Chambers and Regions will also contribute for the market monitoring if the pertinent authority decides their involvement.

For GPP, the MEECC was assigned as the authority responsible to design the National Policy and drawing of a National Action Plan for promoting the Green Public Procurements (Law 3855/2010 - Government Gazette 95 A, 23.06.2010[7]). MEECC will need to cooperate with other Ministries and bodies of the public and private sector for proceeding with the necessary legislative settings and measures for implementing the "Green Public Procurements". For the better coordination of these efforts an eleven member Interministerial Committee was established[8]. Its Members are: The Minister of Economy, Infrastructure, Shipping and Tourism (Head of Committee), The Minister of Finance, The Minister of Productive Reconstruction, Environment and Energy (Former MEECC), The Minister(s) who supervise(s) each of the Public Bodies that are examining the implementation of PPP projects, under their competencies.

There is a direct policy interaction since the MEECC is mainly responsible for the implementation of both policy instruments. However, due to the lack of information about the implementation of both policy instruments, the policy interaction can be characterized as negative for this part. This is justified as follows: i) There is still no national action plan about the Green Public Procurement[9]. Greece, along with Croatia, Estonia, Hungary, Luxemburg and Romania has not submitted such a plan. This situation imposes administrative burden to the implementation network. ii) there are no tenders with criteria related to Energy or eco-labelling or energy efficiency[10] on the Hellenic web-page for PPP. This is attributed to the inadequate implementation network (lack of skills and knowledge to use the energy or eco-labelling standards under the GPP, lack of relevant studies, available perhaps but non-accessible information for the public through web-sites). This second reason is significant also from the perspective that public authorities are expected to be open and

[6] http://www.cres.gr/kape/calendar/progr_ypapen_8_6_15.pdf
[7] http://www.ypeka.gr/LinkClick.aspx?fileticket=AxgQsUVAUjA%3d&tabid=506
[8] http://www.sdit.mnec.gr/en/information
[9] http://ec.europa.eu/environment/gpp/action_plan_en.htm
[10] http://www.sdit.mnec.gr/en/information/PPP/procedures

transparent about the management of the public funds and assents (Domingues A.R. et al., 2015). The interaction can become positive if the necessary actions are undertaken (establish a pertinent authority with qualified staff etc).

1.1.2 CASE STUDY FOR THE BUILDINGS SECTOR

Introduction

The second case study is about the policy Interactions between the policy instruments of "*Regulation for the Energy Performance of Buildings (KENAK)*" and "*Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs*". The first policy instrument was presented analytically in D.1.2. The second one will be described in this session. This pair of policy instruments was identified and selected as a case study due to significant market share that Greece has in the European solar market.

More specifically, solar energy systems either as solar thermal systems or as photovoltaics have very high penetration rates in Greece (Tsalikis G. and Martinopoulos G., 2015). For year 2013, the Hellenic Photovoltaic (PV) market exceeded the 1GW mark, recording PV capacity of 1,04GW and ranking fifth in the European market behind Germany, United Kingdom, Italy and Romania (European Photovoltaic Industry Association, 2014). The residential segment of this market has developed rapidly from year 2012 to 2013 (European Photovoltaic Industry Association, 2014).

During year 2014, there were positive signs for the Hellenic solar thermal market which grew by 18,9% compared to year 2013 (European Solar Thermal Industry Federation, 2015). Domestic Solar Hot Water Systems (DSHWS) are characterized as mature and widely available technology, with installed capacity of 4,2 million m^2 (2.900 MW_{th}) at the end of 2013 from 4,1 million m^2 (2,8 MW_{th}) at the end of 2011 (Tsalikis G. and Martinopoulos G., 2015; Martinopoulos G. and Tsalikis G., 2014). In 2014, the total installed capacity reached the 3 GW_{th} (4,3 million m^2), representing an increase of 2,6% over the previous year and providing an estimated energy supply of 2.989 GW_{th}, which corresponds to 52% of the indicative 2020 target (European Solar Thermal Industry Federation, 2015). The increase during the period 2013-2014 is attributed to investments in the Hellenic tourism sector (European Solar Thermal Industry Federation, 2015).

