National Renewable Energy Source Industry Roadmap

GREECE

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Renewable Energy Policy Action Paving the Way towards 2020

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I. CURRENT SITUATION

The New Government formed after the parliamentary elections of October 4^{th}, 2009 has announced a strongly oriented policy towards sustainable development.

- A new Ministry for the Environment, Energy and Climate Change has been established in order to bring under one sole structure the respective bodies committed with the greatest part of RES licensing procedure, related to energy, environmental and forestry policies. The new Ministry is replacing two Ministries of the previous Government: the Ministry of Environment, Physical Planning & Public Works and the Ministry of Development. The aim of the reform is to facilitate the effective promotion and to fasten the adoption of legislative actions and measures in favour of sustainable development.
- Towards the achievement of the set targets by the 2009/28/EC Directive and the international commitments of the country for protection of the environment, the Greek government adopted a “green development” model (Prime Minister’s speech in the house on the stability and development programme, March 22^{nd} 2010).

An important move towards this direction is the key objectives of Greece under the 2009/28/EC Directive and additionally as highlighted within the present Greek Renewable Energy Action Plan that are leading to a long term development strategy of the Greek energy system, going further than the milestone year of 2020 while ensuring the drastic reduction of GHG emissions, the escalating penetration of RES and achieving energy saving at end-use. Moreover, the Greek energy system planning will serve as a key instrument for boosting both the competitiveness of the economy and the entrepreneurship at national and local level.

To provide some key facts about the Greek energy mix, it should be mentioned that the contribution of RES to the national energy balance was about 5% in 2008, at the level of total gross inland energy consumption and around 16.3%, at the level of primary energy production. Primary energy produced from RES in 2008 was 1.64 Mtoe. Out of these, 600 ktoe are accounted to the use of biomass in households, 265 ktoe to the use of biomass in industry, 285 ktoe from hydroelectric generation, 193 ktoe from wind energy, 174 ktoe from solar thermal systems, 63 ktoe from biofuels, 35 ktoe from biogas, mainly for electricity generation and 17 ktoe from geothermal energy.

From a technical point of view, Greece has a rich wind and solar energy potential, which has already attracted market investments, as well as a promising biomass and geothermal potential which however, still remains untapped. Hydro potential is vastly exploited but a further exploitation of several new large hydro plants together with a limited number of small hydro plants is envisaged.

The targets set within the RES roadmap until 2020, call for strategies elaboration which serve the simultaneous fulfilment of the “20-20-20” obligations and the boost of the Greek economy in terms of “green” development and competitiveness of the Greek market. Towards this direction the new law 3851/2010 (OG A/85/4th June 2010) “Accelerating the development of Renewable Energy Sources to deal with climate change and other regulations in topics under the authority of the Ministry of Environment, Energy and Climate Change”, amends significant provisions of the currently applicable legislation, aiming to assist towards the simplification of the licensing procedure, the rationalization of the feed-in-tariff scheme, to tackle specific barriers at local level, as well as to establish specific regulations for the use of RES in buildings in accordance with the recently released “Energy Performance of Buildings Regulation” - KENAK (OJ

407/B/2010). Additionally, L3851/2010 sets specific targets for 2020 regarding the share of RES in final energy consumption, electricity generation and contribution in heating, cooling and transport.

However, to be more specific, it is essential to undertake the following framework and technical measures in order to achieve the planned evolution of the Greek energy system.

RES-Electricity

Higher penetration of RES in the electricity generation will be achieved through a coordination and implementation of fiscal, regulatory, spatial planning and technical measures that are targeted to exploit the technical potential for development of large RES plants, to complete the necessary grid infrastructure works, to work towards the establishment of a distributed power generation structure in the planning of the new power plants and to facilitate the gradual decommissioning of the old and outdated thermal power plants.

The different RES technologies should be considered both on the most cost-efficient and domestic added value aspects. Security of supply, reduction of GHGs emissions and competitiveness of the Greek economy are key parameters in the design of the national energy policies and are also considered in the elaboration of the Greek NREAP, while all the relevant indexes related to the socio-economic and demographic factors as well as the costs associated with the RES technologies are regarded in relation with the different scenarios in order to meet the 2020 target.

Moreover, the development of RES plants requires the successful tackling of identified barriers, related with social oppositions at local level, bureaucratic constraints, lengthy timeframes for the licensing procedure and deficiencies in the spatial planning.

Considering the characteristics of the Greek energy system, measures and targets are decided on two different pillars:

a. Electricity – Interconnected system

The energy supply of the interconnected system will be based on the power production from:

- *Lignite power plants which will be modernized using "CCS ready" technology, as well as adopting new technologies for biomass residues exploitation, through co-firing and CO_2 emissions reduction, along with the gradual decommissioning of the less efficient and more pollutant ones.*
- *Large scale RES plants, mainly large hydroelectric and wind farms, as well as medium scale RES plants (photovoltaic plants, small hydro, biogas, geothermal plants, biomass co-generation, CSP); Additionally, new hydroelectric reversible pumping plants will become operational, contributing towards the stabilization of variable power generation from wind parks.*
- *Further utilisation of Natural gas combined cycle plants and of smaller degree gas turbines.*
- *Development of CHP plants*

b. Electricity – Non-connected islands

The main priorities for the non-connected islands are:

- *Gradual grid connection of the islands, which will secure electricity supply from the mainland to the islands, resulting also in the decommissioning of the local oil-fired plants.*
- *Delivery of power produced by local RES plants (high potential of wind, solar and in some cases geothermal energy) and supply of the excess electricity towards the mainland via the new grid connections.*
- *Development of local hybrid RES plants while considering the local resources and needs.*
- *Development and exploitation of offshore wind parks, development of concentrated solar power plants and possibly wave energy in a timeframe also beyond 2020.*
- *Design of RES energy autonomous systems and pilot implementation on small non-connected islands.*

<u>RES-Heat</u>

In order to accomplish the National Renewable Energy Action Plan and the “20-20-20” targets it is foreseen to develop specific national energy policies and to establish new financial incentives for the support of the heat production from biomass and geothermal energy, along with the implementation of all the technical measures that are described in the “Energy Performance of Buildings Regulation”, aiming to achieve significant energy savings. Although solar thermal applications already have a significant penetration, it is considered that a new fiscal framework will further assist, along with the technical requirements that are set from the “Energy Performance of Buildings Regulation”.

The new building regulation will act as the main legislative tool for the promotion of RES systems for heating and cooling in the tertiary and residential sector, while the development of specific policies and fiscal instruments will additionally foster the development of such systems also in the industry and the agriculture sector. Furthermore, the successful implementation of energy saving measures and the end-use along with the development of new market mechanisms (i.e. ESCOs) for both the public and private sector are considered essential in order to achieve the projected RES share in heating and cooling.

<u>RES-Transport</u>

The penetration of biofuels in the transport sector will be achieved through a combination of regulatory actions targeted to promote both the use of more energy-efficient vehicles and the domestic production of the required amounts of biodiesel in order to meet the 2020 target. Emphasis will be given to the exploitation of the local potential for the development of energy crops for biofuels and the development of the necessary supply chains in order to assure a significant contribution of the domestic resources. The additional development of specific policies and fiscal instruments will facilitate both the supply and use of the biofuels in the transportation sector, in compliance with the set targets.

II. TARGETS AND TRAJECTORIES

- NATIONAL OVERALL TARGET

The new law L3851/2010, notes that the protection of the climate, through the promotion of electrical energy production from RES, constitutes an environmental and energy priority of the highest significance for the country and sets specific targets for RES electricity share (40%), RES heating and cooling share (20%), RES transport share (10%) in order to achieve the national target of contribution of the energy produced from R.E.S. to the gross final energy consumption by a share of 20%.

The target regarding the share of renewable energy sources in final energy consumption in 2020, will be achieved through the combination of a mix of measures related to the implementation of policies in the field of energy efficiency and the large penetration of RES technologies both in electricity production and heat supply.

(A) Share of energy from renewable sources in gross final consumption of energy in 2005 (S_{2005}):	6.9 %
(B) Target of energy from renewable sources in gross final consumption of energy in 2020 (S_{2020}):	18 %
(C) Expected total adjusted energy consumption in 2020 (from table 1, last cell)	24012 ktoe
(D) Expected amount of energy from renewable sources corresponding to the 2020 target (calculated as B x C)	4322 ktoe

Table 1: National overall target for the share of energy from renewable sources in gross final consumption of energy in 2005 and 2020:

The Centre for Renewable Energy Source and Saving (CRES) and the Fraunhofer Institute developed two energy demand scenarios for Greece based on two different targets (figure 1). For CRES the target of energy from renewable sources in gross final consumption in 2020 is 20.4% and for Fraunhofer 20.2%. The estimated results are shown in Table 2.

