SWISS FEDERAL INSTITUTE OF TECHNOLOGY ZURICH

Recent Changes in the Structure of Greek Wind Power Support Policies

Is enough being done to avert the wrath of Aeolus' sack of winds?

Aryestis Vlahakis
Student No. 09-934-464
aryestis@student.ethz.ch

Energy Economics & Policy Term Paper
Professor Thomas F. Rutherford

Final Submission 4 June 2010

1 Introduction

Wind has always been part of the Greek narrative. The ancients believed that the winds were controlled by Aeolus, son of Poseidon. Today, the fearsome summer 'meltemia' that blow from the north-east are one of the few things that can put a damper on travel between the lively islands of the Aegean. The winds have a beneficial side to them too: the country's excellent wind potential. In the past two decades, attempts have been made to take advantage of this resource. Environmental concerns have now added another strong motive to the promotion of renewable energy sources (RES).

As part of the 20-20-20 set of European Commission goals, Greece is required to increase the proportion of renewable energy it uses to 18% by 2020[1]. Greece has had legislation dealing with renewable energy production in place since 1987[2]. Particularly in the electrical energy sector, the Greek government has, since 2006, chosen to promote RES using a mix of up-front subsidies and feed-in tariffs. The system used resembles those used by the German and Spanish governments in successfully supporting RES. Whilst there has been an increase in the installed capacity of Greek wind power, this has not necessarily been as large as necessary or even as expected. Out of all forms of RES, the most significant growth has been in wind energy (European Commission, 2010). Even this, however, only represents a small fraction of the overall Greek electrical energy generation capacity (Table 1).

In October 2009, a new government was elected in the aftermath of the world financial crisis. The new Prime Minister Georgios Papandreou has made green energy one of his key platforms. In March 2010, the House of Parliament began debating new legislation regulating the support and licensing of RES. The bill has now passed through parliament[3] and is in the process of being protocolled and issued in the government gazette. In the case of wind energy, the new legislation proposes increasing the feed-in tariff to an as-yet-undetermined amount. The changing feed-in tariff, combined with the termination of additional programs to stimulate investment around the country which provided a subsidy of 30% for the capital costs of building

[1] European Commission Directorate of Energy 2010
[2] Government of the Hellenic Republic 31 Dec 1987b
[3] Aggelioforos Newspaper 18 May 2010

a wind park, could significantly alter the behaviour of wind park investors. This paper's main goal is to investigate the likely effect of this change on investor behaviour.

2 Greek Wind Energy Past, Present and Future

2.1 Until Today

Table 1: Summary of regulations & legislation pertaining to wind energy production in Greece

Date	Published in	Law	Description
31/12/1987	FEK 1987/761B[1]	Ministerial decision	Regulations concerning the siting of wind turbines.
07/10/1994	FEK 1994/168A	2244/94	Legislation concerning the production of electrical energy from RES.
10/05/1995	FEK 1995/385B	Ministerial decision	Regulations on issuing electricity production licences to private companies; technical and financial terms of their connection to the grid.
28/08/1996	FEK 1996/766B	Ministerial decision	Modification of regulations issued in FEK1995/385B pertaining to the sale of electrical energy by a private producer to the PPC.
26/05/1998	FEK 1998/502B	Ministerial decision	Modification of regulations issued in FEK1995/385B.
22/12/1999	FEK 1999/286A	2773/99	Liberalization of Greek Electrical Energy market. Foundation of Greek TSO. Regulations on issuing electricity production licenses. Regulations aiming to encourage development of renewable energy production (Articles 35-40).
12/09/2001	FEK 2001/201A	2941/01	Legislation aiming to simplify the licensing process for renewable energy production plants.
27/06/2006	FEK 2006/129A	3468/06	Legislation regulating the production of electricity from renewable energy plants, setting of feed-in tariffs.

Wind power first became a feature in the Greek energy mix in the early 1990s. Its initial development was under the auspices of the then government owned Public Power Corporation (PPC or Dimosia Epeixirisi Hlektrismou, DEH), which constructed and operated most Greek wind parks in the early nineties. Legislation mandating and supporting the development of renewable energy including wind power has been enacted and modified regularly since then (Table 1).

As far as wind power is concerned, the most interesting and important reforms are Laws 2773/99, 2941/01 and 3468/06. The first enacted the liberalisation of the Greek electrical energy market, the second streamlined licensing for RES and the third includes several provisions for the support of RES. The increases in installed capacity for wind power have occurred following the enactment of this legislation. It is interesting to see the correlation between the changes in installed wind power capacity (Figure 1) and the dates when new legislation concerning wind power was enacted (1999, 2001, 2006, Table 1). Naturally, this is not a true indication of the success or failure of these policies, but it is clear that there was a definite impact on the wind energy industry, particularly in 2006.