The newly installed capacity was 189 MW_{th}, representing 270.000 m^2 of newly installed collector area and the majority was for hot water supply in the tourism sector/islands (hotels, holiday lets, etc.) (European Solar Thermal Industry Federation, 2015). There was also a welcome market upturn for replacing old solar thermal systems with new ones (European Solar Thermal Industry Federation, 2015).

In 2014 Greece ranked second with 9% in the shares of the European Solar Thermal Market (Newly Installed Capacity) behind Germany with 31% (European Solar Thermal Industry Federation, 2015). In 2012, Greece was fifth with 7% in the shares of the European Solar Thermal Market (Newly Installed Capacity) (European Solar Thermal Industry Federation, 2013).

Although photovoltaics are characterized as a relatively new technology for the Hellenic residential market, more than 40.000 systems were installed in residential buildings up to 2013, resulting to increased installed capacity (from 47 MW_p in 2007 to 1.536 MW_p in 2012 and to 2.579 MW_p in 2013) (Tsalikis G. and Martinopoulos G., 2015). Greece is among the ten top PV markets globally (10^{th} in 2011 and 2012, 9^{th} in 2013)(IEA, 2014b).

Relation to energy efficiency

In 2012 the buildings sector (residential and tertiary together) accounted for 45% of the total final energy consumption (YPEKA, 2014). Their thermal energy consumption is for space heating,

production of domestic hot water use and cooking (Table 1). In 98,6% of the Hellenic household dwellings there is a system / equipment for their needs in hot running water (Hellenic Republic, Hellenic Statistical Authority, 2013). More specifically, 74,5% of households use an electrical thermo siphon system, 37,6% a solar thermo siphon system, and 25.2% a system linked to the central heating system (boiler) (Hellenic Republic, Hellenic Statistical Authority, 2013).

Despite the economic recession, the installation of PV systems on building roofs was significant (Build Up Skills – Energy Training for Builders, 2013). The share of PV systems that were installed on roofs when compared to the whole Hellenic PV market demonstrated an increase from 4% in year 2010 to 19% during the first six months of year 2012 (Build Up Skills – Energy Training for Builders, 2013). This increase continued (Table 2). By April 2013, the installed capacity grew up to 341MW_p (HELAPCO, 2013).

Table 1: Average thermal energy consumption per household – Percentage distribution by type of end-use.

Type of end-use	Average thermal energy consumption (in %)
Space heating	85,9
Production of domestic hot water use	4,4
Cooking	9,7
Total	**100,00**

(Source: Hellenic Republic, Hellenic Statistical Authority, 2013)

Table 2: PV Installations per category.

Interconnected systems per category	Roofs <10 KWp	<20 KWp	20-150 KWp	150 KWp – 2MWp	>2MWp
Total installed capacity (MW_p)	298,7	62,5	582,6	395,2	198,2

(Source: YPEKA, 2014)

The combined implementation of the two policy instruments "*Regulation for the Energy Performance of Buildings (KENAK)*" and "*Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs*" demonstrates that EE interventions are adopted favoring the introduction of RES and promoting the nearly zero energy buildings.

The Regulation for Energy Efficiency of Buildings, that was introduced in year 2008 (see details at D.1.2) focuses mainly on the heat efficiency of buildings while it includes specifications for the efficient use of electricity also.

The "*Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs"* was set in force in year 2009 and focuses on the penetration of PV systems in the building sector. This programme is expected to contribute in the achievement of the EE target for year 2016 according to the developed methodology of the 1st National Energy Efficiency Action Plan (NEEAP) (Build Up Skills – Energy Training for Builders, 2013; First Hellenic National Energy Efficiency Action Plan, 2008). The target of total energy savings due to the installation of PV systems in the buildings sector for the production of domestic hot water use is estimated to 4.128 GWh until year 2020 (Build Up Skills – Energy Training for Builders, 2013). The expected installed capacity of PV systems on lofts-roofs is expected to be by year 2020 at 1.150MW (Build Up Skills – Energy Training for Builders, 2013).