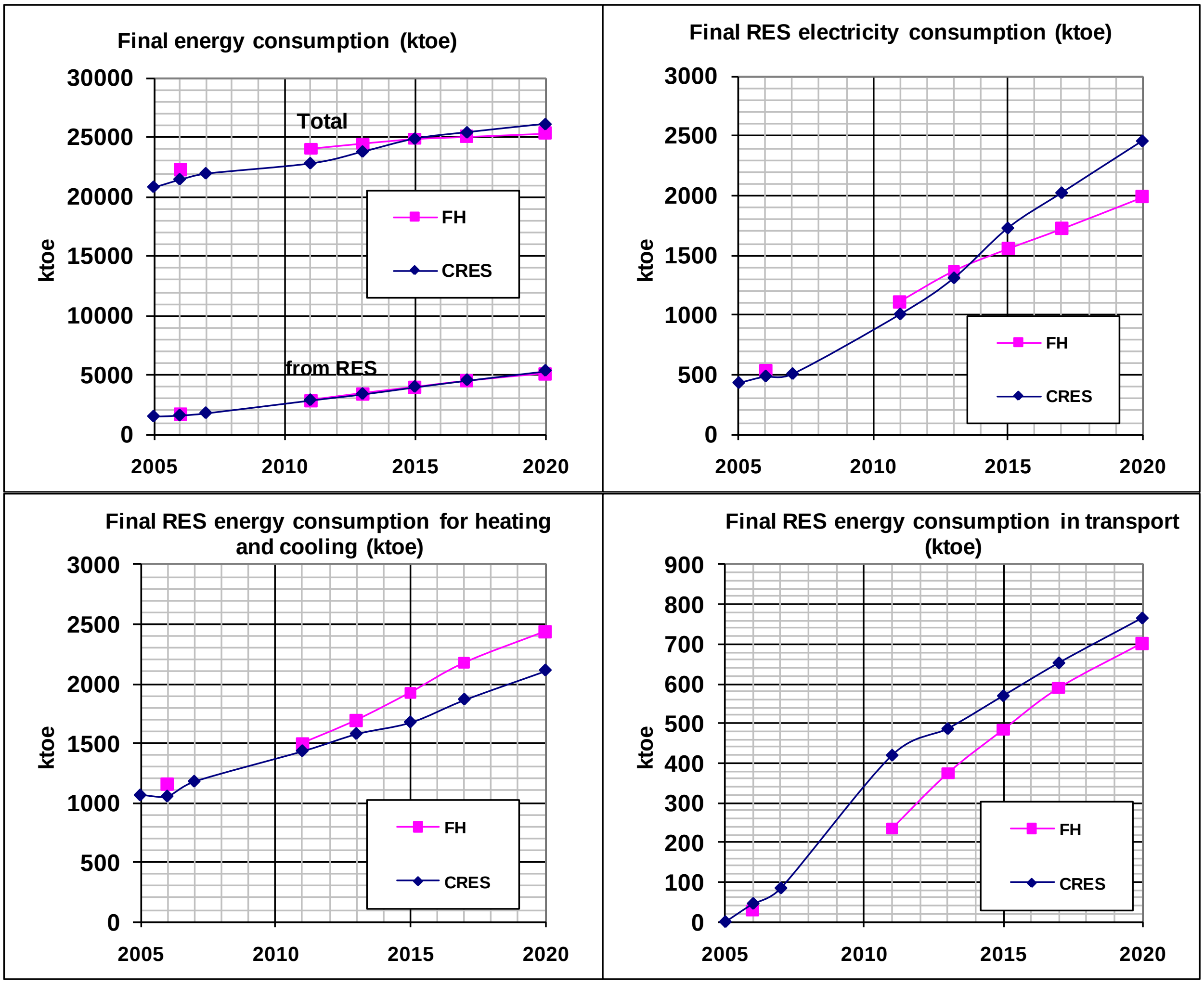

Figure 1. Final energy and RES consumption according to CRES and Fraunhover scenarios: a) total, b) electricity, c) heating and cooling and d) transport.

Ktoe/%		2005	2006	2007	2011-12	2013-14	2015-16	2017-18	2020
Expected gross final energy consumption from renewable sources (ktoe)	CRES	436	491	511	1010	1313	1730	2025	2459
	FH		532		1114	1372	1557	1726	1993
Expected RES contribution to final electricity consumption (%)	CRES	7.9	8.8	8.8	18.97	23.78	30.3	34.2	39.31
	FH		9.7		20.45	24.28	27.41	29.82	33.64
Expected gross final consumption for heating and cooling from RES (ktoe)	CRES	1066	1057	1181	1435	1579	1676	1866	2109
	FH		1159		1498	1692	1925	2176	2441
Expected RES contribution to final consumption for heating and cooling (%)	CRES	14.7	14.4	16.2	16.32	16.98	17.16	18.86	21.05
	FH		13.52		16.1	17.7	19.73	22.29	24.89

Expected gross final energy consumption in transport from RES (ktoe)	CRES	0	46	85	420	487	570	653	766
	FH		28		235	374	484	589	702
Expected RES contribution to final consumption in transport (%)	CRES	0	0.54	0.96	6.38	7.23	8.09	9.16	10.65
	FH		0.34		2.58	4.03	5.12	6.18	7.28
Expected RES contribution to gross final energy consumption (%)	CRES	7.20	7.40	8.10	12.57	14.21	16.09	18.85	20.42
	FH		7.70		11.8	14.00	15.90	17.90	20.20

Table 2: Targets and potential trajectories for 2020 in the sectors of electricity, heating & cooling and transportation based on the scenarios of CRES and Fraunhofer.

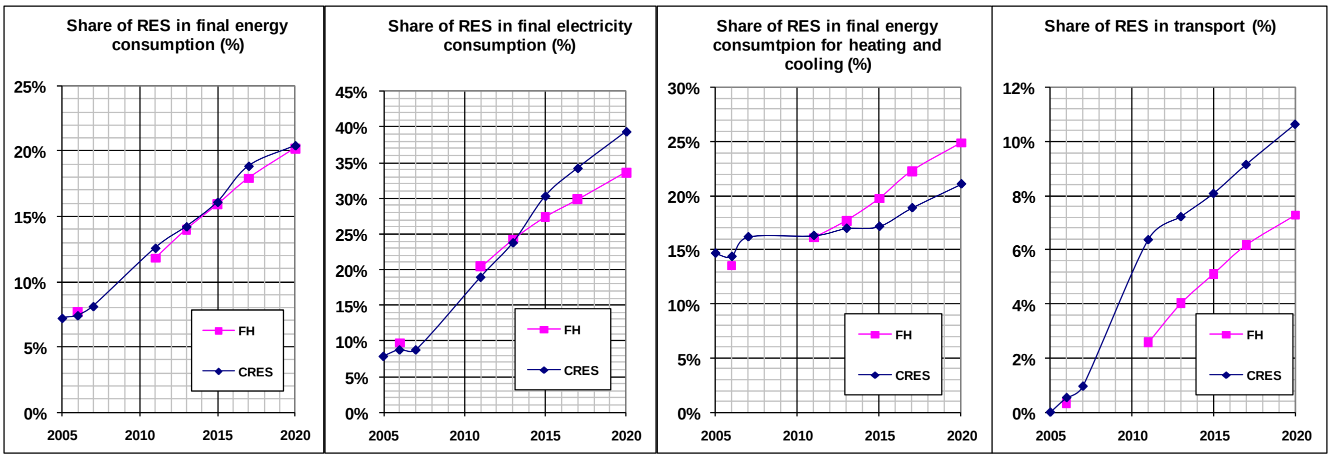

Figure 2: Targets and potential trajectories for 2020 in the sectors of electricity, heating & cooling and transportation based on the scenarios of CRES and Fraunhofer.

- CONTRIBUTION OF RENEWABLES TO ELECTRICITY CONSUMPTION

In figure 3, the installed capacity of the different RES technologies for electricity production until 2020 based on the scenarios of CRES and Fraunhofer are compared.

The projected installed capacity and electricity production from the different RES technologies is presented in figure 4, while figures 5 & 6 present the contribution of the different technologies and fuels in power generation and installed capacity respectively, for CRES scenario. It is obvious that a steady-state growth of all the considered RES technologies and the gradual shift towards specific ones along with the technology advancements and the cost reduction per technology for electricity production is highly important for achieving the aforementioned targets.