Table 2: Feed-in tariffs in 2006 and 2009 Government of the Hellenic Republic

Type of wind park	2006	2009
Onshore, grid connected	73 .0 EUR/MWh	87.85 EUR/MWh
Onshore, non-grid connected	84.6 EUR/MWh	99.45 EUR/MWh
Offshore	90.0 EUR/MWh	104.85 EUR/MWh

In 2006, the Greek government decided upon a combination of up-front subsidies and feed-in tariffs to encourage and support the development of wind energy. During the licensing stage, the wind park owner would sign an agreement with the Greek TSO, valid for 25 years with the possibility to extend for a further 25 years should the wind park owner wish to do so (Government of the Hellenic Republic, 27 June 2006). The unit price of electrical energy sold was set by the 2006 legislation and adjusted annually by decision of the Minister for Development[4]. The adjustment occurs on the advice of the TSO and is indexed to the average changes in the PPC's electricity tariffs. This latter change is connected to the demand and supply of each 'type' of electricity in the previous year. The up-front subsidies are provided with the support of the European Union and amount to 25-40% of the investment costs. These subsidies are not directly linked to the legislation on feed-in tariffs but are part of wider efforts on the part of the government to encourage new investment in all sectors throughout the country

[4]Currently, this is the Minister of Environment, Energy and Climate Change, but the titles and responsibilities of Greek Ministers and ministries often change with new governments.

(Hellenic Ministry of Development, 2009).

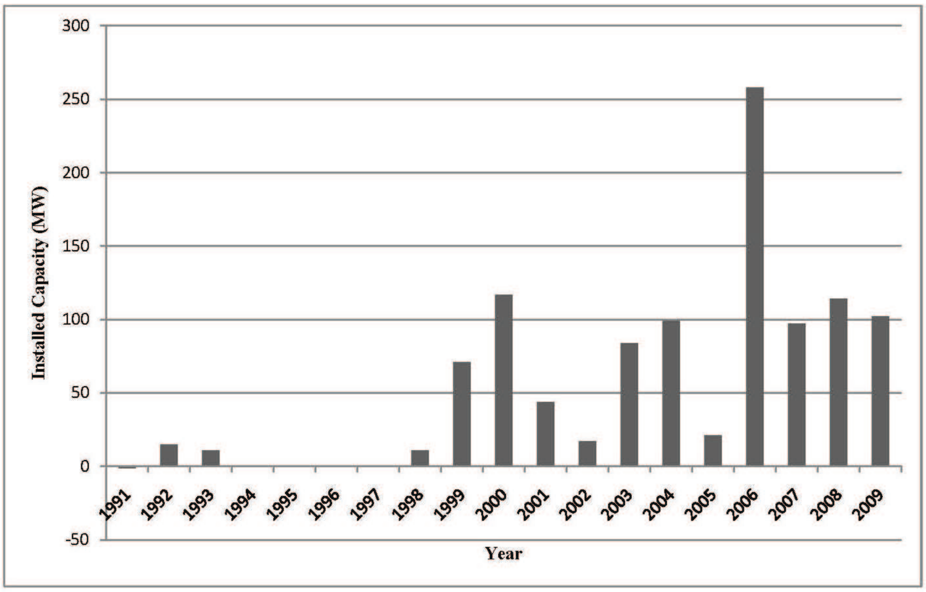

Figure 1: New capacity installed in Greece 1991-2009 (European Commission, 2010)

2.2 Potential for Development

Amongst the government efforts to encourage wind power in Greece has been the mapping of the wind potential across the country. This, together with information on the existing electricity transmission grid and transportation infrastructure, is freely available on the website of the Centre for Renewable Energy Sources, CRES (http://www.cres.gr). Figures 3 and 4 show country level maps. Higher resolution can be obtained through the software available on the CRES website. This mapping has shown that Greece, particularly on the Aegean islands and the mountainous areas close to the coast[5], holds wind potential that has proven sufficient for investment in other European Union countries.

Apart from the superb wind potential offered by the geographical features in Greece, the make-up of the national electrical energy generation system offers a number of drivers for the development of wind power. Currently, more than half of the Greek electrical energy is generated using lignite. The largest power plants are due to be decommissioned by 2050 (Hellenic Ministry of Development, 2009). In the new energy bill, the government is proposing

[5]The strong wind patterns that come off the sea undergo an acceleration effect as they meet the mountainous areas

