



Market of Olive Residues for Energy



Regional Energy Agency of Central
Macedonia



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1. The institutional framework for RES (biomass) in Greece

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 permit generally applicable to manufacturing facilities.

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, the only company until 1994 producing, transmitting and distributing electrical energy in Greece having a market share over 95% in 2007, installed around 24 MW of RES whereas local government organizations installed 3 MW until 1995 and the private sector was left out of the scene entirely.

Law 2244/1994 "*Regulation of power generation issues from renewable energy sources and conventional fuels and other provisions*" (Official Gazette A 168) allowed to auto-producers and independent producers to generate electrical energy from RES while 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.

Law 2773/1999 for the liberalization of the electricity market maintained the favourable pricing regime for RES by also placing emphasis on priority access to the grids.

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 Council of State, Greece's 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 blow.

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.

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*.

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 under Law 2742/1999 "*Spatial Planning and Sustainable Development and other provisions*" (Official Gazette A' 207). All these frameworks highlight RES and stress the need for their development. At the same time the issue of these decisions filled the gap identified by the ruling 2569/2004 of the Supreme Administrative Court having been promulgated in the meanwhile.

Already in **2004**, for the more effective and integral settlement of the issue of RES physical planning, the inner cabinet decided to push forward on an urgency base the drafting of the Special Spatial Framework on country's scale. The RES special planning framework is abiding by the principles and criteria applicable to spatial planning under article 2 of Law 2742/1999 and elaborates the directions towards a sustainable development and organization of the national territory with respect to the spatial structure of power generation from RES as a sector of productive activity and as infrastructure of public interest of nation-wide range and decisive importance for the protection of the environment. Also, the said framework provides guidelines for the underlying planning levels (Regional Frameworks, General Town-planning Schemes, Housing Organization Plans of Non-compact Towns, Housing Control Zones, etc).

Also, worth of 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.

On the regulatory level, specially for RES two joint ministerial decisions were issued, namely decision oik.104247/EYPE/YPEXODE/25.5.2006 *"Procedure of preliminary, environmental assessment and approval of environmental terms of power plants using renewable energy sources according to article 4 of Law 1650/1986 as replaced with article 2 of Law 3010/2002"* (Official Gazette B 663) and decision oik.104248/EYPE/YPEXODE/25.5.2006 *"Content, supporting documents and miscellaneous data of preliminary studies of environmental impact assessment, environmental impact assessment studies and appurtenant environmental studies of power plants using renewable energy sources"* (Official Gazette B 663) in order to be adjusted the overall licensing of RES facilities to the regime of environmental consensus. 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 lapse 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 in the spirit of Directive 2001/77/EC article 6. Future projects for another 58MWe from biomass CHP have already received power production permits from the Regulatory Authority of Energy (RAE, 2007).

Today the RES deployment regime is governed primarily by *Law 3468/2006 "Generation of electricity from renewable energy sources and through high-efficiency co-generation of electricity and heat and miscellaneous provisions"* (Official Gazette A' 129). The law put 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.

Table 1 below presents the Renewable energy feed-in tariffs for the year 2007¹

¹ www.ypan.gr

Table 1: Renewable energy feed-in tariffs in the year 2007

Generation of electricity from:	Price of energy (Euro/MWh)	
	Interconnected System	Non-interconnected islands
Wind energy, hydraulic energy exploited in small-scale hydroelectric plants with an installed capacity up to 15 MW, Geothermal energy, biomass , gases released from sanitary landfills and biological treatment plants and biogases, miscellaneous RES, High-efficiency cogeneration of heat and electricity	75.82	87.42
Wind energy from sea wind farms	92.82	
Solar energy utilized in photovoltaic units with an installed capacity less than, or equal to 100 kW, and which will be installed in a lawfully owned or possessed property or in adjacent properties of the same owner or lawful possessor	452.82	502.82
Solar energy exploited in photovoltaic units with an installed capacity of over 100 kW	402.82	452.82
Solar energy exploited in units employing a technology other than that of photovoltaics with an installed capacity up to 5 MW	252.82	272.82
Solar energy exploited in units employing a technology other than that of photovoltaics with an installed capacity of over 5 MW	232.82	252.82

For the enforcement of *Law 3468/2006* an unprecedented in form and extend regulatory framework was set up as detailed below.

1. *Ministerial decision D6/F1/oik.18359/14.9.2006* "Form and scope of electricity supply contracts in the System and the Interconnected Network according to the provisions of article 12 par. 3 of Law 3468/2006" (Official Gazette B 1442).

