

**HELLENIC REPUBLIC
MINISTRY OF DEVELOPMENT
DIRECTORATE GENERAL FOR ENERGY
RENEWABLE ENERGY SOURCES
AND ENERGY SAVING DIRECTORATE**



**3rd NATIONAL REPORT
REGARDING THE PENETRATION LEVEL
OF RENEWABLE ENERGY SOURCES
UP TO THE YEAR 2010
(ARTICLE 3 OF DIRECTIVE 2001/77/EC)**

ATHENS, OCTOBER 2005

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1. Directive 2001/77/EC

Directive 2001/77/EC *on the promotion of electricity produced from renewable energy sources in the internal electricity market* (OJ L283/27.10.2001) in its annex sets an indicative target for Greece to cover a part of its gross national electricity consumption¹ by 2010 from renewable energy sources (RES) equal to 20.1 percent, with the contribution of large-scale hydroelectric plants included. This target is compatible with the international commitments of the country resulting from the Kyoto protocol signed in December 1997 within the context of the Rio UN framework agreement on climate change. The Kyoto protocol anticipates that Greece, by 2010, will reduce the rate of increase of CO₂ and other gases that aggravate the greenhouse effect by 25 percent² in relation to the base year 1990.

According to the most recent estimates, the gross consumption of electric power in 2010, amounts to 68 TWh. This estimate, based on recent data, is moderate compared to the previous one of 72 TWh assumed in the 2nd National Report. Subsequently, production of electric power from RES in the order of 13.7 TWh (including large-scale hydro-electric plants) is the goal for 2010.

In order to create a realistic RES installed power capacity demand scenario to achieve the above target, the following assumptions have been made:

- The share of various RES types will not vary significantly in the next five years. This assumption is considered as realistic given that rapid technological evolution that would lead to significant changes in the economic viability of the various technologies is not expected.
- The average power production per installed capacity unit (load factor, or equivalent operation hours) will be lower due to the necessary development of projects in areas of inferior RES potential.

According to the above, the installed RES capacity required for 2010 in order for the target to be achieved, are presented in table 1:

2. Basic characteristics of the Greek economy

Greece occupies an area of 132,000 square kilometers and has a population of 10.96 million according to the 2001 census. It is estimated that this year the per capita gross national product (GNP), in current prices, will be approximately 16,200 Euro. During the same year, the rate of growth, as a percentage change of the volume of the gross national growth, is estimated at 3.5 percent.

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

² It is an intra-Community quota within the framework of a burden-sharing agreement between the Ministers of Energy of the EU member states.

	Requirements in installed capacity by 2010, in MW	Energy gene- rated in 2010 in Twh	Percentage share of every renewable energy source in 2010
Wind parks	3,372	7.09	10.42
Small-scale hydro	364	1.09	1.60
Large-scale hydro	3,325	4.58	6.74
Biomass	103	0.81	1.19
Geothermal	12	0.09	0.13
Photovoltaics	18	0.02	0.03
Total	7,193	13.67	20.10

Table1. RES installation requirements to meet the 2010 target.

3. Basics of the electrical system for the year 2005

At present, the electricity sector operates within the framework set by Law 2773/1999 "Liberalization of the Electricity Market- Regulation of energy policy issues and other provisions (Official Gazette A 286) enacted for the transposition of Directive 96/92/EC for the liberalization of the electricity market (OJ L27/30.1.1997) as it was revised by Law 3175/2003 "*Exploitation of the geothermal potential, district heating and other provisions*" (Government Gazette A 207). The Public Power Corporation (PPC) was established in 1950, on a monopolistic basis, having as a main target the production and transmission of electric power.

Electricity consumption in 2005 is estimated to reach 57.8 TWh, with an installed capacity of 12,500 MW of PPC-operated plants ³ and 1400 MW of auto-producers, conventional power and renewable energy sources generators. The transmission lines in the interconnected system have a length that exceeds 12,000 km whereas the distribution lines exceed 200,000 km. The number of customers served is some 7 million. With respect to the trading of electricity, it should be noted that with the neighbouring Balkan countries (Albania, FYROM and Bulgaria) there are connections capable of meeting on an annual basis electric power transactions at a level higher than 7 percent of Greece's needs mainly from the surplus of the Bulgarian and Romanian systems. The matter of re-connection with the countries of Central Europe participating in the UCTE, which was pending

³ Other than the Public Power Corporation (PPC S.A.), the only power production units that use natural gas are those of the company "HRON" in Voiotia that already operate mainly for serving demand peaks with an installed capacity of 147 MW and of those of the company "ENERGEIAKI THESSALONIKIS" (affiliated company of "HELLENIC PETROLEUM S.A") with an installed capacity of 390 MW that is estimated to start operating in December 2005 in Thessaloniki.

since the war in Yugoslavia⁴, was finally settled. The submersible link with Italy via a 400 kV direct-current cable has a transmission capacity of 500 MW and was commissioned in 2002.

The main fuel source is domestically extracted low-calorific-value lignite (70 million tons), which accounts in 2005 for 55.9 percent of the total needs for energy. Oil, mainly used by the power plants on the islands not connected to the mainland's system, is estimated to have a share of 13.5 percent. Natural gas imported from Russia and Algeria in the form of LNG will cover 12.9 percent. In the same year large-scale hydroelectric plants are estimated to produce 6.3 percent. Lastly, wind energy, small hydro, biomass and photovoltaics combined, muster 3.1 percent whereas the net of imports-exports make up the remaining 5.5 percent.

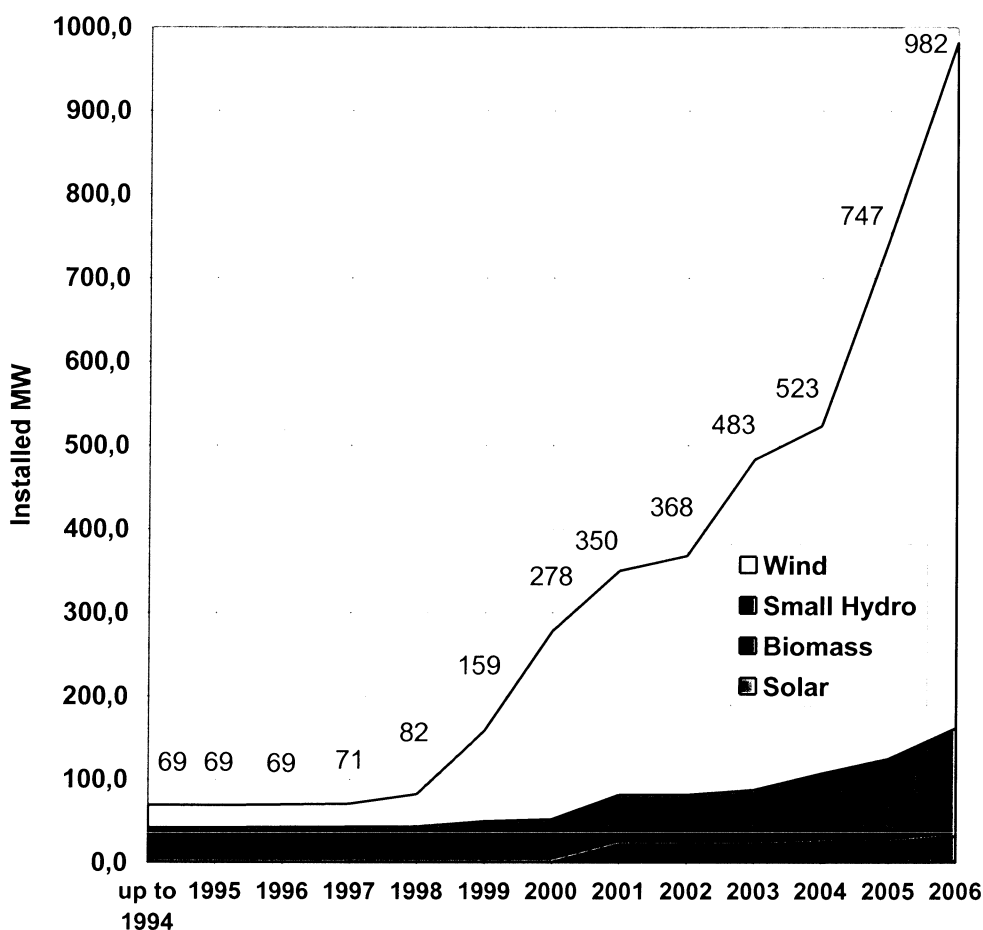


Figure 1: Cumulative capacity of RES installed plants

The cumulative capacity in MW of the RES plants added each year (except large-scale hydro), based on reliable forecasts, for the years 2005 and 2006, according to a survey of the degree of completion of each RES project is shown in Figure 1. It is emphasized that the 2005 and 2006 data concern the capacity of plants

⁴ During 2004 the transmission line, which was cut off due to heavy damage to the substations at Mostar in Bosnia-Herzegovina and Ernestinovo in Croatia, was re-established using funds by the World Bank.

that will be operating or will have been installed and will be operating on a test basis.