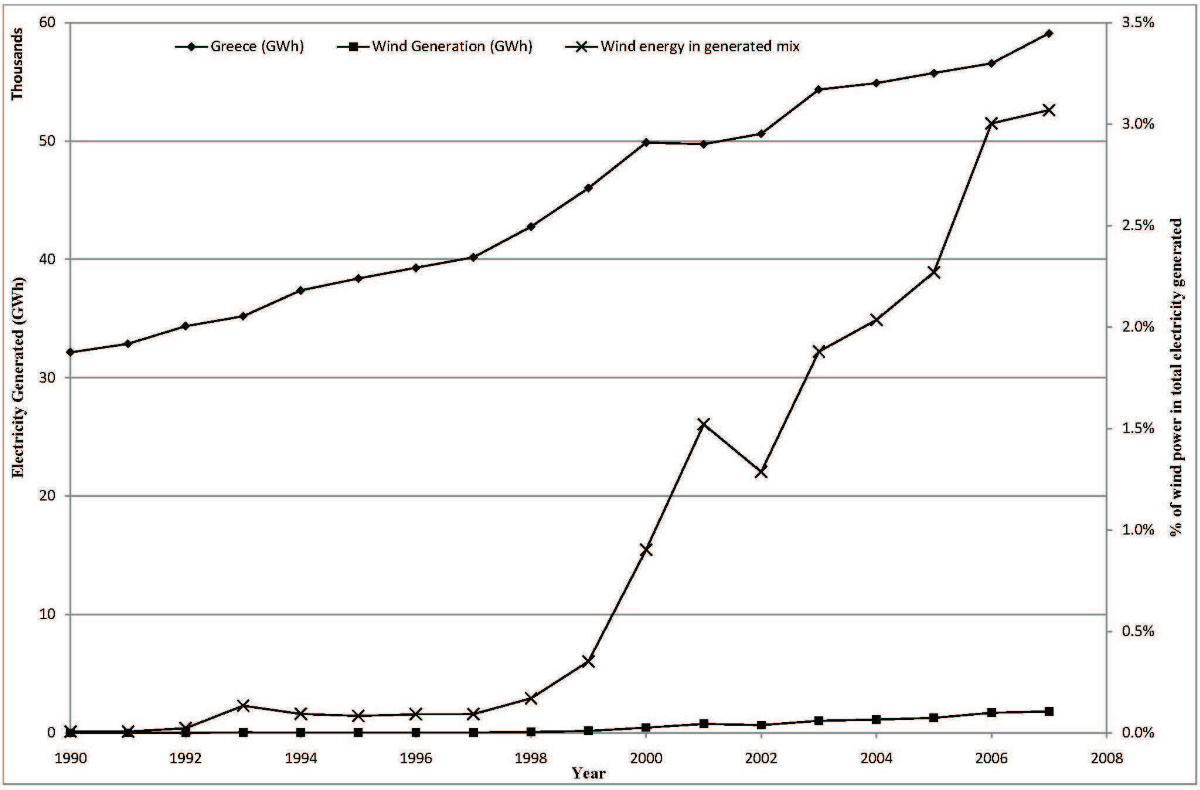

Figure 2: Electrical energy generated, total & wind (European Commission, 2010)

that much of this this future electrical energy shortfall is to be made up by increasing renewable energy generation. Whilst such a large increase in renewable energy generation may be optimistic at best, this shortfall will present an opportunity for the development of wind energy. In short, whilst the country's wind potential is good enough for investment, it is hamstrung by financial and political hurdles. These challenges will be discussed further on in the paper.

2.3 Proposed Changes

As previously stated, the current government of Giorgos Papandreou is very keen to encourage new energy policies for Greece. During the re-organization of the government's structure as part of national cost-cutting measures, the Ministry for the Environment, Energy and Climate Change was instituted, taking over responsibilities pertaining to environmental and energy policy from a number of other ministries and government organizations such as those of public works, agriculture and so on. The creation of an agency dealing specifically with issues of energy policy, particularly when it does so in connection to the environment, should bode