Under Law 3851/2010 (Government Gazette 85 A, 04.06.2010[11]) which was devoted to the RES development a link was created between RES and EE. One of its provisions sets under KENAK the obligation that all new buildings need to "cover the total of their primary energy consumption with

[11] http://www.ypeka.gr/LinkClick.aspx?fileticket=pnhppGnURds%3D

energy supply systems based on RES", focusing on solar thermal, photovoltaic and ground heat-pump systems (pellet or other biomass residential heating systems are only hinted within the overall RES terminology) (Christidou C. et al., 2014). Consequently, the law formed a favorable context especially for photovoltaic installations on buildings, taking into consideration the very high prices for the generated electricity by these installations (550 EUR /MWh) when the maximum electricity price, for the household sector, for that period according to consumption ranged from 56,25 to 91,55 EUR /MWh) (Christidou C. et al., 2014). PV investments under these conditions had pay-back periods shorter than six years (Christidou C. et al., 2014).

Policy interaction between these two policy instruments appears to be positive overall (Christidou C. et al., 2014; Build Up Skills – Energy Training for Builders, 2013).

Interactions between objectives

The objectives that KENAK serves are the reduction of energy consumption for heating, cooling, lighting and production and use of hot water with the simultaneous ensuring of comfort conditions for the indoor spaces of the buildings. It aims also to promote the improvement of the energy performance of buildings in Greece, considering: i) outdoor climatic and local conditions and ii) indoor climate requirements and cost-effectiveness.

The "*Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs"* was set in force by a Joint Ministerial Decision No. 12323[12] (Government Gazette 1079 B, 04.06.2009[13]). Law 3851/2010 (Government Gazette 85 A, 04.06.2010[14]) had relevant provisions with more important that for the feed-in-tariffs. Law 4023/2013 (Government Gazette 235 A, 11.11.2013[15]) has also provisions that refer to PV systems on buildings.

The objective of the "Specific Programme[16]" is to contribute in the achievement of the national RES penetration target. It is the combination of two types of policy instruments: i) a regulatory policy instrument due to the rules for the installation of the PV systems and ii) a financial policy instrument due to the feed-in-tariffs for the PV systems.

The two policy instruments (KENAK and the regulatory part of the "Specific Programme") interact positively through their common secondary objectives. The financial policy instrument of the "Specific Programme" reinforces this interaction.

Interactions between target groups

For KENAK the following categories of buildings fall under its framework: i) Households of different types such as detached houses, apartments and apartment complexes; ii) Multi-apartment buildings; iii) Offices; iv) Educational buildings; v) Hospitals; vi) Hotels and restaurants; vii) Sports facilities; viii) Buildings for Wholesale and retail trade services; ix) Any other category of buildings that are consuming energy. There are exemptions such as:

[12] http://www.desmie.gr/ape-sithya/adeiodotiki-diadikasia-kodikopoiisi-nomothesias-ape/periechomena/timologisi-energeias-apo-ape/

[13] http://www.cres.gr/pvcatalog/FEK_1079_2009.pdf or http://www.deddie.gr/Documents2/%CE%A6%CE%A9%CE%A4%CE%9F%CE%92%CE%9F%CE%9B%CE%A4%CE%91%CE%99%CE%9A%CE%91/eidiko%20programma%20steges/nomothesia/%CE%A6%CE%95%CE%9A%201079_4-6-2009.pdf

[14] http://www.ypeka.gr/LinkClick.aspx?fileticket=pnhppGnURds%3D

[15] http://www.ypeka.gr/LinkClick.aspx?fileticket=6FFnUN2JqSg%3d&tabid=555&language=el-GR

[16] The term "Specific Programme" refers to the *Specific Program for the Development of Photovoltaic systems on buildings and specifically on their lofts and roofs*

