Barriers on the propagation of renewable energy sources in Greece

Sofia - Natalia Boemi[1], **Agis M. Papadopoulos**

Laboratory of Heat Transfer and Environmental Engineering School of Mechanical Engineering, Faculty of Engineering, Aristotle University of Thessaloniki,

54006 Thessaloniki, Greece

[1] Corresponding author: E-mail: boemi@aix.meng.auth.gr,

Tel +30 2310 996011, Fax: +302310996012

Abstract: Renewable Energy Sources (RES), excluding big hydroelectric plants, covered in 2010 7,6% of total electricity production in Greece. According to the current European and national legislation, Greece targets to a 40% share of renewable energy sources (RES) in electricity production by 2020, which is a major challenge. The potential, though, does exist; so does a series of barriers. National legislation is trying to support the development of a "green" electricity market, by means of supply-side policies like subsidies for renewable electricity production and attractive feed-in tariff rates. However, socio-economic and public awareness problems are still met in the planning and implementation of RES projects, together with the lack of a completed national cadastre and a spatial development master plan, specifying areas eligible for RES development. A consolidated study of this broad set of barriers will be discussed in this paper.

Keywords: Renewable energy sources; energy policies; barriers;

1. Introduction

Since the early 1990s the demand for a change in energy policies became a major issue of discussion around the world, driven by economic, environmental, security of supply and social concerns. Political and legislative changes occurred, having a profound influence on the development of Renewable Energy Systems (RES), directly or indirectly. On a European level changes were expressed i.a. by a series of Directives dealing with renewable energy matters, including the Directive on the promotion of electricity from renewable energy sources (Directive 2009/28/EC; 2001/77/EC) and the Directive on the promotion of biofuels (Directive 2003/30/EC) which aimed at the elimination of existing barriers. Within this process, the Directive 2009/28/EC, regarding the promotion of use of energy from renewable sources, sets the mandatory national targets for their overall share in gross final consumption of energy and in transport by 2020. It is a far-reaching package of measures that falls within the line of the European Union's ambitious commitment to fight climate change and promote renewable energy up to 2020 and beyond. Moreover, it establishes a common framework for promoting energy from RES regarding statistical transfers between Member States and third countries, guarantees of origin, administrative procedures, information, training and access to the electricity grid from RES.

In Greece, the first national renewable energy allocation plan foresaw an initial aim of 18%, as determined by the aforementioned Directive 2009/28/EC; it increased to 20%, corresponding to 40% of the total national electricity production in

2010 (Law 3851/2010, NREAP, 2010; Kambezidis et al., 2011). The share of renewable energy sources, with the non-interconnected islands included is depicted in table 1.

When referring in real terms, the overall share of RES in the Greek final energy consumption shows a notable positive trend during the last two decades, rising from 4.5% in 2008 to 7.6% in 2010. Hydropower still represents the dominant renewable energy source; its development has been relatively steady during the last years mainly due to the introduction of other emerging technologies such as wind and solar. Thus, given the present state of market progress on RES and especially on wind power and solar-photovoltaic (PV) applications in Greece (table 1), the target offset for 2020 is rather realistic, under the condition that specific developments will be realized, like removing certain bureaucracy barriers or strengthening the existing legislative frameworks, and persistence or even improvement of the existing policy instruments will be ensured (Kaldellis, 2012).

2. The Greek policy framework

The Greek policy framework is related to the development of a common European energy policy, refers to an integrated strategic objective known as the ‘‘20-20-20’’ target. In this line of approach a series of supplementary laws and ministerial decisions were introduced, to create the framework for an efficient implementation of the aim.

Specifically, Greek legislation incorporated the aforementioned directives in a series of successive laws.

The Law 3468/2006 on “Production of Electrical Energy form RES and combined heat and power in the gross electricity production and other”. The law simplified licensing procedures, whilst it provided a feed-in tariff guarantee for 10 years, which could be extended by 10 years following a producer's unilateral declaration towards the Transmission System Operator. That was made in order to expanse the electrical power market and to provide long term stability. The 20 years period is one element of best practice for national support schemes because it provides stability and support of long term mechanisms.

