HELLENIC REPUBLIC MINISTRY OF THE ENVIRONMENT & CLIMATE CHANGE
DIRECTORATE GENERAL FOR ENERGY
RENEWABLE ENERGY SOURCES AND ENERGY SAVING DIRECTORATE

5TH ANNUAL REPORT ON THE PENETRATION LEVEL OF RENEWABLE ENERGY SOURCES IN THE YEAR 2010

(ARTICLE 3 OF DIRECTIVE 2001/77/EC)

September 2009

THE REPORT WAS DRAFTED BY RAE IN COOPERATION WITH CRES AND WAS SUBMITTED BY RAE TO THE MINISTRY OF THE ENVIRONMENT & CLIMATE CHANGE TO BE FINALIZED

Contents

1. Introduction – Directive 2001/77/EC 4
2. Basic elements of the Greek economy 4
3. Basic elements of the electrical system for the year 2009 5
3.1 Climate factors affecting the penetration of RES 6
4. The market in electricity 7
5. The evolution of the institutional framework for RES 7
6. Current developments in the institutional environment of RES 12
6.1 Law 3734/2009 (Government Gazette • 8/28-1-09): "Promotion of the cogeneration of two or more useful forms of energy, regulating issues relating to the Mesochora Hydroelectric Project and other provisions" 12
6.1.1 Regulatory framework established by Law 3734/2009 — Joint Ministerial Decision 1079/2009 "Special Scheme for the Deployment of Photovoltaic Systems in buildings, and in particular on building roofs and facades". 13
6.2 Changes to the regulatory framework for Geothermal projects 14
6.3 Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC 15
6.4 Transposing new Directive 28/2009/EC into national law 16
7. The physical planning dimension of RES deployment 16
8. State aid for RES projects 19
8.1 Aid for RES projects using resources from the 2nd Community Support Framework 19
8.2 Aid for RES projects using resources from the 3rd Community Support Framework 19
8.3 Law 3299/2004 on Development 20
8.4. Fiscal regulations for RES investments without capital subsidy 22
9. Current status of RES and large-scale hydroelectric plants 23
10. Management of dispersed power generation 26
11. Guarantee of origin for electricity generated from RES 26
12. Engineering activities under way to enhance power transmission capacity 26
13. Conclusions – targeting - need for additional measures 29
13.1. Optimistic Scenario 29
13.2. Conservative Scenario 30
13.3. Additional measures 31

1. Introduction – Directive 2001/77/EC

This report is drafted as per the provision of Article 21(3) of Law 3468/2006.

Directive 2001/77/EC *on the promotion of electricity produced from renewable energy sources in the internal electricity market* has set an indicative target for Greece to cover 20.1% of its gross domestic national electricity consumption[1] by 2010 from renewable energy sources (RES), including the contribution of large-scale hydroelectric projects. This target is compatible with Greece's international commitments under the Kyoto Protocol signed in December 1997 within the context of the United Nations framework convention on Climate Change. The Kyoto Protocol[2] requires that Greece reduces the rate of increase of CO_2 and other greenhouse gas emissions, from 2008 to 2012, by 25% as compared to the base year 1990. In addition, Directive 2009/28/EC,[3] which was established to implement the European Energy Policy, approved a binding target of a 20% share of renewable energy sources in overall EU energy consumption by 2020, with the new target for Greece being set to 18%. The target is becoming more and more necessary for the improvement of the quality of life at a global scale, which was confirmed by the fourth report of the Intergovernmental Panel on Climate Change,[4] which estimated that renewable energy sources would contribute to energy security, employment and air quality. According to the latest estimates, gross electricity consumption reached **61 TWh**[5] in 2010**,** i.e. much lower than the level of 68-72 TWh predicted in the National Reports submitted in previous years under the Directive. The revision is due to a drop in demand, as well as a significant reduction in the anticipated growth rate. Subsequently, production of electric power from RES in the order of **12.26 TWh** (including large-scale hydroelectric plants) is the goal for 2010.

2. Basic elements of the Greek economy

Greece occupies an area of 132 000 square kilometers and has a population of 11.26 million according to the 2009 census. It is estimated that the 2009 per capita gross national product (GNP), in current prices, is approximately Euro 21 100. During the same year, the growth rate as a percentage change of the volume of the gross national product is estimated to be marginally negative, and this trend is expected to continue and deteriorate in 2010.

[1] It is defined as the national electrical power production including autoproduction plus imports minus exports.

[2] By virtue of Law 3017/2002 *"Ratification of the Kyoto protocol within the context of the UN framework convention on climate change"* (Government Gazette A 117) the Greek Parliament put on official footage the country's commitment to undertake actions against the aggravation of the greenhouse phenomenon. The 25% is an intra-Community quota within the framework of a burden-sharing agreement between the Energy Ministers of the EU Member States.

[3] "DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC"

[4] 4th Assessment Report of the UN Intergovernmental Panel on Climate Change (IPCC), February 2007

[5] The estimated quantity also included the electricity consumed for powering the generation machinery (6%), as well as transmission losses (2.5%).

3. Basic elements of the electrical system for the year 2009

The main part of electricity is still produced by the Public Power Corporation (PPC S.A.), which was established in 1950 on a monopolistic basis to focus mainly on the generation and transmission of electric power. Electricity consumption in 2008 reached 63.7 TWh, with an installed capacity of the order of 12 843 MW for PPC-operated plants[6] and 1 770 MW for auto-producers and conventional and renewable energy producers. The System transmission lines are 12 000 km in length, and the Grid distribution lines in the entire country are approximately 217000 km in length. The number of customers served are approximately 7.5 million. With respect to the exchanges in electricity, it should be noted that there are links to neighbouring Balkan countries (Albania, FYROM and Bulgaria) capable of meeting on an annual basis exchanges at a level of up to approximately 7% of Greece's needs, mainly from the surplus of the Bulgarian and Romanian systems. The link to Italy via a submerged 400 kV DC cable has a transmission capacity of 500 MW and has been in commercial operation since 2002.

The main source of fuel is domestically extracted lignite (70 million tons), which met 50.5% of the total needs for electric power in 2008. Oil, mainly used by power plants on the islands that are not connected to the mainland system, is estimated to have a 13% share. Natural gas imported from Russia and Algeria in the form of LNG met 22.5% of the total needs. In 2008, hydraulic power had a 6% share. Finally, wind farms, small-scale hydroelectric plants, biomass and photovoltaic farms had a 4.3% share, whereas imports-exports met the remaining 5.6% of the total needs.

Installed Electric Power Capacity (MW)										
RES Technology	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	269	338	355	444	556	581	855	989	1 232	1 398
Small-scale hydros	42	45	45	50	59	64	77	95	158	180
Solar	0	1	1	1	1	1	5	9	12	37
Wind	226	270	287	371	472	491	749	846	1.022	1.140
Biomass	1	22	22	22	24	24	24	39	40	41

Table 1 : Growth of the installed capacity of RES plants in the last ten years

Table 1 and Figure 1 present the growth of the installed capacity of RES plants per technology, indicating that the average growth rate of wind farms and small hydroelectric plants is still approximately 20%, with maximum and minimum growth values occurring usually before and after changes to the institutional framework and the respective aid schemes (see par. 5 and 8).

[6] The only power plants other than those operated by PPC are the natural gas fueled ones operated by: (a) the company "IRON" in Voiotia, which is mainly used during demand peaks, of an installed capacity of 147 MW; and (b) the company "ENERGEIAKI THESSALONIKIS" (an affiliate of HELLENIC PETROLEUM S.A.) in Thessaloniki, of an installed capacity of 390 MW, which has been in operation since December 2005.

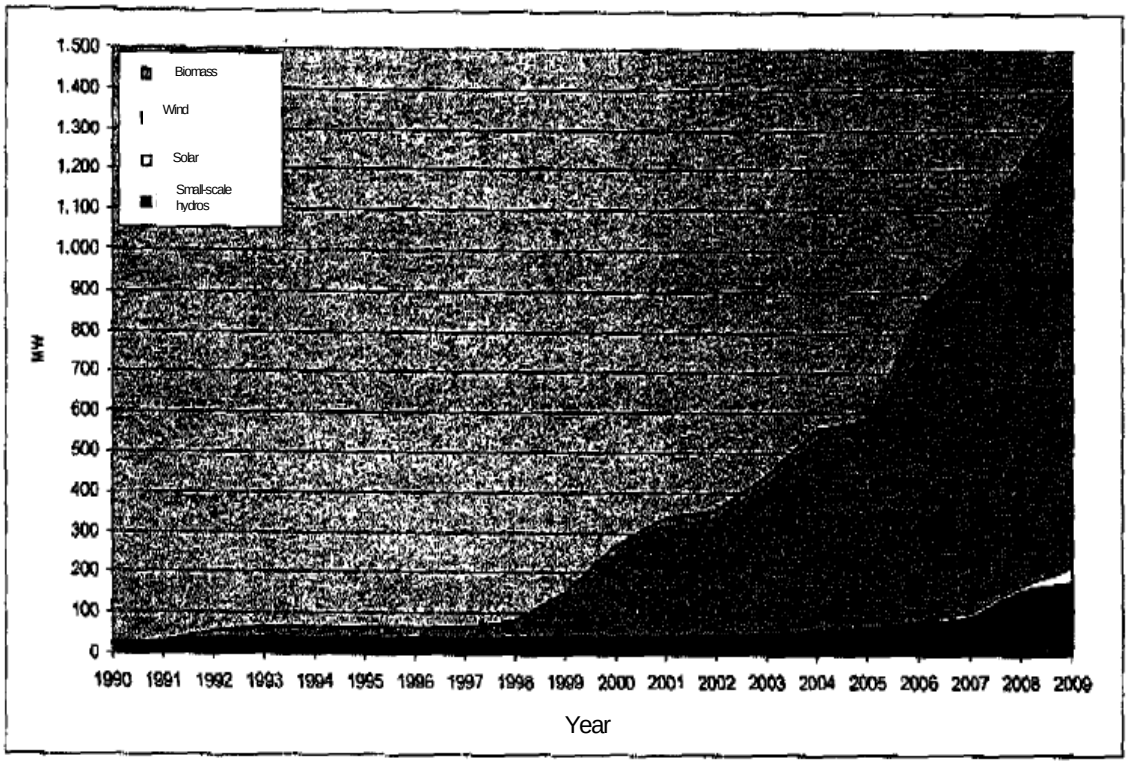


Figure 1: Aggregate installed capacity of RES power plants (source: HTSO, September 2009)

The electric power produced using ordinary RES in Greece (exclusive of large-scale hydroelectric plants) represented 4.3% of the gross domestic electric energy consumption in 2008. It comes mainly from wind farms and small-scale hydroelectric plants, and less from biomass/biogas and photovoltaic farms. On the basis of available information collected up to September 2009, it seems that the installed capacity of photovoltaic farms is getting higher and higher, whereas the relevant high growth rate (200% by the quarter of 2009) is expected to remain unchanged until it is settles at lower rate values possibly after 2012.