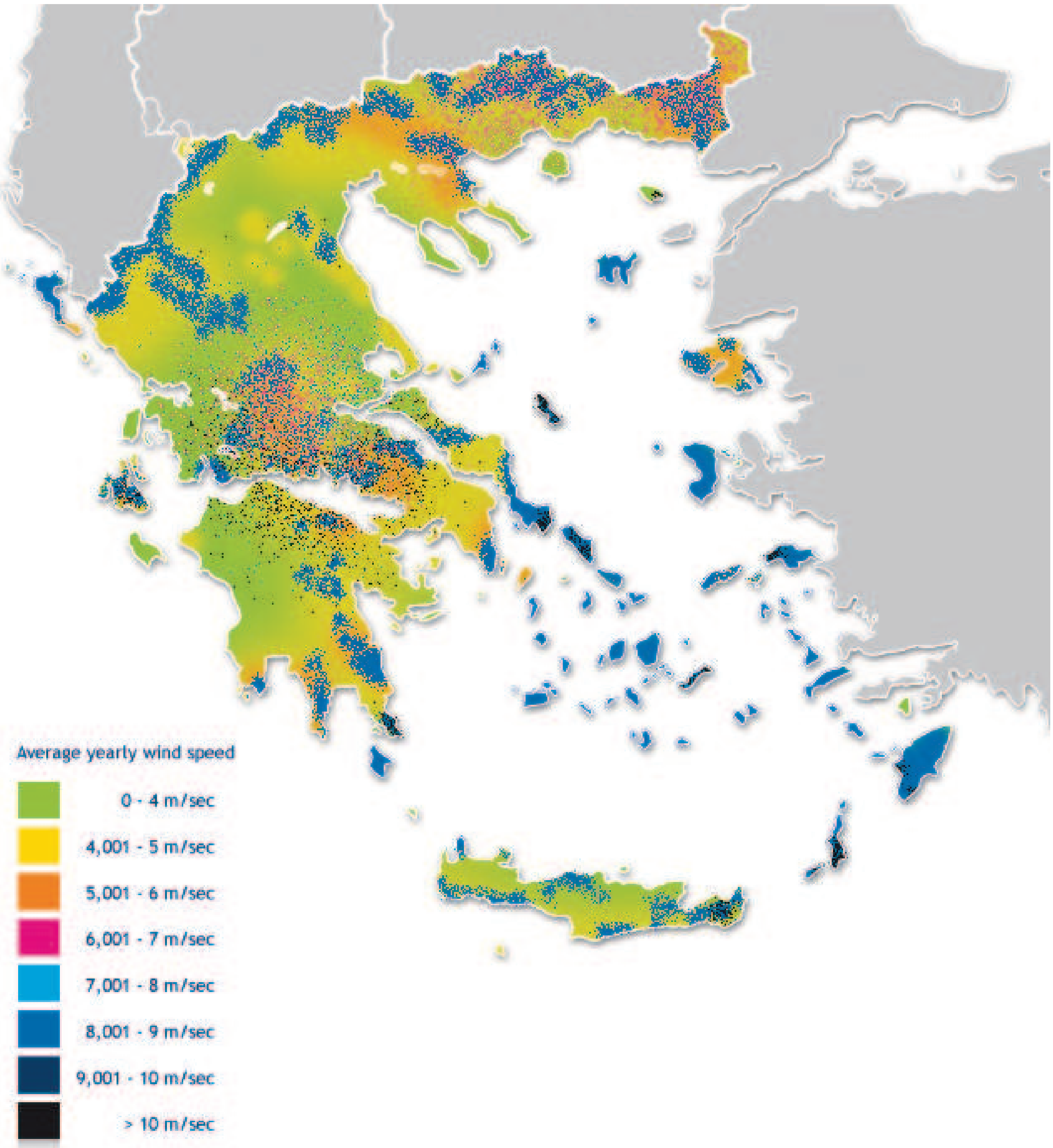

Figure 3: Wind Potential (Center for Renewable Energy Sources)

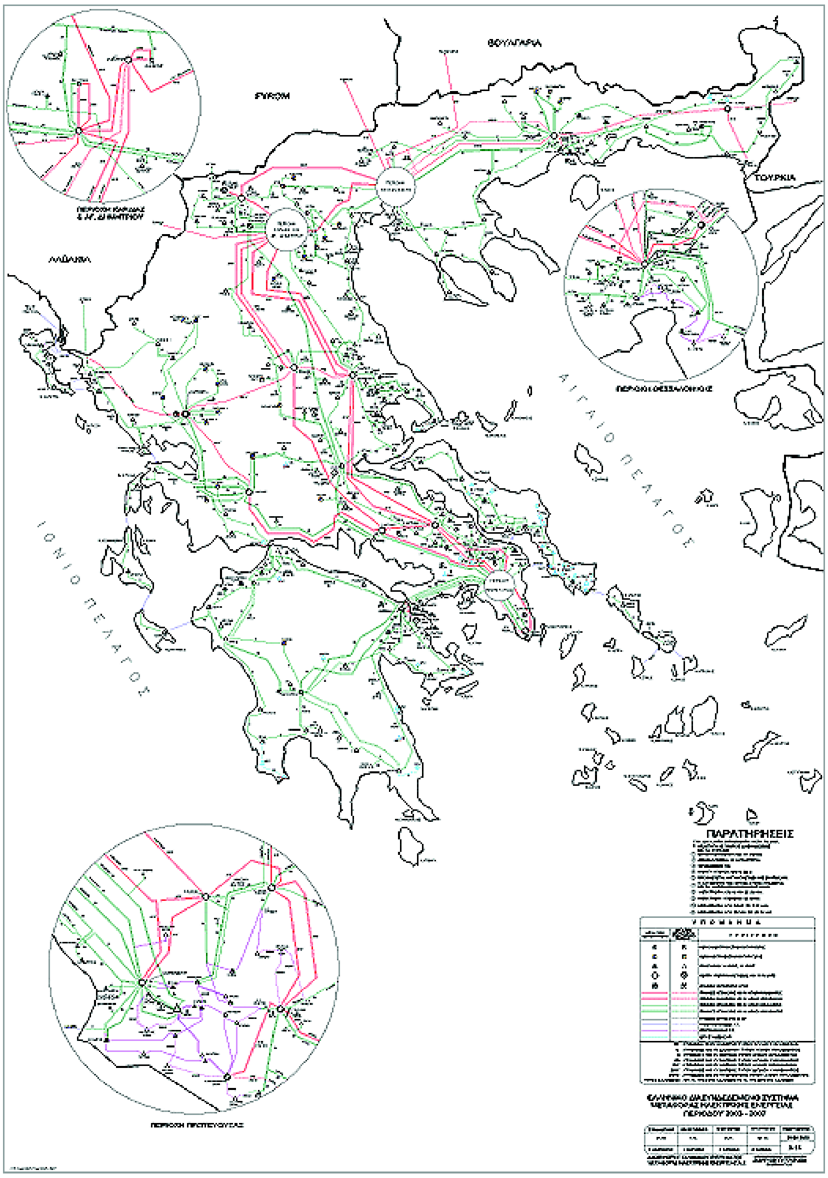

Figure 4: Greek National Electricity Transmission Grid (Global Energy Network Institute)

well for the future of renewable energy in Greece. This change must be assessed by looking at the actual data. The re-organization of ministries could amount to nothing more than politicking, especially under Greece's current economic climate.