In figure 1 a clear and impressive acceleration of the RES market's development is presented for the two year period 2005-2006, which is documented from the analysis of the development of each project separately. This acceleration is due to:

- The completion, during this period, of many starts initiated by private entities that had been delayed during the period 2001-2004, mainly due to institutional reforms in the power sector, which had begun in early 2000 (e.g. creation of the Regulatory Authority for Energy)
- The maturing and consolidation of administrative and institutional actions during 2003-2004, which definitely simplified the investing environment compared to the previous era and lifted many administrative barriers.

4. The evolution of the institutional framework for RES

The beginning of RES entry into Greece was Law 1559/1985 "*Regulation of issues of alternative forms of energy and specific issues of power production from conventional fuels and other provisions*" (Official Gazette A 135) under which the PPC, leading the way with RES, installed 24 MW whereas local government organizations confined themselves to a meager level of 3 MW until 1995 and the private sector was left out of the scene entirely. In spite of the small outcome, the effort showed the strengths and weaknesses of the sector and in particular the initial failures paved the way for more mature implementations.

Law 2244/1994 "*Regulation of power generation issues from renewable energy sources and conventional fuels and other provisions*" (Official Gazette A 168) modeled on the pattern of the German Stromeinspeisungsgesetz ushered in the RES era. The Law established for the country's interconnected system fixed sale rates for renewable energy at a level equal to 90 percent of the medium-voltage, general use tariff and made it obligatory for the PPC to buy that energy. For the reimbursement of the capacity part, a scale pricing system was introduced according to the type of RES plant in terms of time availability at nominal capacity. Roughly speaking, the capacity part merely augments the energy earnings by a small percentage in the range of 6.5 percent so that the final rate corresponds to Euro 0.07287 per kWh. In the islands that belong to the non-connected system the pricing is based on 90 percent of the low-voltage, household rate corresponding to Euro 0.08458 per kWh and no capacity reimbursement is provided.

Law 2773/1999 for the liberalization of the electricity market maintained the favorable pricing regime for RES by also placing emphasis on priority access to the grids. At the same time, the law introduced a fee of 2 percent on the renewable energy proceeds for the benefit of the relevant local government organizations. Further, renewable energy sale rates were deemed as "cap prices" and the Minister of Development was given the authority to ask for a discount to be given on them but so far no resort to such an option has been made. This provision is due to be abolished (see paragraph 5).

The increased investment interest in renewable energy plants in some areas of Greece such as Southern Euboea (Evvoia), and Lakonia (Southeastern Peloponnese), which exhibit especially favorable wind potential, provoked fierce objections from local communities. On the other hand, the lack of provisions concerning the installation of RES plants in forests and scrublands put the licensing regime to the test according to relevant decisions by the Council of State (the Supreme Administrative Court) which pushed towards the enactment of stricter rules on that issue.

Law 2941/2001 "*Simplification of procedures for establishing companies, licensing Renewable Energy Sources plants, regulation of issues of the company GREEK SHIPYARDS S.A. and other provisions*" (Official Gazette A 201), coped successfully with the issue of RES installation in forests and scrublands by including provisions upheld and ruled as constitutional by the Supreme Administrative Court. Furthermore, this Law filled some important gaps in the legislative fabric and also attempted to deal the licensing process pathogenesis a thorough blow⁵.

By virtue of Law 3017/2002 "*Ratification of the Kyoto Protocol to the Framework-convention on climate change*" (Official Gazette A 117) the Greek Parliament put on an official footing the country's commitment to actions to counter the growth of the greenhouse phenomenon.

Law 3175/2003 ⁶ established for the first time a comprehensive set of rules for the rational use of geothermal energy. The new framework is compatible with Community's view on geothermal energy as a renewable energy source contributing to sustainable development. Thus, law 3175/2003 moves in a direction at variance with the long entrenched view of geothermal energy as a mineral obeying the rather rigid rules of Legislative Decree 210/1973 "*Mining Code*" (Official Gazette

⁵ The pillars of Law 2941/2001, in addition to the settlement of forests and scrublands issues, are:

- The exemptions from the overall restrictions imposed by the forest laws applicable to the implementation of large-scale infrastructure works for public benefit in forests and scrublands, are extended to include RES,
- With the exemption of civil works no building permit is required for the installation of solar systems and wind farms
- Connection lines for electricity producing facilities using RES with the interconnected system of the mainland and the grids of autonomous island areas may be constructed by any interested investor, according to specifications provided by the System Operator
- The renewable electricity projects including the connecting lines, substations and infrastructure works in general are deemed as public utility works irrespective of the entity implementing them and therefore the expropriation of landed property or the mandatory acquiring of rights over them is possible
- The issuing of a joint ministerial decision is provided for, by means of which more relaxed zoning and subdivision controls, in comparison with the generally applicable town-planning regime, will be enacted in areas beyond the limits of existing city plans to facilitate RES development.
- The Planning and Development Directorates of the relevant Regions having jurisdiction over the issue of installation and operating permits, act in some ways according to the one-stop shop principle, by coordinating the issues of environmental licenses that include many public services and other bodies.

⁶ As a matter of fact the main scope for the passage of the law was the development and reinforcement of competition in the electricity market, the attraction of new investment sources and the safeguarding of electricity sufficiency for the sake of ensuring competitive consumer prices.

A 277). In short, any geothermal field will be addressed as a unique deposit-source by avoiding any breakdown according to individual concession procedures. A concrete bidding procedure was set up for the whole range of products, by-products and process residues. The recoverable potential of the two fully explored high-enthalpy fields for power generation purposes amounts to 170 MW_e whereas the probable potential of the whole country exceeds 500 MW_e.

However, the main scope of the new law was to revise Law 2773/1999 in order to make up for the slowness of the liberalization process of the electricity market mostly attributed to the dominant position held by PPC S.A. This revision was also necessary in order to reflect the modifications that were about to be made in Directive 2003/54/EC.

In the realm of RES, law 3175/2003 reiterated the definition of Directive 2001/77/EC article 2 regarding hybrid plants in order to remove the existing ambiguity with respect to the actual classification of the energy produced from these systems. Thus, they enjoy the same favorable pricing regime as other forms of RES although especially in the non-connected system they are not exempted from a tendering procedure being a precondition for being granted production authorizations⁷.

In the pattern of breakthrough law-making initiatives taken to speed up the implementation progress of projects pertinent to the 2004 Olympics, Law 3175/2003 provided further actions including the introduction of shortened and simplified procedures regarding expropriations necessary for the reinforcement and extension of power transmission lines which will also serve RES deployment⁸.

The environmental process follows a revised path following the passage of Law 3010/2002 "Harmonization of Law 1650/1986 with Directives 97/11/EC and 96/61/EC, *procedure for delineation and regulation of matters regarding water courses and other provisions*" (Official Gazette A 91) for the harmonization of national legislation for the protection of the environment with the *acquis communautaire*.

On the regulatory level, the joint ministerial decision 1726/2003: "*Procedure for approval of preliminary impact appraisals, environmental terms and conditions, transfer of property or of the right of use of forests and scrublands in the context of the issue of*

⁷ This provision is due to be abolished.