Also including the energy from large-scale hydroelectric plants, the electric power generated from RES in 2008 represented 10.3% of the gross domestic electric energy consumption. The respective installed capacity of RES plants in the same year was 4 293 MW.

More specifically, the installed capacity of wind farms rose from 27 MW in 1997 to 1 022 MW at the end of 2008. The installed capacity of small-scale hydroelectric plants rose from 43 MW in 1997 (all of them operated by PPC) to 158 MW at the end of 2008. Finally, the installed capacity of the power plant using biogas from the Thessalonica landfill rose by 5 MW and that of the power plant using biogas from waste water in Liosia rose by 9.7 MW, thus leading to a total electric power capacity, including Psytalleia, of 29.6 and 10.4 MW, respectively. The electric power generated from RES in 2008 reached approximately 6.6 TWh, broken down as follows: 63.2% from hydroelectric plants (4 149 GWh); 34.1% from wind farms (2 242 GWh); 2.6% from biogas (171 GWh); there was also a limited amount of electric power generated by photovoltaic farms, i.e. 5 GWh (0.1%). The gross electric energy consumption in the same year was 63.7 TWh.

3.1 Climate factors affecting the penetration of RES

Statistical data collected in the last five years show a fluctuation in the share of RES in the generation of electric power from 7% to 13%, with the power generated from other RES (mainly wind farms) rising steadily from 15% to 43% and the power generated by large-scale hydroelectric plants dropping significantly, mainly in 2008, due to draught, mainly because large-scale hydroelectric plants in Greece (using dams almost in all cases) are used primarily for demand peaks and their production is dependent on the amount of available water in the dams.

4. The market in electricity

At present, the electricity sector operates within the framework established by Law 2773/1999 *"Liberalisation of the market in electricity – Regulation of energy policy issues and other provisions"* (Government Gazette A 286), which was adopted to transpose into national law Directive 96/92/EC on the liberalisation of the market in electricity (OJ L 27/30.1.1997). This fundamental law was revised mainly by Law 3175/2003 "*Utilisation of the geothermal potential, district heating and other provisions*" (Government Gazette A 207) and Law 3426/2005 *"Acceleration of the process for the liberalisation of the market in electricity"* (Government Gazette A 304).

5. The evolution of the institutional framework for RES

Law 1559/1985 "Regulation of issues relating to alternative forms of energy and specific issues relating to power generation using conventional fuels and other provisions" (Government Gazette A 135) provided the framework for the establishment of the first RES plants in Greece. It was under this framework that PPC proceeded to establish plants of an installed capacity of 24 MW, mainly small wind farms and photovoltaic systems, whereas the total installed capacity of the plants established by local government organizations was only 3 MW by 1995, and the private sector did not have any share in those efforts.

Law 2244/1994 "Regulation of issues relating to power generation using renewable energy sources and conventional fuels and other provisions" (Government Gazette A 168) modeled after the law applicable in Germany at that time (Stromeinspeisungsgesetz) laid the foundation for the actual development of RES. The Law established fixed rates for the sale of RES-generated electric power to the country's interconnected system, at a level equal to 90% of the general MV tariffs, and made it obligatory for the PPC to buy that power. As for the reimbursement of the capacity part, a scale pricing system was introduced according to the type of each RES plant in terms of time availability at nominal capacity. Based on calculations, the capacity part merely increased the energy tariff by just 6.5% so that the final tariff in 2006 was 0.07287 Euro/kWh. On the islands that were not linked to the mainland's interconnected system, the tariff was based on 90% of the LV household tariff and was 0.08458 Euro/kWh in the same year, whereas no capacity reimbursement was provided for. Today the revised feed-in tariff regime is detailed in par. 6.

Law 2773/1999 on the liberalisation of the market in electricity maintained the favourable tariff regime for RES, also placing emphasis on priority access to the grid.

Law 2941/2001 "Simplification of company establishment procedures, licensing Renewable Energy Sources plants, regulation of issues relating to GREEK SHIPYARDS S.A. and other provisions" (Government Gazette A 201) was successful in coping with the installation of RES plants in forests and wooded areas, by including provisions upheld and ruled by the Council of State as constitutional. Furthermore, this Law filled some significant gaps in the legislative fabric and also remedied a number of weaknesses inherent in the licensing process.

Law 3175/2003 established for the first time a comprehensive set of rules for the rational use of geothermal energy. The new framework was compatible with Community's view on geothermal energy as a renewable energy source contributing to sustainable development. It also changed the long-entrenched view of geothermal energy as a mineral, which was subject to the rather rigid rules of Legislative Decree 210/1973 "Mining Code" (Government Gazette A 277). In short, each geothermal field is now dealt with as one single deposit-source, to prevent the breakdown that resulted from individual concession agreements. Thus a concrete bidding procedure was set up for the whole range of products, by-products and process residues. Following the pattern of breakthrough initiatives taken to speed up the implementation of projects relating to the 2004 Olympics, Law 3175/2003 provided for further actions including the introduction of shortened and simplified procedures regarding expropriations necessary for the enhancement and extension of power transmission lines which would also support the deployment of RES plants[7].

The environmental licensing process has already followed a revised path after the adoption of Law 3010/2002 "Transposition of Directives 97/11/EU and 96/61/EU into Law 1650/1986, procedure for the delineation and regulation of matters regarding water courses and other provisions" (Government Gazette A 91) for the harmonisation of national legislation on the environmental protection with the acquis communautaire. At a regulatory level, the following joint ministerial decisions were issued specifically for RES: D6/F1/oik.19500/ 4.11.2004 (•6/ • 1/•••.19500/ 4.11.2004) (Government Gazette B 1671), classifying small-scale RES power plants in the zero-disturbance category, thus making it possible to incorporate them in a residential environment; oik.104247/EYPE/YPEHODE/25.5.2006 *"Procedure for Preliminary Environmental Assessment and Evaluation and Environmental Terms Approval for RES Projects under article 4 of Law 1650/1986, as replaced by article 2 of Law 3010/2002"* (Government Gazette • 663); and oik. 104248/EYPE/YPEHODE/25.5.2006 (••. 104248/• • • • /• • • • • • • /25.5.2006) *"Content, supporting documents and miscellaneous data relating to Preliminary Environmental Impact Assessments, Environmental Impact Assessments, and other relevant environmental assessments for Renewable Energy Sources Projects (Government Gazette B* 663); to adjust the overall licensing procedure for RES plants to the environmental authorisation regime. The regulations introduced also included a reduction in the number of opinion issuing authorities, the establishment of short deadlines, the inactive lapse of which would allow the authority in charge of environment licensing to consider the missing intermediate authorisations and opinions of other bodies as positive, and generally the streamlining of the sequence of the intermediate consents in line with the spirit of Article 6 of Directive 2001/77/EC .

[7] The law stipulates that private wooded areas may be expropriated for the benefit of the State without having to alter their classification or observe the procedure laid down in the provisions of Article 14 of Law 998/1979 *"On the protection of the country's forests and wooded areas in general"* (Government Gazette A 289). These provisions had established a tedious administrative procedure for the interlocutory settlement of disputes concerning forest classification, given the fact that there was no forest registry. Furthermore, Law 3175/2003 provided that, by virtue of decisions taken by the Minister for Development, some projects may be designated as public benefit projects. Any expropriations necessary for the implementation of such projects are announced through a Cabinet act, in the event that certain expropriated areas have to be occupied prior to the determination and payment of the compensation. The above law did designate as projects of public interest the following projects: *"Development of a 400 kV loop in Eastern Macedonia and Thrace", "Nea Makri-Polipotamos Link and High Voltage Grid in Southern Evia",* and *"High Voltage Line for connecting the new power plant on Southern Rhodes".* Although all such projects aimed at enhancing the transmission capacity of conventionally generated power, their impact on the development of RES was nevertheless obvious.

Law 3468/2006[8] *"Production of electricity from Renewable Energy Sources and High-Efficiency Cogeneration of Electricity and Heat and other provisions" (Government Gazette A* 129) introduced certain provisions aiming exclusively at regulating issues relating to the deployment, incorporation in the System/Grid and pricing of RES and High-Efficiency Cogeneration of Electricity and Heat projects. The main axes of that legislative initiative are outlined below:

§ Setting the national target for the share of RES to 20.1%, in 2010, and 29%, in 2020, of the net domestic electric power consumption.

• Setting the deadlines in which authorisations must be issued or consents must be granted by agencies and bodies involved in the different licensing process stages. More specifically, provision is made to the effect that, should the Secretary General of the local Regional Government fail to issue an installation permit within 15 days, the relevant duty will be transferred to the competent Minister.

• Changing the previous all-inclusive feed-in tariff regime mainly in favor of photovoltaic systems, in order to boost investments in that sector lagging behind so far. The tariffs set by the law will be adjusted annually by virtue of a decision taken by the Minister, following an opinion issued by RAE, on the basis of the weighted average increase in the tariffs of PPC S.A., whereas following full liberalisation of the market in electricity, the adjustment will be equal to 80% of the consumer price index. The prices of Table 2 will apply in the current year.