- monuments, buildings used as worship places, industrial installations, manufactories, workshops;
- Buildings that are characterized as protected either as part of specific environment or due to their unique architecture or historical value such as preserved and located in traditional settlements are exempted up to the degree that compliance to specific Minimum requirements of energy performance for buildings would altered by an unacceptable manner their character or appearance.
- Buildings of temporary use which based on their planning the duration of their use will not exceed the period of two years, industrial installations, laboratories, buildings for agricultural use – not residences - with low energy requirements and similar buildings that are used under a relevant national agreement that concerns the energy performance of the buildings (Law 3661/2008, Presidential Decree 100/2010; Law 4122/2013).
- buildings with a total useful floor of less than 50 square meters only the minimum requirements of Energy Performance about the building elements of the building are set (not for the technical characteristics of the installations).

The "Specific Programme" concerns Photovoltaic (PV) systems with power up to 10kW$_p$ for buildings that are used either as households or for housing small businesses. It will last until 31 December 2019 and covers the whole Hellenic territory. Initially non-interconnected with the mainland system islands were exempted, but based on a RAE decision (1251/2010) these islands have been included since January 10th 2011[17] (HELAPCO, 2013; Joint Ministerial Decision No. 12323, 2009). The allowed capacity is for them up to 5kW$_p$ (HELAPCO, 2013). Natural persons that are non-traders and natural or legal persons that are traders (of very small businesses) can participate at the "Specific Programme" as long as they own a space at which they can install a PV system. The only condition is that there has to be an active connection for electricity consumption in the name of the PV owner at the building where the system is installed.

The two policy instruments interact between the target groups of the "Specific Programme" ie households of different types (for example detached houses, apartments and apartment complexes), multi-apartment buildings, offices, hotels – restaurants, buildings for wholesale and retail trade services and any other category of buildings that are consuming energy.

Interactions between rules-influencing mechanisms

Within the framework of the "Regulation for the Energy Performance of Buildings (KENAK)" and the provisions of Law 3851/2010[18] (Government Gazette 85 A, 04.06.2010[19]), the use of RES in buildings and particularly the production of domestic hot water use by solar systems is obligatory for new buildings, while for those buildings that are totally renovated the needs for hot water can be covered partially by solar thermal systems (YPEKA, 2014). The minimum percentage of annual solar share (in renovated buildings) is defined at 60% (YPEKA, 2014). This obligation is not applied for the uses that are exempted by the KENAK or when needs in domestic hot water use are covered by other decentralized energy supply systems that are based on RES, CHP, tele-heating systems (regionally or building block scale), heat pumps whose seasonal performance factor must be higher than 3,3 (YPEKA, 2014).

[17] http://www.deddie.gr/el/upiresies/fwtovoltaika-kai-alles-ape/fv-tou-eidikou-programmatos-stegwn (available in Greek language)

[18] The law is about "Accelerating the RES development and confronting climate change - other provisions for issues under the responsibility of the MEECC

[19] http://www.ypeka.gr/LinkClick.aspx?fileticket=pnhppGnURds%3D

The Joint Ministerial Decision for the "Specific Programme" sets also the rule that "part of the thermal needs in domestic hot water use under the household of the PV owner needs to be covered by renewable energy sources such as solar thermal systems and solar water heaters. The PV owner should not receive public financial support due to the Development-Investment Law or European financial mechanisms or any other funding resource so as to participate at the "Specific Programme" (Joint Ministerial Decision No. 12323).

The connection to the grid and to the interconnected system of photovoltaic systems that are installed at the premises of public authorities for research purposes is possible (Law 4023/2013 – Government Gazette 235 A, 11.11.2013[20]). Surplus of the electric energy that is provided to the system or the grid from these systems and up to 20% of the total produced energy annually is compensated according to provisions of Law 4023/2013.