⁸ The law stipulates that private forest expanses may be expropriated for the benefit of the State without any alteration of their classification being necessary nor the observance of the procedure laid down in the provisions of article 14 of law 998/1979 re: "*Protection of the country's forests and scrublands in general*" (Government Gazette A 289). These provisions established a tedious administrative procedure of interlocutory settlement of disputes concerning forest classification because there is no forest registry. Furthermore, the law provides that by virtue of decisions taken by the Minister of Development, some projects may be designated as of public benefit. Any expropriations necessary for their implementation are announced through an act of Cabinet in case the early, i.e. in advance of the payment of the compensation to the owner of the property, occupation of the property is considered of importance. The law itself already designates the following projects as serving the public interest: "*Development of 400-kV loop in Eastern Macedonia and Thrace*", "*Connection line between Nea Makri-Polipotamos and the high-voltage grid in Southern Evvoia*", and "*High-voltage connecting line for new power plant in Rhodes*". Although all of them aim at strengthening the transmission capacity of conventionally generated power, their impact on the development of RES as well is nevertheless obvious.

installation permits for power plants using renewable energy sources" (Official Gazette B 552)⁹ signed by the Ministers of National Defense, Development, Environmental - Physical Planning and Planning Works, Agriculture, Culture and Transportation - Communication, was issued so that the overall licensing process of RES facilities be adapted to the environmental permitting. Among the regulations introduced, worth mentioning is the restriction of the number of consenting authorities to the absolute minimum necessary, the establishment of short-cut deadlines, the inactive passing of which will allow the authority in charge of environment permitting to consider as positive the lacking intermediate approvals and opinions of other bodies and generally the streamlining of the sequence of the intermediate consents according to the spirit of article 6 of Directive 2001/77/EC.

Lastly, the regulatory framework governing the enforcement of the laws also underwent a profound revision. In particular, ministerial decision 8295/1995 (Official Gazette B 385) forming the necessary sequel to Law 2244/1994 was replaced by the newer decision 2000/2002 (Official Gazette B 152), which is in fact an updated Licensing Code for installation and operating permits for RES plants¹⁰.

Also, being mentioning is the joint ministerial decision D6/F1/oik.19500/4.11.2004 (Official Gazette B' 1671) by virtue of which small-scale RES plants were shifted to zero-impact level in order to make their integration possible into towns and settlements. Finally, the circular of the Deputy Minister of Development D6/F1/oik.20603/19.11.2004 established cases of minor amendments to the physical scope of the projects for which no revision of the generation authorization is required.

5. Current development in the institutional environment of RES

Recently, on the basis of the existing regime, the Ministry of Development prepared a draft law to create a new institutional framework for RES. Its goal is the establishment of fundamental principles and the institution of modern organs, processes and means for implementing energy policy concerning RES. The text has been put on public consultation and it is foreseen that it will be tabled in parliament for voting by the end of 2005. The main axes of this profound lawmaking initiative are outlined below.

- Putting the national target for the share of RES on an official footing in the net domestic power consumption in the year 2010 at 20.1 percent and in the year 2020 at 29 percent.
- Taking initiatives in environmental permitting through the setting of exclusive time limits within which approvals should be granted or consensus rendered by services and bodies involved in the interim stages of the overall licensing.

⁹ Greek and English text to be found at Ministry of Development website
http://www.ypan.gr/fysikoi_poroi/pdf/JMD1726-2003.doc

¹⁰ Greek and English text can be found at the Ministry of Development website
http://www.ypan.gr/docs/Decision_2000-2002.pdf

- Setting up a central coordinating body, on a civil service level, aiming at the coordination of the licensing processes control and the provision of support and guidance to authorities involved therein.
- Introduction of a regime of strict follow-up procedures for the holders of generation authorizations, in order to keep them bound to their legal commitments and making provisions for getting rid of those profiteering from license trading.
- Creation of a favorable feed-in tariff regime for photovoltaic systems in order to boost investments in that sector which has been lagging behind so far.
- Amending the recently enacted Law 3299/2004 providing economic growth incentives with the aim of clarification of issues relative to granting public funding for RES installations, the ownership status of interconnection assets etc.
- Enabling the installation of offshore wind farms following the successful precedent of the implementation of corresponding projects in the North Sea.
- Direct indexing of the energy tariff regime applicable to hybrid stations that will be installed in island systems not connected the mainland's interconnected system to the avoided cost of conventional plants whose operation is thereby supplanted to ensure the economic viability of the said stations. Abolishing the previous disposition providing for recourse to a bidding procedure for the licensing of hybrid stations.
- Completion of the package of efforts at bringing national laws into line with the requirements set forth in article 5 par. 5 of Directive 2001/77/EC through the set up of a system for issuing warranties of origin for renewable energy with the System Operator as agency in charge of the mainland's interconnected system and the PPC in the autonomous island electrical systems. At the same time, RAE which is institutionally independent from generation and distribution activities will be entrusted with the task of overseeing the overall issue mechanism of the warranties and the settlement of any disputes that might arise.
- Improvement of produced power purchase terms with the aim of facilitating bank financing of the projects. Abolishing article 38 par. 5 of law 2773/1999 thus enabling the Minister of Development to solicit for discounts to be given on the established feed-in prices so that legal certainty will be restored making it possible for investors to operate in stable environment.
- Redrafting and putting on legislative footage the required 2 percent fee that had been imposed for the benefit of local governments, on the pre-tax proceeds from the sales of renewable energy and abolishment of the relative authorizing provision of article 38 par. 7 of Law 2773/1999, which the Supreme Administrative Court ruled as unconstitutional in 2005 for typical reasons.

6. The planning dimension of RES deployment

As mentioned at the outset, at the time the institutional framework for RES was established, the emphasis was placed on the granting of financial incentives in the form of feed-in tariffs guaranteed by law in combination with the simplification

of the licensing procedure by means of omitting the establishment authorization generally applicable to manufacturing facilities.

The issue of siting from the point of view of abiding by the physical planning which was then covered inadequately by Law 360/1976 "*Physical Planning and Environment*" (Official Gazette A' 151) was not a cause for concern. The same happened also with the more specific but still important matter of installation in forests and scrublands.

In 2001 by virtue of Law 2941/2001 the issue of RES installation in forests and scrublands was dealt with and settled effectively with special provisions, which laid down a new fixed and general regime that was ruled as constitutional by the Supreme Administrative Court (Ruling 2569/2004).

Furthermore, by mid 2003 by virtue of decisions of the Minister of Environment, Physical Planning and Public Works the Regional Frameworks for Spatial and Sustainable Development Plans were instituted according to Law 2742/1999 "*Spatial Planning and Sustainable Development and other provisions*" (Official Gazette A' 207). All these frameworks highlight RES as an advantage and an opportunity for country's regional development and define clearly the necessary directions thereto. The institution of these frameworks filled the gap identified by Supreme Administrative Court ruling 2569/2004 issued in the meantime. Through that ruling an installation permit for a wind farm in Lakonia (Southeastern Peloponnese) which was issued before 2003, was revoked on the grounds that a permit may only be granted in an area with a large number of applications if the endorsement of these Special Zoning Plans or the declaration of the area as an Integrated Productive Activities Development Area (IPADA) was preceded.

In order that the RES spatial planning issue be dealt with effectively and in its entirety, the inner cabinet already in 2004 had decided to promote on an urgent basis the drafting of the Special Spatial Plan for RES on a national level, using the tools of Law 2741/1999 so as to stress the priority RES over other land uses, as dictated by the Green Paper for the Security of Energy Supply (European Commission COM (2000) 769 final, page 44). Simultaneously, the promotion of the General Spatial Plan, as well as of the Special Plans for tourism, industry, highlands and coastal zones was decided. Especially for RES, the Ministry of Environment, Physical Planning and Public Works in cooperation with the Ministry of Development and the Regulatory Authority for Energy established the scope of the study. Following a bidding procedure the contract was awarded to a private design firm in partnership with CRES. A Special Committee and the ministries having jointly responsibility supervise the preparation of this study.