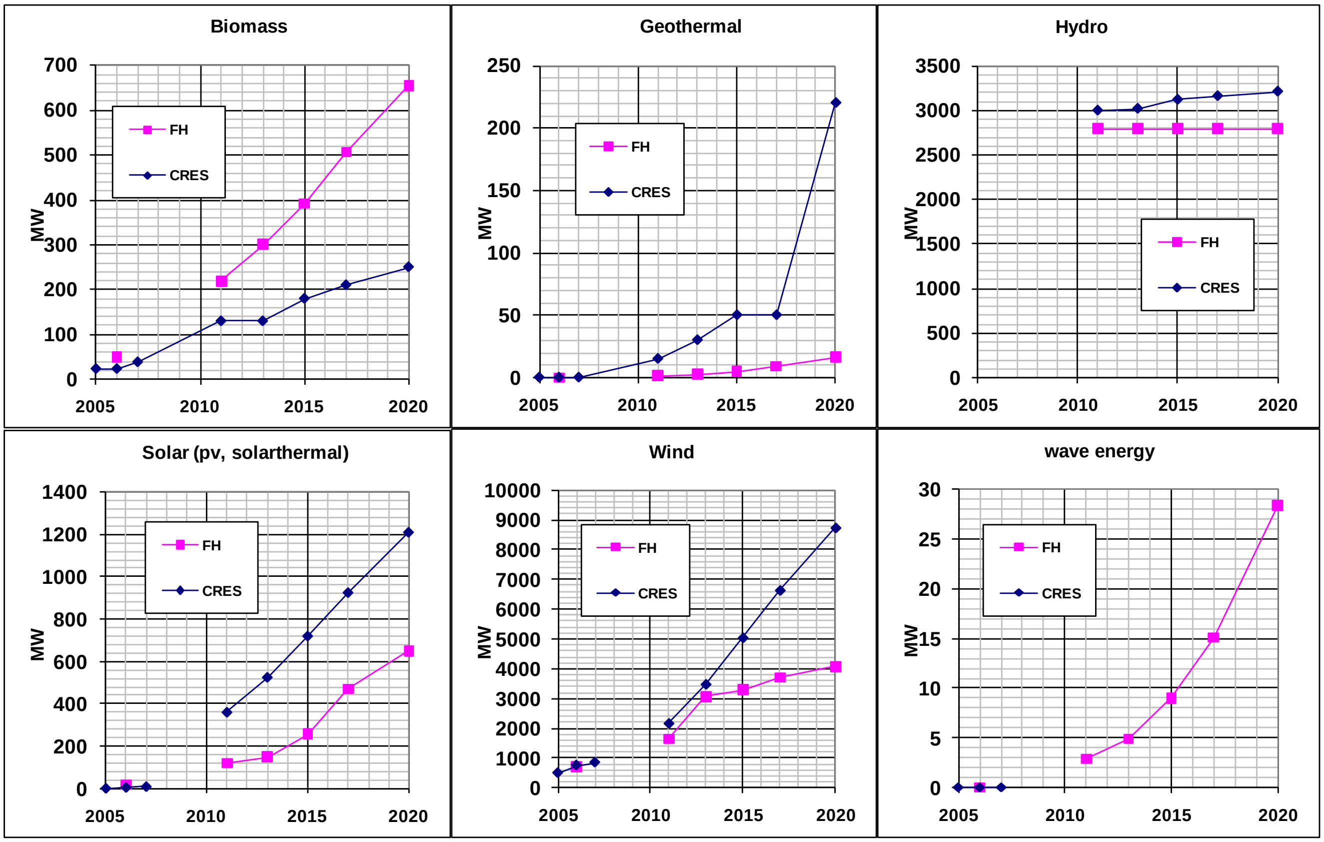

Figure 3. Estimated installed capacity of the different RES technologies for electricity production until 2020 based on the scenarios of CRES and Fraunhofer

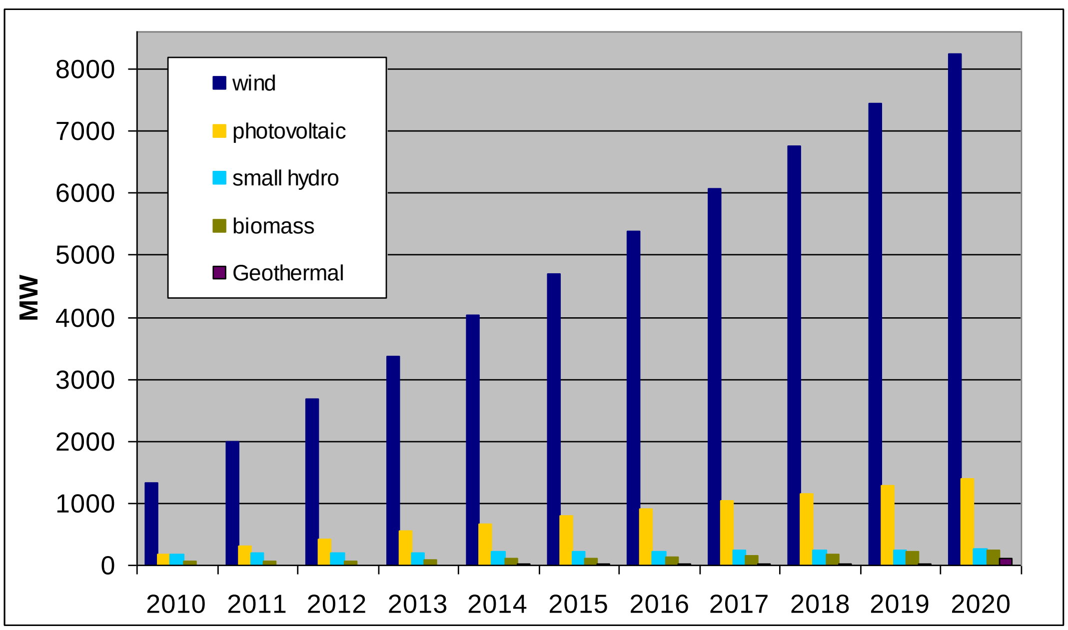

Figure 4. Estimated installed capacity of the different RES technologies for electricity production until 2020 (CRES)

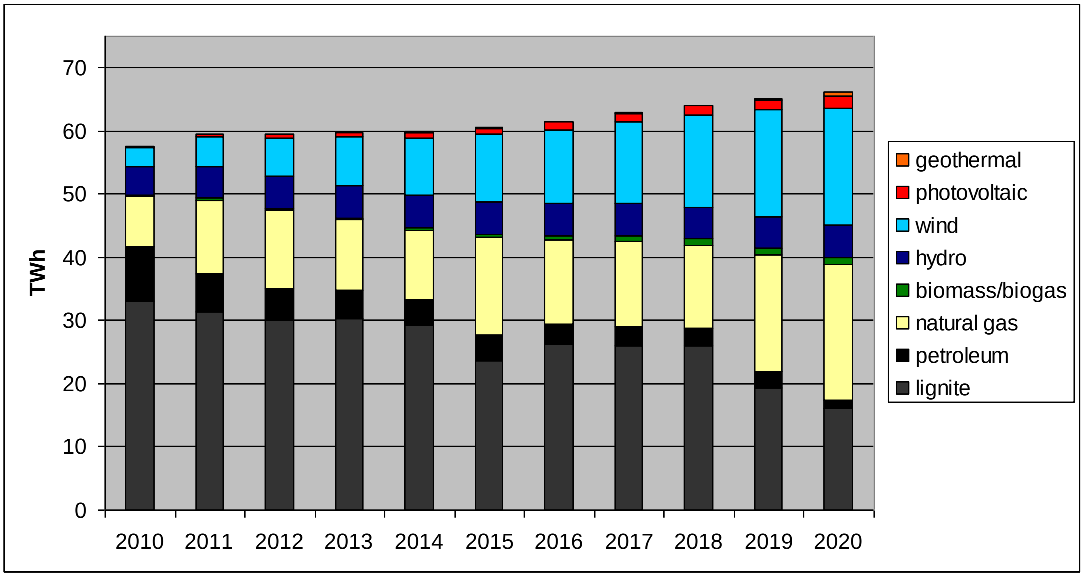

Figure 5. Estimated power generation from the different technologies/fuels until 2020 (CRES)

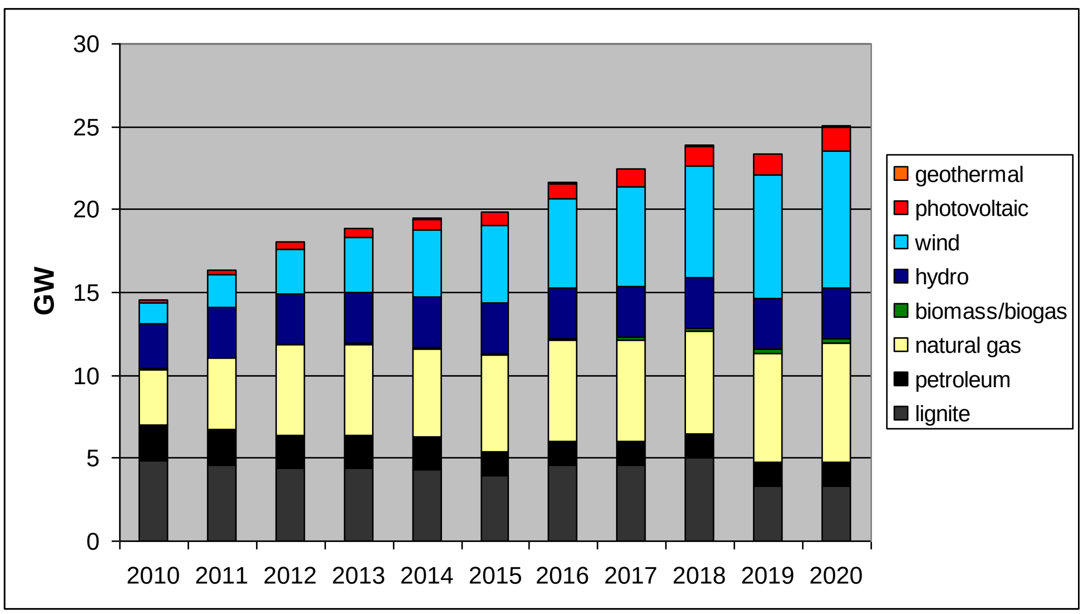

Figure 6. Estimated installed capacity from the different technologies/fuels until 2020 (CRES)

- CONTRIBUTION OF RENEWABLES TO HEATING AND COOLING CONSUMPTION

In order to meet the RES Heat and Cooling target the contribution of different technologies is presented in figure 7, which leads to a final share of 20,2% RES in heating and cooling.

