



INSTITUTE FOR SUSTAINABLE ENERGY, UNIVERSITY OF MALTA

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**AN EMPIRICAL ASSESSMENT TO ESTABLISH THE ROLE OF RENEWABLE ENERGY
SECTOR IN THE GREEK ECONOMY UNDER THE ASPECT OF ECONOMIC RECESSION**

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ABSTRACT: The challenging economic environment that affects most European countries has driven the Greek economy through a volatile transition period. The economic crisis is considered in some cases as an opportunity for economic development in several sectors. The energy sector is one of them, and it is expected to play a key role in the recovery of the economy. The current research will inspect whether the renewable energy sector could play a vital role in boosting the Greek economy, but mainly why it has not been done as it was expected. In addition, this paper will demonstrate in detail the renewable energy sources that represented the core investment targets in the country, along with the current status of completion. Furthermore, the idea that renewable energy sources could help the improvement of country's economy will be elaborated, along with the reasons that show why this idea has failed. The data analysis is based on an empirical assessment on energy projects that have been developed around the country. The presentation of the obstacles that an investor faces prior and after the completion of the projects will justify the reasons that investments in renewable energy sources could not ameliorate the economic crisis of Greece.

1. INTRODUCTION

Economic growth in many countries is often a result from increasing their independence in energy supply and securing the energy needs of citizens. Investments in the renewable energy industry aim at recuperating the economy or this was the primary estimate that it would comprise [1]. It is in common belief that sustainability within a country's energy sector will increase energy efficiency and energy security encouraging at the same time, economic prosperity, industrial development, work positions creation and the promotion of technological innovation [2].

The affordable access to energy in the form of electricity is important not only for individual citizens, but also for the industries that are part of a country's economy. As the development of renewable energy proceeds in increasing system capacity and efficiency, the costs of energy production will drop [3].

These trends aim to increase the availability of clean electricity in the long run, and eventually providing lower energy costs, and lower pollution or energy taxes. Despite the above constitute a general rule in the economic status of any country, however it is

under consideration what is actually happening in countries that expect that renewable energy sector could constitute a 'survival kit' to their economy. Quite representative examples are many European countries that being under the 'Kyoto Umbrella', could benefit from the promotion of investments in renewable energy.

2. ENERGY STATISTICS IN EU COUNTRIES

The EU has set out regulations in order to establish a new energy strategy aiming to provide a secure, sustainable and low-carbon economy to its Member-States. Apart from the climate change abatement by diminishing greenhouse gas emissions, the use of renewable energy sources is likely to result in more secure energy supplies, greater diversity in energy supply, less air pollution, as well as the possibility for job creation in this sector.

The EU Integrated Energy and Climate Change Strategy adopted in December 2008 provided a more triggering plan in order to increase the use of renewable energy sources to 20 % of the total energy consumption by 2020 [4], [5].



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In parallel, the Strategy calls for energy consumption and greenhouse gas emissions to both be cut by 20 % on the same year target. In addition the Directive 2009/28/EC of the European Parliament and Council on the promotion of the use of energy from renewable sources set an overall goal across the EU-27 for a 20 % share of energy consumption to be derived from renewable sources by 2020, with renewables to account for a 10 % share of the fuel used in the transport sector by the same date [6].

The changes proposed in the Directive alter the legal framework for promoting renewable electricity, in order to enforce the national action plans and to demonstrate how renewable energy projects will be developed in each Member State. Under this framework the Directive aims to strengthen cooperation mechanisms, and establishes sustainability criteria for biofuels as well [6].

The following figure demonstrates the share of renewable energy in EU countries, according to Eurostat (2010).