Generation of electricity from:	*Energy tariff (Euro/MWh)*	
	Interconnected system	**Non-interconnected islands**
Wind energy, hydraulic energy utilised by small-scale hydroelectric plants of an installed capacity up to fifteen (15) MW_e, geothermal energy, biomass, gases released from landfills and waste treatment plants, and biogases, miscellaneous RES, high-efficiency cogeneration of heat and electricity	87.84	99.44
Wind power from marine wind farms	104.84	
Solar power utilised by photovoltaic plants of an installed capacity of less than, or equal to, one hundred (100) kW_{peak}, which are installed in an owned or lawfully possessed property, or in adjacent properties of the same owner or lawful possessor	454.73	505.25
Solar power utilised by photovoltaic plants of an installed capacity of over one hundred (100) kW kW_{peak}.	404.20	454.73
Solar power utilised by plants employing a technology other than PV of an installed capacity up to five (5) MW_e	264.84	284.84

[8] Law 3468/2006 was amended by virtue of Article 17 of Law 3489/2006 "Thessaloniki Innovation Zone and other provisions" (Government Gazette A' 205) and article 19 of Law 3587/2007 "Amending and complementing Law 2257/7934 "Consumer Protection", as currently in force – Transposing Directive 2005/29 of the European Parliament and of the Council (OJ L. 149)" (Government Gazette A 152).

Solar power utilised by plants employing a technology other than PV of an installed capacity of over five (5) MW_e.	244,84	254,84
Other RES (geothermal, biomass-biogas, high-efficiency cogeneration of heat and electricity, etc.)	87.84	99.44

Table 2. Guaranteed renewable energy feed-in tariffs in the year 2009

- Licensing of hybrid plants without a tendering procedure and linking the energy tariff regime applicable to hybrid plants to be installed on independent island systems mainly to the avoided cost of the operation of conventional plants that are replaced by those hybrid plants, to ensure the economic viability of said plants.

- Completion of the transposition into national law of the requirements set out in Article 5(5) of Directive 2001/77/EC regarding the establishment of an appropriate mechanism to issue guarantees of origin of the electric power generated from renewable energy sources.

- Improvement of the terms applicable to the sale of the electricity generated, in order to facilitate bank financing of relevant projects. More specifically, the initial 10-year effective period of the contracts may be extended by an equal period of time simply upon a producer's unilateral statement filed with the competent Operator.

- Redrafting and legislative consolidation of the levy imposed on the gross proceeds from the sale of renewable energy (exclusive of PV) in favour of local government organizations, which is increased from 2% to 3%.

- Increase of the installed capacity limit up to which no installation and operating permits are required[9].

- Increase of the limit up to which a hydroelectric plant is designated as a small-scale plant from 10 MW to 15 MW so that more plants can be subject to a feed-in tariff regime plus priority by load dispatch.

- Lifting of the prior 50 MW installed capacity limit up to which the competent operator was under obligation to give priority in load dispatch.

In implementation of Law 3468/2006 a significant regulatory framework, as regards its content and extent, was set up as detailed below:

1. Ministerial Decision D6/F1/oik. 18359/14.9.2006 (•6/•1/•••. 18359/14.9.2006) *"Form and content of contracts executed for the sale of electricity to the System and the Interconnected Grid according to the provisions of Article 12(3)of Law 3468/2006" (Government Gazette B 1442).*

2. Ministerial decision D6/F1/oik.1725/25.1.2007 (•6/•1/•••.1725/25.1.2007) *"Determination of the form and content of contracts executed for the sale of electricity generated using Renewable Energy Sources and High-efficiency Cogeneration of Heat and Electricity to the Grid of Non-interconnected Islands according to the provisions of article 12(3)* of Law 3466/2006" (Government Gazette B 148).

3. Ministerial decision •6/F1/•••.5707/13.3.2007 (D6/•1/oik.5707/13.3.2007) *"Regulation of Production Authorisations issued for the generation of electricity using Renewable Energy Sources and High-efficiency Cogeneration of Heat and Electricity"* (Government Gazette B 448).

4. Ministerial Decision D6/F1/oik.13310/18.6.2007 (•6/•1/•••.13310/18.6.2007) *"Procedure for the issue of installation and operating permits for power plants using renewable energy sources"* (Government Gazette B 1153)[10].

[9] Under the previous regime the limit was 20 kW, and the new law increased it to 0.5 MW for geothermal energy, 100 kW for biomass and biofuels, 150 kW for PV systems, but maintained it to 20 kW for wind power in case of wind farms installed on non-interconnected islands, except for Crete where the limit was increased to 40 kW, or 50 kW for wind farms installed in the mainland interconnected system, as well as for all other forms of RES. The exemption is valid where the plants are not installed in areas with congested grids, and pursuant to Article 19 of Law 3587/2007, the relevant right is non-transferrable before the implementation of projects.

[10] The main points of the new regulation for the issue of installation and operating permits are as follows:
a) The formulation of the connection offer shall be done before the filing of the application for the issue of the installation permit. After the formulation of the connection offer by the responsible Operator, the holder of the Production Authorization shall map out on a topographic diagram the method used for connecting the plant to the System or Grid and shall submit it to the Operator for ratification. In the event that the plant is connected via a new MV to HV substation, the applicant shall furnish the Operator with a suitability certification for the plot of land to be used for the installation of the substation, as issued by the responsible service of the System and Grid Owner. The Operator shall ratify the topographic diagrams with respect to compatibility thereof with the content of the connection offer. The above is aimed at ensuring that the content of the Environmental Impact Assessment to be prepared thereafter by the producer, which should include the connection works, shall not be subject to further modifications and shall be approved by the Operator.
b) Thereafter, the applicant shall submit a file to the licensing authority for the issue of the Environmental Terms Approval (EPO) and the concession of the right to use a wooded area, where required, as well as other supporting documents (including the production authorization and the connection offer). After a preliminary check aimed at comparing information against that of the production

5. The scheme established by the new law for the Deployment of Photovoltaic Plants, which was elaborated by decision D6/F1/oik.8684/24.4.2007 (•6/•1/•••.8684/24.4.2007) (Government Gazette A 694) taken by the Minister of Development and was amended by decision D6/F1/oik.15450/18.7.2007 (•6/•1/•••.15450/18.7.2007) (Government Gazette A 1276), was an initial effort made at a national level towards organizing the spatial deployment of plants exploiting solar energy, following the pattern used in other countries at a European and international level which have much less solar energy that that of Greece.

On the basis of the above scheme, licenses may be issued for PV plants of a capacity of 590 MMW_P for the Interconnected System, 200 MW_P for the Non-interconnected Islands, and 50 MW_P for auto-producers in the years 2007-2020. Taking into account the licensing process mainly for large-scale plants, this leads to the full deployment of PV plants as per the Scheme within an eight-year period, i.e. by 2015. Furthermore, the experience gained so far from the deployment of RES plants has shown that the implementation of all plants for which a production authorisation has been issued is not feasible, which means that the deployment of PV plants as per the relevant target is expected to take place gradually by 2020, as provided for in Law 3468/2006.

Table 3 shows the proportion of licensed capacity as a percentage of the total capacity provided for in the Scheme, as well as in MW_P.

Time frame	*Percentage of scheme's total capacity*	*Licensed capacity in the Interconnected system*	*Licensed capacity on Non-interconnected islands in [• W_p]*
Up to 31.12.2007	**50%**	**295.50**	**100**
Up to 31.12.2008	**70%**	**413.00**	**140**
Up to 31.12.2009	**90%**	**531.00**	**180**
Up to 31.12.2010	**100%**	**590.00**	**200**

Table 3. Licensed capacity as a percentage of the total capacity of the PV energy deployment scheme

According to the above decisions, the capacity (MW_P) of PV plants installed in the Interconnected System, which are included in the Scheme, shall follow a geographical distribution per Administrative Region. In the determination of the geographical allocation within the Interconnected System, sunshine and temperature data were taken into account, along with the needs of the local system where most of the country's demand is concentrated, whereas RAE announced a call for licensing plants of a capacity of up to 150 kW, also taking into account the amount of capacity that can be absorbed by each electrical system in order to prevent any stability problems.

A fundamental goal of the Scheme is to ensure the maximum possible deployment of small-scale plants of up to 150 kW_p as close as possible to the areas where electricity is consumed, in accordance with peak demands recorded in each area, in the entire territory of Greece and mainly on the islands, where only such small-scale plants are to be deployed actually. The total capacity provided for plants of up to 150 kW_p is over 40% of the target in the Interconnected System and includes the aggregate capacity on non-interconnected islands, i.e. 410 kW_p. The benefits expected from the implementation of the above Scheme are numerous, since smaller plants cause much less environmental impact, networks are decongested due to the decentralized generation at the ends of the grid lines, and regional development is boosted through creating jobs and ensuring revenue for small, mainly local, producers. It should also be pointed out that the benefit arising from PV plants includes more than mere replacement of the electricity generated by conventional

---

authorization, the licensing authority shall forward the information to the authority responsible for issuing the EPO. Finally, following issue of the EPO, an application shall be submitted to the above authority for the issue of the installation permit.
c) For the issue of the operating permit, the applicant shall submit a file to the authority which has issued the installation permit. The ministerial decision has detailed the new procedure established within the framework applicable to the issue of operating permits for RES plants as per paragraph 5(8) of Law 3468/2006, i.e. for checking the operating characteristics of the plant's equipment by the Centre for Renewable Energy Sources (CRES).
d) Any pending applications submitted after the effective date of Law 3468/2006 and up to the effective date of the ministerial decision for the issue of an installation permit, the environmental terms approval, the concession of the right to use a wooded area, or the issue of its operating permit shall be subject to the provisions of that decision. To consider these applications, a prior positive opinion must have been issued by the competent service within the framework of the Preliminary Environmental Impact Assessment procedure, which, in the case the a production authorization issued before the effective date of Law 3468/2006, shall be issued upon application filed by the person involved directly with the service responsible for environmental licensing.
e) The formulation of the connection offer for pending applications shall be done after the receipt of a positive opinion within the framework of the Preliminary Environmental Impact Assessment procedure so that no capacity is taken up in the System for projects that lack the proper environmental planning required for the issue of a positive opinion in connection with the Preliminary Environmental Impact Assessment.
f) The effective period of installation permits issued for RES plants is increased. More specifically, permits for the establishment or expansion of the above plants issued after the effective date of the decision in question shall remain in effect for two years; the effective period of such permits shall be subject to a conditional two-year extension.

plants. PV plants, due to their dispersed nature, generate electricity during average and high demand hours and serve as a replacement for installed conventional capacity used for meeting peak demand needs.