The Special Spatial Plan for RES will inevitably comply with the principles and criteria applicable to Physical Planning as provided for in article 2¹¹ of Law

¹¹ In par. 1 The targets are defined which push to the fore the triptych of integral, balanced and sustainable development of land and demonstrate the need for safeguarding and highlighting the country's comparative geographical natural, cultural and productive advantages. Par. 2 includes the essential principles that contribute to meeting the planning target and into which, inter alia, the guidelines of Agenda 21 and the 5th Action Plan for the European Union Environment, as well as the general criteria for a planning approach on a

2742/1999. The Special Plan will indicate the specific criteria and methodology for siting RES plants at each area of Greece. In addition thereto, the directions of the Planning and Sustainable Development Regional Frameworks will be taken advantage of, as well as of the Athens and Thessaloniki Zoning Plans with regard to the perspectives/guidelines for the siting of various activities per areas and zones endowed with considerable RES potential. This macroscopic survey will be supplemented, if necessary, also with additional directions and guidelines, which should be taken into consideration in the preparation stage of the Environmental Impact Assessment.

The Special Spatial Plan will also include the study of other individual topics, such as the analysis of the institutional framework for the siting of RES with explicit reference to provisions, if any, of already adopted Regional Spatial Plans, presentation of the world experience regarding the planning environment for RES, as well as elucidation of the notion of carrying capacity. Lastly, the Special Spatial Plan will include distinct sections for every category of RES.

In sum the Special Spatial Plan for RES:

- Will specify the directions for sustainable development and organization of the national space with respect to the spatial structuring of power generation using RES, as a sector of productive activity and as infrastructure of social benefit with a countrywide scope weighing in with the protection of the environment.
- Will promote RES by priority after taking into consideration the impact on the local level, for meeting the world, European and national commitments with respect to power generation using RES
- Will aim, on the operational level, at the simplification and shortening of the procedures of spatial planning and spatial-environmental specialization for the construction of RES works, as well as the establishment of legal certainty for investors without relegating the issue of the protection of the environment to a subordinate role.
- Will formulate, with respect to scope, the guidelines for the siting of RES projects on a national, regional and local level, by setting suitable criteria and conditions and by providing at the same time guidance for the restructuring of the licensing procedures.
- Finally, it will include particular references to projects belonging to the individual categories of power generation plants using RES, i.e. a) wind farms, b) small-scale hydro and c) other categories of RES (solar energy, geothermal energy, wave energy, tidal energy, biomass, biogas, gas produced in sanitary landfills and sewage biological treatment plants, or co-generation of heat and power using some of the above categories.

During the preparation of the study the close collaboration with the Ministry of Development will continue whereas there consultation will ensue with the

European scale as mapped out in the Community documents 'Europe 2000', 'Europe 2000+', the Community Area Development Plan, etc. are incorporated.

bodies involved, rendering of the Physical Planning and Sustainable Development National Board consultatory response, and approval by the competent inner cabinet with the prospect of having the overall process concluded by May 2006.

7. The role of the Regulatory Authority for Energy

The Regulatory Authority for Energy (RAE) was established by virtue of article 4 of Law 2773/1999 as an independent public agency entrusted with the task of monitoring and controlling the electricity market and the delivery of opinions regarding the observance of the rules of genuine competition and the protection of consumers.

In addition, RAE formulates proposals to the Minister of Development with regard to the issue of power generation authorizations and thereafter monitors the implementation progress of the RES projects through quarterly reports and recommends the removal of those investors who exhibit unjustifiable delays. Also, RAE recommends legislative measures for the further deregulation of the electricity market within which critical RES issues can be addressed (as is the case of hybrid plants).

The evaluation of all applications is performed by RAE assisted in the technical part by the Centre for Renewable Energy Sources on the basis of the criteria laid down in article 9 of the Production Authorization Regulation which was issued according to Law 2773/1999 article 28 (see also RAE's website <http://www.rae.gr>).

8. The role of the Transmission System Operator

The creation of a System Operator was provided for in article 14 of Law 2773/1999 and it was set up by virtue of Presidential Decree 328/2000 "*Establishment and statutes of the Societe Anonyme HELLENIC ELECTRIC POWER TRANSMISSION SYSTEM OPERATOR S.A.*" (Government Gazette A 268). Its task is the operation, maintenance and development of the electric power transmission system throughout the whole country, as well as, of its interconnections with other systems, in order to secure Greece's electric power supply in a sufficient, safe, cost effective and reliable way¹². The Transmission System Operator (DESMIE S.A) assumed the commercial management of the renewable energy plants of the interconnected system in October 2002.

According to the provisions of article 21 of Law 2773/1999, the PPC S.A. which had already floated on the stock market by virtue of Presidential Decree

¹² According to Law 3175/2003 the System Operator assumes expanded duties as regulator of the daily electricity market, settles the supply and demand imbalances, and provides ancillary services and reserve capacity. The System Operator is entrusted with the enforcement of the law's provisions, which aim at the development of genuine competition on the basis of a more deregulated and flexible daily market. That upgraded role runs in conjunction with the development of an actual daily electricity market, which lessens the business risk and ensures the viability of new entrants in the field of small-scale power generation. Further, the System Operator is obliged to ensure a sufficient long-term margin of domestic power generation potential to cope with probable power shortages in the future. For that purpose the holders of supply authorizations are obliged to provide availability guarantees for productive potential.

333/2000 "Conversion of the Public Power Corporation (PPC) into a Societe Anonyme and approval of its statutes" (Official Gazette A 278) performs the duties of system operator for the island grids which are not connected to the mainland's system.

9. The role of the Centre for Renewable Energy Sources

The establishment of the Centre for Renewable Energy Sources (CRES) was provided for in article 25 of Law 1514/1985 "*Promotion of scientific and technological research*" (Government Gazette A 13) and was implemented by virtue of Presidential Decree 375/1987 "*Establishment of a legal entity under private law with the registered name Centre for Renewable Energy Sources*" (Official Gazette A 167). The scope of CRES is the promotion of RES, energy saving and rational use of energy, as well as all kinds of support for activities in these fields. Further, by virtue of article 11 of Law 2702/1999 "*Regulation of matters falling under the jurisdiction of the Ministry of Development and other provisions*" (Government Gazette A 70), CRES operates as the national coordinating centre of all these activities.

CRES has laboratories for certification of RES technologies, carries out studies for the determination of the physical as well as technical and economical potential of RES and participates effectively in the evaluation and monitoring of the investments implemented in the sector, including the energy savings field.

10. Public funding

10.1 Granting of funding to RES using funds from the 2nd Community Support Framework

The Operational Programme for Energy (OPE), managed by the Ministry of Development, drew funds from the 2nd Community Support Framework (CFS), which ended in December 31, 2002, to grant public aid to projects with a total budget of Euro 1.061 billion. The European Regional Development Fund provided 33.8 per cent of that amount and national resources 45.2 percent (including the PPC's funds) whereas private capital flows made up the remaining 21 percent. A part of the sub-programme 3 addressed the issue of RES promotion. Summary data is shown in table 2.

On the other hand, the Ministry of National Economy (now Ministry of Economy and Finance) provided funding from national resources under Law 1892/1990 "*Modernization and development and other provisions*" (Official Gazette A 101) and thereafter under Law 2601/1998 "*Private investment aids for the country's economic and regional development and other provisions*" (Official Gazette A 81). From the available data, it is estimated that one third of the operating plants was funded from national resources.

10.2 Essentials of current status of public funding for RES investments

The Operational Programme "Competitiveness" (OPC)¹³ that uses funds from the 3rd Community Support Framework provides public funding for RES and energy saving, substitution and other energy-related actions as high as Euro 1.02 billion.