The legislation currently passing through Parliament proposes an increase in feed-in tariffs to balance out the upcoming elimination of the up-front subsidy. The structure of the feed-in tariff will not change significantly[6]. The legislation also proposes the creation of a new government agency whose mission it is to assist investors interested in renewable energy technologies both by providing data and by dealing with issues that arise in the licensing process[7]. In line with the government rhetoric, the new legislation defines the 20-20-20 EC goals as a national goal. It also proposes that RES represent 40% of electricity consumption by 2020. Just as significantly, it places the development of renewable energy as a priority over other environmental or social concerns[8]. The proposed change that will likely have the most important long-term impact is the streamlining of the licensing process, with specific time limits within which the government agencies have to respond to interested investors[9]. This will not only make the work of investor's easier, it will also eliminate older permits issued to projects that have not progressed past the planning stage and stopping stalled permits in the future. These stalled projects are a major obstacle to further development because they unecessarily take up part of the already limited transmission grid capacity. They had also given rise to a secondary market for licenses, were the company holding the license could be bought out by another interested developer.

Under the current legislation, a wind park owner receives an up-front subsidy of 25%, is required to raise his own capital worth 20% of the overall cost and covers the remaining 55% using loans[10]. Following the proposed changes, the up-front subsidy will no longer be available, which means that the 25% of the cost previously covered by it will not have to be funded by further loans. The cost of these loans is what the increase in feed-in tariff will have to cover if the owners are to see no decrease in their profits. Of course, it is possible that current profits

[6]Hellenic Ministry of the Environment, Energy and Climate Change (accessed 2 May 2010), Article 5
[7]Hellenic Ministry of the Environment, Energy and Climate Change, Article 11
[8]Hellenic Ministry of the Environment, Energy and Climate Change, Article 1
[9]Hellenic Ministry of the Environment, Energy and Climate Change, Article 2
[10]This is data from two months spent working for a wind park developer in Greece. It is generally unavailable in any published format.

exceed the threshold that make wind parks an attractive investment. Investors may be willing to absorb part of the loss of the up-front subsidy through a fall in their profits.

3 Money Matters: Finances of a Greek Wind Park[11]

3.1 Installation and Construction Costs

A significant amount of capital is required in order to build the physical plant that is used to convert the kinetic energy of wind into electrical energy. As opposed to thermal plants, the cost of installation and construction is the largest portion of lifetime cost of a wind park. Once the plant has been built, the only running costs are the interest on the capital that was used to finance the plant's construction and the operation and maintenance. Whilst thermal plants face a high lifetime outlay for fuel, wind plants get their fuel for free.

The initial investment cost for the park includes not only the cost of purchasing a turbine but also the cost of installing the associated infrastructure, as well as the cost of connecting the park to the grid. Depending on the generation capacity of the park, the connection cost could include the construction of a substation to manage the influx of electric power to the transmission grid. The connection cost is of the order of 40,000-50,000EUR/MW of substation capacity. Wind power plants throughout the world often suffer from the fact that areas of high wind capacity are not always close to areas of high electricity demand. This is also the case in Greece. Constructing the power lines between the existing grid and the wind plant's potential site adds a significant cost. This is especially true for parks located on the Greek islands, which will have to absorb the higher costs of a connection via the sea.

3.2 Capital Investment Structure

As described in the previous section, the highest proportion of cost in establishing a wind farm is concentrated in the first few years up to the end of construction. This presents a challenge

[11] Again, much of the information without citations in this section is from two months spent working for a wind park developer in Greece and is generally unavailable in any published format.

to prospective wind park developers: the capital outlay to turn the plans into reality is required up front, whilst the revenue is spread over the lifetime of the park. Equity investors will place higher premiums in the form of higher interest rates and onerous conditionalities to make equity available to developers. The ability of the wind park owners to raise equity if it is not readily available and obtain loans is the main determinant of whether a park becomes reality.

3.3 Licensing Costs

The Greek licensing process has been streamlined with the last rounds of legislation. Even so, the process still places a high burden on prospective investors. In order to keep things simple, licenses can be divided into a few broad categories: production licences, installation licenses, connection licenses and power purchase agreements.

The production licence is the first step towards a wind park. Prospective wind park owners are required to submit a wind study of the proposed location and their business model. Using this information, the Energy Regulatory Authority decides whether there is potential for a wind park. The wind study must include sufficient wind data from the prospective site that demonstrates that a return on equity of at least 5% is possible under the proposed business model. Sufficient wind data means at least 12 months of wind data from an accredited and certified company company or organization. If the site is particularly good with average winds above 7.5m/s then 6 months of data is sufficient. Taking into account the high capital cost of equipment needed for this task and the length of time involved, this is an additional burden that an investor has to bear before the construction of the wind park is assured. Good wind data and analysis is absolutely essential for any investor to reduce the greatest risk in the investment: the wind potential.

The installation license is issued after all involved agencies give their approval. The large number of highly bureaucratic organizations involved makes this step the most onerous. The four separate Archaeological Authorities (Prehistoric, Classical, Byzantine and Modern as well as the speleological department) affirm that there are no historically significant artefacts that will be affected by the construction of the wind farm. The Forestry Service offices at the local, regional and national level give their environmental seal of approval. The transmission system operator (TSO), the PPC, the Civil and Military Aviation Service, the local municipal authority, national radio station and so on all have to give their approval, ensuring that all aspects and impact of establishing the wind farm have been considered.

