

THE CURRENT STATE OF THE PV MARKET AND INDUSTRIAL ACTIVITIES IN GREECE

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Abstract: This paper presents in short the developments in the legal framework for PV systems and the current state of the PV market, the achievements so far and the prospects in view of the modified RES Law. Obstacles in the promotion of the PV programs are discussed and suggestions for improvement are proposed. In anticipation of a support scheme for PV systems in Greece several industrial efforts were initiated to establish PV wafer, cell and module production in Greece. The most noted efforts and the PV production capacity will be presented. **Keywords:** PV Market, Funding and Incentives, Manufacturing and Processing.

1 INTRODUCTION

In June 2006, the Hellenic Law 3468/2006, titled: "Generation of Electricity using Renewable Energy Sources and High-Efficiency Cogeneration of Electricity and Heat and Miscellaneous Provisions", (Official Gazette A' 129/27.06.2006), was passed for the promotion of electricity producing RES systems. The law announced the establishment of a Photovoltaic program for the introduction of PV systems in Greece that will be ending on the 31.12.2020 for a total installed capacity of at least 640 MWp in the interconnected electrical system and at least 200 MWp in the autonomous island systems. The PV electricity produced will be sold to the electric system operator between 40 and 50 ¢cent/kWh depending on the size and the location of the PV installation. Such a support scheme was very attractive for the introduction of larger PV systems by companies in Greece.

Table I: the number and the total equivalent power of applications submitted to RAE

PV system power category	No Applications	Applications in MWp
>20KWp and ≤ 150KWp	6,647	714.646
>150KWp and <2MWp	1,004	1,217.039
≥ 2MWp	296	1,824.900
TOTAL	7,947	3,756.585

In Table I, the number and the total equivalent power of applications submitted to the Regulatory Energy Authority (RAE) as of April 2008 are summarised, when the application procedure was postponed by RAE, for all PV power system categories above 20 kWp, due to the large number of applications. The planned power shown in the third column is according the announcement of RAE for the distribution of PV capacity in the different

PV system categories. In terms of number of applications, the most popular category was for power between 20kWp and 150kWp, with about 6650 applications as by March 2008, when the application procedure for this PV system category was postponed by the RAE (web site of RAE: www.rae.gr).

2. NEW LEGISLATIVE DEVELOPMENTS

In January of 2009, a new law was passed (Law 3734/2009) mainly dealing with Co-generation systems but with several articles devoted to the improvement and modifications according to the needs according to the experienced gained for more than two years. The PV related articles of the law 3734/2009 were prepared by the Ministry of Development in order to:

- organise the procedure for evaluation due to the large number of outstanding applications for PV systems,
- to provide a 20 year contract for electricity sale for PV systems to the grid operator and thus a secure environment for investments,
- to introduce a new table (see Table II) with PV feed-in tariffs that start decreasing for new PV installations after August 2010. This new table eliminates the old feed-in tariff table.
- It abolishes the existing scheme for the distribution of PV capacity in the different regions and the timeframe of PV capacity introduction introduced from 2006 to 2009.
- All the outstanding PV applications are planned to be evaluated within the year 2009.
- A special program for the mainland and interconnected islands, for PV systems up to 10kWp on buildings, and simplified procedures was announced.

The building installed PV systems will contribute in the achievement of the 2020 objectives of the country with regard to the generation of electricity from RES, while exploiting the advantages of distributed generation.

Table II: The new feed-in tariff table according to Law 3734/2009.

Year Month	Interconnected System		Autonomous Power Systems	
	>100kW	≤ 100kW	>100kW	≤ 100kW
2009 February	400	450	450	500
2009 August	400	450	450	500
2010 February	400	450	450	500
2010 August	392.04	441.05	441.05	490.05
2011 February	372.83	419.43	419.43	466.03
2011 August	351.01	394.88	394.88	438.76
2012 February	333.81	375.53	375.53	417.26
2012 August	314.27	353.56	353.56	392.84
2013 February	298.87	336.23	336.23	373.59
2013 August	281.38	316.55	316.55	351.72
2014 February	268.94	302.56	302.56	336.18
2014 August	260.97	293.59	293.59	326.22
From 2015 and on	1.3 X ASMP	1.4 X ASMP	1.4 X ASMP	1.5 X ASMP

ASMP: Average System Marginal Price of the previous year.