6. Current developments in the institutional environment of RES

6.1 Law 3734/2009 (Government Gazette • 8/28.1.09): "Promotion of the cogeneration of two or more useful forms of energy, regulating issues relating to the Mesochora Hydroelectric Project and other provisions"

The above law transposed into national legislation Directive 2004/8/EC of the European Parliament and of the Council, of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC (OJ L 52/50) and complemented the legal framework on the promotion of cogeneration of two or more useful forms of energy.

The law included provisions amending Laws 3468/2006 and 3199/2003"[11], and introduced the following fundamental conditions applicable to the development of the PV market and RES in general:

- The process followed for the issue of installation and operating permits was simplified at a central level, as they were now issued on the basis of a Ministerial Decision, not a Joint Ministerial Decision.
- To lift the virtual "congestion" of grids, one single framework was established for the issue of a Connection Offer, older Connection Offers were rendered void on the basis of transitional provisions, and the effective period of new Connection Offers was set to 3 years, with a renewal option only on condition that a relevant installation permit had been issued.
- The exclusive deadlines set out in Law 3468/2006 were rationalised and the risk of acts being rendered void was eliminated.
- The term "ratification" instead of building permit was eliminated, and provision was made for "approval of works" for non-structural constructions of wind and PV farms.

More specifically, the Law provided, among other things for new tariffs for the sale of the electricity generated by PV plants, also taking into account the technological progress that has led to a significant reduction in installation costs in the years 2007-2008, as well as the expectations expressed in the sector for a significant rise in the performance of such plants along with a further reduction in the relevant procurement and installation costs in the mid-term. It was stipulated that the new tariffs might be modified on the basis of a decision taken by the competent Minister, following an opinion issued by RAE, and they should be adjusted annually by 25% of the previous year's Consumer Price Index. The relevant contracts for the sale of electricity should have a 20-year term and should be executed on the basis of the reference tariffs given in the following table, corresponding to the month and year of signature of the contract, subject to the condition that the trial operation should begin, or if there is no provision for such a trial operation, the connection of the plant should be activated, within a specific deadline; otherwise, the tariff given for the month of commencement of the trial operation or activation of the connection should apply, in accordance with the capacity of the plant at that time.

[11] Amendments to Articles 3, 8, 25, 3, new Articles 25a and 27 of Law 3468/2006 and Article 7 of Law 3199/2003 regarding substantial improvements to the licensing process for RES projects (rejection opinions by RAE, production authorisations, installation and operating permits) and ensuring the licensing regime for small-scale hydroelectric plants.
- Special provisions for facilitating the connection of RES plants to the system (HTSO).
- New provisions for the rational deployment of PV plants and facilitating installation thereof in buildings.

Year	Month	INTERCONNECTED		NON-INTERCONNECTED	
		A	B	C	D
		>100kW	<=100kW	>100 kW	<=100 KW
2009	February	400.00	450.00	450.00	500.00
2009	August	400.00	450.00	450.00	500.00
2010	February	400.00	450.00	450.00	500.00
2010	August	392.04	441.05	441.05	490.05
2011	February	372.83	419.43	419.43	466.03
2011	August	351.01	394.88	394.88	438.76
2012	February	333.81	375.53	375.53	417.26
2012	August	314.27	353.56	353.56	392.84
2013	February	298.87	336.23	336.23	373.59
2013	August	281.38	316.55	316.55	351.72
2014	February	268,94	302,56	302,56	336,18
2014	August	260,97	293,59	293,59	1.5•••••n-1
For each year n from 2015 onwards		1.3•••••n-1	1.4•••••n-1	1.4•••••n-1	

Table 4. Gradual reduction in the tariffs applicable to the sale of electricity generated by PV plants

6.1.1 Regulatory framework established by Law 3734/2009 and Joint Ministerial Decision 1079/2009 "Special Scheme for the Deployment of Photovoltaic Systems in buildings, and in particular on building roofs and facades".

Following the adoption of Law 3734/2009, Joint Ministerial Decision of 4th June 2009 (Government Gazette B 1079/4.6.2009) was issued to establish a Special Scheme for the Deployment of Photovoltaic Systems (PV Systems) in buildings, and in particular on building roofs and facades. The Scheme pertains to the installation of systems of a capacity of up to 10 kW_p in buildings and very small enterprises, in the Mainland System and on the Interconnected Islands and has been in effect since 1st July 2009. At the same time: (a) a decision has been taken by the Minister for the Environment, Physical Planning and Public Works on the "Conditions applicable to the installation of Photovoltaic Systems of up to 10 KW on building roofs and terraces" (Government Gazette 344/20.07.2009), regulating town planning issues; and (b) a circular was issued by the Secretary General for Tax and Customs Issues of the Ministry of Finance on how to handle tax issues relating to PV Systems of up to 10 kW_p to be installed under the Scheme (Circular 1101/06.08.2009).

Natural persons who are not professionals, as well as natural or legal persons who are professionals classified as very small enterprises can be subjected to the Scheme, provided that they own the land where the PV system is to be installed. Following are the conditions to be met for subjecting a PV system to the Scheme:

- There must be an active electricity consumer connection in the name of the PV system owner, in the building where the system is to be installed.
- Part of the heat needed for hot water used by the PV system owner, if the relevant building is used as a residence, must be derived from renewable energy sources, e.g. solar thermal systems, solar water heaters.

- There must have been no state aid within the framework of the Law on Development - Investment, as in force at any given time, of the aid schemes that are jointly funded by the European Union (e.g. within the framework of OP of NSRF), or any other funding scheme in general.

The Scheme also lays down the institutional framework for the implementation of contracts. The PV system Offsetting Contract shall be entered into between the PV system owner and PPC S.A. or another supplier providing electricity to the building where the system is to be installed for a term of twenty five (25) years; the date of activation of the PV system connection shall be the effective date of the contract. The Contract shall be executed on the basis of a fixed reference tariff and shall correspond to the year of execution of the contract, as per paragraph 3 of the Law, on condition that the PV system connection is activated within six (6) months of the date of execution of the Offsetting Contract. If not, the reference tariff shall be equal to the tariff corresponding to the year when the PV system connection is activated. The feed-in tariff for the electricity generated by the PV system is set to 0.55 €//kWh for Offsetting Contracts entered into in 2009, 2010 and 2011, and it shall be reduced by 5% annually for Offsetting Contracts entered into from 1.1.2012 to 31.12.2019. The tariff used as a basis for executing the Offsetting Contract shall be adjusted on an annual basis by 25% of the previous year's Consumer Price Index, as set out by the National Statistical Service of Greece or any other competent authority. If the tariff arising from the above adjustment is lower than the mean System Limit Value set for the previous year, increased by 40%, the pricing shall be done on the basis of the Mean System Limit Value of the previous year, increased by the above coefficient.

The scheme provides incentives in the form of aid granted for each kWh generated by PV systems so that domestic producers or small enterprises can ensure a payoff for the system installed and make a reasonable profit for the (energy and environmental) services they provide to the grid.

6.2 Changes to the regulatory framework for Geothermal projects

Law 3734/2009 is expected to facilitate investments in geothermal energy and use thereof in agricultural operations, whereas the respective changes to the executive ministerial decisions associated with that law have been completed. This are aimed at:

- Simplifying and standardising the licensing process for the use of geothermal energy for domestic purposes (low-depth geothermal energy).
- Expanding its use to include agricultural operations (greenhouses), setting forth one single standard permit, and allowing the use of closed systems in areas where drilling is prohibited.
- Amending the Ministerial Decision on the tendering process for leasing out the rights to carry out exploration in large geothermal fields, making it clearer and fully transparent.

Following is a description of the relevant Ministerial Decisions:

1. *Ministerial Decision D98//2009 (• 98//2009) — Installation permits for heating-cooling systems using heat from geological formations, etc.*

The decision laid down the terms, conditions, required supporting documents and process for the issue of a license in favor of a property owner to make own use of heating or/and cooling energy systems in each part of the property through exploitation of the heat of geological formations and surface or ground waters that are not designated as geothermal potential.

2. *Ministerial Decision D9D//2009 (• 9• //2009) — Terms for leasing out State rights for the utilisation & management of geothermal potential*

The purpose of the ministerial decision was to create the proper conditions for a rational utilisation of the country's geothermal potential. The utilisation of geothermal potential, as a renewable source of energy, promotes sustainable development and is in the interests of the general public. As per Article 1, the competent Minister may take a decision to stipulate that the right to manage the geothermal potential supersedes the right to exploit other metal ores or quarry materials, should utilisation of that geothermal potential, at the Minister's discretion, be more important for the national economy. The Decision is expected to provide a substantial boost in a relatively new business sector, that of Geothermal Energy, and thus help the country achieve its environmental commitments.

3. *Ministerial Decision D9B.D/F166/7859/1392 (• 9• .• /• 166/7859/1392) — Identification and classification of Geothermal Fields.*

The Decision identified and added to a respective category seven new geothermal fields in the country. More specifically, the following geothermal fields were identified and classified:

- Verified Low Temperature Geothermal Field in Thymiana, Chios
- Possible Low Temperature Geothermal Field in Thymiana, Chios
- Possible Low Temperature Geothermal Field in Sykies, Arta
- Verified Low Temperature Geothermal Field in Damasta, Fthiotida
- Verified Low Temperature Geothermal Field in Lichades, Evia
- Verified Low Temperature Geothermal Field in Nea Apollonia, Thessalonica
- Verified Low Temperature Geothermal Field in Riza, Antirrion, Aitoloakarnania

Geothermal fields are certified after conducting a relevant exploration and on condition that specific criteria are met. According to existing law, a field is identified as a "law temperature field" if the temperature of liquid matter ranges between 25°C and 90°C. Exploration has been performed by the Institute of Geology and Mineral Exploration (IGME). There are a total of forty one verified and possible law temperature geothermal fields in the country. The recoverable potential of the two fully explored high-enthalpy fields for power generation purposes amounts to 170 MW_e whereas according to estimates, the probable potential in the whole country is more than double that amount.