2. *Ministerial decision D6/F1/oik.1725/25.1.2007* "Establishment of form and scope of sale contracts of electricity generated using renewable energy sources and through high-efficiency cogeneration of heat and electricity in the Network of the Non-Interconnected Islands according to the provisions of article 12 par. 3 of Law 3468/2006" (Official Gazette B 148)

3. *Ministerial decision D6/F1/oik.5707/13.5.2007* "Regulation of production authorization regarding electricity generated using renewable energy sources and through high-efficiency cogeneration of heat and electricity" (Official Gazette B 448).

4. *Ministerial decision D6/F1/oik.13310/18.6.2007* "Procedure for the issue of installation and operating permits of power plants using renewable energy sources" (Official Gazette B 1153).

Potential Olive pomace applications in Greece include:

- Small- to medium-scale heat generation or co-generation in agro-industrial mills.
- District heating applications in central-northern high-elevation villages.
- Co-firing with lignite in existing power stations.
- Heat generation for individual buildings (schools, hospitals, public buildings). Improved stoves for households based on the different fuel types available in Greece (olive kernels, fruit kernels).

Table 2 below presents some industries in Greece which use exhausted pomace in addition to other biomass sources for the energy production²

Table 2: Greek industries which use exhausted pomace in addition to other biomass sources for the energy production (1)

Area	Power (MWe)	Thermal Energy (MWh/y)	Fuel
Meligalas, Messenia	8,14	-	Olive prunings
Iraklion, island of Crete	5,42	-	exhausted pomace
Meligalas, Messenia	5	-	exhausted pomace
2.633 units	-	2.325.556	exhausted pomace

² Exhausted pomace gasification for the production of energy, B.Skoulou, A.Zampaniotou

2. Public funding of RES (biomass) projects

The **Operational Programme for Energy** (OPE), managed by the Ministry of Development, drew funds from the 2nd Community Support Framework (CFS), which ended on 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 3. On the other hand, the Ministry of National Economy (now Ministry of Economy and Finance) provided funding from national resources under Law 1892/1990 "Modernisation 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 resources³

Table 3: Summary data of cost and capacity of biomass applications funded from the 2nd CSF

	Bio-mass	Total RES
Number of investments	2	42
Total budget in million Euro	31.50	196.40
Total public expenditure in million Euro	14.80	79.90
Total installed electric power in MW	20.70	153.90
Annual power production in TWh	168.00	576.00

The **Operational Programme "Competitiveness"** (OPC) 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. Public aid accounts for 30 percent of the eligible cost of the projects and goes up to 60 percent whereas the cost of transmission lines independently of the technological category of the investment receives by 45 percent for areas A and B of Central Macedonia and Attica as they are characterised in Law 3299/2004 and 50 percent for the rest country whereas for small-scale enterprises a flat 50 percent applies all over the country.

Table 4: Financial data of biomass applications and energy saving projects co-financed from 3rd CSF in million Euro

	Bio-mass	Total RES
Number of investments	3	172
Total budget in million Euro	25.70	735.79
Total public expenditure in million Euro	10.30	252.70
Total installed electric power in MW	17.30	664.71
Annual power production in TWh	136.30	1,852.62

³ National report, regarding penetration level of RES in the year 2010 (Article 3 of Directive 2001/77/ec)

A considerable funding tool for RES investments is the so called **Investment Incentives Law or National Development Plan 3299/2004** (NDP), following its amendment by virtue of article 37 of law 3522/2006.

The NDP is an open type (no time frame limitations) financing tool for the support of investments over 100.000 €. It aims to increase employment, improve the competitiveness of the economy, promote entrepreneurship and technological innovation, support environmental protection and energy saving. All private enterprises are eligible to be granted incentives by NDP. Small-medium enterprises and enterprises engaged in raising and innovative sectors of economy are promoted..

Eligible sectors of investment are classified in two categories. The eligible sectors related with biomass are:

Category 1

- a) Production of electricity from RES (biomass included)
- b) Cogeneration of heat and electricity
- c) Substitution of fossil fuels or electric power with RES
- d) Production of liquid and solid biofuels & production of plant biomass for energy purposes

Category 2

- a) Thermal utilization of RES (steam and hot water production)

Eligible are the investments:

- > 500.000€, for large enterprises
- > 250.000€, for medium enterprises
- > 150.000€, for small enterprises
- > 100.000€, for very small enterprises

Type and amount of financing

For the investments fall under the provision of the Law the following types of incentives are foreseen: - *Cash Grant*, up to 60%, that covers part of investment cost

- *Leasing Subsidy*, up to 60%, that covers part of the payable instalments relating to a lease that has been entered into for the use of new mechanical or other equipment
- *Wage Subsidy*, up to 60%, provided for employment created by the investment
- *Tax Allowance*, up to 100% that allows income tax exemption on non-distributed gains. The allowance is effective upon completion of the investment for the first ten years of operation and is created through a tax-exempt reserve.