In June 2009, a Ministerial Decree (FEK B 1079, June 4th 2009, page 13717-13724) detailed the special program, applied to the mainland and interconnected islands, for PV systems up to 10kWp on buildings, with a feed-in tariff of 0.55 Euro/kWh, a 25 year contract and a simplified and straight forward administrative procedure that should not take more than a month to complete. The response of the market was enthusiastic and in order to promote good practices in designing, installing and safety issues, the Ministry of Development requested from CRES to prepare a “Guide for the installation of PV systems in buildings” (www.cres.gr/pvcatalog). The guide was put in consultation with interested parties, such as, PPC (the largest electric utility and Distribution System Operator in Greece), the Hellenic Association of PV system companies (www.helapco.gr) and NTUA.

3. OVERVIEW OF THE GREEK PV MARKET

Until three years ago, the installed PV systems in Greece were mainly privately owned autonomous systems in remote locations, where there is no electric grid. The grid connected market, besides a few demonstration projects, was relatively small until 2006. Although there was a legal framework for the RES market since 1994 the lack of a significant support scheme running over a long time, the involvement of many public services in order to receive a large number of licences and the lack of concrete regulations for the market players have hampered the larger introduction of PV systems.

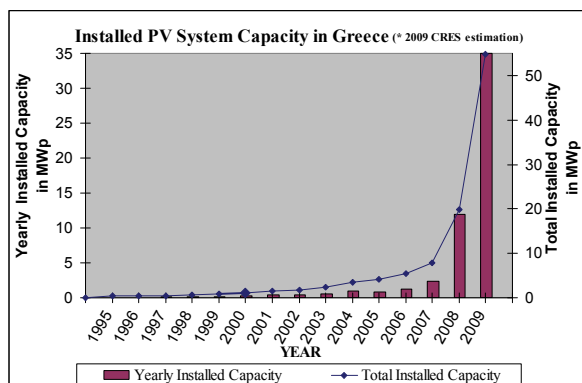


Figure 1: Yearly installed and total PV capacity in Greece.

The annual installed capacity of Photovoltaic systems in Greece before 2006, excluding demonstration programs and research projects, did not exceed 200 to 300 kWp. Figure 1, presents the installed capacity of PV systems in Greece until 2009 according to the estimates of CRES. Last year the installed PV system capacity was raised by 12 MWp, most of it coming from grid-connected PV systems due to the new law 3468/2006.



Figure 2: Two PV systems 2MWp and 1,25 MWp, of the same owner, installed one next to the other near Thiva.

Regarding PV systems above 20 kWp, in December 2008, the PV systems with a signed a feed-in contract totalled a power capacity of 34.055 MWp, while 10.983 MWp were in operation. At the end of July 2009, the capacity of the PV systems that have signed a feed-in contract increased by 23 MWp, while 19 MWp more were in operation. During the year 2008, 5.1 GWh were fed into the grid by PV systems with capacity above 20 kWp. During the first 7 months of 2009, already 19.5 GWh of PV electricity was produced. This means that at the end of the year 2009 we will exceed 0.06% of the electricity consumed in Greece. In Figures 2 and 3, large PV systems above 1 MWp, installed and operated in the past year are presented. Recently, several PV systems (above 5 MWp) have received the energy production license and some are expected to be operational in 2010. For 2009, it is expected that installed and operating PV capacity will reach somewhere between 30 and 40 MWp.



Figure 3: A 2 MWp PV system installed in the industrial zone of Volos.

3.1 Non-interconnected Insular Regions

RAE announced in the summer of 2007 a call for

application submissions for PV systems, in the non-interconnected islands. It was scheduled as follows: for Crete the call was open from 2nd of July to 31st of August 2007 and for all other islands from 1st of August to 28th of September 2007. The maximum allowed power capacity per PV system is 150kWp.

In May 2009, RAE announced the results of the evaluation of the 1638 applications for the island of Crete. Out of those applications 1216 applications were evaluated positively and are proposed to receive the exemption from energy production licence from the Ministry of Development. The installation of the PV system is not possible before an environmental permit is received and a permit for the local office of planning for the works that will follow on the property. This last permit has to do with the allowed uses of the land and a minimum surface area for the property. For this reason, an environmental study for the impact of the PV system is prepared and approvals and opinions from all relevant authorities are collected. After the positive expression of all the authorities a environmental permit for the PV system is issued by the region environmental office.