6.3 Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

The Directive on the promotion of the use of energy from renewable sources (2009/28/• •), which was a historic landmark in European legislation, set a mandatory target of 20% share of energy from renewable sources in overall EU-27 energy consumption by 2020. The respective target for Greece was set to 18%. The Directive provided all necessary political support for renewable energy markets, offering a tremendous potential for financial growth and creation of new jobs. Under the Directive, the EU-27 Member States are required to submit a National Renewable Energy Action Plan (NREAP) by 30/6/2010, on the basis of a sample provided by the EU. The Directive is part of a legislative package on Energy and climate change endorsed by the Council on 6th April 2009. Under the new Directive on the use of energy from renewable sources:

- A legally mandatory target of 20% share of energy from renewable sources in overall energy consumption by 2020, including a 10% share thereof in the transport sector, is set.
- Provision is made for the first time to utilise RES for all energy purposes (generation of electricity, cooling/heating, transport/biofuels).
- The more specific targets set at a national level are based on the GDP, starting from the share of RES in each Member State in 2005; the relevant percentage is set to 18% for Greece.
- Transfers of guarantees of origin are recommended, along with an option for maintaining national support schemes (e.g. feed-in tariffs).

6.4 Transposing new Directive 28/2009/EC into national law

New interventions are expected in 2010 within the RES framework in order to transpose the provisions of Directive 28/2009 into national law and establish a new national mandatory target for the share of RES in overall energy consumption by 2020.

7. The physical planning dimension of RES deployment

The RES institutional framework, with its very first laws, placed emphasis on the granting of financial incentives in the form of feed-in tariffs, in conjunction with the simplification of the licensing process as compared to the process applicable to industrial facilities in general.

However, the option of installing RES power plants in protected natural lands or forests and wooded areas, as well as the relevant terms and conditions and all other RES-related physical planning issues were addressed inadequately in Law 360/1976 *"Physical Planning and Environment"* (Government Gazette A 151) and were not a cause for concern.

Law 2941/2001 was the first serious effort made to resolve the problem as it regulated the installation of RES plants in forests and wooded areas through specific provisions which formed a new standing and generally applicable regime.

Furthermore, by mid 2003 by virtue of decisions taken by the Minister for the Environment, Physical Planning and Public Works, the Regional Frameworks for Physical Planning and Sustainable Development Plans were established under Law 2742/1999 "Physical Planning and Sustainable Development and other provisions" (Government Gazette A' 207). The issue of the above legislative acts filled the gap identified by ruling no 2569/2004[12] issued by the Council of State in the meantime.

To deal with the physical planning of RES in a more effective and integrated way, the Ministry of the Environment, Physical Planning and Public Works took advantage of the options granted by the provisions of Law 2742/1999 and, taking into consideration the recommendations and criteria set out in the above court ruling, decided to establish a Special Physical Planning Framework for the promotion of RES in the Greek energy system, which would also contribute towards the achievement of the national targets relating to the greenhouse effect, as required in the Green Paper "Towards a European strategy for the security of energy supply" (European Commission COM (2000) 769 final, p. 44).

It was also decided to promote the General Physical Planning Framework, as well as the Special Frameworks for tourism, industry, mountains and seaside areas. Most of these Special Frameworks, as well as the National Physical Planning Framework, for RES, after being drafted by the Ministry for the Environment, Physical Planning and Public Works, were posted for public consultation following an opinion issued by the National Council of Physical Planning and Sustainable Development, and then the relevant Joint Ministerial Decisions were issued.

The Special Framework for RES is in line with the Physical Planning principles and criteria laid down in Article 2 [13]of Law 2742/1999 and elaborates the directions relating to the sustainable development and organisation of the national territory with respect to the spatial structure of power generation from RES as a sector of production activity and as a public utility infrastructure of nation-wide importance, while at the same time providing directions at lower planning levels (Regional Frameworks, General Town Plans, Residential Organisation Plans for Open Cities, Residential Control Zones, etc.).

More specifically, the **"Special physical planning and sustainable development framework for renewable energy sources"**[14]

- Establishes policies for the siting of RES projects per activity category and area category, on the basis of data available at a national level.
- Establishes siting rules and criteria which will allow, on the one hand, the setting up of viable RES plants and, on the other hand, their harmonious incorporation in the natural and man-made environment. That is, the endorsement of the framework is aimed at providing, in addition to other benefits, a more clear-cut guide for licensing authorities and investors so that they can be oriented towards installation locations that are initially appropriate from a physical planning point of view, thus reducing the ambiguities and conflicting land uses often arising on the spot.

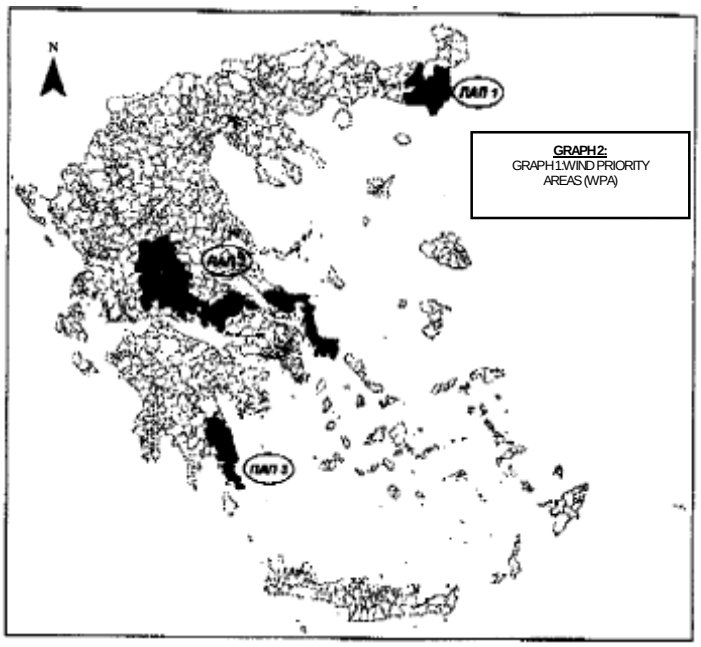
[12] By virtue of that ruling the installation permit for a wind farm in Lakonia, which had been issued before 2003, was revoked since it was ruled that a permit could be issued in an area where so many applications had piled up only after the establishment of relevant frameworks or following designation of the area as an Area for Integrated Deployment of Production Activities.

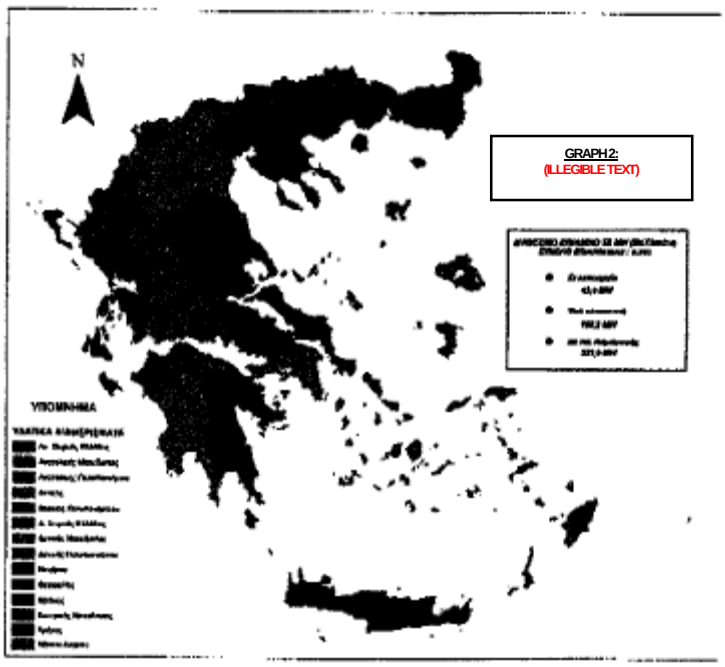
[13] Par. 1 sets the goals promoting the three aspects of the integrated, balanced and sustainable development of an area, and highlighting the need for securing and promoting the country's comparative geographical, natural/cultural and productive advantages. Par. 2 sets forth the fundamental principles contributing towards the achievement of the physical planning goal, including, among other things, the guidelines of Agenda 21 and of the 5th Action Plan for the Environment of the European Union, as well as the general criteria for a physical planning approach at a European scale as set forth in the Community documents 'Europe 2000', 'Europe 2000+', the European Spatial Development Perspective, etc.

[14] Joint Ministerial Decision 49828/2008 (Government Gazette B 2464/3.12.08)

- Sets in motion an effective siting mechanism for RES plants, in an effort to achieve national and European policy targets.
- At an operational level, it is aimed at simplifying and shortening the spatial planning and spatial-environmental elaboration procedures relating to the establishment of RES plants, as well as setting up an environment of legal certainty for investors without compromising environmental protection.

Following are graphs presenting wind and hydrodynamic activity areas, as laid down in the special RES framework.





8. State aid for RES projects

8.1 Aid for RES projects using resources from the 2nd Community Support Framework

Using resources from the 6th Community Support Framework, which was completed on 31.12.2002, the Operational Programme for Energy (OPE), which was managed by the Ministry of Development, provided funds for projects of a total budgeted value of Euro 1.061 billion. 33.8% of the budget came from the European Regional Development Fund (ERDF), 45.2% came from national resources, including PPC S.A. resources, and 21% came from private funds. Part of subprogramme 3 related to generation of electricity from RES. Summary information is provided in Table 5.

	Wind	*Small-scale hydros*	*Solar*	*Biomass*	*Total*
Number of investments	16	9	15	*2*	**42**
Total budget in Euro million	141.60	17.20	6.10	31.50	**196.40**
Total public expenditure in Euro million	53.20	7.70	4.20	14.80	**79.90**
Total installed capacity in MW	121.00	11.50	0.74	20.70	**153.90**
Annual power production in GWh	**354.00**	**53.00**	**1.00**	**168.00**	**576.00**

Table 5 : Summary cost and production information on RES power plants funded using resources from the 2nd CSF (within the framework of OPE)

Besides, the Ministry of National Economy (now Ministry of Economy and Finance) provided funds from national resources under Law 1892/1990 *"Modernisation and development and other provisions"* (Government Gazette A 101) and thereafter under Law 2601/1998 *"Aid to private investments for the economic and regional development of the country and other provisions"* (Government Gazette A 81).