The amount of incentives, granted under the NDP, depend on the geographic region within the country. Specifically, the Greek territory is divided into three (3) zones where the capital grants are as high as 20, 30 and 40 percent respectively of the eligible investment cost, the connection cost to the grid being also included in the case of large scale enterprises. The grant is increased up to 10 percent for medium-scale enterprises and up to 20 percent for the small ones. In particular, for investments in power generation using solar and wind energy, the grant intensity along with the above markup amounts to 40 percent. The classification of Prefectures in zones A, B and C is illustrated in Figure 3.2., while the amount of incentives for each zone can be seen in Tables 5 & 6 below.

Table 5: Amount of Cash Grant/ Leasing subsidy or wage subsidy per zone and investment category

Investment Category	Zone A	Zone B	Zone C
Category 1	20%	30%	40%
Category 2	15%	25%	35%

Table 6: Amount of Tax Allowance per zone and investment category

Investment Category	Zone A	Zone B	Zone C
Category 1	60%	100%	100%
Category 2	50%	100%	100%

Additional incentives up to 10% for small enterprises and up to 20% for very small enterprises are envisaged.

Eligible costs

The eligible cost related with bioenergy investments are:

- Cost of construction, extension or upgrading of buildings/plants
- Purchase of new equipment
- Cost of the main grid for transferring hot water to consumers, in case of investments for steam or hot water production
- Cost of connection with the national electricity transport grid, in case of investments for electricity production from RES or cogeneration
- Cost of consultancy services and of technical and other studies

In general, eligible are the costs related to assets. Non assets costs and cost of consultancy services should correspond to up to 8% of total investment cost. Operational costs are not eligible.

Description of procedure

The NDP is open throughout the year. The responsible public authority for evaluation of the application varies according to the type and amount of the investment.

The application for funding should be accompanied by a technical-economical study, the invoice of deposit payment, techno-economical data and other documentation. Approval or not of the investment is confirmed between 2-3 months.

Upon approval, 50% of cash grant is released upon completion of 50% of the project or advance payment with a bank guarantee and the remaining 50% is released upon full completion of the project. Cash grants for wages are released every six months, following an application submitted by the investor.

Responsible Authority:

The National Development Law is administrated by the Greek Ministry of Development:

The law is not in force any more, is expected the new one to be announced on September 2010.

The most up to date data for RES facilities is shown in table 7.

Table 7: Installed capacity of RES systems in MW (December 2007 – January 2008)

Region	Large-scale hydros	Wind	Small-scale hydros	Photo-voltaic	Biomass	Totals
Eastern Macedonia & Thrace	500.0	196.67	2.97	0.00	0.00	699.64
Attica	0.00	3.11	0.99	0.10	29.63	33.83
North Aegean	0.00	29.90	0.00	0.00	0.00	29.90
Western Greece	907.20	58.15	24.31	0.00	0.00	989.66
Western Macedonia	375.00	0.00	0.00	0.00	0.00	375.00
Central Macedonia	492.00	17.00	34.00	0.40	8.38	551.78
Epirus	543.60	0.00	45.75	0.00	0.00	589.35
Ionian islands	0.00	40.20	0.00	0.00	0.00	40.20
Thessaly	130.0	17.00	11.43		0.35	158.78
Crete	0.00	129.50	1.00	0.80	0.36	131.66
South Aegean	0.00	37.56	0.00	0.00	0.00	37.56
Peloponnesse	70.0	119.80	2.00	0.00	0.00	191.80
Central Greece	0.00	204.30	24.62	0.00	0.00	228.92
Totals	3,017.80	853.19	147.07	1.30*	38.72	4,058.08

Besides what is presented in table 7, at present, there are further installation authorisations for RES stations totalling a capacity of 813 MW out of which 32 MW biomass stations. A reliable picture of this investment interest is given in table 8, which shows the capacity of energy production authorisations in mainland areas beyond those where transmission line reinforcement has begun and no installation authorisations haven been issued.

Table 8: RES production authorisations in the mainland without installation authorisation, except the areas where grid reinforcement has been scheduled

Technology	Capacity (MW)
Wind farms	3,059
Small hydros	316
Biomass	5
Geothermal energy	0
Photovoltaics	10
Total	3.390

3. Policies to boost the olive residue energy market

In Greece, olive residues have been widely used in the past for space heating in the domestic sector (and still remains an important fuel type for rural areas) and as fuel for process heat requirements in a large number of small-scale industries (i.e. olive mills, greenhouses, cotton ginning factories, sawmills, etc.).⁴

The main reasons for this high adoption rate in rural areas have been:

- Inexpensive source of energy,
- Disposal method deriving from agricultural factories and sawmills and
- High cost of other sources of energy in the respective regions.