The connection license and power purchase agreement are the paperwork needed to connect the wind park to the grid. They depend on the capacity of the TSO to accept power into the grid at a particular location and the projected demand for power. This data has more to do with the TSO that the wind park owner.

A prospective wind park developer needs to fund all the required studies for the licenses. Wind studies, environmental impact assessments, road designs, environmental impact assessments, substation and connection designs, turbine micro-siting. The outlay for all these lies between 20,000-40,000EUR/MW for wind farms 10-50MW. A wind farm of 40MW could well cost EUR1million or 2%-3% of total cost by the time the park is ready to be build. Although this is not a large amount, it is very high risk equity. The challenge is to raise the financial support for this outlay before the construction of the wind park is certain.

3.4 Other costs: Operation and Maintenance, Losses

The two final components of costs are the operation and maintenance and the costs of losses associated with operation. Operation and maintenance in a wind park is a significant part of the lifetime costs, on the order of 10% of gross revenue. In addition to operation and maintenance costs, there are costs associated with power losses between the point at which electrical power is ‘produced’ and the point at which it is metered to be sold to the grid. These power losses are those due to the transformers in the wind park, and those due to the transmission lines between the park and the metering point. They can be anything between 2-5% depending on proximity to the connection points and the transmission voltage level.

3.5 Compensation: Feed-In Tariffs and Subsidies

As briefly described in section 2.1, feed-in tariffs have been defined by the last set of legislation passed by the Greek parliament[12]. The agreed upon feed-in tariff is paid for the amount of electricity metered at the point of sale of the generated electric energy to the grid. The connection is usually a PPC substation; it could be as much as several kilometres from the wind park.

In addition to the feed-in tariff, there is also the up-front subsidy provided by a number of European Union and Greek government business development schemes[13]. It was introduced in order to encourage smaller private investors to participate in a Green Energy development initiative. It did not seem to produce the desired results and is being phased out starting 2010.

4 Calculations

The goal of this paper is twofold. The first is to assess how much the feed-in tariff should rise in order to balance the loss of the up-front subsidy. The second is to obtain insight into the state of Greek wind power investments as the new legislation is implemented and investors look to the future. This is particularly interesting given the present turbulent state of the Greek economy.

4.1 Income: Subsidies and Feed-In Tariffs

One of the key changes in the proposed legislation, is the elimination of the up-front subsidy, in favour of an increased feed-in tariff. It is important to assess the feed-in tariff increase that is necessary to offset the subsidy's elimination.

Under the current legislation the net present value for the lifetime income for a wind

[12] Government of the Hellenic Republic (27 June 2006)
[13] Hellenic Ministry of Development (2009)

power plant is described in the equation that follows.

$$I = \sum_{t=0}^{T} P_{park}\eta_t\tau_t + \frac{\widehat{s}}{(1+r)^N}\widehat{p}_{install}P_{park} \quad (1)$$

Under the previous and new legislation, there is an initial feed-in tariff which is then adjusted annually for inflation. The subsidy is technically an up-front amount awarded at the beginning of the park's construction. Due to the red tape in Greek public institutions, it may not be awarded for at least a year after completion; N is the year following completion in which the subsidy is awarded. In equation 1, η_t is the capacity factor of the park in each year of operation. This also incorporates the wind potential of the wind park's location. The τ_t is the feed-in tariff in each year of the park's operation. The average interest rate is r, the subsidy rate $\widehat{s}$.

4.2 Costs: Location, location

In addition to the lifetime income, a wind park is also associated with certain costs. The equation below describes the contribution of installation costs, capital costs, licensing costs, operation and maintenance costs (OM) and transmission loss costs. The prices are normalised to be per MW or per km in the case of transmission losses and distance from transportation infrastructure.

$$C = P_{park}\left(\widehat{p}_{install} + \widehat{p}_{licensing} + \sum_{t=0}^{T}\left(\widehat{p}_{capital,t} + \widehat{p}_{OM,t}\right)\right) + d\left(\widehat{p}_{geo,t} + \sum_{t=0}^{T}\widehat{p}_{loss,t}\right) \quad (2)$$

The variability in the cost of a wind park is introduced mainly by the location of the park. The distance from the nearest grid connection point determines how much has to be spend constructing transmission lines between the point and the park. The geographical features of the location determines how much has to be spent constructing roads of sufficient standards to transport the wind towers and construction materials to the site.