The Law 3851/2010 on accelerating the development of Renewable Energy Sources in order to deal with Climate Change and other regulations (Governmental Gazette 85/4-6-2010) integrates Directive 2009/28/EC into the national legislation and sets the following national targets until 2020: 40% RES penetration in gross electricity production, 20% RES share in gross energy consumption for heating/cooling and 10% RES share in the transport sector. It is an extension of Law 3468/2006 and it also includes issues regarding the simplification of licensing procedures for RES-E units and establishment of a RES agency under the Ministry of Environment, Energy & Climate Change (MEECC) for advising RES-E investors. Additionally to this law the Ministerial Decision on Physical planning and allocation of RES has been issued (Governmental Gazette B 2464/3-12-2008).

Finally, a series of supplementary presidential decress ministerial decisions were issued to enable the effective implementation of the laws.

3. The barriers for RES in Greece

Greece is, considering its morphology, climate and spatial development, a rather clustered country, as it incorporates mountainous areas and islands, high income touristic places and low income rural areas as well as highly urbanized cities and sparsely populated remote areas. Despite this fact, a series of studies have proven that there are drivers and barriers common in the whole country. Administrative and procedural decoupling of conflicting interests characterizes most of the barriers. Eurostat (2007) used socioeconomic indicators in order to categorize the RES barriers in Greece. The five major types are:

(1) technological barriers;
(2) environmental barriers;
(3) social/public opinion barriers;
(4) economic barriers;
(5) regulatory, administrative and legislative barriers.

The present study, the main finding of which were based on the DEPOIR consolidated Hellenic – Canadian research project, adopts that approach and attempts to identify the existing barriers.

3.1. Technological barriers

There are different needs for the use of RES on the mainland, compared to the islands. It is obvious that, when it comes to the needs of the mainland, the infrastructure network is much more suited to absorb the electrical energy produced by RES in areas with increased potential. The insular electrical connections are, at best, limited to absorb or to store the whole some of the power produced by wind parks (Oikonomou et al, 2009a).

Concerning the wind energy Papadopoulos et al (2007) presented the limited capabilities of absorbing RES-generated power. The need of upgrading existing grids, a time consuming and expensive procedure, especially in the case of high-voltage nets. These problems occur mainly in the regions of Thrace, Evoia and Lakonia, where there is a high interest for investments due to the very favourable wind potential. The seasonal fluctuation of the energy demand, especially on Greek islands, underlines the weakness of the network's infrastructure. There is an problem of concurrency between the demand and the offer of energy and this is, in an insular system, a significant drawback.

3.2. Environmental barriers

The problem with the Greek energy market, at least in its current shape, is that environmental costs are not adequately internalised. While the production of fossil energy is combined with the greenhouse gas emissions as well as with environmental degradation, the costs of these external factors are poorly reflected in the pricing of energy and therefore in the operation of the market. Even thought there has been an effort to reflect environmental costs through the national transmission fees, this reflects only to a small extent on the eco-system (Stangeland, 2007).

According to Oikonomou et al (2009b) the effects on environmental barriers can be recognised on the ecosystems, on the landscape and on the change of land use. More analytically, fauna and flora can change until a RES work completion. Especially, minimal interventions should be made in order for the side to return to its original environmental state as close as possible upon completion of all works.

Also, the upgraded levels of dust and noise during infrastructure works, such as road opening, cables of electric current transport, may lead to an environmental devaluation of the environment. Finally, special attention should be given after completion of all works in order to minimize the intervention with the environment and return the site as close as possible to its original environmental state. The necessary measures include the plantation of trees where new roads need to be constructed, so that the former land use around a wind park does not change.

3.3. Social / public barriers

This is probably the most important underlying factor, because it refers to the public acceptance of the RES. During the last years, a significant number of large-scale RES-based projects have been installed or planned in many places all over Greece, with the public opinion being generally in favour of them. But, moving from global to local, the aforementioned positive view for RES may change considerably (Walker et al., 2010). It should be noted that the public concern often originates from the fact that environmental advantages of RES projects are perceived on a global or national level, whereas, environmental impacts of such systems only affect the local environment and habitants.