The Joint Ministerial Decision No. 12323 for the "Specific Programme" has provisions about: i) contracts and solution of contract; ii) installation and operation of the PV system – connection to the grid; iii) tax treatment; iv) measurements; and v) obligations of the PV owner.

Table 3: Feed-in-tariffs for PV systems installed on roofs.

Month/Year	Feed-in-tariff (EUR/MWh)
2009	550,00
2010	550,00
2011	550,00
January 2012	522,50
August 2012	250,00
February 2013	238,5
February 2013	125,00
August 2013	125,00
February 2014	120,00
August 2014	120,00
February 2015	115,00
August 2015	115,00
February 2016	110,00
August 2016	110,00
February 2017	105,00
August 2017	100,00
February 2018	95,00
August 2018	90,00
February 2019	85,00
August 2019	80,00

Note: for years 2009, 2010, 2011 and for January 2012 the figures were defined in Government Gazette 1079 B, 04.06.2009. For February 2012 the figure was defined in Government Gazette 97 B, 31.01.2012. For August 2012 and February 2013 the figures were provided under Government Gazette 2317 B, 10.08.2012. The price changed for February 2013 by the Joint Ministerial Decision Φ1/1289/9012 (Government Gazette 1103 B, 02.05.2013[21]). (Source: YPEKA, 2015[22]; HELAPCO, 2013)

[20] http://www.depa.gr/uploads/files/ethniko_el/FEK235_1%2011%202013_%CE%A1%CF%85%CE%B8%CE%BC%CE%AF%CF%83%CE%B5%CE%B9%CF%82%20%CE%98%CE%B5%CE%BC%CE%AC%CF%84%CF%89%CE%BD%20%CE%91%CE%A0%CE%95.pdf

[21] http://www.ypeka.gr/LinkClick.aspx?fileticket=CPlp8mM2iTg%3D&tabid=555&language=el-GR or http://www.deddie.gr/Documents2/Fotovoltaika/%CE%A6%CE%95%CE%9A%201103_2-5-2013.pdf

[22] http://www.ypeka.gr/Default.aspx?tabid=785&sni%5B524%5D=2401&language=el-GR

Rules for the feed-in-tariffs, bills and payments are also defined. In 2010 the amount of the feed-in-tariffs was 550 EUR/MWh (Law 3851/2010). New adjustments followed. The figures in Table 3 demonstrate why the feed-in-tariffs (financial policy instrument of the "Specific Programme") were a strong incentive that contributed to the penetration of PV systems installed on lofts-roofs (HELAPCO, 2013). The target groups that fall under both policy instruments benefitted the most. Furthermore, the reduction of the average investment cost for PV systems with installed capacity up to 10kW$_p$ was another significant factor for this penetration. The reduction was 64% comparing prices in year 2010 and 2013 (HELAPCO, 2013).

Interactions between the implementation network/ governance structure

The two main entities that are responsible for the implementation of both policy instruments are the MEECC and CRES (details can be found in D.1.1 and D.1.2). MEECC has established a special service under its supervision for providing information about investments for RES[23]. The implementation network includes also the Regulatory Authority for Energy (RAE), the Technical Chamber of Greece and the Hellenic Electricity Distribution Network Operator S.A. (HEDNO S.A.[24]).

In 2013, because of the activities of implementation network, there were approximately 150 small and medium companies activated in the field (solar systems) with about 3.000 people working in this area (Build Up Skills – Energy Training for Builders, 2013).

1.1.3 Case Study for the Transport Sector

Please see first case study. It is common case.

1.2 Policy Instruments with an Indirect Link to Energy

1.2.1 Case Study for the Buildings Sector

No case study.

1.2.2 Case Study for the Transport Sector

Introduction

The examined policy interactions are between the planning policy instrument for "*Intelligent transport systems*" and the regulatory policy instrument for "*Emission standards (Euro 5 and 6)*". The first policy instrument will be presented in the following paragraphs while the second one was described in D.1.2. The first policy instrument does not have a direct link with energy; it belongs to the policy area of "Communications-Technologies".