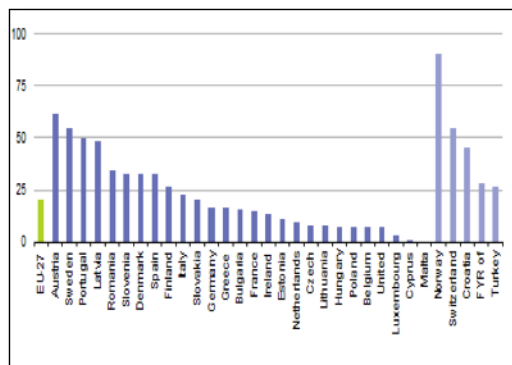


Figure 1: Electricity generated from renewable sources. (Source : Eurostat, 2010).

It is in common provision that energy policies are promoting stronger growth in RES deployment, affecting the economy as a whole. The impact of these policies is not restricted to the energy sector. All economic agents and sectors are directly or indirectly affected.

This indicates that promoting RES deployment influences households, industry and services as well as external relationships. The main effects are changes in prices and demand, which in turn have an impact on the

output and employment of the economy. The main economic mechanisms that are affected concern several branches.

Firstly, changes in direct demand for investment as well as operation and maintenance in the renewable and conventional energy sector. Adding to that, employment also depends on the productivity of the corresponding sectors.

Further than that, changes in the price of energy for households leads to a relative change in income and consumption patterns and affects the demand for consumption goods, thereby triggering a multiple effect on several economic sectors.

Investments in renewable energy sector have brought changes in prices for energy in industry and services, affecting the delivery of intermediate inputs from the energy sector to industry and service sectors, thus affecting end-user prices of goods and services.

Another important benefit of investments in renewable energy technologies, could support changes in the export and import trade pattern for fuels and technologies.

New investments normally lead to increases in productivity, reducing the need for labor for the same economic output. Furthermore, promoting new technologies should create an advantage in qualitative competitiveness.

All of these effects lead to changes in the structure of economic output and production and thus affect employment and economic activity [7].

As a general output it is quite apparent that investments in the renewable energy sector could only be beneficial for any country that has the potential for the development of such projects. However, even though in theory the beneficial results are vital for any country's economy, in the practical aspect the reality varies.

The fact that policy implications are differently interpreted in each country of the EU, makes the investments and thus the economic results vary. In addition to that it is essential to mention that each country due to its environmental and meteorological conditions has a different potential for investing in different types of renewable energy sources.



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3. GREECE AND RENEWABLE ENERGY SOURCES

Greece is located in south east of the European Union, with total land area approximately 132.000 square kilometers, consisting of the large peninsulas of the Peloponese and Attika. It includes over 2,000 islands, which cover one fifth of the total Greek land.



Figure 2: Map of Greece.

Greece has extensive coastlines on the Aegean Sea, eastern Mediterranean and Ionian Sea. According to the 2009 census the Greek population was almost 10.74 million. Over 66% of the population lives in urban areas, with 35.5% of the total population being located in Athens. Greece is geographically distant from the rest of the EU countries except for Italy and has or will develop energy links with its neighboring countries; Italy, Albania, Bulgaria and Turkey [8].

Greece is a parliamentary democracy with a president at its head and a government led by a prime minister. The country is divided into 13 regions with elected governments and these are subdivided again in 51 prefectures. Prefectures are headed by an administrator appointed by the central government and are subdivided into 147 counties. Below the prefecture level, elected local authorities govern 900 urban and 133 rural communities.

After the two oil crises during the 1970s, the reduction of the price of oil supply had led

to the double increase of the world oil price which had a dramatic effect on the economies dependant on oil imports. In 1974 the change of the oil price was 68% which eventually caused inflation in the economies, and in turn negative change in the unemployment rates [10].

The Greek economy was severely affected and thus the adoption of energy policies was considered vital in order to decrease the country's dependency on oil. The main aim of these policies was the exploitation of domestic energy sources such as the lignite and hydro power, the production of electricity from renewable energy sources and the import of natural gas. However, the last two only, started developing after 1995 [9].