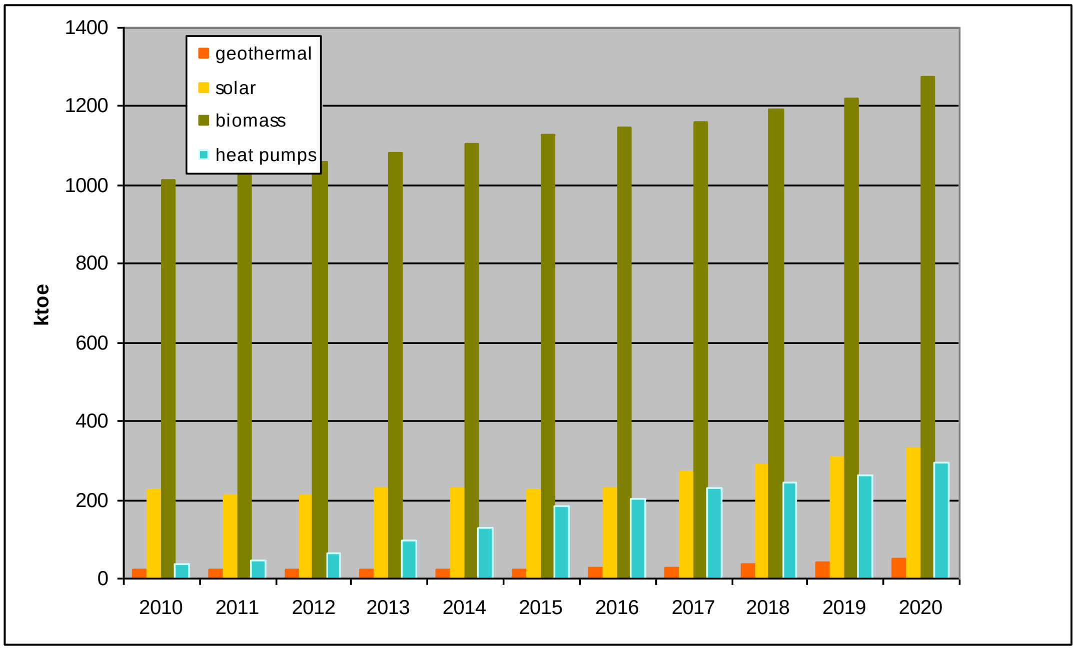

Figure 7. Estimated contribution of the different RES technologies for heating and cooling until 2020 (CRES)

- CONTRIBUTION OF RENEWABLES TO TRANSPORT FUEL CONSUMPTION

Table 3: Calculation table for the renewable energy in transport share

(ktoe)	**2005**	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
(C) Expected RES consumption in transport [1]	1,19	109,8	214,4	258,2	300,5	344,8	393,3	441,0	485,8	533,9	584,4	633,9
(H) Expected RES electricity in road transport[2]	0,00	0,7	0,7	0,9	1,0	1,2	1,3	1,4	1,6	3,3	4,5	5,1
(I) Expected consumption of biofuels from wastes, residues, non-food cellulosic and lingo-cellulosic material in transport	0	0	0	0	0	0	0	0	0	0	0	0

[1] Containing all RES used in transport including electricity, hydrogen and gas from renewable energy sources, and excluding biofuels that do no comply with the sustainability criteria (cf. Article 5(1) last subparagraph). Specify here actual values without using the multiplication factors.

(J) Expected RES contribution to transport for the RES-T target: (C) + (2,5 - 1) x (H) + (2 - 1) x (I)	1,2	110,8	215,5	259,5	302,1	346,5	395,3	443,1	488,2	538,9	591,1	641,6

III. MEASURES FOR ACHIEVING THE TARGET

- POLICY MEASURES

1. Measures on administrative procedures, regulations and codes.

As mentioned above the new **Ministry for the Environment, Energy and Climate Change** is responsible for the greatest part of the RES licensing procedure, related to energy, environmental and forestry policies.

The **Regulatory Authority for Energy** (RAE) is an independent administrative authority that was established on the basis of the provisions of L. 2773/1999. New competences and duties were assigned to RAE with respect to electricity and natural gas sectors by the Electricity Law 3426/2005 and the Gas Law 3428/2005, in alignment with the relevant provisions of the EC Directives 2003/54 and 2003/55, in particular with respect to access tariffs to electricity and gas networks, the terms and conditions for the provision of balancing services in natural gas, as well as on issues related to security of electricity and natural gas supply. Furthermore, RAE acts as a dispute settlement authority with respect to complaints against transmission or distribution system operator in both electricity and natural gas sectors.

DESMIE S.A. (Transmission System Operator of the Greek Electricity Transmission System), was created by Law 2773/1999, which transferred the responsibility for the operation of the transmission system for electricity from the producers to the grid. DESMIE ensures the electricity is supplied with security and reliability, incorporating producers into the systems (PPC and independent producers) in the most cost efficient way.

The Centre for Renewable Energy Source and Saving (CRES) is the national centre for Renewable Energy Sources, Rational Use of Energy & Energy Saving. Founded by Presidential Degree in 1987, CRES is supervised by the Minister of Environment, Energy and Climate Change and has financial and administrative independence. The mission of CRES is to promote RES/RUE/ES applications at a national level and under article 30 of L3734/2009; CRES facilitates the national energy planning, assists on the formulation of energy policies and fosters the development of research and development activities in the field of RES/ES.

Are there unnecessary obstacles or non-proportionate requirements related to authorization, certification and licensing procedures applied to plants and associated transmission and distribution network infrastructure for the production of electricity, heating or cooling from renewable sources, and to the process of transformation of biomass into biofuels or other energy products? If so, what are they?

The most important problem of this type in the country is related to the development of RES-E plants. In order to accomplish significant growth, identified barriers, related to social oppositions at local level, bureaucratic constraints, lengthy timeframes for the licensing procedure of both RES stations and grid infrastructure and deficiencies in the spatial planning should be carefully tackled. The law 3851/2010 which was recently enacted deals with the very important obstacle of local opposition.

Is comprehensive information on the processing of authorization, certification and licensing applications for RES installations available?

Public information with regard to the current RES legislative framework and proposed amendments or modifications (public consultation) is provided through the web sites of RAE, HTSO and the competent Ministries. The new Law foresees the establishment of the one stop shop unit/agency for facilitating all issues related to RES development under the auspices of the Ministry of Environment, Energy and Climate Change.

Should authorization procedure take into account the specificities of different renewable energy technologies? If yes, how?

Authorization procedure should take into account the specificities of the various renewable energy technologies. According to the provisions of Law 3468/2006 (art.4) exemptions from the requirement of issuing a Generation Licence are given in the following cases:

> i) Geothermal power plants of installed power ≤ 0.5MWe.
>
> ii) Biomass or bio-fuel plants of installed power ≤ 100kWe.
>
> iii) PV stations of nominal capacity ≤ 150kWp.
>
> iv) Wind power parks of installed power: ≤ 20kWe for plants in isolated microgrids; ≤ 40kWe for plants on the remaining non-interconnected islands; ≤ 50kWe for plants in the interconnected system.
>
> v) Power plants of installed power ≤ 5kWe operated by educational or research institutions of the public or private sector exclusively for RTD purposes.
>
> vi) Power plants installed by CRES for as long as these plants operate in order to carry out certification work or measurements.
>
> vii) Other RES power plants of installed power ≤ 50kWe.

The recently enacted Law 3851/2010, further simplifies the procedure. According to the new provisions for all the cases below, no generation license or exemption decision is needed. The candidate producers need to have only approval of the environmental terms and terms/conditions for access to the grid issued by the relevant administrator in order to sign a Power Purchase Agreement. Especially for PV stations with capacity lower than 500kW and rooftop PVs with capacity up to 10kW, no approval of the environmental terms is needed.

Should the renewable energy potential be taken into account in spatial planning?

The renewable energy potential should and is taken into account in spatial planning. The evaluation process includes a series of objective criteria such as the investor's technical and financial capability, project's viability and compliance with two basic provisions of the existing spatial planning, i.e RES are not installed within restricted zones and the total number of wind turbines allowed shall not exceed a prefixed capacity per municipality calculated with respect to the wind turbines diameter and the total area of the municipality.

How many steps should be needed to obtain the final authorization? Should there be a one-stop shop for coordinating all the steps? Should a timetable for processing applications be communicated in advance?

The main procedural steps towards granting the Operation License after commissioning are six (6) in the following order: Generation License (1) that is followed by the Environmental Terms Approval (2); Terms and Conditions for Access to the Grid (3) issued by the System Operator (HTSO or PPC); Approval for intervention on public land (4), the Installation License (5) and signing of the Power Purchase Agreement (6) between the investor and the System Operator. However, it should be emphasised that within the procedure for granting the approval of the environmental terms, several intermediate approvals from various public authorities are needed (average estimate 20, taking into account the specificities of different technologies e.t.c).

Up to now the average lead time for the entire authorisation procedure is lengthy and exceeds three and a half (3,5) years for small hydro power plants and wind farms. For PV stations with capacity below 2MW the average lead-time is one year while for larger stations the average lead-time is estimated at 2 years.

In order to streamline this, complying with the European directive 2009/28/EC, the law 3851/2010 enacted on 04.06.2010, sets the following mandatory deadlines for the intermediate stages of the RES licensing procedure:

- Generation license: three (3) months
- Environmental terms Approval: four (4) months for stations with a larger impact and two (2) months for projects characterized as ‘low or zero disturbance’ stations.
- Terms and Conditions for Access to the Grid: four (4) months
- Installation License: forty five (45) days

With the new law a one stop shop agency that coordinates all the steps is established with the Ministry for the environment Energy and Climate Change in order to cover the entire licensing procedure.