[23] http://www.ypeka.gr/Default.aspx?tabid=546&language=el-GR (available only in Greek language)
[24] http://www.deddie.gr/en/upiresies/fwtovoltaika-kai-alles-ape/fv-tou-eidikou-programmatos-stegwn

Directive 2010/40/EU[25] (dated 7 July 2010) "*on the framework for the deployment of Intelligent Transport Systems[26] in the field of road transport and for interfaces with other modes of transport*" set into force this planning policy instrument of the EU transport policy that concerns traffic management.

Presidential Decree No. 50 (Government Gazette 100 A, 27.04.2012[27]) incorporated Directive 2010/40/EU into national legislation, but the document presenting the "*National Strategy for the Intelligent Transport Systems, 2015-2025*" was released by the Ministry of Economy, Infrastructure, Shipping and Tourism this year (March 2015) (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015). This document aims to identify shortages for the ITS, to present the relevant national needs and to define a set of principles that are required for the ITS implementation (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015). The document serves as a Roadmap for planning, implementing, operating and maintaining the ITS.

An indicative example of the use of ITS in the country is for supporting the maritime-railway interconnection. Such integration in Greece is the 17 km of railway connection between the port of Neo Ikonio (Port Authority of Piraeus) and the Thriasio area freight centre. Among the benefits of this interconnection are: elimination of congestion in ports; improved transit times; improved utilization of resources (South East Europe, 2013).

However, the implementation in Greece of the planning policy instrument for the "Intelligent Transport Systems" encounters barriers such as required investment costs, financing restrictions, uncertainty as to the payback period - ROI, failure of planning, while others are technical (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012). These obstacles are due attributed mainly to economic instability and uncertainty about demand (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

The "Intelligent Transport Systems" policy instrument is creating a promising positive synergy with the regulatory policy instrument of "Emission Standards (Euro 5 and Euro 6)". The implementation of ITS will probably contribute significantly in the reduction of road transport related GHG emissions, but empirical evidence to quantify the potential is not yet sufficient (European Commission, 2009). ITS for fuel consumption and/or emissions will allow monitoring and feedback so as to influence driving style and vehicle behavior (Ministry of Infrastructure, Transportation and Networks, 2014; European Commission, 2009). On the other hand, GHG emission reductions depend on cleaner cars and cleaner fuels. A combination of new technologies, improved efficiency of highway and vehicle operations, changing the driving behaviour and cutting-edge public policy will lead to the expected EE outcomes (European Commission, 2009).

This type of policy interaction is presented in the next paragraphs.

Relation to energy efficiency

A preliminary cost-benefit analysis that was carried out for the Commission indicated a positive cost/benefit ratio for real-time traffic information in a 10-year study window (2015-2025) (European Commission, 2014). The identified benefits included: i) the accelerated provision of information about traffic management measures (implemented in case of incidents and location along the road

[25] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:207:0001:0013:EN:PDF

[26] Intelligent Transport Systems (ITS) are advanced applications that integrate telecommunications, electronics and information technologies with transport engineering in order to plan, design, operate, maintain and manage transport system. ITS provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated and 'smarter' use of transport networks.

[27] www.yme.gr/getfile.php?id=4653

network of other real time traffic data (e.g. location of queue)), and ii) efficient routing for equipped drivers (also for areas where there is no variable message sign) iii) reduced costs for digital map providers and ITS service providers due to more / easier access to data (European Commission, 2014).

It is estimated also that road congestion leads to economic losses of approximately 1% of GDP, while more than 35.000 citizens are killed on the road per year (European Commission, 2010). Possible benefits of including traffic management measures such as the ITS (implemented in case of incidents so as to provide necessary data for real time traffic information services) could result to 167,8 million EUR whereas including road-works information would lead also to benefits of 182,6 – 219,1 million EUR (European Commission, 2014). For the Hellenic case this problem is particularly important, since for the last decade approximately 1,500 people on average are lost in road traffic accidents annually, while the estimated socio-economic cost of road accidents is more than 5 billion EUR annually (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

From the point of efficiency the benefits concern the public and the private sector. However, benefits for business are difficult to be quantify due to costs of poor data and poor access that are usually hidden within organisations or because benefits will result in terms of new services. The distribution of the benefits between the two sectors is difficult to be established (European Commission, 2014).