8.2 Aid for RES projects using resources from the 3rd Community Support Framework

The Operational Programme for Competitiveness (OPC) that uses funds from the 3rd Community Support Framework provides public funding for RES and energy saving, substitution of conventional fuels and other energy-related actions amounting to a total of Euro 1.644 billion. State aid covers a percentage of eligible costs ranging from 30% to 60%, on a case-by-case basis, whereas the cost of interconnection lines irrespective of the technology used for the investment is covered by state aid by 45% in areas A and B of Central Macedonia and Attica, as set forth in Law 3299/2004, and 50% in the rest of the country; the respective coverage percentage is 50% for small and medium enterprises in the entire territory of Greece.

Following is a presentation of the projects funded from the Operational Programme for Competitiveness (OPC):

	Wind	*Small-scale hydros*	*Solar*	*Biomass-Biogas*	*Total*
Number of investments	34	*22*	54	3	113
Total budget in Euro million	352.04	100.29	22.27	26.52	501.13
Total public expenditure in Euro million	111.05	40.42	9.93	10.61	172.01
Total installed capacity in MW	380.30	74.54	2.62	18.80	476.26
Annual power production in GWh	**893.64**	**271.94**	**3.43**	**127.2**	**1.296.21**

Table 6: Summary cost and production information on RES power plants funded using resources from the 3rd CSF (within the framework of OPC)

8.3 Law 3299/2004 on Development

A considerable funding tool for RES investments is the so called Law 3299/2004[15] on Development, as currently in force, following its amendment by Article 37 of Law 3522/2006[16]. More specifically, the territory of Greece is divided into three (3) zones where aid is granted amounting to 20%, 30% and 40% of the total eligible investment cost, respectively, also including the cost incurred for connection to the power grid for large enterprises. The aid percentage is increased by up to 10% for medium enterprises and up to 20% for the small ones.

More specifically, the aid zones are divided as follows (see map below):

- Zone A, including the prefectures of Attica and Thessalonica (exclusive of industrial areas and islands therein, which belong to zone B)
- Zone C, including the prefectures of the regions of Eastern Macedonia and Thrace, Peloponnese, Epirus, Western Greece and Northern Aegean Islands
- Zone B, including all other areas

[15] Visit the Website of the Hellenic Center for Investment (http//www.elke.gr) to see the Greek and English texts of Law 3299/2004 on Development and its amending Law 3522/2006 (Government Gazette A 276).
[16] Article 37 of Law 3522/2006 (Government Gazette 276 • 22/12/2006)

Map 1: Geographical zones under the Law on Development

Category 1 of subsidised investment plans also include RES-related actions, and in particular:

- Investment plans for electric power generation from environmental-friendly forms of energy, and in particular, wind, solar, hydroelectric, geothermal energy and biomass, as well as plans for the cogeneration of electricity and heat.
- Environmental protection investment plans for the reduction of the pollution of the soil and subsoil, water and atmosphere, restoration of the natural environment and water recycling, and desalination of sea and brackish water.
- Investment plans for the utilisation of renewable energy sources, replacement of liquid fuels or electric energy with gaseous fuel, processed materials disposed of by domestic industrial plants, renewable energy sources, recovery of disposed heat, as well as cogeneration of electricity and heat.
- Investment plans for saving energy on condition that such plans pertain, not to the production equipment, but to the equipment and facilities used for the function of the plant and also on condition that the plant results in a reduction of the energy consumed by at least 10%.

Following is a table presenting the subsidy percentages per zone also for category 1 relating to RES projects:

Type of Subsidy	Geographical Zone		
	A	B	C
Coverage of investment plant cost / Subsidy for finance lease cost	20%	30%	40%
Tax exemption	60%	100%	100%
Subsidy for payroll cost	20%	30%	40%

Table 7 : Subsidy percentages per zone also for category 1 relating to RES projects (under the Law on Development)

A new Ministerial Decision was issued on 10 July 2007, to make certain changes to the subsidy percentages set forth in the Law on Development for wind farms and photovoltaic plants in particular. Those changes are summarised in the following table.

Size of enterprise	Geographical Zones / Subsidy Percentage		
	A	**B**	**C**
large	20	30	40
medium	30	40	40
small	40	40	40
very small	40	40	40

Table 8 : Subsidy percentages per zone for wind farms and PV plants (under the Law on Development)

As regards PV system and wind farm investments in particular, the aid intensity along with the above percentage increase may not exceed 40%.

8.4. Fiscal regulations for RES investments without capital subsidy

The projects to receive state aid from national and Community resources under the National Strategic Reference Framework (NSRF) in conjunction with large-scale hydroelectric projects are not enough to achieve the target of 20.1% and therefore investments utilising purely private funding are necessary. The lack of measures for granting state aid must be offset by:

• A reduction in bureaucratic costs through simplification of procedures and elimination of administrative obstacles.

• The consolidation and stabilisation of the investment environment through broader development and taxation policies in the country.

• The facilitation of bank financing for projects through measures to be taken pertaining mainly to the conditions set forth in, and term of, renewable energy sales contracts.

A further boost in the development of RES is expected from the implementation of the new Operational Programme for Competitiveness & Entrepreneurship (OPCE) over Programme Period 2007-2013, whose planning was completed in 2006. Interventions are to be implemented to contribute both to a gradual reduction in the country's dependency on oil through promotion of natural gas and electricity networks and a higher share of renewable energy sources in the energy balance, and reinforce the country's geostrategic role in the energy map of the wider region through the country's participation in large international networks.

A fundamental axis of such interventions is, among other things, Renewable Energy Sources (RES) – Energy Saving (ES), in support of the following actions:

- Subsidising investments for the generation of energy from RES and High-efficiency Cogeneration of Electricity and Heat .
- Saving energy and improving the energy performance in the secondary and tertiary sectors.
- Subsidising investments to meet the needs on the islands.

The following entities can benefit from the Actions of the above Axis:

- Enterprises of all types and sizes, as well as Greek households in the new areas covered by the expansion of natural gas networks.
- Enterprises implementing investments for saving energy and improving the energy performance in the secondary and tertiary sectors.
- Enterprises active in energy generation from renewable energy sources and high-efficiency cogeneration of electricity and heat in the secondary and tertiary sectors, utilisation of biomass, etc.
- The country's islands.

In a broader sense, the society in general will also benefit from the interventions included in the Axis, through the above-mentioned actions for supporting the liberalisation of the energy market and the country's participation in large international electricity and natural gas transmission networks, the completion, modernisation and securing of the adequacy of the country's electrical grid, the utilisation of renewable sources for energy saving, environmental protection and rational management of natural resources.

9. Current status of RES and large-scale hydroelectric plants

The total production capacity of hydroelectric plants using RES (exclusive of large-scale hydroelectric plants and pumping projects) that had been installed and operated by the end of 2008 was 2.76 TWh, broken down as follow: 81.2% from wind farms, 11.8% from small-scale hydroelectric plants, and 7% from other renewable forms of energy (biogas, and PV systems). Moreover, PPC S.A. operates 15 large-scale hydroelectric plants[17] of a total installed capacity of 3 017.8 MW, mainly used to meet peak demand needs, which have an average power output of 4.16 TWh under average hydraulic conditions and based on a conservative water management scenario, also due to the multi-purpose character of most projects. The 2008 output was 4.15 TWh (including a 0.8 TWh output from pumped storage), and the respective 2007 output was 3.4 TWh. Details on RES plants, including large-scale hydroelectric plants, are provided in Table 8.

[17] See the 3rd Report for a list of projects

Region	Large-scale hydros	Wind	Small-scale hydros	Solar	Biomass	Totals
Eastern Macedonia & Thrace	500.0	197.5	2.2	0.2		**199.9**
Attica	0.0	3.1	0.6		33.9	**37.6**
North Aegean	0.0	27.9				**27.9**
Western Greece	907.2	93.4	26.5			**119.9**
Western Macedonia	375.0		4.5			**4.5**
Central Macedonia	492.0	27.0	45.2	1.7	5.0	**78.9**
Epirus	543.6		45.2			**45.2**
Ionian islands	0.0	70.8				**70.8**
Thessaly	130.0	17.0	20.8		1.9	**41.6**
Crete	0.0	164.5	0.6	0.5	0.4	**166.0**
Southern Aegean	0.0	40.6				**40.6**
Peloponnese	70.0	212.8	3.0	2.6		**218.4**
Central Greece	0.0	285.3	31.8	3.2		**320.3**
TOTALS IN OPERATION (MW)	**3 018**	**1 140**	**180**	**37***	**41**	**1 398**

*** = PV < 15O kW in OPERATION:27.1 • W**

Table 9 :*Installed capacity of RES systems in MW by September 2009*

In addition to what is presented in Table 9, there are now (September 2009) further installation permits for RES plants of a total capacity of **1 271 MW,** of which 1 048 MW are wind farms, 93 MW are small-scale hydroelectric plants, 83 MW are PV systems and 47 MW are biomass plants. These are mature projects throughout Greece, without any grid connection or environmental licensing problems and therefore it is estimated that they will have been completed by the end of 2010. It should be noted that these projects could be connected directly without any need for costly projects to enhance local electricity transmission grids.

On the contrary, in such areas as Southern Evia, Southeastern Peloponnese and Eastern Macedonia and Thrace, the planned RES projects will have to remain pending until completion of the relevant planned transmission projects.

As regards the progress of the less mature RES projects in the rest of Greece, i.e. except for the areas where extensive grid enhancement projects have been planned, it should be noted that the wind potential, in particular, has been identified in areas where local wind flow acceleration circumstances are appropriate for utilisation thereof. It is a fact that the wind potential in such areas is unexplored. However, in recent years considerable and detailed exploration has been carried out by private entities to identify appropriate locations in areas that are free from grid adequacy problems or/and where there is no trouble associated with acceptance by local populations. The situation is similar regarding the other types of RES, where there are numerous ongoing efforts for the development of projects in different areas of Greece.

A reliable picture of such investment interest is given in Table 10, which shows the capacity of energy production authorisations in mainland areas, in areas other than those where grid enhancement has been planned, for which no installation authorisations have been issued. It should be noted that, should a project be delayed due to the investor's own fault (e.g. due to the investor's financial inability to implement the project), the relevant production authorisation is revoked. So far, authorisations for about 668 MW, already issued for RES projects in the past, have been revoked.