3.1 Total Primary Energy Supply and Final Energy Consumption

In 2010, the total primary energy supply (TPES) in Greece was approximately 45 Mtoe [10], showing an increase around 40% from 1995, as Figure 3 demonstrates. Total primary energy supply (TPES) had an average growth of 2.3% per year during the period 1995-2008 with a big raise in 2003-2004, around 9.5% [8]. The government forecasted an average growth of TPES by 1.4% by 2010 due to the efforts to promote further penetration of natural gas and to increase energy efficiency [7].

The most significant change in the fuel mix of TPES has been achieved due to the shift from coal to gas use. Coal accounted for 8 Mtoe, 36% of TPES in 1995, and 9 Mtoe in 2006, decreasing by 23%. The natural gas introduction to the Greek energy market started with 1.4 Mtoe in 1995 increasing by 6%. In addition, TPES of oil was increased from 12.8 Mtoe, to 19.5 Mtoe from 1995 to 2008. The share of renewable energy sources was stable at 5% of total TPES, with the largest share to be covered by the large hydro power stations [9].

The indigenous production of energy in Greece is mainly covered by coal, for electricity generation. Energy imports cover needs in coal, oil and petrol products, LPG, natural gas and electricity.



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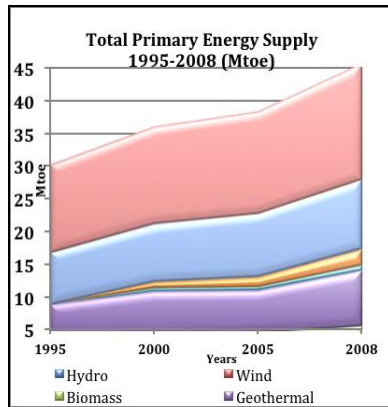


Figure 3: Total primary energy supply for Greece 1995-2008 (Source: Ministry of Development, 2008)

Renewable energy sources cover only 1.68Mtoe of the total energy supply. Half of it comes mainly from solar, wind energy and combustible wastes whereas the other half from large hydro plants [7]. It is noteworthy that Greece does not have energy exports and it relies mainly on energy imports.

Transportation has the highest energy consumption, which is mainly covered by oil, which is also demonstrated in Figure 5. Residential sector is responsible for 2.6Mtoe of oil consumption, while commercial sector follows with 0.5Mtoe, whereas electricity consumption for the commercial sector is 1.6Mtoe and for the residential sector 1.5Mtoe [8].

It would be expected that the final energy consumption would have similar values as the final energy supply, something that does appear in Figure 4 though, since there is almost a difference of 12Mtoe between the two final values. This is due to energy losses that exist in the Greek energy system [8].

The primary energy supply includes the energy consumption from the usage of each fuel but it also includes losses from transportation, friction, heat losses and other inefficiencies.

The total final energy consumption (TFC) in Greece for the year 2007 was approximately

22 Mtoe, showing an increase of 52% from 1995, with an annual increase of 2.6% [7]. The amount of oil in TFC increased from 14 Mtoe to 17 Mtoe between the years 1995 to 2008, as displayed in Figure 4 [5]. The next source that has an important share on the TFC is lignite.

As shown in Figure 4, there has been a raise of 75% during the years 1995 – 2008 in fuel consumption. This large increase appeared due to the country's economic development, which improved the citizens' way of living, and enhanced their living standards. The position of renewable energy sources in the TFC of the country remained very low, at 3 Mtoe by 2008 [6].

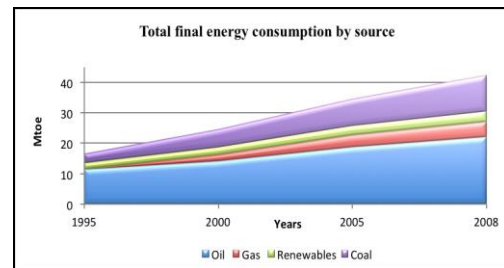


Figure 4: Total final energy consumption by source from 1995 to 2008 (Source: Ministry of Development, 2008).