Future trends aim to the further improvement of the traffic management, the reduction of pollution and of fuel consumption and to increasing the level of road safety (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015). These trends will be supported among others with e-ticketing, navigation systems for road safety and protection, ITS for logistics and supply chain, services for sustainable mobility and systems for improved environmental and energy efficiency (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015).

The ITS implementation is expected to increase employment and create new green jobs, which are priority objectives of the broader political agenda of Greece (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

The second policy instrument with which the planning instrument for ITS interacts is the "Emission standards (Euro 5 and Euro 6)". The EC Regulation No. 443/2009[28] "*setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles*" introduced common requirements for emissions from motor vehicles and their specific replacement parts (standards Euro 5 and Euro 6). It also laid down measures, allowing improved access to information on vehicle repairs and promoting the rapid production of vehicles in compliance with the provisions of the Regulation. Its combination with the "ITS" can demonstrate the outcomes of EE efforts (real-time information about fuel consumption, fuel economy, GHG emissions etc, less travelling but with clean vehicles).

Interactions between objectives

The objectives of Directive 2010/40/EC are: i) establishment of the necessary specifications to ensure the accessibility, exchange, reuse and update of road and traffic data for the provision of real-time traffic information services in the European Union (European Commission, 2014). ii) Optimal use of road, traffic and travel data continuity of traffic and freight management ITS services; ITS road safety and security applications; Linking the vehicle with the transport infrastructure. Facilitation of Traffic management is the main objective of ITS.

[28] http://eur-lex.europa.eu/legal-content/EL/TXT/?uri=CELEX:32009R0443

According to this Directive it is expected that the ITS application[29] (to the road transport sector and its interfaces with other modes of transport) will contribute significantly to improved environmental performance, efficiency, including energy efficiency, safety and security of road transport, including the transport of dangerous goods, public security and passenger and freight mobility, ensuring also the functioning of the internal market and increasing the levels of competitiveness and employment. The ITS provide reduced travel time, savings by avoiding unnecessary vehicle-kilometers, reduction in fuel consumption, reduction in environmental pollution and of accidents (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015).

The purpose of the emissions standards "Euro 5 and Euro 6" is to limit the pollution caused by road vehicles and support emission reduction actions in transport by introducing stricter limits on polluting emissions. These limits are applicable to light road vehicles, particularly with regard to emissions of particles and nitrogen oxides.

The two policy instruments share common secondary objectives which are the improvement of environmental performance (reduction of polluting emissions) and of energy efficiency (support of emission reduction actions).

Interactions between target groups

The introduction and usage of ITS forms the following set of target groups: public authorities, private service providers (satellite links, internet, dedicated cable networks etc), road operators, private companies that develop and purchase the necessary equipment (traffic cameras, loop detectors), companies that own, elaborate and provide data and end-users (travelers, all categories of drivers (professional drivers, taxi drivers, drivers in public vehicles, elderly people etc) (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015; European Commission, 2014; TISA, 2014).

Under the emissions standards the target groups are: i) vehicle manufacturers and ii) owners of vehicles (categories[30] M1, M2, N1 and N2, with reference mass not exceeding 2.610 kg[31]). These vehicles include, among others, passenger vehicles, vans and commercial vehicles intended for the carriage of passengers or goods or certain other specific uses (for example ambulances), provided that the vehicles are equipped with engine-spark ignition (gasoline engines, engines with natural gas or Liquefied Petroleum Gas - LPG) or compression ignition (diesel engines).

In order to limit as much as possible the negative impact of road vehicles on the environment and health, the Regulation (for Euro 5 and Euro 6) covers a wide range of pollutant emissions: carbon monoxide (CO), non-methane hydrocarbons and total hydrocarbons, oxides of nitrogen (NO_x) and particulates (PM). These include emissions of tailpipe, evaporative emissions and crankcase emissions.