This has been also the case in Greece. Deploying a renewable energy project, such as a wind farm, a hydro or, to a lesser extent, a PV plant, close to a community sometimes causes the local population to react, mainly owed to the local habitants' suspicion and negative expectations about this type of applications in their neighbourhood (Kaldellis et al., 2012). Specifically, levels of public acceptance and reactions are usually considered among the primary indicators for implementing a RES project, comprising at the same time a matter of political interest (Elliott, 1994) for all bodies involved (e.g. government, developers, etc.). In some cases, environmental concerns become important enough to affect negatively, or even hinder, the implementation of such projects. Public opposition often focuses on the environmental impacts caused by the installation and operation of wind farms, like the visual impact , the impact on birds' populations and migration, the noise emission, the change in land use, the moving shadows in the nearby vicinities etc.

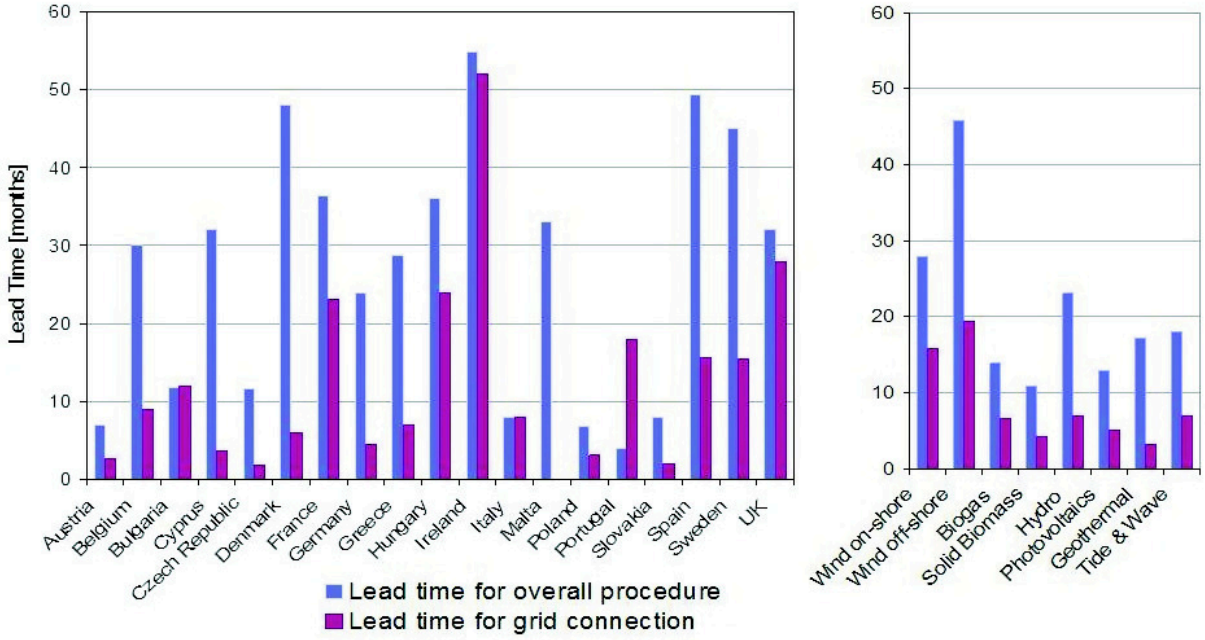

Fig. 1. Average lead time for overall authorisation procedure and grid connection
Source: "Promotion and growth of renewable energy sources and systems" COM 2009

3.4. Economic barriers

Significant economic incentives, together with other forms of stimulus have been launched for propagating the implementation of RES systems in the field and in buildings. Efforts were made on the Greek market to reduce the final price of PVs, but the initial cost is still high, both for commercial and domestic use, to make them attractive without any form of subsidies. Even where feed-in tariffs were attractive, almost excessively so, as in the case of photovoltaics in field, progress is slow and tedious (Papadopoulos et al, 2009).

Referring to the use of wind energy, market distortion and competition exists and unequal distribution of the subsidies' allocation can be monitored between RES and other competitive activities like tourism. Also, an important obstacle for the infiltration of wind energy is the lack of a tax-free income against the expenditure for purchasing small domestic wind turbines (Oikonomou et al., 2009b).