4.3 Profits

As discussed in the section on the proposed changes, the wind park owner covers a portion k of the park's cost through the use of his or her own capital. The owner expects a certain return on investment R over the lifetime of the park. The relation between this return and the lifetime income and cost of the park is $(1 + R)kC = I - C$. Replacing the income and cost equations into this, we obtain:

$$\sum_{t=0}^{T} \tau_t = \sum_{t=0}^{T} \frac{1}{\eta_t} \left((1 + R)k + 1 \left(\widehat{p}_u + \frac{d}{P_{park}} (\widehat{p}_{geo,t} + \sum_{t=0}^{T} \widehat{p}_{loss,t}) \right) - \frac{1}{(1+r)^N} \frac{S}{P_{park}} \right) \quad (3)$$

Where: $S = \widehat{s}\, \widehat{p}_{install} P_{park}$ and $\widehat{p}_u = \widehat{p}_{install} + \widehat{p}_{licensing} + \sum_{t=0}^{T} (\widehat{p}_{capital,t} + \widehat{p}_{OM,t})$

4.4 Impact of Decreasing Subsidy and Increasing Feed-in Tariff

Equation 3 gives us some idea of how large the feed-in tariff increase has to be to balance out the fall in the up-front subsidy. For a 40MW park[14], the elimination of the subsidy would be balanced out if the feed-in tariff goes to 108EUR/MWh, a 47% increase. The new legislation is proposing feed-in tariffs that approach this value, so it can be argued that the remainder will be made up by the investor's accepting a reduced return on their investment.

The fact that the government believes that wind power can continue to develop must mean one thing: it is confident that the Greek wind power industry has reached a level of respectability in the financial community at which it can secure the financing for a wind park without the added security of a government subsidy. Whether this is true is up for debate, particularly in the current volatile economic climate in Greece and the world. Mulder (2008) proposes that as long as the overall financial support is attractive to investors, the exact combination (subsidies, feed-in tariffs, etc) is not important. However, particular investment conditions in each country make some policies not just more politically palatable, but also more attractive to investors. The elimination of the up-front subsidy could lead to a fall in new wind power investment due to

[14] 40MW capacity; EUR42million total investment; EUR1million per 1MW wind turbine; up-front subsidy equal to 30% of total investment; built 2006; initial FIT 73EUR/MWh

the high up-front costs of dealing with Greek bureaucracy and licensing process as well as the higher Greek construction costs as compared to the rest of Europe. Danchev et al. (2010) argue that this is the case for Greek photovoltaic investments.

The effect of distance on cost is shown through equation 2. Clearly, all other things being equal, the greater the distance from the grid and the more challenging the terrain, the higher the cost of constructing the wind park. The next step is to compare maps of the national grid (Figure 4) with the locations that are suitable for the development of wind power (Figure 3) that are not yet developed in order to gain greater insight into what the future development of the wind power industry in Greece could be.

5 Issues Facing Development of Greek Wind Power

5.1 Bureaucratic Hurdles

A major challenge in assessing an economic support scheme in Greece is the effect of bureaucracy. This is a major concern in Greece, where most government services are notorious for their complexity in operation as well as cronyism and corruption. Indeed, several pieces of legislation concerning RES and wind energy have devoted themselves to the simplification of the licensing process. In 2006 over 20 licenses were required in order to plan, construct and operate a wind power plant. These licenses were not issued by a central organization but by numerous ministries and secretariats ranging from the National Archeological Office to the local municipality. The fact that in some cases it is necessary to procure one license before moving on to the next makes this process very time consuming. This is compounded by unstaffed departments - despite the large number of civil servants.

5.2 Technical Challenges

As previously mentioned, the Greek electricity grid has not kept up with the increase in electrical energy demand. This is beginning to create a significant bottleneck in the development of wind power. Whilst there is strong increasing demand for electricity and Greece is a net importer of electrical energy, in many areas it is not possible to sign connection agreements with the TSO due to limited grid capacity. This has been a problem that is slowly building in Greece (Kabouris and Perrakis, 2000). Not only do wind power developers have to contend with transporting their electrical energy from remote areas to the main grid, the grid itself is unable to provide the required additional capacity.

There is not only the high capital cost of the power lines themselves, but the cost associated with obtaining the licensing to install them. This undertaking is particularly onerous in a country with a high population density and a well-developed legal system that ensures due process for passing through public or private lands. Greece's electricity demand is growing faster than the capacity of its electricity grid, with the result that wind park developers currently face serious hurdles in obtaining connection licenses in many areas. Whilst the cost of expanding the grid may not necessarily be shouldered by the wind park investor, it is an investment that will have to be made if wind power is to continue developing in Greece.

5.3 Lack of Know-How

The Greek economy is not known for large capital projects. Most infrastructure projects - roads for instance - occur in close conjunction and with the financing of the government and the European Union. A 40MW wind park that was recently constructed in the Peloponese, a large region of southern Greece, was likely one of the largest capital investment projects in the area. There are few companies that are able to leverage the necessary technical knowledge to run large scale technical projects. Projects are often undertaken by small companies founded for the purpose. The problem with this is that without skilled personnel they are unable to persuade banks and investors to provide financing and cannot put together the necessary reports to secure the licensing from the government. Larger companies and multinationals would avoid this problem and are slowly starting to be a presence in the Greek wind industry.