The TFC by sector is distributed as demonstrated in Figure 5. The figure shows that transportation is responsible for 40% of the TFC, while industry has had almost the same share (35%) during all these years. Buildings include the commercial and residential buildings and their energy consumption almost doubled during 1995-2008 [13]. This is due to the growth in construction of the commercial buildings and the increased use of services that require electricity for operation.



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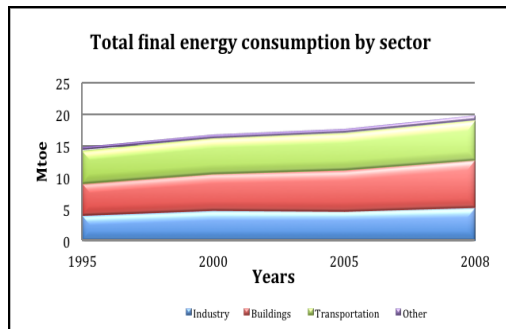


Figure 5: Total final energy consumption by sector (Source: Ministry of Development, 2008).

4.2 Energy imports

Energy imports are a very distinctive characteristic of the Greek energy system. Greece imports oil mainly from Russia, (32.2%), Saudi Arabia (31.1%) and Iran (28.6%). The country's energy dependence from oil and natural gas imports was roughly 75% in 2005. The demand in natural gas is mainly covered from imports from Russia (85%) through the pipelines of Bulgaria or from Algeria as liquefied natural gas (15%). In 2005, the total imports of natural gas reached 2.8 bn m³ and 3.1 bn m³ in 2010 [13]

4. GREEK ENERGY POLICY AND RES INVESTMENTS

The PV industry has been facing many attacks for the past two years in the Greek market and its future does not look very promising. Four main factors have affect and will continue to affect the market of the PV projects.

A moratorium, a Feed in Tariff (FiT) reduction, and the very recent retrospective tax on income have created a profound distrust from investors towards the Greek market. PV project developers were already facing big difficulties due to the lack of liquidity in Greece, and the adoption of these retrospective measures simply drove many solar companies out of business.

4.1 Authorisation suspension in PVs

The suspension of authorisation procedures for new PV projects since August 2012 was one of the main discouragements in investments in PV projects. In addition to this, in August 2012, all authorisation procedures for new PV projects were put on hold, creating distrust to the market and investment cycles. The moratorium has been prolonged once and is valid until the end of 2013. Over 7.5 GWp of PV projects were directly affected. Only residential PV systems under 10 kWp and projects on fast-track were not affected by the moratorium [13].

The Greek Ministry for Environment, Energy and Climate Change (YPEKA) argued that this moratorium was due to the large number of applications overriding the PV national target for 2020. However, this target (2.2 GWp) is only indicative and can be revised every other year. Thus, a revision and a significant increase of that PV target should be considered in order to revive the suffering Greek PV sector. The lack of such an effort from the governmental side, enforced the distrust of potential investors and disappointed also those, that were expand their investment interest in other renewable energy sources in the country. However, by the end of 2012, PV projects were considered as the most easy to develop projects, in the renewable energy market and only large investing companies where dealing with other types of renewable energy sources. At this point though it is essential to mention that even for those, the investing environment was considered very hostile due to the instability of the Government.

4.3 Feed in Tariffs Reduction

Further than that, in June 2013 the retrospective measure, reduced FiTs and it was applied to PV plants installed after February 2013. The FiT reduction amounts to over 40% for ground-mounted and rooftop PV installations and an additional progressive FiT reduction have been foreseen. As a result, this measure put an end to the robust and sustainable development of the Greek PV market, as observed in 2012 [12].

4.4 PV Taxation



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In addition to all the above, as part of the austerity measures, a taxation on existing RES plants revenues was set up in November 2012. This measure was amended in May 2013, supposedly to contribute to the deficit reduction of the Greek Electricity Market Operator. For PV installations, the tax ranges from 25% to 42%, much higher than the 10% tax applied to all other RES plants. Only two categories of PV installations are excluded from the taxation. The rooftop PV systems below 10 kW_p, and the PV systems installed after 1 January 2012 that receive a FiT which has been calculated after 9 August 2012 [12].