	Capacity [MW]
Wind farms	5033
Small-scale hydros	390
Biomass	37.3
Geothermal	8
Solar	135.6
TOTAL	**5 604**

Table 10: RES production authorisations without installation permits, in mainland areas other than those where grid enhancement projects have been planned

It should be noted that investors have expressed increased interest in the deployment of large-scale wind farms on the islands and connection thereof to the mainland system. Finally, in the isolated power system of Ikaria, the Hydroelectric Projects Development Division of PPC has tendered a hybrid System comprising a typical pumped storage hydroelectric unit combined with two pumped reservoirs of a capacity of 4.1 MW, assisted by a 2.4 MW wind farm for the generation of approximately 10.9 GWh/year. The project has already been subjected to the 3rd Community Support Framework to receive state aid, and the first installment has been paid in advance. The implementation of the project is expected to be completed by 2010.

In addition to the projects referred to in the previous paragraph, Table 11 presents the projects planned[18] by PPC (to be operated within the next 5 years), of a total annual output of 1.67 TWh.

Region	Plant Name	Capacity [MW]	Output (GWh/year)
Central Macedonia	**Ilarionas**	**153.0**	**527**
Western-Central Greece	**Sikia**	**126.5**	**296**
Thessaly	**Pefkofito**	**160.0**	**340**
	Mesochora	**161.6**	**384**
Eastern Macedonia	**Temenos**	**19.0**	**60**
Epirus	**Metsovitikos**	**29.0**	**67**
TOTALS		**649.1**	**1.674**

Table 11 :*PPC-planned hydroelectric projects to be operated in the next five years*

As regards the Mesochora Hydroelectric Project in particular, of a capacity of 160 + 1.6 MW (small-scale hydroelectric plant) in particular, Law 3734/2009 regulated all pending issues relating to the relevant expropriations and the relocation of the affected populations, so that that the remaining works can be started. However, by virtue of Ruling 141/2010 issued by the Commission of the Council of State responsible for granting stays of execution, it was decided to suspend all works relating to the diversion of Acheloos River, including the Hydroelectric Plant and the Small-scale Hydroelectric Plant of Mesochora, until a final ruling is issued by the Council of State. According to the plans made by PPC S.A., the construction of the Ilarionas Hydroelectric Plant, of a capacity of 153 MW, is still under way. The Mesochora, Ilarionas and Metsovitiko plants are to be put in commercial operation by the end of 2010, according to plan.

[18] As some of them are multi-purpose projects, implementation thereof is not exclusively dependent on the PPC mid-term strategy priorities.

10. Management of dispersed power generation

In Greece, as in most European countries, the functioning of existing power generation systems is structured on a centralized production pattern, as PPC S.A. has been the sole operator since its establishment. In the case, however, of many small-scale RES plants whose operation is dependent on the randomness of the natural resource exploited, uninterrupted control thereof turns out to be a complex task. Taking this into consideration, RAE is looking into parameters relating to the use of new data transmission and processing and control technologies in order to address the problem effectively; however, such technologies tend to increase the cost of the electricity supplied to consumers significantly. The implementation of the above, within the context of a liberalised electricity market , requires the pricing and evaluation of different techniques and capabilities parallel to the operation of conventional sources in order to achieve the best result for customers.

The problem becomes more intense in independent island systems where the introduction of hybrid systems of considerable installed capacity poses highly complex problems to be addressed by the Grid Operation Code[19].

11. Guarantee of origin for electricity generated from RES

As mentioned above, Law 3468/2006 has already endorsed a mechanism to guarantee the origin of energy generated from RES, as provided for in Article 5(5) of Directive 2001/77/EC.

According to the relevant provision, the System Operator shall be responsible for the issue of Guarantees of Origin for electricity fed to the System, directly or via the Grid. With respect to the energy fed to the Grid of the non-interconnected islands the Grid Operator shall be responsible for the issue of such guarantees.

The Centre for Renewable Energy Sources (CRES) shall be responsible for the issue of Guarantees of Origin for electricity generated by independent plants not connected to the System or the Grid. Thus, CRES shall install, at the expense of any producer who wants to have guarantees of origin issued, appropriate measuring devices.

The Regulatory Authority for Energy (RAE) shall be responsible for monitoring the Guarantee System. RAE shall monitor the reliable operation of the guarantees of origin of electricity, shall cooperate with the competent Authorities of Member States, and shall handle issues relating to the mutual recognition of Guarantees issued by other EU Member States or third countries.

12. Engineering activities under way to enhance power transmission capacity

Areas of high wind potential (Non-interconnected Aegean islands - Non-interconnected Islands, Southern Evia, Eastern Peloponnese, Thrace) have already attracted a large number of investors. The main feature of highly windy and, usually, sparsely populated areas, is their inadequate power electricity transmission infrastructure, which was constructed decades before emergence of renewable energy as a viable option. Thus, in certain mainland areas of a high wind potential (Non-interconnected Islands, Thrace and Southern Evia), the potential for wind power investments were limited at first due to the initial inability to feed electricity into the power grid, i.e. in the Transmission System (System).

[19] As regards the mainland's interconnected system and the islands connected thereto, the issue is regulated by the System Management Code.

Activities have already been undertaken to enhance and expand the System in such areas as Southern Evia, Southeastern Peloponnese and Eastern Macedonia – Thrace, which are shown in maps 1 and 2, respectively.

With regard to Southern Evia, the progress of the main works is summarised as follows:

a) Construction of the Nea Makri – Polypotamos Transmission Line (comprising an overhead 28/150 kV section, as well as 150 kV underground and submerged cables). The project, which will have been completed by 2012, will increase the transmission capacity form Southern Evia – Andros – Tinos by 400-500 MW.

- Construction of a Polypotamos – Southern Evia 28/150 kV overhead Transmission Line. The implementation of the project started in early summer 2008.
- Upgrade of the Aliveri-Kalamos submerged cable link by adding a submerged cable of a nominal capacity of 175 MVA, which will be part of the Aliveri-Kalamos linking circuit. The existing cables will function in parallel and will be part of the other Aliveri linking circuit.
- Kalamos. An alternative is also being examined for replacing both existing cables, due to their age, with two new 175 MVA cables.
- Construction of a new 150 kV Transmission Line from Aliveri to the area of Kymi, for connecting licensed wind farms in the area.

b) The deployment of new power generation plants (conventional and RES) on Evia requires expansion of the 400 kV grid to Aliveri. Within that framework, the construction of a new Ultra High Voltage Centre has been planned in Aliveri. The integration of the Ultra High Voltage Centre of Aliveri in conjunction with the appropriate restructuring of the 150 kV Transmission Lines linking Evia to Aliveri will also allow for feeding more wind power into the system on Evia. The first 400 kV Ultra High Voltage Centre of Aliveri – System Transmission Line will serve initially the new (natural gas combined-cycle) PPC plant in Aliveri and will also allow for feeding RES power of the order of 150 kV into the Ultra High Voltage Centre. Furthermore, the construction of a second 400 kV Transmission Line from Aliveri to the Ultra High Voltage Centre of Larimna will enhance the reliability of the link and will increase significantly the conventional or/and wind power fed into the system, in conjunction with appropriate restructuring of the 150 kV Transmission Lines linking Southern Evia to Aliveri.

In Peloponnese, 15 wind farms of a total capacity of 212 MW had been put in operation by September 2009. Moreover, Connection Offers had been granted to wind farms of a total installed capacity of 634 MW, whereas applications for the issue of wind farm Connection Offers of a total installed capacity of 476 MW are still pending.

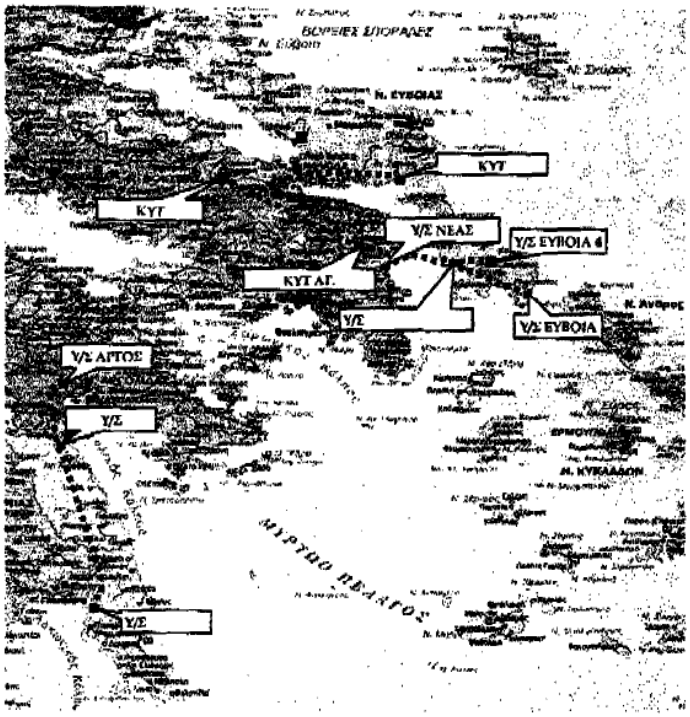
The transmission capacity to and from Peloponnese, which is now estimated approximately at 1100 MW, will be increased significantly upon completion of already planned transmission works of a capacity of 400 kV, which are included in the Transmission System Development Design. Such works include the following:

- The Ultra High Voltage Centre of Patras and its link to the 400 kV Western Greece System.

- The Ultra High Voltage Centre of Megalopoli and its link to the Ultra High Voltage Centre of Patras.

- The Ultra High Voltage Centre of Corinth and its links to the Ultra High Voltage Centres of Koumoundourou and Megalopolis.

Also under development are the works for the Argolida Loop and the enhancement of the supply line to Tripolis in order to allow for feeding into the System the power generated by the wind farms already licensed in the area of Troizinia. The works will contribute to a safer supply of increased loads in the area (in summertime, in particular) and a reduction in low voltage and overloading problems occurring in local substations under fault conditions.