For which small scale projects, should there be simplified and less burdensome authorization procedures?

For the case of solar thermal systems the only license that is needed before the installation, is a “small works permit” given by the local building authorities. In case of multi-flat buildings, there should be a consensus from the other owners as well, which should be considered as the only barrier nowadays for this type of installations.

Furthermore, for the installation of Photovoltaic systems up to 10kW nominal capacity on the building’s rooftops, which are additionally entitled for a very favorable FIT scheme (Joint Ministerial Degree OG. B1079/4.6.2009), the procedure is rather simple as residential users do not have to be registered as “business” with the tax authorities and are exempted from any tax (with the exception of the 19% VAT paid for the initial investment). Small companies are also exempted from any tax as long as they keep the income from PV as untaxed reserves.

2. Measures concerning buildings.

There are no specific requirements for mandatory RES implementation in buildings, apart from those which are in place with the law on “Acceleration of RES development aiming at coping with the climate change and other provisions relevant to issues administrated by the Ministry of Environment, Energy and Climate Change”, Article 10 – RES implementation in buildings and specifically:

- Paragraph 3 states that after 1.1.2011 the new buildings must cover 60% of their need in hot water from solar thermal systems (the same requirements are also found in KENAK) and
- Paragraph 4 states that until 31.12.2019, all new buildings must cover their total primary energy consumption with energy supplied from RES, CHP, district heating on a large area scale/ block scale as well as heat-pumps.

Specific incentives are required (financial, tax, and legal) for this target to be met, as well as development of market mechanisms (ESCOs and TPF) and credit/loan schemes towards the building owners.

Specific measures and actions that ensure that public buildings fulfill an exemplary role by 2012 are foreseen:

- in the Joint Ministerial Decree (OG 1122/B/2008) "Measures to improve energy efficiency and energy saving in the public and broader public sector”,
- in the draft law entitled "Measures to improve energy efficiency in end-use energy services and other provisions, Article 8,
- in the National Energy Efficiency Action Plan (NEEAP), where measures highlight the use of RES & CHP systems at the premises of the public buildings.

3. Measures on information

Every supportive measure should be accompanied by a large-scale dissemination campaign towards the respective target group. The program may be implemented directly by the Ministry and/or the bodies under its supervision. Each year the ministry defines an “energy objective”, which is usually the main objective of a new law, financial incentive or a supporting measure in general, and creates a multi-targeted awareness campaign that may involve radio and TV spots, a website development, numerous articles to local and national newspapers, promotional brochures, and environmental guides. Moreover, a travelling group of experts may visit various cities all over the country, to distribute the dissemination material, inform the citizens and promote the benefits of the RES & CHP use. Finally, information events dedicated to the specific target groups may be held.

Guidance for planners and architects should be provided through technical seminars and workshops organised regularly mainly from CRES and the Technical Chamber of Greece.

Regional and local actors should be actively involved in the design and management of programmes for information, awareness raising, and training programmes for citizens about the benefits of renewable energy sources. In these activities the local stakeholders should be requested to gather and disseminate the information given to all the interested parties at local level. Furthermore, awareness campaigns targeting students that take place regularly should be organized in collaboration with the Municipalities or network of Municipalities with CRES.

4. Measures on certification of installers

The responsible body/(ies) for setting up and authorizing certification/qualification schemes by 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps are not yet defined.

Certification schemes/qualifications are not yet available. However, specific measures at regional/local levels are taken. More specifically, a database of installers for PV systems in the buildings exists in the CRES website, where the only obligation of the installers is to sign a document declaring that they agree and will implement the technical guidelines that are described in the "guidebook for installing PV systems in building's roofs" and which was developed from CRES, PPC & NTUA. Additionally, CRES keeps an online professional energy catalogue, where many companies and professionals are registered, by their own initiative. The first database numbers 390 entries and the second more than 450.

5. Measures on electricity infrastructure development

Wind is expected to contribute the largest portion of renewable energy in the electricity sector; the contribution of the rest RES options (PV, small hydro, geothermal, etc) seems to be lower. Due to the weak procedures so far, only PV and some small hydro will be connected to the distribution network while the majority of Wind Farms will be connected to the HV network (mainly 150KV). Thus, development of the transmission system has a key role in achieving the targets set.

The licensing procedures foresee firm Connection Offers by the respective System Operator (issued by the Hellenic Transmission System Operator – HTSO for projects in mainland and interconnected islands and by the Operator of Islands for projects at the non-interconnected islands).

<u>Transmission System</u>

Every year HTSO publishes the National Transmission Development Plan (NTDP); this plan describes all the planned transmission projects for a 5-year horizon. A strategic (provisional) view for 10-year horizon is also included.

In this planning process HTSO takes into consideration the production licenses and requests for new licenses in close collaboration with the Regulator, in order to plan (propose) the most suitable transmission projects to accommodate future RES generation.

<u>Distribution System</u>

There is a provision for the so-called Distribution Development Plan in the draft version of the Distribution System Code. A public consultation regarding this Code was launched in September 2009.

<u>Non-interconnected islands:</u>

Due to the small size of the most of the non-interconnected islands most of them are supplied by small local power plants and a MV redial distribution network. A limited connect of RES plants can be installed in these islands. A Code regulating the operation of the non-interconnected islands is foreseen.

In order to exploit the high wind potential of the already mentioned islands, a number of interconnection projects have been either launched (Cycladic Complex) or under study (Crete, NE Aegean islands, etc).

Intelligent networks and storage facilities have been developed in the transmission and distribution system. More specifically, for the transmission system a wind power prediction tool has been put in operation in the Transmission System Operation Center and Special Protection Schemes (SPSs) have been designed by the HTSO to allow for increased wind penetration in specific regions. Moreover, a study is under way by RAE regarding possibilities for development of new pumped-storage hydro plants in the Hellenic interconnected system.

The most important development in this aspect in the Distribution System is the installation and operation of hourly remotely read meters for medium voltage customers. However, this development has no impact on renewable energy. Smart meters for low voltage consumers are under consideration by PPC; however, no substantial progress has been done so far in terms of evaluating the impact of such an investment. Another large investment in the distribution network is the installation of a SCADA system in Athens. Finally, with regard to the storage facilities, a pumped-storage plant project was recently launched in a remote island system (Ikaria).

Currently, the Greek transmission system is interconnected to Bulgaria, FYROM, Albania and Italy.

Another 400 KV interconnector to Turkey (N. Santa (GR) – Babaeski (TR) has been completed and is expected to be energized by the summer 2010. A new 400KV interconnector to Bulgaria (N. Santa (GR) – Maritsa (BG)) is under planning and an MoU has been signed between the respective TSOs; it is expected to be completed by 2014-15. Also, a new 400KV HVDC link to Italy is under consideration.

The construction of new transmission projects faces significant barriers; in order to accelerate authorization procedures, a law was passed on 2003 (Law 3175/2003, art. 15, par.3), which characterizes some projects "of National interest". Simplified authorization procedures are foreseen for such projects.

Under current legislation, connection rights are provided to RES plants by the HTSO (within the ´connection offer´), upon request submitted by the RES plant developer, after successful completion of the 1st licensing step, i.e. after obtaining the production license. When providing such rights, the HTSO reserves network / system capacity for the respective plant. In case there is no more local network capacity available, or an overall system constraint is hit, the HTSO denies the provision of further connection rights in the specific area.

The Directive 2009/28/EC mandates in this direction:

(60) Priority access and guaranteed access for electricity from renewable energy sources are important for integrating renewable energy sources into the internal market in electricity, in line with Article 11(2) and developing further Article 11(3) of Directive 2003/54/EC. Requirements related to the maintenance of the reliability and safety of the grid and to the dispatching may differ according to the characteristics of the national grid and its secure operation.

Concerning the costs of connection and technical adaptation, they are attributed to the producer on a 100% basis - *'shallow' connection cost charging*. These costs are considered as part of the total investment costs (i.e. have to be recovered by selling the energy of the RES plant).

In case further reinforcement of the network is necessary, related costs are born by the TSO/DSO and collected through the regular network charges.

In order to be ensured that the transmission and distribution system operators provide new producers wishing to be connected all the necessary information the “connection offer” exists. It provides information on costs, timetable for connection, etc. The HTSO must provide the connection offer within sixty (60) days from the request.

6. Priority/Guaranteed access to the grid

Priority access (as defined by Directive 2009/28/EK) is ensured as far as system security and security of supply are not jeopardized. Security criteria take into account various factors and parameters such as:

- Technical minimum of conventional thermal power plants
- Flexibility of conventional generation for load following
- Required reserves
- Dynamic security aspects

In order to ensure that transmission system operators, when dispatching electricity-generating installations give priority to those using renewable energy sources, any deviation from the “priority in dispatch” rule has to be documented by the respective system operator and justified. No violation of the rule has been reported so far.

The National Law and the Power Purchase Agreements guarantee the transmission and distribution of RES electricity. In case RES plants are connected to congested areas, a pre-determined upper limit of possible curtailments is contracted; no remuneration of RES plants is foreseen for such cases.