4. PV INDUSTRIAL ACTIVITIES IN GREECE

In anticipation of the support schemes for PV systems in Greece and the development of the PV market several efforts were made to establish PV wafer, cell and module production in Greece. The most noted efforts are:

- Solar Cells Hellas SA has already started ramping up its production in Greece in the beginning of 2009. The total investment amounts to about 100 Million Euro for the construction of an integrated PV production factory in the Industrial Area of Patras in Greece. The products are polycrystalline silicon wafers, solar cells and PV modules. The first phase of investment concerned a 20 MWp/year polycrystalline Silicon wafer line and a 30 MWp/year solar cell line. Shortly after, it proceeded to a second investment for an additional line of 20 MWp/year of Silicon wafers and a line for PV module assembly of 30 MWp/year.
- “Heliosphera” that used to be called “Next Solar”, has setup a production unit of thin film photovoltaic modules (Micromorph: a-Si/ μ c-Si) in the industrial zone of Tripoli. The initial annual production capacity announced it was 30MWp, but Heliosphera had the possibility of practising the option right of upgrading to 60MWp, which it did, therefore now it has the capacity to produce 500.000 PV modules per year. The total investment budget reached the amount of 185 Million Euro. The investment is supported by the Greek investment law. The first production runs have started in the middle of 2009.
- In the industrial zone of Patras, the Kopelouzou energy group has set up two separate companies. The first company named “Pirition S.A.”, with an investment of 40 Million Euro, will produce polycrystalline Silicon wafers and the second company named “Silsio S.A.” will be producing polycrystalline Silicon solar cells, with an

investment budget of 20 Million Euro. PV module assembly

- The “Exel Solar” company is realizing an investment in the industrial park of Stavrochori, in Kilkis, aiming to start assembly of crystalline Silicon PV modules by the end of 2009, aiming finally to reach a nominal annual power production capacity of 70 MWp. Exel Solar in collaboration with the group company Exel Steel is planning to offer support structures for PV modules and integrated solutions for building integrated PV (BIPV).
- Stibetherm, a solar thermal system company, has set up a production line in the industrial park of Stavrochori, in Kilkis, for poly-crystalline silicon PV module assembly with an annual production capacity of 15 MWp.
- Energy Solutions S.A., began its activity in the beginnings 2005 as a subsidiary company of the Greek group of Viohalco. “Energy Solutions”, started assembling c-Si PV modules in Feb. 2005, with 1 MWp/year capacity, in the city of Pernik, near Sofia of Bulgaria. The production capacity was increased to 10 MWp/year in 2007.
- Heliiodomi S.A., a joint venture between Themeliiodomi and EPV (USA) started in 2001 with the construction of a manufacturing plant in Kilkis, Northern Greece, for annual production of 5 MWp of a-Si modules. This effort has been for several years on hold as Themeliiodomi is in financial difficulty.
- Solar Technologies S.A., started as a PV module assembly company in 2005. The capacity announced was 1.5 MWp/year of c-Si modules, but soon after it stopped its manufacturing activity.

The Directive {COM(2008) 30 final} is setting a binding target for the renewable share in the final energy demand of Greece of 18% by the year 2020. Regarding the electricity generated from RES, this means a production of electric energy equal roughly to a share of 35% of the annual domestic national consumption of electricity. Thus today, the objective of 29% that for first time was legislated officially by the Greek Parliament with the Law 3468/2006 is insufficient.

Consequently, the following possibilities are on hand in order to achieve the 2020 objective, either to reduce further the energy consumption, and/or to support an even larger penetration of PV and wind systems to the electric grid. Already the economic elements that are presented in this study show that, provided that the required capital for the initial investment exists, then the balance of cost-benefit will be positive for the society as evidenced in Figure

5 CONCLUSION

With regards to the introduction of Photovoltaic systems in Greece, although the introduction and preferential treatment of large PV systems built up the PV power

capacity faster, as Greece is trailing in RES electricity production implementation, it is hoped that the newly introduced program for PV systems on buildings, will have a serious impact on installed PV capacity as the building sector constitutes the “natural environment” for photovoltaic systems. The photovoltaic technology is suitable for building applications, making it the main component for a decentralized RES development model. In countries with developed photovoltaic markets, such as Germany, the small PV systems in buildings (<10 kWp) constitute 40% of the annual market, while globally the building sector has a share of the order of 90%. It is noted that the program “PV systems on buildings”, put into effect in Greece this summer, does not support building integrated photovoltaic systems. In Law 3734/2009, it was announced that the PV system in buildings program will support PV systems on roofs and facades according to the existing building code. It is obvious, that the building code did not permit the integration of PV systems on buildings (BIPV), this is a disappointment as the integration gives added value to the PV system and promotes the involvement of architects in the integration of PV systems, thus introducing BIPV in the mainstream of building design. In any case, action should be taken to modify the building code in Greece in order to allow PV integration in buildings. This will also bring benefits in the employment and the economy of the country. Finally, in the last few years and months there were environmental and land use planning legislation, regulations and decisions introduced, that sometimes were unnecessarily hostile to the introduction and use of renewable energy sources, including photovoltaics. It seems that there is a lack of information on the local impact of the RES technologies and the global advantages they offer. A more profound and balanced examination should take place.