¹³ See website of Ministry of Development www.ypan.gr

Public aid accounts for 30 percent of the eligible cost of the projects and goes up to 50 percent for transmission lines that will be constructed for the connection of RES plants with the grids

	Wind	Small hydro	Photo-voltaics	Bio-mass	Total
Number of investments	16	9	15	2	42
Total budget in million Euro	141.6	17.2	6.10	31.5	196.4
Total public expenditure in million Euro	53.2	7.7	4.20	14.8	79.9
Total installed electric power in MW	121.0	11.5	0.74	20.7	153.9
Annual power production in billion kWh	354.0	53.0	1.0	168.0	576.0

Table 2. Summary data of cost and capacity of RES funded from the 2nd CSF

According to the approved project plans, installed capacity from RES and co-generation will increase up to 800 MW, which corresponds to an annual energy yield of 3.4 TWh. The annual decrease of CO₂ emissions will total 3.95 million tons, whereas 675 new jobs will be created and 160 enterprises will draw distinct benefits.

The more important actions in the progress of the OPC are outlined below.

Action 2.1.3: Financial incentives for the support of individual private investments in energy and Measure 6.5: Promotion of RES systems, Cogeneration in the country's energy system – Energy Saving

In the context of the two calls for proposals for the Action 2.1.3, 85 and 138 RES projects have been approved for public funding. They concern wind energy system technologies, geothermal applications, small hydro systems, centralized solar thermal energy systems, biomass energy applications, photovoltaic and passive solar systems. The total budget amounted to Euro 588.6 million while public expenditure was Euro 196.8 million. Up to the first quarter of 2005 the expenditure for these projects amounted to Euro 129.1 million, out of which Euro 42 million was public funding.

According to the decision of the Minister of Development F2.1.3/13821/1275/4.8.2004, the co-financing of projects concerning the connection to the electricity grid of RES-electricity production and cogeneration units, that are co-financed through the funds of the Action 2.1.3 of OPC, was retroactively approved. These connection projects will be co-financed through the funds of the Measure 6.5 of the OPC up to 50 percent of their cost as it is estimated by DESMIE or PPC. These projects will not be evaluated on a competition basis, since they are adjunct to RES-electricity production and cogeneration units that are co-financed through the funds Action 2.1.3 of the OPC. The relevant call was signed on 31.1.2005 and the deadline to submit the proposals expires on 31.12.2005. The indicative budget of the call amounts to Euro 40 million. For the submission of the proposal, the existence of

a connection offer to the grid is required, that will have been prepared by DESMIE (for the System) or PPC (for the Network).

Also, in the context of Measure 6.5, there is an on-going call announced on 19.8.2005, which is open until 20.12.2005, for granting public funding to RES investments, co-generation, energy saving and substitution of conventional fuels. The indicative total budget of the call is Euro 363 million, out of which Euro 136 million cover public expenditure. In the case of RES-electricity and cogeneration projects that will be co-financed under this call, the eligible expenditure includes the cost for their connection to the electricity grid, which, in this case, will receive public funding up to 45 percent, for areas A and B of Central Macedonia and Attica as designated in Law 3299/2004, and 50 percent for the rest of the country, while 50 percent co-financing is applicable to small- and medium-sized enterprises in the whole country.

Action 3.1.1 Application of demonstration projects using innovative technologies

The Action concerns support for demonstration and pilot projects using innovative energy technologies. The total budget of the action is Euro 5.43 million. The call for proposals in the context of this action was announced on 28.6.2005 and it was open till 31.10.2005¹⁴.

Action 6.3.2 Projects promoting innovative solutions

In the context of this action, projects that will be implemented in the islands will be funded. These projects will promote innovative solutions to the energy problem of the islands in combination with meeting other needs such as those for potable water and waste treatment. Particular emphasis will be placed on high-enthalpy geothermal applications and for the support and development of cogeneration units that exploit waste heat in a rational way. The total budget of the action is Euro 55 million. Under the action a call for proposals was announced in early 2005 with a Euro 27 million budget and July 28, 2005 as closing date. On the other hand, through other actions of Measure 6.3, emphasis is placed on the special infrastructure projects for the transmission and distribution of electricity in the islands, having as a result an immediate impact on the increase of RES penetration.

¹⁴ The maximum grant percentage differs according to the geographical location of the project and varies between 40percent and 53 percent for large enterprises while in the case of small and medium-sized enterprises these percentages are increased by 15 percent. The technologies that can be financed in the context of this action are (a) cogeneration or polygeneration under 500 kW with the use of RES or natural gas, (b) wind turbines under 80 kW, (c) solar systems for electricity production (except photovoltaics), (d) innovative photovoltaic systems (such as thermovoltaics that exploit thermal or infra-red radiation), (e) innovative hybrid solar lighting systems (such as solar radiation transmission into buildings using wave-guides for the substitution of artificial illumination), (f) solar cooling, (g) combined solar heating and cooling, (h) combined use of biomass or geothermal energy for heating and cooling (i) heating and cooling with the use of geothermal gradient, (j) integrated electricity production with hydrogen production and storage by the use of RES or by waste heat recovery (usually fuel cells), (j) tidal power, wave power and sea thermal energy conversion, (k) combination of the above innovative technologies.

Law providing development incentives

Alternatively, funding from national resources¹⁵ is granted for the implementation of RES projects at 35 to 55 percent of the total eligible budget depending on the installation area and the corporate form.

10.3 Fiscal regulations for RES investments without capital subsidy.

The projects that will receive public funding along with the large-scale hydroelectric projects do not suffice to meet the target of 20.1 percent and therefore investments using purely private funding will be necessary. The lack of measures providing public funding will likely be offset by:

- The alleviation of the bureaucratic burden through the simplification of procedures and the overcoming of administrative constraints (see promoted legislative measures in par. 5 and Special Spatial Plan in par 6.)
- The consolidation and stabilization of the investment environment by means of broader development and taxation policies.
- The continuation of the feed-in price regime of the renewable kWh on a permanent and stable basis¹⁶.
- The facilitation of bank financing of the projects by taking measures that are contemplated in the context of legislative initiatives (par. 5), such as the improvement of terms and duration of the power purchase contracts.

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

11.3 Renewable energy sources

The total energy yield of RES-electricity stations (except large-scale hydroelectric plants) which will have been put into operation up to the end of 2005 or at the latest by end January 2006, amounts to 2.2 billion kWh, 77.4 percent from wind parks, 13.6 percent from small hydroelectric plants and 9.0 percent from other RES (biogas, biomass, photovoltaic).

The most up to date data for RES facilities into which large-scale hydroelectric plants have been included is shown in table 3.

Besides what is presented in table 3, at present, there are further installation authorizations for RES stations totaling a capacity of 590 MW out of which 505 MW are wind parks, 62 MW large-scale hydro and 22 MW biomass stations. They are mature plans for projects throughout Greece, without connection to the grid or

¹⁵ See Greek and English text of Law 3299/2004 providing development incentives at the website of Hellenic Center for Investment (<http://www.elke.gr>)

¹⁶ The establishment of a more favorable grid access regime of energy for large - scale hydroelectric plants, in comparison to conventionally generated electricity could take place insofar as that the measure does not go against the *Acquis Communautaire*.

environmental licensing problems and therefore it is estimated that they will be completed by the end of 2007. It should be noted that these projects could be connected directly without requirement of costly projects to enhance the local transmission energy grids

Region	Large-scale hydros	Wind	Small-scale hydros	Photo-voltaic	Biomass	Totals
Eastern Macedonia & Thrace	500.0	162.2	1.00			663.20
Attica		2.6		0.2	20.70	23.00
North Aegean		28.7				28.00
Western Greece	1,282.2	36.1	17.62			1,335.92
Central Macedonia	492.0	17.0	23.90	0.15	2.50	535.55
Epirus	543.6		28.7			571.00
Ionian islands		10.2				10.20
Thessaly	130.0		4.94		0.35	135.29
Crete		104.5	0.60	0.80	0.7	106.27
South Aegean		20.1				20.10
Peloponnesse	70.0	36.0	2.00			108.00
Central Greece		204.3	22.0			226.30
Totals	3,017.8	621.7	99.86	1.15*	23.72	3,764.23

*This capacity is officially registered but there are many photovoltaic systems not connected to the grid. According to sales data, it is estimated that the total installed capacity of photovoltaic systems will amount to some 4 MW at the beginning of 2006.