The end-users (drivers of all vehicle types, private and publlic) are the common subset of the two target groups that benefit from the implementation of both policy instruments. Owners of vehicles with technology of Euro 5 and 6 when using ITS save travel time, consume less fuel and emit less.

Interactions between rules - influencing mechanisms

The Ministry of Economy, Infrastructure, Shipping and Tourism (MEIST) (former Ministry of Development, Competitiveness, Infrastructure, Transport and Networks) supports centrally the

[29] ITS applications should be without prejudice to matters concerning national security or necessary in the interest of defense.

[30] http://www.dft.gov.uk/vca/vehicletype/definition-of-vehicle-categories.asp

[31] defined in Annex II to Directive 70/156/EEC

availability of real-time traffic data which are accessible by the private sector for a fee (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

There are emission limits for each category of pollutant emissions and for the different types of vehicle. According to provisions of EC Regulation 715/2007, the Member States shall lay down the provisions on penalties "applicable for infringement by manufacturers" according to their obligations under the Regulation. The respective penalties must be effective, proportionate and dissuasive.

Offences subject to a penalty include: a) making false declarations during the approval procedures or procedures leading to a recall; b) falsifying test results for type approval or in-service conformity; c) withholding data or technical specifications which could lead to recall or withdrawal of type approval; d) use of defeat devices; and e) refusal to provide access to information.

There is no policy interaction under this category.

Interactions between implementation network/ governance structures

The same authority is responsible for the implementation of both policy instruments, ie the Ministry of Economy, Infrastructure, Shipping and Tourism.

For the planning policy instrument of ITS, the pertinent national authority will be the Department of Planning and Development of Transport that is under the General Directorate of Transport of the Ministry of Economy, Infrastructure, Shipping and Tourism (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015). This Department is assigned with the following responsibilities (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015):

- Implementation of the "National Strategy and Architecture for the ITS". It is also responsible for the update and specialization of this strategy when these are required;
- Installation of the implementation rules presented in national and European regulation documents for ITS;
- Monitoring of the progress for implementing the actions that derive from the national and European regulation documents for ITS
- Operation of the Advisory Committee for ITS and of the ITS Observatory;
- Supervision of the registries with data required by the national and European regulation documents for ITS.

The Advisory Committee for ITS provides periodically or whenever that is necessary, consulting services to the Department of Planning and Development of Transport (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015).

The ITS Observatory records the ITS actions, evaluates them through appropriate indexes, the implementation outcomes and the ITS performance so as to draw objective conclusions for the progress of their implementation in Greece and the level of coordinated penetration of the ITS applications. The ITS observatory is under the supervision of the Department of Planning and Development of Transport (Hellenic Republic, Ministry of Economy, Infrastructure, Shipping and Tourism, 2015).

The Institute for the Management of Information Systems "Athena" has developed and maintains the website www.geodata.gov.gr, so as to provide national support through a central point for collection, search, distribution and visualisation of information, e.g. bus routes (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

However, there is an overlap by entities such as Municipalities, OASA[32] and the Egnatia Motorway in the performance of necessary actions (ie for implementing an integrated combined public information system for traffic, parking places and routes; informing public transport passengers etc) (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012). Defined roles and responsibilities for planning and coordination of such actions are not allocated clearly across the various levels of government (central government, local government) and transport operators (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

Other obstacles for the ITS implementation in the country are: i) Insufficient collaboration between public (central and regional) authorities and private entities; ii) lack of information for transport operators about the ITS and how they could implement them successfully, producing benefits for enterprises (Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, 2012).

For the second policy instrument the Directorate "Vehicles Technology" of the MEIST is responsible for these issues. However, there are no available information about the implementation.

The policy interaction can be positive if the aforementioned obstacles are confronted.

[32] See Deliverable 1.1 for more information

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