Extended curtailments of power produced by intermittent RES plants (generally wind plants) have not taken place so far in the Hellenic interconnected system due to the low penetration level. However, in the near future, rules must be set by HTSO and the necessary infrastructure must be designed, in order to facilitate this type of action as a measure to increase the penetration of wind power ensuring the security of the electricity system.

There is no balancing market or intra-day market. Further on, the demand side does not yet participate in the daily energy wholesale market. There is no demand side management mechanism apart from a load-shedding program for summer peak hours.

7. Biogas integration into the natural gas network

There is no discrimination in the transmission and distribution of biogas. According to article 39 of Law 3428 regarding the liberalization of the market of natural gas, ‘the use of natural gas systems according to the provision of the Law is also allowed for the distribution of biogas, a gas produced from biomass and other types of gasses, in case this distribution is technically possible and the safety measures are met, taking into account the quality requirements and the chemical characteristics of these gasses’.

The development of the natural gas network was implemented to satisfy the population needs. A detailed map has been elaborated by DESFA (the Hellenic Gas Transmission System Operator S.A) showing the central pipeline, the cities connected to grids of low and medium pressure and the extensions envisaged, which are either at the construction or at an earlier stage. The map also includes the areas where gas production coming from RES is estimated to be sufficient to establish plants for its exploitation.

In Greece there are biogas plants operating of a total capacity of 41 MWe, in sanitary landfills (SL) and municipal wastewater treatment plants (MWTP), the most important being the following:

- In SL of Ano Liossia a co-generation plant is already in operation (23.5 MWe).
- In MWTP of Psytalia a co-generation plant is already in operation (11.4 MWe). The produced biogas is also used to dry the sewage sludge.
- In SL of Tagarades in Salonica a co-generation plant is already in operation (5 MWe).

It is estimated that in the near future additional SL will be constructed near Athens, where the possibility to connect to the natural gas grid will also be assured.

The biogas or other gasses produced by RES have a strong local character, thus the distance of the plants from the existing natural gas grids have to be thoroughly investigated in order to estimate the costs for possible extensions. Closed loops of biogas production plants without being connected to the natural gas grids could be a cheap and more feasible solution.

8. District heating and cooling infrastructure development

The contribution of district heating/cooling installations from RES is foreseen in order to reach the National targets for 2020. However, at present there is no such district heating application in operation.

Based on energy scenarios and projections, it is envisaged that RES district heating/cooling will have to contribute approximately 178 ktoe in 2020, a figure that corresponds to around 8% of the heating/cooling amount that should be produced by RES in 2020.

9. Compliance of biofuels and other bioliquids with sustainability criteria

A proper legislation for the implementation of sustainability criteria for biofuels and bioliquids has not been planned for Greece.

Control of compliance with the sustainability criteria as set by the Directive 2009/28/EC is critical to promote biofuels and bioliquids, because:

- The contribution of biofuels coming from specific production lines in the reduction of greenhouse gas emissions (GHG) will be estimated and confirmed.
- The control of compliance with the sustainability criteria will facilitate the allocation of subsidies to farmers.

To implement such a control, a Certification Sustainability System for biofuels and bioliquids has to be developed. For the development and maintenance of a Certification Sustainability System a relevant entity (could be a technical committee, a body) has to be set up. This so called "Entity" should be consisted of qualified scientists / institutions (e.g. Agricultural University, National Technical University, etc.) in accordance with the working groups of ELOT (the Greek standardisation body). The "Entity" will be assigned to develop a standard, which must be approved by ELOT. The standard should be based on the methodology and values of the tables in Annex V to Directive 2009/28/EC, and include all aspects of the Directive on raw materials and production process.

Voluntary "certification" schemes for biofuel and bioliquid sustainability as described in Article 18(4) are not yet envisaged.

Concerning the protected areas in Greece, the law for the environment (Law 1650/86), defines five categories of protected areas: area of complete nature protection, area of nature protection, national park, protected natural formation and protected landscape, and area of eco-development.

In the European Ecological Network NATURA 2000 the country has enlisted considerable area. More specifically 163 Special Protection Areas (SPA – Directive 79/409/EC) and 239 Areas of Community Interest (SCI – Directive 92/43/EC) have been determined.

Apart from the above, Greece is involved in the international regime of environmental protection which includes: Wetlands of Global International Importance in the Ramsar Convention, Monuments of World Heritage (UNESCO), Biosphere Reserves (UNESCO, Man and Biosphere), Special Protected Areas (Barcelona Convention) and Biogenetic Reserves (Council of Europe).

The procedure of characterization and alteration of the characterization of land use may be implemented at different levels:

- at the national and strategic level with the National General Framework and the Specific Frameworks,
- at regional level with the 12 Regional Frameworks,
- at lower level through GPS, SCHOAP, ZOE, regulatory plans but also through managerial plans for the environment such as those of NATURA, National Parks etc.

Especially for the cases of forests and forest areas, the characterization is done through the elaboration of forest maps and until its completion, through the examination of each area from the responsible forest authorities.

- FINANCIAL SUPPORT

1. Support schemes for renewable electricity

The modern development of RES in Greece showed the first significant growth in the field of active solar thermal systems stimulated by a deduction of the taxable income for final users. However, this measure is temporarily terminated due to budgetary reasons.

Investment

The most important financial-support instrument, which provided substantial public subsidies to RES investment projects, was the " National Development Law " (Law 3299/04), amended by the law 3522/06, Article 37. It was the investment incentives Law that was applicable to enterprises, covering all sectors of economic activity in the regions of the country. Regions with high unemployment rates and low income per capita received the highest investment subsidies from the State.

Investments in RES installations (both electricity- and heat-producing ones) kept their favored status under that Law such as investments in high technology, environmental protection, tourism, etc. The funding was concerned a subsidy for the total investment cost and could be 20%-60% depending on the region and the size of the company.

Now there isn't an active National Development Law or a specific program from the Forth Community Support Framework about the investments in RES

Tradable certificates:

Not applicable.

Feed-in tariffs

The main promotion schemes for RES-E in Greece are based on Law 2244/1994 (feed in tariff), Laws 2773/1999 (liberalisation), 3468/2006, 3734/2009 and on the recently enacted law 3851/2010 for the acceleration of RES development and other measures to cope with the climate change.

Feed in premiums

Not applicable.

Tendering

For the first time in Greece a tendering procedure is foreseen for the construction and operation of offshore wind farms (article 6 of the new law 3851/2010). The state will assess the environmental impacts from the construction and operation of offshore wind farms and then will undertake the procedure of issuing approvals of environmental terms for specific size wind farms in selected areas. An open public tender will follow for financing the construction and connection to the System of the selected wind farms in return to their exploitation rights fully or partly for a predetermined period of time.

Reform or future schemes

With all these measures taken, it appears that the development of RES-E in Greece still needs to be further motivated. The installed capacity from renewables in the country comes primarily from wind on shore (1.18GW, 84.5%) and secondarily from small hydro power plants[3] (0.18GW, 12.3%). The incentives for PVs resulted in a rather promising growth, taking into account that at the end of 2006 the installed capacity from PVs was 4-5MMW off-grid and today 70MW feed energy into the grid and PPAs have already been signed for another 60-70MW. The share of RES-E in gross electrical consumption is close to 13%, with the percentage of the share of energy produced from large hydro power stations reaching 9%.

A reform of the existing support scheme for RES should aim at promoting the technologies for which abundant resource is available and yet no investments have been made or no applications for such investments have been received as well as technologies such as small wts which could result in the development of local construction units offering valuable employment opportunities. Finally, a reform of the existing support scheme should provide strong incentives to investors who undertake the connection of non-interconnected islands to the System via submarine cables, thus exploiting the tremendous wind potential of the islands, offering better power quality to the consumers in the islands, protecting the environment by shutting down the polluting power stations operating in the autonomous island grids and benefiting the national economy with the significant reduction accomplished in of Public Benefit Services.

Under these perspectives, the recently enacted law 3851/2010 "*Accelerating the development of Renewable Energy Sources to deal with climate change and other regulations in topics under the authority of the Ministry of Environment, Energy and Climate Change*", attempts to further rationalize the existing feed-in tariff system and the relevant (Power Purchase Agreement-PPA) contracts duration and to provide stronger motivation to other RES investments such as geothermal plants, biomass and biogas plants for which no significant investment interest has been exhibited so far. The feed in tariffs are set according to the table below:

[3] The installed capacity from large hydropower stations is not taken into account due to the fact that is not supported via feed in tariff scheme.

Table 4: Feed-in tariffs for the year 2010

Electricity production from:	(€/MWh)	
	Mainland	Non Interconnected islands
(a) Wind energy >50kW	87.85	99.45
(b) Wind energy <50kW	250	
(c) Small Hydro electric plants < (15) MWe	87.85	
(d) PVs in households or small enterprises < (10) kWp	550	
(e) Solar thermal energy	264.85	
(f) Solar thermal with storage system (at least 2h at nominal load)	284.85	
(g) Geothermal energy of low temperature	150	
(h) Geothermal energy of high temperature	99.45	
(i) Biomass <1MW (excluding biodegradable sewages)	200	
(ia) Biomass >1 and <5MW (excluding biodegradable sewages)	175	
(ib) Biomass >5MW (excluding biodegradable sewages)	150	
(ic) Landfill gases sewage treatment plants and biogases (including biodegradable sewages) <2 MW	120	
(id) Landfill gases sewage treatment plants and biogases (including biodegradable sewages) >2 MW	99.45	
(ie) Gas from biomass <1MW	220	
(if) Gas from biomass >1MW	200	
(j) Other RES	87.85	99.45

PPAs are valid for 20 years (instead of 10+10 years) for all RES units with the exception of solar thermal units for which 25 years duration is foreseen. The PPA duration may be extended after a bilateral agreement (Operator-Producer) provided that the relevant generation license is still valid. The values from case (a) to case (h) and case (j) of the table are due to a 20% increase if no subsidy is made available to the producer by the state. For biomass/biogas feed in tariffs the corresponding percentage of increase is set at 15%.