Table 3. Installed capacity of RES systems in MW (December 2005 - January 2006)

On the contrary, in areas such as South Euboea, Southeastern Peloponnese and Eastern Macedonia and Thrace, the planned RES projects should wait for the completion of the transmission projects that have begun before they are installed. Detailed presentation of the situation in these areas, as well as in islands not connected to the mainland's interconnected system, is given in par 14.

As regards the development of the less mature plans for RES projects in the rest of Greece, that is to say except the areas where extensive network projects have begun, it should be noted that wind potential especially is confined to areas where the local conditions of accelerated wind flow create the conditions for energy exploitation. It is a fact that this wind potential is unexplored. However, in recent years there has been a considerable and detailed survey by private bodies for the identification of appropriate locations in areas which don't face problems concerning grid transmission and/or local acceptance.

The situation is similar regarding the other types of RES, where there are numerous ongoing efforts for developing projects in many areas of Greece.

A reliable picture of this investment interest is given in table 4, which shows the capacity of energy production authorizations in mainland areas beyond those where transmission line reinforcement has begun and no installation authorizations haven been issued. It should be noted that the delay in the development of a project through an investor's own fault (i.e because of financial inability to implement the project), results in revocation of the production authorization. So far, authorizations for about 500 MW and idling for a considerable time have been revoked.

Technology	Capacity (MW)
Wind parks	2,190
Small hydros	290
Biomass	7
Geothermal energy	8
Photovoltaics	1.31
Total	2,496

Table 4: RES production authorizations in the mainland without installation authorization, except the areas where grid reinforcement has begun.

On the basis of the data presented in table 4 and the assumption that the rate of project installation over the last two years in Greece, will not only continue, but it will also improve during 2008-2010, due to legislative initiatives that have already been launched (see par. 5 and 6), it is estimated that by 2010 a further 600-650 MW of wind parks will be installed, 90-100 MW of small hydro and approximately 40 MW of other RES (biomass, geothermal energy, photovoltaics). Thus, the total is about 780 MW, which corresponds to a percentage of 31 percent of the projects possessing a production authorization today according to table 4.

11.2. Large-scale hydroelectric plants run by PPC S.A

The PPC S.A runs 15 large-scale hydroelectric schemes with a total installed capacity of 3017.8 MW (see table 3) yielding 4.16 billion kWh under average hydraulicity conditions and with a conservative scenario for water management due to the multi-purpose character of most projects. During the current year, the production was expected to reach the level of 5.3 billion kWh (including the production of 0.8 billion kWh coming from pumped storage) and in 2003 this amount also had exceeded 5 billion kWh.

On the other hand, the projects shown in table 6 have been planned¹⁷ by PPC for commissioning by 2010 with an annual combined output of 1,582 billion kWh.

¹⁷ As some of them are multi-purpose projects, their implementation does not exclusively depend on the priorities of the PPC's medium-term strategy.

The Greek Government decided to promote the implementation of all projects and especially those of Messochora and Ilarionas.

Region	Plant Name	Capacity in MW	Mean output in million kWh/year
Eastern Macedonia & Thrace	Thisavros*	384.0	440
	Platanovrissi	116.0	240
Western Greece	Kremasta	437.0	964
	Kastraki	320.0	639
	Stratos	150.0	298
Western Macedonia	Polifito	375.0	386
Epirus	Pournari	300.0	281
	Pournari II	33.6	45
	Piges Aoou	210.0	149
Thessaly	Tavropos	130.0	163
Central Macedonia	Agras	50.0	19
	Edesseos	19.0	16
	Assomata	108.0	126
	Sfikia*	315.0	182
Peloponnesse	Ladonas	70.0	215
Totals		3,017.8	4,163

Note: Plants producing additional total energy 868 million kWh from pumped storage.

Table 5. Large-scale hydroelectric plants run by the PPC S.A

Region	Plant Name	Capacity in MW	Mean output in million kWh/year
Central Macedonia	Ilarionas	120.0	413
Western-Central Greece	Sikia	126.5	296
Thessaly	Pefkofito	160.0	340
	Messochora	161.6	384
Eastern Macedonia	Temenos	19.0	60
Epirus	Metsovitikos	25.0	58
Thessaly	Smokovo	10.0	27
Totals		622.1	1,578

Table 6. Hydroelectric plants planned by the PPC for commissioning by 2010

Today the hydroelectric project of Aghios Nikolaos is in a preliminary stage of implementation by a private company. This plant is situated on the river Arahthos in northwestern Greece and has a total capacity of 93 MW and an annual mean output of 320 million kWh. One more production authorization for a hydroelectric project of another private firm with a 60 MW capacity has been issued for Avlaki on the river Acheloos in Central Greece.

On the basis of a conservative estimate, out of the above 775 MW, a total capacity of 307 MW will have been installed by 2010.

11.3. Hybrid schemes

In the isolated electrical system of the small Aegean island Ikaria a hybrid scheme owned by the PPC S.A. and composed of a 3.8 MW typical hydropower plant served by a two-reservoir pumped-storage scheme coupled with a 2.4 MW wind farm to yield some 14 million kWh/year is going to be tendered. The project is expected to serve as a model for other similar projects of greater scale, especially in Crete¹⁸.

In general, due to the particular significance of the hybrid system in islands not connected to the mainland's interconnected system, the ongoing legislative initiative (see par.5) clarifies the energy tariff regime that is being produced in them, mainly through the direct indexing of the reimbursement due to the avoided cost from the operation of conventional plants, which are substituted due to the financial viability of those systems. Furthermore, according to the bill for accelerating the deregulation of the electricity energy market the licensing of hybrid systems is already provided without recourse to a bidding procedure, as was the case up to now. This fact is expected to stimulate anew the investment interest for particular projects that had been examined in the past.

12. Management of dispersed power generation

In Greece, as in most European countries, the functioning of the existing electrical power system is structured on the pattern of central production because the PPC S.A. was, since its establishment and in fact continues to be, the main player in the field. In the case, however, of many small RES units whose operation is governed by the randomness of the natural resource exploited, their control on an uninterrupted basis turns out to be a cumbersome task. Taking this into consideration, RAE is drafting the parameters for using new technologies for control data processing and dispatching in order to effectively address the problem, at a price, however, of a higher cost of the electricity supplied to consumers. The implementation of the above, in the context of a deregulated electricity market, requires the pricing and appraisal of various techniques and capabilities in parallel with the operation of conventional sources in order to achieve the best result for the customers.

¹⁸ See 2nd Greek National Report for the summary of technical parts of project.

The problem becomes more acute in the autonomous island systems where the introduction of hybrid systems of considerable installed capacity poses highly complex problems due to be faced by the Grid Operation Code¹⁹ now in course of final drafting stage.

13. Guarantee of origin for electricity produced from RES

The institution of the mechanism of guarantees of origin for electricity produced using RES as provided by article 5 par. 5 of Directive 2001/77/EC, has already been included in the bill.

According to the regulation promoted, as issuing organization of the warranties of origin for the energy fed to the system either directly or through the Network, the System Operator is designated, whereas with respect to the energy fed to the Network of the islands not connected to the mainland's interconnected system the Network Operator is designated.

As issuing organization of the warranties of origin of the energy produced by autonomous stations that don't feed the System or the Network, CRES is designated. For this purpose CRES installs the appropriate measuring devices at the expense of the producer who wants to be issued with the warranties of origin.

The Regulatory Authority of Energy is assigned to supervise the organization of the warranties system. RAE exercises a general reliable operation of the system of warranties of energy origin, cooperates with the competent Authorities of the member states and handles issues on mutual recognition of warranties, which have been issued by other member states of the EU or third countries.