However, it should be stressed out that the traditional use of biomass energy has its own problems: inefficient energy production, sharp temperature rises, prolonged drought periods, decreased crop productivity are some of the most important ones that Greece already faces. Increasing oil prices, awareness for climate change and its adverse effects have recently brought biomass to the front stage along with the other renewable energy technologies.

The rural areas present certain characteristics which favour the potential development of an olive –to–energy chain:

- the agricultural sector is one of the most important economic activities of the region which itself is facing significant difficulties. The unemployment rate is higher than the national average, especially among young people (National Statistics on Employment and Unemployment, 2004),
- additional economic activity is offered to the local community. The development of community-based bio industries often results in strengthening the community support services, providing additional jobs in the local government and service sectors.
- Provides a green label to the energy user differentiating it from other competitors
- mitigating rural depopulation

Public awareness

The following aspects should be addressed:

- There is a lack of data for specific quantities of the olive-mill solid residues produced.
- Dissemination of information relating to the disposal and recycling techniques of olive-mill waste in an efficient and economic way.
- Elaboration of common rules about the management of olive-mill solid residues.
- Economic evaluation.

Institutional framework

It is generally acknowledged that biomass lies across the borders of several policy sectors, the most important ones being agriculture, energy, environment and international trade. Each of them has a major effect on the successful development of biomass systems and efficient interaction is expected to be critical for future development. Ideally, a platform should be created linking the relevant policy sectors and using biomass in an overall climate change strategy by the following key areas:

- Effectively linked policy framework

⁴ Bioenergy in Greece: Policies, diffusion framework and stakeholder interactions, Calliope Panoutsou, Available online 13 August 2008

- Harmonise support mechanisms to improve the overall effectiveness of biomass supply chains.
- Favourable national laws should be introduced for obtaining permits for facilities producing energy from biomass

Public funding

The lack of measures providing public funding could likely be offset by:

- The alleviation of the bureaucratic burden through the simplification of procedures and the overcoming of administrative constraints in using pomace as energy source.
- The consolidation and stabilisation of the investment environment by means of broader development and favourable taxation policies.
- The continuation of the feed-in price regime of the renewable energy on a permanent and stable base.
- The announcement of the new Development law with special measures on biomass plants.

Economic viability of the project

Two main conditions are needed for the viability of bioconversion projects and concern both sides, first of all the investors (responsible for the realization and the operation of the biomass units) and the farmers-producers (providers of the primary sources in the conversion units):

- The farmers should provide their primary sources to the plants and keep the agreement with the investors in maintaining steady prices.
- The investors should have a minimum percentage of profit, which is expressed with the Internal Rate of Return (IRR) and is set equal to 15%.

Investors/energy plant owners

Investors/energy plant owners involved in the olive-to-energy schemes are greatly concerned about biomass availability, feedstock properties and the economic viability of such energy systems. Their focus lies on:

- feedstock quality and year-round security of supply,
- current feedstock prices and projected increases,
- efficient technologies,
- governmental support to ensure successful take-off of bioenergy schemes.

Current policies, provide some subsidies for investors. Others believe that the best way to increase competitiveness of biomass to energy schemes is through environmental taxes on fossil fuels.

State-of-the-art technologies, advanced combustion systems and co-generation schemes seem to be the most economically attractive solutions for heat and electricity generation at the moment

A reliable source of energy (heat and/or power) requires long term guaranteed contracts with primary source suppliers. Therefore in the development of local bioenergy schemes it would be advisable to encourage local agricultural cooperatives or other local businesses to participate as contract coordinators. Cooperatives could indeed act as independent power producers, producing the feedstock and using it locally for heat and/or electricity production. Such a role for cooperatives would

be consistent with their existing roles with respect to conventional crops. Local cooperatives could join bioenergy schemes in order to raise their income and keep their interest in the subject.

Decision-making groups

Politicians, who constitute the most important decision-making group, raise a great number of questions, which can be categorised as follows:

- Environmental impacts:
 - of exploiting residues for energy purposes,
 - of feedstock production/handling schemes, and
 - of their use as a fuel.
- Competitiveness of biomass in the market (compared to the alternative market demands);
- Agriculture's role within an appropriate energy policy;

Questions in all these areas need to address in order to minimise misconceptions and possibly adverse reactions.

Current subsidy programmes for the energy industry and for agriculture should be evaluated and perhaps integrated to support this opportunity. Olive pomace energy production has the potential to benefit not only the power industry and the agricultural community, but the public and environment as well.

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