A Ministerial Decree is also foreseen for the determination of further increase of the feed in tariff with which wind energy producers will be remunerated in case the operating units are installed in areas of low wind potential. Furthermore, the basic principles are set for compensating at the end of every year, the energy curtailments up to a percentage, which is fixed at 30% of the curtailment imposed during the previous year. This percentage is increasing every year up to 100% until the total remuneration of the producer reaches the smallest amount among a) the remuneration for 2200 equivalent hours of operation and b) operation without curtailment. Finally, the energy produced from wind parks operating in the islands and are connected to the mainland System is remunerated with the tariff set for wind parks in non interconnected islands throughout the entire duration of the PPA, increased by a percentage ranging from 10 to 25% depending proportionally on the distance of the connection line and reversely on the total installed capacity of the unit.

2. Support schemes for renewable heating and cooling

The use of RES systems in heating and cooling is only supported by a set of financial instruments, while until now there are is no regulatory support scheme (referring to targets or obligations) for the use of such systems. The financial support measures are either in the form of tax rebates or capital subsidies.

However, the legislative framework has been modified in the past years and now after the implementation of **Law 3175/2003** for electricity production from high enthalpy geothermal energy and **Law 3734/2009** for the co-generation of heat and electricity, there is in place a specific legal framework for the installation and use of RES/CHP systems for heating and cooling applications.

Investment subsidies

The use of RES in the heating and cooling sectors was supported by investment subsidies, which were granted in the framework of the following programmes and National Investment laws:

- Operational Programme for Energy – OPE (2nd Framework Programme (1994- - 2000)
- Operational Programme for Competitiveness – OPC (3rd Framework Programme (2000 – 2006), "Promotion of RES systems, co-generation – energy conservation" which is included in the theme "Security of energy supply and promotion of the liberalization of the energy market".
- Support for private investments through the investment and development Law 2601/1998.
- Development and Investment Law 3299/2004 "Incentives for private investments for economic development and regional convergence" which replaced the above law and which was amended by Law 3522/2006.

Feed-In Tariff Scheme

In the financial support system for electricity generation from RES, there is a special category for a feed-in tariff scheme for kWh derived from CHP plants. There is neither a special price for kWh derived from RES-CHP installations, nor any other subsidy for thermal energy produced by RES.

Tax Deductions

For the production of heating/cooling from RES, **Law 2364/1995** was applied, according to which 75% of the acquisition cost of RES systems could be deducted from the taxable income. This tax deduction was used mainly for the purchase of solar thermal systems (for the production of domestic hot water) and was in force until 2002.

In December of 2006, **Law 3522/2006** was put in force. This law reactivates the tax deduction scheme that existed with the Law 2364/1995, but sets lower financial benefits. Thus, according to this law, small domestic RES systems are eligible for a 20% tax deduction capped at € 700 per system.

3. Support schemes for renewable resources in transport

The harmonization of the Directive 2003/30/EC regarding the promotion of biofuels and other renewable fuels for transport and the introduction of biofuels in the Greek market was accomplished by their inclusion in the existing legal framework of the oil products, with the appropriate modification of Law 3054/2002 "Organisation of the oil market and other provisions", with Law 3423/2005 " Introduction of biofuels and other renewable fuels in the Greek market" (ΦΕΚ Α' 304/13.12.2005). Law 3423/2005 foresees the introduction of biofuels and other renewable fuels in the Greek market until the end of 2010 (article 8 paragraph 1).

Since December 2005 pure biodiesel is distributed in the country, which is blended in oil refineries or in oil marketing companies with diesel used in transport in a percentage up to 5% per volume (according to EN 590:2004) and is distributed to the whole Greek territory in the existing distribution network of the diesel for transport. In the decision of the Supreme Chemical Council (SCC) 460/2009 (ΦΕΚ Β' 67/28.01.2010) the EN 590:2009 was adopted and thereafter the maximum allowed blending proportion of biodiesel into diesel for transport was increased to 7% per volume.

The distribution of biofuels in the Greek market is implemented through the annual biodiesel quota system, which determined the blending obligations of the oil refineries and oil marketing companies (exact amounts of pure biodiesel to be blended with diesel for transport). In order to further promote the distribution of higher blends (biodiesel in diesel and bioethanol in gasoline), according to paragraph 1, article 15A of Law 3054/2002, as modified by Law 3769/2009, the distribution of blends higher than the blends set by the SCC is now allowed, in the condition that the rest of the blends' characteristics fulfill the standards as set by the SCC for the biofuels or other renewable fuels and the fossil fuel. The distribution of the higher blends of biofuels is allowed only if there is a special labeling in the fuel stations (to get a special labeling a JMD of the Ministry of Economy, Competitiveness and Shipping and the Ministry of Environment, Energy and Climate Change is required).

It has to be noted that in order to distribute any biofuels in the market, pure or in blends with fossil fuels, a decision of the SCC is requested (paragraph 1, article 15A of Law 3054/2002, as modified and valid). The adoption of the EN15376 standard for "Transport fuels – ethanol of biological origin (bioethanol) as blending component in gasoline – Requirements and Testing methodology. However, this standard has not been adopted as yet in the Greek legislation.

There is differentiation in the support of fuel types, as biodiesel is the only biofuel for transport distributed in the Greek market. For the annual quota system the following formula is being used, which includes criteria with specific weighting factors. More specifically, the annual compulsory biodiesel share for 2009 quota system (July 2009 until June 2010) was based on the following formula:

Ki = { [0,35 * EL1i / (Total EL1i)]+ [0,05 * L2i / (Total EL2i)]+ [0,075 * EL3i / (Total EL3i)] + [0,20 * Ai / (Total Ai] + [0,05 * Ii / (Total Ii)] + [0,05 * Ei / (Total Ei)] + [0,15 * Pi / (Total Pi)] + [0,075* PKi / (Total PKi)]} * annual compulsory biodiesel quantities, where:

i = the company under study

Ki = compulsory pure biodiesel quantities, in Kiloliters

EL1i = Kiloliters of pure biodiesel produced from domestically grown energy crops through contractual agreements with farmers, assuming a production of 1.0 kiloliters of biodiesel per hectare of energy crop

EL2i = Kiloliters of pure biodiesel produced from domestic cottonseed through submitted invoices or/and accounts assuming a production of 0,14 kiloliters of biodiesel per ton, or/and from domestically produced cottonseed oil through submitted invoices assuming a production of 0,95 kiloliters of biodiesel per metric ton.

EL3i = Kiloliters of pure biodiesel produced from used vegetable oils, fried oils and animal fats of domestic origin that are considered appropriate for biodiesel production, through submitted invoices or/and accounts, assuming a production of 0,95 kiloliters of biodiesel per metric ton of raw material.

Ai = total requested quantity of pure biodiesel, in kiloliters, which cannot exceed the annual capacity of the plant.

Ii = index, based on the submitted justifications, equal to 1 if there is an ISO 9000 certificate or a contract for getting it, or 0 if there is not.

Ei = index, based on the submitted justifications, equal to 1 if research activities are included 0 if there are not.

Pi = total delivery of pure biodiesel, in kiloliters, for the quota system of 2007 και 2008.

PKi = index, based on the consistency of deliveries in the oil refineries in 2008, equal to 1 for declination of up to 2% on the total biodiesel quantities of the year, or 0.5 for declination of the total deliveries ranging from 2% to 5% of the total biodiesel quantities of the year, or 0 for declination higher than 5%.

- INCREASING BIOMASS AVAILABILITY

Table 5: Biomass availability in 2006

Sector of origin		**Amount of domestic resource**[4]	**Imported**		**Exported**	**Net amount**	**Primary energy production (ktoe)**
			EU	**Non -EU**	**EU/non-EU**		
A) Biomass from forestry[5]**:**	*Of which:*						
	(1) direct supply of wood biomass from forests and other wooded land for energy generation	2036000				2036000	702
	Optional — if information is available you can further detail the amount of feedstock belonging to this category: (a) fellings (b) residues from fellings (tops, branches, bark, stumps) (c) landscape management residues (woody biomass from parks, gardens, tree rows, bushes) *(d)* other (please define)	a) 2036000				a) 2036000	a) 702
	(2) indirect supply of wood biomass for energy generation						
	Optional — if information is available you can further detail:	a) 76077				a) 76077	a) 27

[4]Amount of the resource in m³ for category A and its subcategories: and in tonnes for categories B and C and their subcategories.
[5]Biomass from forestry should also include biomass from the forest-based industries. Under the category of biomass form forestry processed solid fuels, like chips, pellets and briquettes should be included in the corresponding subcategories of origin.