14. Engineering activities under way to boost power transmission capacity

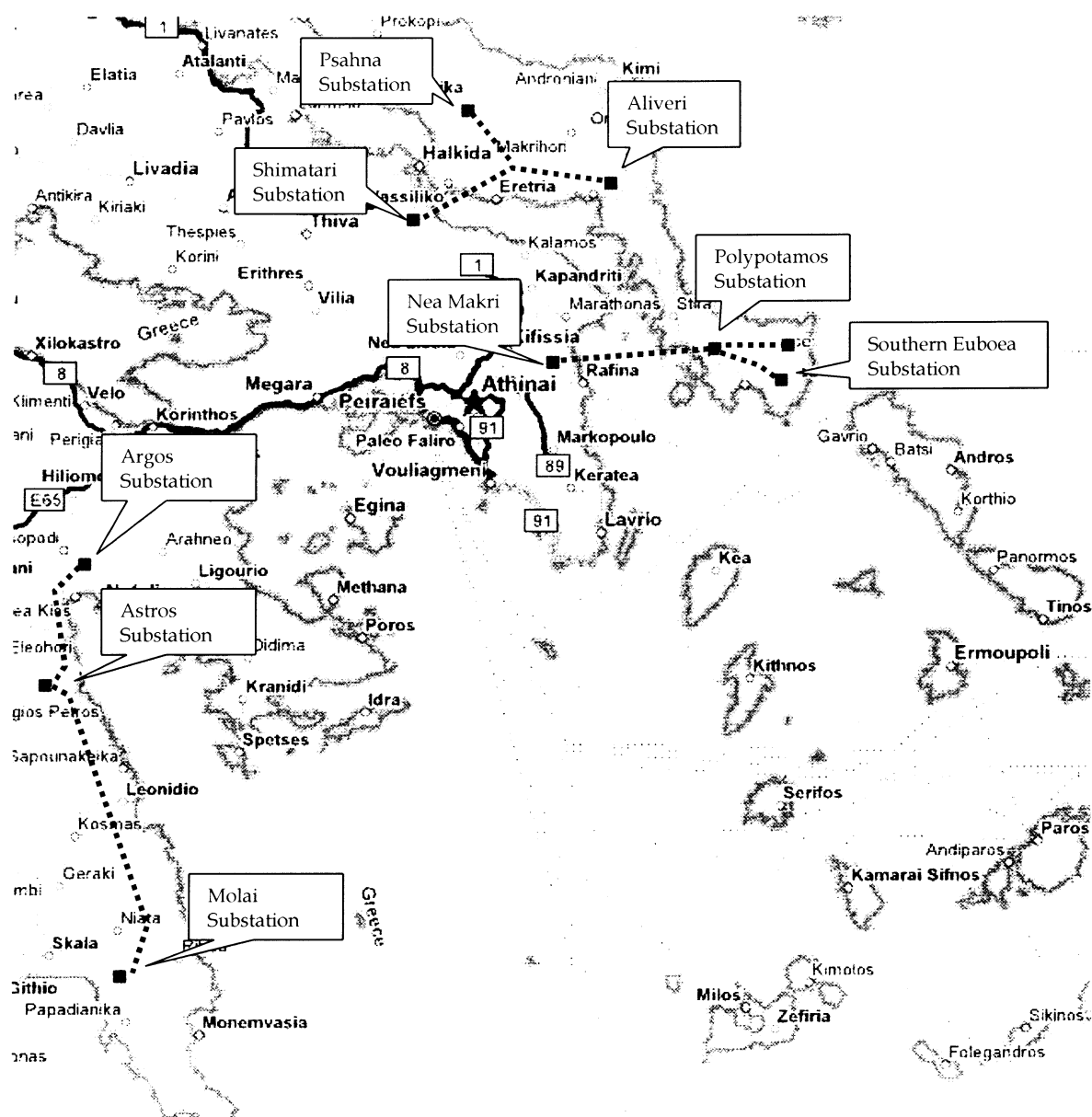
The areas of high wind potential (**Aegean islands, Southern Euboea, Eastern Peloponnese, Thrace**) have already attracted a great number of investors. The main feature of these profoundly windy, and usually sparsely populated areas, is their inadequate power transmission infrastructure constructed decades before renewable energy emerged as a viable option. Thus, in the mainland's areas with high wind potential, the investment capabilities have been restricted due to low feed-in capacity of the local grids. Similar restrictions in the islands are hampering further renewable energy penetration.

The main actions for the reinforcement of the existing power transmission infrastructure are planned to be implemented in the areas of Southern Euboea and South-eastern Peloponnese (see map 1) and Eastern Macedonia-Thrace (see map 2).

With regard to **Southern Euboea**, the connection of its grid, through the construction of a new substation in the area of Polypotamos, with the Nea Makri substation in Attica (two submarine 150 kV cables included), for the tapping of

¹⁹ In the mainland's interconnected system and the islands connected thereto the matter is governed by the already enacted System Operation Code

renewable energy produced in the wider area is planned²⁰. Moreover, the reinforcement/ upgrading of the Aliveri-Psachna-Shimatari line and the construction of two new radial lines linking the new substation in the area of Polypotamos with South Euboea and a simultaneous development of 9 substations 20/150 kV are planned. So far, the planning of routing and most of the environmental impact studies concerning Southern Euboea, have been completed. The combined projects will permit the connection to the grid of a total of 530 MW of new wind farms to be erected in Euboea and the Cyclades islands which are connected to the mainland's interconnected system (Andros, Tinos). Existing wind farms totaling 203 MW are served by the existing local system.



Map 1: Routing of electricity transmission enhancement projects in the areas of South Euboea and East Peloponnese

With regard to the **South-eastern Peloponnese**, the connection of 40 MW to the Molai substation is now feasible. Also, the construction of the double-circuit 150 kV transmission line 80 km long, connecting the Astros and Molai substations, began in March 2005. 25 per cent of the project has already been constructed while it is expected to be completed in the first half of 2006. The upgrading of the transmission line Astros II- Astros is in the stage of approval of environmental impact assessment while the project is expected to be completed in 2007. After the completion of the projects, the connection of other 280 MW will be feasible.

Wind parks of a 162,5 MW total capacity have already been connected to the grid in **Eastern Macedonia and Thrace** and are operating while there is one more under construction with a capacity of 34 MW. The absorption of additional capacity is placed against the background of the national system's transmission capacity in the related area and specifically to the construction of a) the Filippi- Nea Santa stretch of the double circuit 400kV transmission line and the Nea Santa-Turkey (Babaeski) stretch of the single circuit line that is estimated to begin in December 2005 and to be completed in 2007 and b) the Super-High Voltage Centre of Nea Santa that is at the stage of environmental licensing with estimated time of completion the 2009 where the total absorption of wind energy will be increased by 350 MW.



Map 2: Routing of electricity transmission enhancement projects in the areas of Eastern Macedonia and Thrace

With respect to **Crete, Rhodes and the other Aegean islands which are not connected to the mainland**, the restrictions imposed today by the grids correspond to an absorption capacity of energy from wind farms in the order of 30 percent of the peak demand, without taking into consideration the storage capabilities of hybrid systems (see par.11.4), i.e. some 300 MW out of which 210 MW have already been granted an installation permit or an operation permit. However, a study is

being carried out to establish in a more accurate way the absorption capacity of these islands. More specifically, in Crete there are wind farms operating with a total installed capacity of 87 MW whereas the overall capacity exceeds 120 MW.

On the basis of the above considerations, the capacity of the additional wind farms that can be installed on islands or areas where the development of the grid has been launched is summarized in table 7.

Area	Capacity (MW)
1. Euboea- Andros -Tinos	530
2. Southeastern Peloponnese	280
3. Eastern Macedonia-Thrace	350
4. Crete, Rhodes and other islands not connected to mainland Greece	80
Total	1,240

Table 7. Additional wind parks capacity from ongoing initiatives.

It should be noted that production authorizations have been issued for 970 MW for the projects presented in table 7 with a total capacity of 1,240 MW.

15. Conclusions – targeting - need for additional measures

15.1 Basic scenario

After the completion of all planned works for the enhancement of the transmission capacity of the grids and on the basis of the economic potential of RES, the investment interest and the realistic estimates already mentioned, an approximate assessment of the penetration capabilities by 2010 is presented in table 8.