3.5. Regulatory, administrative and legislative barriers

Government procurement policies aim to promote sustained and sustainable commercial development of renewable energy, but bureaucracy still creates obstacles.

One of the major barriers is the overall authorisation procedure together with the grid connection process. As depicted in Figure 1, with respect to the average lead time for overall licensing procedure in Europe, Greece ranks in the last third of the countries.

This is mainly because there is a rather complicated licensing procedure for RES. Concerning the construction of a wind park the duration of the entire procedure can take more than 3 years (Figure 4).

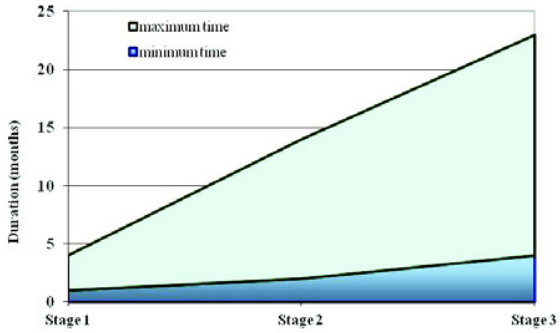

Fig. 4. Stages of development and operation of a PV park - Source: DEPOIR 2007

The first stage, which lasts 3-6 months, is planning and includes site selection and all the required studies.

One of the criteria that should be taken into consideration during the planning phase is, fairly obviously, the wind potential of the selected area. Still, it was not until 2006 that adequate data were available. Other parameters that have to be considered are:

- The distance form transmission networks
- The distance from similar installation;
- The distance from residential areas;
- The distance from archaeological areas;
- The distance from airports and areas protected by international agreements like NATURA, RAMSAR, etc.

The next stage involves the authorization of the wind park project, which lasts from 9 to 18 months, which includes the approvement of a series of detailed studies considering the installations, the construction works and the electrical connections

Finally, the construction of the wind farm, its connection to the grid and a test operation phase are part of the last stage of implementation prior to the plant's commercial operation.

Concerning the construction of a PV park more than ten essential documents are needed in order to start (Figure 5).

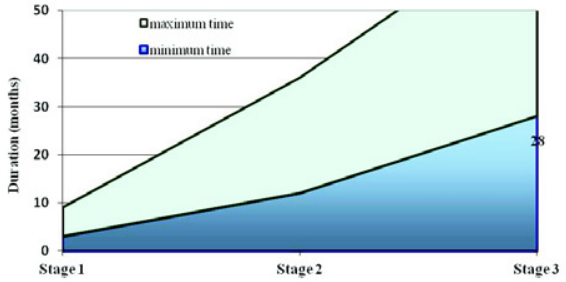

Fig. 5. Stages of development and operation of a wind park - Source: DEPOIR 2007

The first stage for implementing a PV park is the planning. It includes the selection of the suitable area for the installation and the selection of PV frameworks and other system installation based on the best financial deals. The duration of this stage is one to three months.

The next stage includes all the bureaucratic process and lasts from two to nine months. The third and final stage of a PV park project includes (1) ordering and purchase of the equipment [0- 3 months, depending on the availability of materials], (2) installation of PV frames and equipment (not required in buildings), (3) connection to the network. This stage can last from 1 to 7 months depending on the size of the park.

Finally, a problem that cannot remain unaddressed concerns the fact that the same projects are monitored concerning their operation and performance by different authorities simultaneously. The turn-key cost of wind parks is monitored by the Ministry of Development, which is granting the production licences and is also responsible for managing the funding from European Union sources, if applicable. The monthly and annual energy output is monitored by the Hellenic Transmission System Operator (HTSO) which is responsible for the payment of energy producers. The Regulatory Authority of Energy is monitoring the producers' compliance with the terms of the production licences, as well as the evolution of the electricity market as a whole. Although both HTSO and RAE are supervised by the Ministry of Development, this fragmentation does not enable a rundown of the data needed for the evaluation of the wind parks' energy performance and economic efficiency (Papadopoulos et al, 2007). Finally, the Ministry for Finance is monitoring the cash flows from national funding sources.