Sector of origin		Amount of domestic resource[4]	Imported		Exported	Net amount	Primary energy production (ktoe)
			EU	Non -EU	EU/non-EU		
	(a) residues from sawmilling, woodworking, furniture industry (bark, sawdust) (b) by products of the pulp and paper industry (black liquor, tall oil) (c) processed wood-fuel (d) post consumer recycled wood (recycled wood for energy generation, household waste wood) *(e)* other (please define)						
B) Biomass from agriculture and fisheries:	*Of which:*						
	(1) agricultural crops and fishery products directly provided for energy generation						
	(2) agricultural by-products/processed residues and fishery by-products for energy generation	508886				508886	202
	Optional — if information is available you can further detail: (a) straw (b) manure (c) animal fat (d) meat and bone meal (e) cake by-products (incl. oil seed and olive oil cake for energy) (f) fruit biomass (including shell, kernel) (g) fishery by product (h) clippings form vines, olives, fruit trees (i) other (please define): residues from rice mills and cotton ginning factories	f) 472190 i) 36696				f) 472190 i) 36696	f) 189 i) 13
C) Biomass from waste:	*Of which:*	79038904				79038904	33
	(1) Biodegradable fraction of municipal solid waste including biowaste (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) and landfill gas	55476426				55476426	23.3
	(2) Biodegradable fraction of industrial waste (including paper, cardboard, pallets)						
	(3) Sewage sludge	23562478				23562478	9.6

In order to form a representative picture of the state of RES in Greece and with regards to the new E.E. directives, the development of a suitable system for the collection, recording and processing of the data is required. This system includes the drafting and the filling of forms, the use of a database with suitable software, statistical processing software and a geographical information system.

The first step must be to make a description and evaluation of the existing systems for recording and processing data on the generation and administration of the generation of electrical and thermal energy from RES.

The basic stages followed in statistical research are the collection, classification, presentation, analysis and interpretation of statistical information.

Up to the present, statistical research was carried out using the following process:

First Stage: Search-Organization

In this stage, the original search was made which consisted mainly of the choice of the target group by technology, either through files, which were shared with us by the Ministry of Energy and Climate Change or through authoritative financial guides, i.e. ICAP, or in person by C.R.E.S.

This was followed by the formation of the new RES database.

Second Stage: Collection

When the final structure of the RES database was organized, the dispatch and collection of the data for both inventory and sampling was done, i.e, by filling in a special form. The questionnaire was filled in directly or indirectly (in person interviews, postal dispatch or other means).

Third Stage: Classification.

This was the classification of the information according to a specific criterion, so as to facilitate the sorting and analysis of the data.

Fourth stage: Presentation of the statistical data

The collection and processing of the statistical data was followed by the presentation of the data in a systematic way so that they would be easily understood and to facilitate the work of statistical analysis.

The statistical data were presented mainly in excel tables with corresponding diagrams where needed, and also they were accessible by other programs (Access, GIS, etc.).

Table 6: Estimated domestic supply in 2015 and 2020

Sector of origin		**2015**		**2020**	
		Expected amount of domestic resource	**Primary energy production (ktoe)**	**Expected amount of domestic resource**	**Primary energy production (ktoe)**
	(1) direct supply of wood biomass from forests and other wooded land for energy generation	800,000 m3	1,361		
	(2) indirect supply of wood biomass for energy generation	-	-	-	-
B) Biomass from agriculture and fisheries:	**(1) agricultural crops and fishery products directly provided for energy generation**	75,000 tons	68,000	176,000	159,000
	(2) agricultural by-products/processed residues and fishery by-products for energy generation	10,000,000 dm tons	1,200	23,000,000	1,500

C) Biomass from waste:	*Of which:* **(1) Biodegradable fraction of municipal solid waste including biowaste (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) and landfill gas**	-	-	-	-
	(2) Biodegradable fraction of industrial waste (including paper, cardboard, pallets)		-	-	-
	(3) Sewage sludge		-	-	-

The estimated domestic supply of biomass from agriculture (Table 7a, row B1) for 2015 and 2020 is mainly referred to oil crops – sunflower and rapeseed. To cover the biofuels target of 5,75%, biofuels consumption on the total consumption of fossil fuels for transport, around 148,000 tons of biodiesel have to be produced by 2010 according to the Ministry of Environment, Energy and Climate Change. These quantities require around 16,000 hectares, assuming that 9,2 tons of biodiesel are produced per hectare on average. Taking into account there were around 4,700 hectares cultivated with sunflower for the food market, it is obvious that in order to cover the energy targets for biofuels for transport - for the 2010 and 2020 - either imports or a radical reformation of agriculture will be required – or both.

Table 7: Current agricultural land use for dedicated energy production in year 2006

Agricultural land use for dedicated energy production	Surface in ha
1. Land used for short rotation trees (willows, poplars)	**0**
2. Land used for energy other energy crops such as grasses (red canary grass, switch grass, Miscanthus), sorghum	**0**

Are any measures planned to encourage unused arable land, degraded land, etc. to be used for energy purposes?

In the Programme of Rural Development of Greece 2007-2013 (PRDG) in Axis 2: Improvement of environment and countryside, there are two measures 2.1.1 and 2.1.2 regarding financial support for the farmers of “mountainous” and “other disadvantageous areas”.

The mountainous areas are characterized by high elevations and high inclinations, characteristics that either alone or in combination deteriorate the choices of farmers for crops and species that can be adapted to such conditions and increase production costs. As a consequence large areas are abandoned or tend to be abandoned causing negative effects in land conservation, environmental protection and fire prevention.

The maintenance of the agricultural activities in these areas is of upmost importance and for this reason a financial support of farmers for a number of agricultural activities, including these of growing aromatic and pharmaceutical crops, leguminous, cereals and other non-food crops is foreseen. Energy crops being non-food crops are –indirectly- included in the measures. The financial support foreseen for non-food crops ranges from 100€/ha to 140€/ha depending on the farmers (younger than 30, others) and on the location for the mountainous areas and from 100€/ha to 125€/ha for the rest of the disadvantageous areas.

Is energy use of certain already available primary material (such as animal manure) planned?

The energy use of the available raw materials (like animal manure, agricultural/forest residues) directly depends on the market demand. In Greece, electricity generation is the only well developed energy market for this feedstock.

Although the energy use of the available residual biomass is not planned, the new Law on RES is expected to provide incentives for investments.

What measures are planned to improve forest management techniques in order to maximise the extraction of biomass from the forest in a sustainable way? How will forest management be improved in order to increase future growth? What measures are planned to maximise the extraction of existing biomass that can already be put into practice?

The contribution of forests in the Gross National Income is generally low ranging around 1.32% This is because the forests in Greece are of low productivity as they have a rather “protective” character and the benefits coming from the forest are not quantified as income.

In the Programme of Rural Development of Greece 2007-2013 (PRDG) in Axis 1: Improvement of environment and countryside, there is Measure 2 regarding the ‘reform and development of biomass potential and promotion of innovation” and most specifically measures 1.2.2 ‘Improvement of the economic value of forests” and 1.2.3B “improvement of the value of forest products”.

- FLEXIBILITY/JOINT PROJECTS/EUROPEAN PERSPECTIVE

National procedures for arranging a statistical transfer or joint program have not been established yet in Greece. However, the supervising body to initiate these kinds of mechanisms would be the Ministry for Environment Energy and Climate Change.

On the other hand, the private entities are already taking part in joint projects (CDM, JI mechanisms). This is done on a private basis and with direct communication and collaboration of the companies with the appropriate institutions at third countries.

It is not yet clear in which sectors Greece can offer renewable energy use for the purpose of joint projects. However, possible sectors could be those that are currently less developed (i.e geothermal, CSP)

With regard to the identification of sites for joint projects, there is not a specific scheme and structure and it is not clear which stakeholders can be involved and where.

The potential for joint projects in other Member States or in third countries is known but no project is under way yet.

IV. ESTIMATED COSTS & BENEFITS OF RES POLICY SUPPORT MEASURES

Table 8: Estimated costs and benefits of the renewable energy policy support measures

Measure	**Expected renewable energy use (ktoe)**	**Expected cost (in €) – indicate time frame**	**Expected GHG reduction by gas (t / year)**	**Expected job creation**
L.3851/2010, new feed-in-tariffs for RES technologies, optimization of the licensing procedure	1650ktoe in 10 years	13m€	1630 ktn CO_2/yr	Around 5200 direct jobs during installation phase and more than 1650 new jobs during the operation of the plants

New Building code Joint Ministerial Degree Δ6/Β/οικ5825 and article 10 at L.3851/20, along with the implementation of specific measures from the Greek NEEAP	350ktoe in 10 years	Cost not estimated, affects all new buildings and the total sum of buildings for the installation of energy efficient systems for heating and cooling	346 ktn CO_2/yr	Not estimated
Action "Exoikonomo kat'oikon" of the National Strategic Reference Framework	Energy savings of about 87ktoe/yr (incl. small RES systems in buildings)	Public funding of 200m€, Not yet defined the timeframe	500 ktn CO_2/yr	Not estimated
Action "Green Tourism" and "Green Enterprise"of the National Strategic Reference Framework	Not estimated	Public funding of 60m€: 30m€ per action, start date:2010	Not estimated	Not estimated
Piraeus Bank & YPEKA programme for industrial zones and green entrepreneurship parks	7ktoe/ year (only calculated for the target of 50MW of PV parks)	1,5billion€ - 4yr duration	60 ktn CO_2/yr	12000 (for the whole programme)
Specific measures at the public sector, article 10 at L.3851/20				