In the event of implementation of all the above investments, the target of the Directive will satisfactorily be reached. In sum, the conditions of fulfillment of the scenario concisely embodied in table 6 and approaching that target for 2010, are the following:

- The implementation of the investment for which installation permits have been granted, will continue unimpeded. This assumption is realistic considering that the planning of the projects is at a mature stage, the licensing procedure has been completed, the access to the grid has been guaranteed and consequently the projects can be granted public funding.
- The extensive projects destined to boost transmission capacity of the grids in the areas of Eastern Macedonia-Thrace, Southeastern Peloponnese and Euboea will be completed. The assumption is realistic considering the progress of these projects as presented in par. 14.
- The general course of RES investment implementation over the last two years, in areas beyond those where grid transmission capacity projects are underway, is going to improve thereon.

	Installed capacity in MW (beginning 2006)	Additional Installation Authorizations in capacity (MW)	Additional wind parks due to initiatives already launched (MW)	Additional RES in the rest of Greece (MW)	Estimated total capacity 2010 in MW	Estimated energy production 2010 in billion kWh	Share per RES type during 2010 to meet the 13,67 billion kWh target
Wind parks	622	505	1,240	650	3,017	6.34	9.33
Small-scale hydros	100	62		90	252	0.76	1.11
Large-scale hydros	3,018			307	3,325	4.58	6.74
Biomass	24	22		25	71	0.56	0.82
Geothermal	0			8	8	0.06	0.09
Photovoltaics	1*	1		8	10	0.01	0.02
Total	3,765	590	1,240	1,088	6,683	12.31	18.10

*See note of table 3

Table 8. Basic scenario - Estimation of RES production figures in 2010.

15.2 Conservative scenario

The above three conditions highlight simultaneously the dangers that may cause deviation in reaching the target expressed by the scenario presented in table 8. The Greek Government has focused on these dangers.

	Capacity installed in MW (early 2006)	Implementation in force of additional installation permits (MW)*	Additional wind plants due to routing initiatives (MW)*	Additional RES in remaining Greece (MW)*	Conservative Estimation for total capacity in 2010 in MW	Unfavorable Estimation for Power Generation in 2010 in TWh	Percentage share of every renewable energy source by 2010 (target 13.67 TWh)
Wind	622	-76	-610	-228	2,104	4.42	6.50
Small-scale hydro	100	-9	0	-32	211	0.63	0.93
Large-scale hydro	3,018	0	0	0	3,325	4.58	6.74
Biomass	24	-3	0	-9	59	0.46	0.68
Geothermal energy	0	0	0	-3	5	0.04	0.06
Photovoltaics	1**	0	0	-3	7	0.01	0.01
Total	3,765	-88	-610	-273	5,711	10.15	14.92

* Change in comparison with the basic estimation of table 8

** See note of table 3

Table 9. Conservative scenario - Estimate of RES production figures in 2010.

Indicatively, there can be said that in the case that:

- the percentage of implementation of projects that already have an installation permit is reduced to 85 percent

- no additional wind parks on South Euboea and on the islands (see table 7) will be installed
- the expected growth rate in the rest of Greece will be reduced to 65 percent (that is to say only 20 percent of projects that today have a production authorization will be installed)

then the share of renewable energy in gross electricity consumption will approach 15 percent, as shown in table 9.

It should also be remembered that the mean production of energy per installed capacity unit (load factor or equal hours of operation) will be slightly reduced because of the necessary development of projects in areas with inferior RES potential.

15.3 Optimistic Scenario with additional measures

From what has been said, it is clear that to reach the 20.1 percent target **additional measures and policies** are required. According to that assumption, the additional initiatives that have been or will be undertaken in the near future could be divided into institutional measures and technological/commercial actions.

As far as the **institutional** measures are concerned, the following are under examination or have already been launched:

- Promotion and granting of public funding to the island hybrid systems, which will lead to increased RES penetration in areas which have a rich wind potential, which as mentioned earlier, is presently not being put to use.
- Set up of conditions for photovoltaic market development by means of the incentives under consideration (see par. 5)
- Establishment of the possibility of RES installation in coastal zones and the sea, so as the development of offshore wind farms, which has been up to now prohibited by virtue of article 14 of Law 2971/2001 "*Shoreline, seashore and miscellaneous provisions*" (Official Gazette A' 285). This will allow the prospecting of areas by investors who presently cannot do business there because of the above prohibition.

As far as the **technological – commercial** actions are concerned:

- The connection of Northeastern Cyclades with the mainland's interconnected system has been decided and has started to get up steam. A feasibility study was prepared by a joint team of cadres from the RAE, the PPC, and the HTSO (Hellenic Transmission System Operator) under the auspices of Ministry of Development and was finished in May 2005. The study makes a provision of the connection of the island of Syros with Lavrio (south of Athens) through a DC or AC high-voltage submarine cable and the deployment of the remaining high-voltage grid in the form of submarine cables. Only in this way, overhead transmission lines are not required, which usually provoke fierce opposition from the local communities. At present, the implementation process of this complex project is at the stage of acquiring suitable land for the erection of new 150/20 kV substations and the landing of the ends of the submarine cables. The connection of these islands

will allow the transmission of considerable quantities of wind and of high-enthalpy geothermal power to the interconnected system, out of which today only a small percentage can be absorbed locally from the existing autonomous “weak grids”. It is estimated that by 2010 a part of the project may be implemented.

- Taking advantage of the investment interest in large RES plants in isolated areas with parallel deployment of projects connected to the trunk of the interconnected system, at the investors’ expense, by virtue of article 2 of Law 2941/2001. In general, recent investment interest for such large-scale projects has been demonstrated, which according to the would-be investors don’t experience problems of local acceptance which are commonplace in other Greek areas (because they are isolated areas). Moreover, it seems that these areas provide investors with relative confidence in keeping on track the implementation schedule since the connection works can be constructed by the investors themselves, i.e. without having to rely on the owner of the transmission system (PPC).
- Intensification of the efforts for the implementation of the planned for development of large-scale hydro.

	Additional RES plants resulting from additional measures by 2010 (MW)*	Optimistic estimation for total capacity in 2010 (MW)	Optimistic estimation for power generation in 2010 (TWh)	Percentage share of every renewable energy source by 2010
Wind	+250	3,267	7.00	10.29
Small-scale hydro		252	0.76	1.11
Large-scale hydro	+100	3,425	4.80	7.06
Biomass		71	0.56	0.82
Geothermal energy	+30	38	0.29	0.42
Photovoltaics	+30	40	0.05	0.07
Total	410	7,093	13.46	19.79

* Change in comparison with the basic estimation of Table 8

Table 10. Optimistic scenario - Estimate of RES production figures in 2010.

Under the optimistic scenario, assuming that all the above additional measures will be effective, the meeting of the target is possible²¹. This presupposes the installation by 2010 of about RES generated additional 400-450 MW (wind plants 250 MW, large-scale hydro 100 MW, geothermal 30 MW and photovoltaic 30 MW,

²¹ The meeting of the target depends indirectly on the promotion of measures to be taken in the context of electrical energy. In particular, the transposition of Directive 2002/91/EC for the energy performance of buildings and the draft Directive for energy saving in end uses are expected to give positive results in the effort to restrain energy demand in 2010. That element is not incorporated in the present estimate. Furthermore, the PPC works out its tariff structure, to be proposed to the Minister of Development so as to be incorporated therein the logic of demand-side management. It is noticeable that already in July 2004 successful special billing arrangements were applied to large industrial consumers including rather token incentives in the form of rebates for restrained energy use. It is estimated that conservation policies may contribute considerably to reaching the of RES target at least by 0.5 percent.

table 10). It is estimated that the load factor of 250 MW of wind parks due to the special attributes of the areas where they will be installed will be 30 percent.

Summing up, it should be stressed that Greece takes pains on the institutional, legislative, technical and financing level, to attain the Directive 2001/77/EC indicative target of 20.1 percent which under quite favorable circumstances can be achieved. It is important that reference is made to the fact that many risk – posing factors have been identified and coordinated effort is being expended on investigating whether they could cause a diversion from the desired goal.

This 3rd National Report, which was drawn up as far as possible on the basis of the latest data and reliable forecasts, is seeking to map out most of the aspects of these efforts.