The implementation of the national spatial master plan for RES is another barrier. In 2007 was published the spatial plan specifically for RES, but its implementation has shown that there are many question to be answered before it actually contributes to speeding up the whole procedure.

4. Conclusions

Price-setting policies in order to reduce cost and pricing related barriers will give a boost to the development of RES. Also, proper dissemination of knowledge on the level of local communities will help in overcoming the social reactions even though the negative social impacts have reduced significantly the last years. Also, a wide variety of policies are designed to explicitly to promote renewable energy and a rise is to the MW produced from RES is obvious Greece need more effective measures to achieve the 20-20-20 target.

Finally, policymakers should provide 'smart' targeting policies in order to boost the RES in early market stages with a view to overcome the institutional barriers to commercialization, to encourage the development of appropriate infrastructure and provide the local markets paths for technologies that require intergraded technical, infrastructure and regulatory changes.

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Table 1: Mainland's primary energy production for the period 2005–2010 and the demand for 2020
Source: NREAP, 2010; Kambezidis et al., 2011

	2005	2006	2007	2008	2009	2010	2020
Wind	943.8 MW	1199.4 MW	1333.1 MW	1661.2 MW	1908.3 MW	2061.7 MW	7.5 GW
Hydro	164.2 MW	220.4 MW	223.2 MW	324.9 MW	657.2 MW	753.5 MW	3.5 GW (including large hydropower plants)
Solar (photovoltaic and concentrating solar power (CSP) plants	–	-	0.1 MW	5.1 MW	45.1 MW	132.0 MW	2.2 GW and 250 MW
Biomass–biogas	98.1 MW	91.9 MW	155.9 MW	176.7 MW	181.9 MW	193.9 MW	250 MW and biofuels 10% of final con-consumption in the transportation sector
Geothermal energy (including GHP)	14.4 MW	9.1 MW	34.0 MW	34.8 MW	144.1 MW	114.6 MW	120 MW 880 MW of pumped storages systems - concerning exclusively the non-interconnected (NI) islands
RES in total	2.7 %	3.4%	3.5 %	4.5 %	6.5 %	7.6 %	

Table 2: Drivers and barriers for RES and projects in Greece.
Source: DEPOIR, 2007

Barriers	Renewable Energy Systems
Technological	Lack of trained human resources.
Environmental	Incorporation costs for RES High cost of grid connection.
Social and political	There is no maturity in the recognition and realistic assessment of the RES potential .
Economic	Lack of funds. Participation in EU funding projects in public-private partnerships.
Legislative and administrative	Delays in the overall procedure. Lack of special spatial design for RES. Ineffective control mechanisms and administrative structures.

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Барьеры для Распостранения Возобновляемых Источников Энергии в Греции

София – Наталья Boemi, Агис М. Papadopoulos

Лаборатория Теплопередачи и Экологической Инженерии, Отдел. Машиностроения, Факультет Инженерии, Университет имени Аристотеля в Салониках, 54006 Салоники, Греция

1 Соотвествующий автор: E-mail: boemi@aix.meng.auth.gr, Тел. +30 2310 996011,

Факс: +302310996012

Резюме: Возобновляемые источники энергии (ВИЭ), без учета больших гидроэлектростанций, покрыли в 2010 году 7,6% общего производства электроэнергии в Греции. В соответствии с действующим европейским и национальным законодательством, Греция нацелена на 40% долю возобновляемых источников энергии (ВИЭ) в производстве электроэнергии к 2020 году, что является серьезной задачей. Потенциал, хотя, действительно существует, так же и серия барьеров. Национальное законодательство пытается поддерживать развитие «зеленого» рынка электроэнергии с помощью производственно-сбытовой политики, как субсидии на производство возобновляемой электроэнергии и привлекательные льготные тарифы. Однако, социально-экономические и проблемы общественной информированности, до сих пор встречаются в планировании и реализации проектов, указывают вместе с отсутствием совершенного национального кадастра и пространственного генерального плана развития, области имеющие право на развитие ВИЭ. В этой статье, будет рассматриваться консолидированное изучение этого широкого спектра барьеров.

Ключевые слова: Возобновляемые источники энергии; энергетические политики; барьеры;