5.4 Investment Climate

As a member of the European Economic Union, Greece and the Greek government consistently make efforts to attract foreign investment. Yet amongst European nations, the country still lags behind the average or even what is desirable. The wind power industry also suffers as a result of this. The Greek economy is not seen as an investment destination. The reasons for this are numerous and mainly include what has already been discussed here. The poorly functioning public sector, the Byzantine legislation, the creaking judicial system all contrive to dissuade investors from sinking their money into enterprises that could easily become a black hole, devouring time and capital. This problem is redoubled as the government teeters on the brink of bankruptcy. Whilst the economy could well do with new investments, even Greek companies that were previously active in the wind power industry are holding back to see what will happen in the upcoming months. The Greek government is going to have to think quickly yet carefully as to how to sustain the level of activity in the wind power industry. Multinational companies that are active in wind power projects such as Electricite de France Energies Nouvelles and Iberdrola mainly by buying up or creating smaller Greek subsidiaries. However, they are treading carefully. Further foreign investment and participation in any sort of project is even less likely in the current unstable economic climate.

6 Conclusions

The challenge of increasing the presence of wind power in the Greek electrical energy mix goes beyond the legislation or the financial concerns of wind power investors. The new proposed legislation no longer relies on an up-front subsidy that was key to minimizing the risk and the cost of dealing with the red tape and delays that bedevil any investment in Greece. Although the subsidy elimination is to be accompanied by higher feed-in tariffs, their dispersal over time means they are not a direct substitute for the focused, immediate influx of financial support of an up-front subsidy. The promised reforms of the Greek bureaucratic process are the key to maintaining the momentum of wind park investments.

The upside of the subsidy elimination is that feed-in tariff linked to the price of electricity are more in line with the operation of a free market. Incentives such as subsidies and feed-in tariffs distort the market price of wind energy and creates dead-weight loss (Pindyck and Rubinfeld, 2005). This distortion has to be balanced against the 'desire' of society for cleaner, more sustainable energy. Even so, the lower the cost of the incentives to society, the easier they will be to sustain. The Greek government should be looking to use the optimum combination of policies to support wind power. Using electricity price indexed subsidies could be seen as an improvement over up-front subsidies, as long as the latter is no longer necessary to encourage investment. In the time following the implementation of the new legislation, the Greek government needs to be extra-vigilant to detect possible fallout from absence of the up-front subsidy and be ready to step in should wind power development begin to stall.

A loss of momentum is all the more likely given the Greek economic crisis. The poor credit rating of the country raise the cost of financing any capital intensive project. The lack of direction means that the few international investors are holding back on new projects until they have a better idea of how the economy is likely to change in the coming years. Just as importantly the government's focus on dealing with the economy's crisis risks placing energy legislation on the back burner for the time being.

The prospects of wind power in Greece are certainly less rosy than they were a few years ago. This is not due to a change in political support but the coincidence of changing support policies and economic crisis. The upside to this is that the current government is promoting wind energy and renewable energy as an industry which will help the desired economic growth. In addition, the economic crisis is perpetuating big reforms in the operation of the Greek bureaucracy. These can only make the work of investors easier and keep the industry moving forward in the coming years. So far, Aeolus' sack of winds have not been unleashed upon Greek wind power. Both the government and investors are going to have to work hard to make sure it stays that way.

References

Aggelioforos Newspaper. "Parliament: Legislation for RES passed in principle (in Greek)." http://www.agelioforos.gr/default.asp?pid=7&ct=1&artid=42819, 18 May 2010.

Center for Renewable Energy Sources. "Wind Map of Greece." http://www.cres.gr, (accessed 15 May 2010).

Danchev, Svetoslav, George Maniatis, and Aggelos Tsakanikas. "Returns on investment in electricity producing photovoltaic systems under de-escalating feed-in tariffs: The case of Greece." *Renewable and Sustainable Energy Reviews* 14, 1: (2010) 500–505.

European Commission. "Eurostat." Online, 2010.

European Commission Directorate of Energy. "Renewable Energy Forecast Documents - Greece." Online, 2010.

Global Energy Network Institute. "National Electricity Transmission Grid Greece Map." http://www.geni.org/globalenergy/library/national_energy_grid/greece/index.shtml, 2007.

Government of the Hellenic Republic. "Law 3468/06." Greek Government Gazette, 27 June 2006.

———. "Ministerial decision on necessary documents for issuing licenses for foundation, installation and operation of electrical power plants." Greek Government Gazette, 31 Dec 1987a.

———. "Ministerial decision on necessary terms and preconditions for the installation of wind turbines." Newsletter of the Greek Government, 31 Dec 1987b.

Hellenic Ministry of Development. "Energy Outlook of Greece." Informational Society Operational Program, 2009.

Hellenic Ministry of the Environment, Energy and Climate Change. "Re-adjustement of feed-in tariffs for electrical energy produced by renewable energy plans or high efficiency co-generational plants or hybrid plants." Newsletter of the Greek Government, 14 Dec 2009.

———. “Public Consultation of the Legislative Plan ‘Acceleration of the development of Renewable Energy Sources for the treatment of Climate Change’ (in Greek).” http://www.opengov.gr/minenv, (accessed 2 May 2010).

Kabouris, John, and Kostis Perrakis. “Wind electricity in Greece: recent developments, problems and prospects.” *Renewable Energy* 21, 3-4: (2000) 417–432.

Mulder, Arjen. “Do economic instruments matter? Wind turbine investments in the EU(15).” *Energy Economics* 30, 6: (2008) 2980–2991.

Pindyck, Robert S., and Daniel L. Rubinfeld. *Microeconomics*. Prentice Hall, 2005, sixth edition.