This additional tax on PV plants brings the overall taxation to a very high level, making many investments unsustainable and thus driving many small- and medium-size solar installations out of business. For these reasons, an ongoing complaint has been filed towards the European Commission against this retrospective tax on income generated by RES installations. Nevertheless, the Greek government is still considering a one-year extension of the tax.

A new “security of energy supply tax” on revenues generated by energy producers was adopted in November 2013. This new tax aims at financing the so-called “services for load interruption” which offers lower electricity prices to industrial consumers accepting load interruptions [13]. These industrial consumers are eligible to lower prices, regardless of whether the transmission system operator will actually need to interrupt the load or not in order to maintain the stability of the system.

In Greece, there is no mid-day peak anymore due to the significant PV contribution at that time of the day, therefore during the time that PV is feeding into the grid there is practically no way to have need for load interruptions. However, PV and other RES are still required to pay for that, which clearly seems unjustified [12].

Furthermore, the tax is not imposed on the amount of energy fed into the grid but on the gross income raised by the producers. In addition, the tax is based on a coefficient which is expected to be higher for RES, leading to a situation where PV is affected the most, while lignite and other fossil fuels will

pay relatively less [12].

As expected, the investment status on PV projects has diminished by the last 3 years, with final attempt to invest the current year 2014, where 45% has been posed to the profits of currently installed and operating projects [13].

4.5 Biofuels and Bureaucratic Procedures

It is however necessary to point out that the last semester of 2013 and beginning of 2014, a new investing ‘window’ has opened. Biofuel market is getting larger in Greece and increased interest has been given on it. So far there are no issues and problems to projects that have been developed already. However, still, the Greek bureaucratic system of the public service increases the obstacles that an investor may face. The process is very time-consuming, the prerequisites set to develop a biomass project are very demanding, and of course any involvement with the public services creates many delays. Of course when the investors are Greeks, they are familiar with the current situation. But what is happening with foreign investors, who show increased interest lately on developing RES projects in Greece? It is of common sense that foreign investors cannot follow the delay of the Greek system therefore it is almost possible that they are losing their interest on investing in Greece under these circumstances [13].

The main issues concern a very long list with license authorizations and permissions for connecting to the main electricity grid, with permissions to use the manure of the local animal farms, permission and authorization from the civil authority the area belongs, that water will be supplied to the biofuel installation, authorization that the locals are accepting and agreeing the development of such project in their area, and many others. Apart from all that it is essential to mention also that in the case the papers require to be revised, then the whole process is delayed for another 5-6 months, even though it is about only one small addition.

5. CONCLUSIONS



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As it is seen from the aforementioned section, it is of common idea that Greece is a country that has the potential to assist the development of renewable energy projects. However, the effects from the previously mentioned problems have a significant position in preventing from economic growth.

The measures will drive many small- and mid-size solar companies out of business because they will not be able to repay bank loans. Solar plants were already charged with tax of 40% on profits; the new measure brings the overall taxation unrealistically high and makes unsustainable many investments. In addition, the bureaucratic system that exists in every process that concern any type of investment in Greece, creates a very unfavorable investing environment for foreign companies that are expanding in the renewable energy sector.

As a consequence, they lose their interest in the Greek energy market, even though the climate and geographic conditions of the country could bring important profits in investing opportunities like this. At the same time, investments like this could bring new job positions and help reduce the unemployment that has increased rapidly the past 4 years in the country.

All the above issues are not obstacles that cannot be overcome; however, they are important factors that stop the development and the improvement of the Greek economy. The chance that Greece had to include an important sector in contributing to the dropping economy has been lost. Even though, the interest still remains from foreign investors, the legislative authorities still have not done any effort to improve this unfavorable environment.

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