Map 2: Routing of electricity transmission enhancement projects in the areas of Southern Evia and Eastern Peloponnese

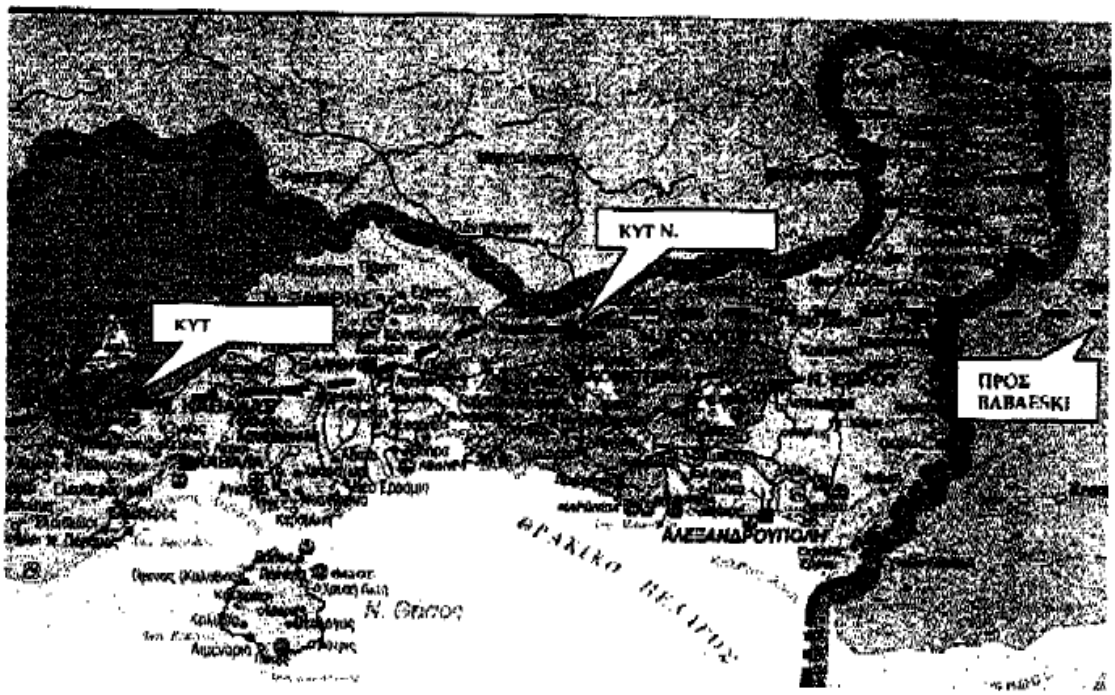
Eleven wind farms, of a total installed power of 197 MW, are in operation in the Eastern Macedonia – Thrace System. Taking into account the current topology of the System, it is impossible to feed any more power into the System.

To eliminate this restriction, the Hellenic Transmission System Operator (HTSO) has planned and initiated the implementation of construction works for the Ultra High Voltage Centre of Nea Santa and the 400 kV double circuit Transmission Line between the Ultra High Voltage Centres of Langada and Philippi. Their effect on the transmission capacity towards the West is detailed below:

- Ultra High Voltage Centre of Nea Santa: The project is under construction and will allow initially for connecting another 10 licensed wind farms in the area, of a total installed power of 115.65 MW, which are already planned. The Production Authorisations issued for those wind farms stipulate that they will be connected to the System *"following completion of planned transmission projects in the area".* On the basis of relevant studies prepared by HTSO, it is estimated that, upon completion of the Ultra High Voltage Centre of Nea Santa, it will be able to receive power from wind farms of a total installed capacity of the order of **500 MW.** Respectively, it will be possible to connect wind farms of a total installed capacity of the order of **100 MW** to the 150 kV grid in the southern part of the area.

- 400 kV double circuit Transmission Line form the Ultra High Voltage Centre of Langada to the Ultra High Voltage Centre of Philippi: On the basis of studies prepared by HTSO, it is estimated that, upon completion of the project, access to an additional capacity of **250 MW** will be possible.

In total, the construction of the Ultra High Voltage Centre of Nea Santa will enable the connection of (existing, licensed and new) wind farms in the area of Thrace of a total installed capacity of the order of **900 MW**. Upon completion of the 400 kV Transmission Line from the Ultra High Voltage Centre of Langada to the Ultra High Voltage Centre of Philippi, the above capacity will be increased to **1160 MW.**



Map 3: Routing of electricity transmission enhancement projects in the areas of Eastern Macedonia and Thrace

Finally, on Crete, Rhodes, Lesvos and other non-interconnected Aegean islands, taking into account current restrictions due to local grids, it is estimated that the power generated by wind farms of a total capacity of approximately 400 MW can be fed into the system, without taking into consideration storage capabilities through hybrid systems. Out of the above total capacity, wind farms of a capacity of 230 MW are already in operation.

13. Conclusions – targeting - need for additional measures

13.1. Optimistic Scenario

The optimistic scenario for the penetration of RES in 2010 is presented in Table 12. Following are the conditions for the realization of the scenario presented in Table 12, which predicts that the 2010 target will be realized by 80.4%, i.e. 9.86 TWh, as compared to 12.26 TWh (see par. 1; the national gross electricity consumption in 2010 is estimated at 61 TWh, and the desired share of RES is 20.1% of that consumption, i.e. 12.26 TWh):

- The implementation of 50% of the investments for which installation permits have already been granted will continue without any obstacles. This assumption is realistic considering that these projects are at a mature stage, no appeals have been filed against them with the Council of State, access thereof to the grid has been guaranteed, and consequently it is possible to secure funds for these projects. In particular, as regards Photovoltaic projects for which installation permits have already been granted, it is estimated that 80% of them will be completed. Moreover, it is expected that additional new small-scale (up to 150 kW) projects of a total capacity of approximately 30 MW — for which no production authorisations, or installation or operating permits are required — will be implemented.
- The extensive works for enhancing local grids in the areas of Eastern Macedonia - Thrace will be completed, and thus it will be possible to implement 50% of the projects for which production authorisations have already been granted on condition that they will be implemented following the extension/enhancement of the System, of a capacity of 115 MW.
- The planned large hydroelectric projects of Mesochora, Ilarionas and Metsovitiko will have been completed by 2010, and thus the flow electricity therefrom into the System will start.

	Installed capacity in (Sep 2009) [MW]	***Installation permits (Sep 2009) [MW]***	***Additional wind farms due to already planned activities [MW]***	***Additional RES (50-80% of installation permits) [MW]***	***Estimated total capacity in 2010 [MW]***	***Estimated output in 2010 [TWh]***
Wind	1 140	1 048	58	524	1 722	3.92
Small-scale hydros	180	93		47	227	0.7
Large-scale hydros	3 018		344	0	3 362	4.57
Biomass	41	47		23	64	0.49
Geothermal				0	0	0
Solar	37	83		66+30	133	0.18
TOTAL	**4 416**	**1 271**	**402**	**690**	**5 508**	**9.86**

Table 12 : Optimistic scenario – Estimated possible RES output in 2010

13.2. Conservative scenario

The three conditions of the optimistic scenario described in paragraph 13.1 also point to the risks that could prevent the realization of the target. That is why a more conservative scenario has also been formulated, taking into account the following:

- That 20% of the projects for which installation permits have already been granted (50% of PV systems and an additional 20 MW from small-scale plants) will be implemented from the last months of 2009 up to the end of 2010.
- That there will be a delay in the completion of the works for enhancing local grids in the areas of Eastern Macedonia – Thrace and the completion of the licensing process for relevant additional RES projects, and thus it will be possible to implement only 20% of the projects for which production authorisations have already been granted on condition that they will be implemented following the extension/enhancement of the System
- That the planned large-scale hydroelectric projects will not be implemented.

	Installed capacity in (early 2009) [MW]	*Additional wind farms due to already planned activities [MW]*	*Additional RES in the rest of Greece [MW]*	*Conservative estimate of total capacity in 2010 [MW]*	*Estimated output in 2010 [TWh]*
Wind	1 140	-35	-314	1 373	3.13
Small-scale hydros	180		-28	199	0.61
Large-scale hydros	3 018	-344	0	3 018	4.2
Biomass	41		-14	50	0.38
Geothermal				0	0
Solar	37		-34	99	0.13
TOTAL	**4 416**	**-379**	**-390**	**4 739**	**8.45**

Table 13 : ***Conservative scenario – Estimated possible RES output in 2010***

According to the above scenario, the share of renewable energy in the gross electricity consumption will reach 69% of the target, as shown in Table 13, i.e. 13.85%

13.3 Additional measures

In view of the above, it is clear that additional measures and policies are required to realize the 20.1% target . According to that assumption, the additional actions that have been or will be undertaken in the near future could be broken down into policy institutional measures and technological/commercial actions. As far as policy institutional measures are concerned, the following are under examination or have already been launched:

- Promotion and granting of aid to hybrid systems on the islands, thus leading to increased RES penetration in areas having a high wind potential, which has not been utilised so far, as mentioned above.
- Rapid development of the PV system market and completion of the relevant licensing process for mature projects. Moreover, the new scheme for the installation of PV systems on building roofs will further contribute towards that direction.
- In the mid-term and in addition to the achievement of the 2010 target, planning must be initiated immediately to make it possible to use the coastal zone and the sea for the installation of RES plants.

- Deployment of wind farms on islands and transmission of the electricity generated therefrom to the interconnected system through lines-cables to be installed by the producers

Finally, as regards technological-commercial actions, it should be noted that a decision has been made, and is being promoted, for the interconnection of the Northeastern Cyclades to the interconnected system A relevant feasibility study has been prepared by a joint group of RAE, PPC and HTSO staff members, under the supervision of the competent Ministry. The study has provided for the connection of Syros to Lavrion, via a submerged high voltage DC or AC cable and the deployment of the rest of the high voltage grid using only submerged cables. Connection of these islands will allow for the transmission of considerable quantities of wind and high-enthalpy geothermal power to the interconnected system, of which only a small percentage can be utilised now locally, as there are only independent weak grids on such islands. It is estimated, however, that only a part of the project may be implemented by 2010.

In conclusion, is should be noted that Greece is going at great lengths at institutional, regulatory, technical and financing levels to reach the 20.1% target set in Directive 2001/77/EC, which can be realized in a relatively short time after that date, under favorable circumstances.

It is important that the relevant obstacles have been identified and a coordinated effort is being made to contain and deal with any parameters making it hard to achieve the desired progress rate of RES projects, whereas a further deployment of new RES projects and the expected completion of grid infrastructure projects are expected to make an additional contribution towards the achievement of the desired national goal.