

# THE PV MARKET DEVELOPMENTS IN GREECE, FEED-IN-PREMIUM SCHEME

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Abstract: This paper presents the current state of the PV market in Greece, the achievements so far and the projections of the PV market for next years. The PV market environment in terms of new PV development policies and deployment, such as the new feed-in-premium scheme and the virtual net-metering are presented.

Keywords: Greece, PV Market, Feed-in-Premium

## 1. OVERVIEW OF THE GREEK PV MARKET

In the following paper the PV market achievements so far, the current environment in terms of PV development policies such as the feed-in-premium scheme are going to be presented. During the period 2008-2013, a total amount of around € 5 billion were invested in Greece in photovoltaics and the cumulative installed capacity is currently standing at 2600 MWp. For 2013, despite the economic crisis, the momentum due to the attractive feed-in tariff contracts that certain developers were still holding boosted the annual installed capacity to 1042.5 MWp. In the year 2013 the energy produced by photovoltaic systems in Greece reached 6.7% of the electricity consumed and for the year 2014 it was roughly 7%. The development of the annual and cumulative PV system capacity in Greece is presented in Figure 1. The installed capacity in 2014 and 2015 collapsed to 16.95 and 10.3 MWp respectively. Furthermore, the increasing penetration of PV systems should also push the authorities to study, plan and adopt technical and regulatory measures in order to allow higher penetration of RES in the future. In this direction a new law, 4203/2013 was passed by the parliament that allows net-metering for PV systems on buildings. The PV market environment in terms of new PV development policies and deployment, such as virtual net-metering and the new feed-in-premium scheme are going to be presented. The net-metering did not regenerate the PV market in Greece as the economy is still frozen due to uncertainty and the capital controls measures applied since June 2015.

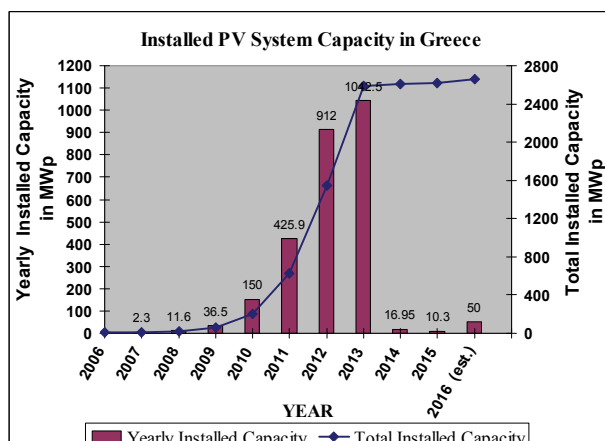


Figure 1: Historic PV market data, yearly and cumulative introduction of PV systems in Greece (CRES estimate for 2016).

Since 2010 the feed-tariffs (FiT) for new PV systems were reduced four times, the first time in 2010, then twice during 2012, and finally in May 2013. Now the current feed-in tariffs for PV systems under 100 kWp are standing at 1.2 times the System Marginal Price (SMP) of electricity of the previous year and for systems over 100 kWp, it is 1.1 times the System Marginal Price (SMP). For all PV systems in the non-interconnected system (islands) the feed-in tariff stands at 1.1 times the System Marginal Price (SMP). Given that the average SMP for 2015 was 50.4 Euro/MWh, it is calculated that for the year 2016 the FiTs in the Interconnected Electrical System for PV Systems under 100 kW stands at 60.48 Euro/MWh, while the for PV Systems over 100 kW it stands at 55.44 Euro/MWh. Regarding the feed-in-tariffs for new PV systems under 10 kWp on buildings, for the year 2016, the FiT is standing at 110 €/MWh, digressing to 80 €/MWh in the year 2019 [1].

In Table 1, the PV electricity generation and power consumption in Greece for the year 2014 is presented. Practically all the PV installed capacity is connected to the low and medium voltage grid and up to now the PV generated electricity is experienced by the System Operator as a negative load. This can be tolerated without any negative effects when the instant power penetration level is relatively low and does not create any operation and security related problems. Nevertheless, there are already locations in the distribution grid where the local penetration has increased significantly and measures are taken at the moment to limit new capacity in these grid segments by not allowing any new PV installations. In 2013 the PV electricity consumed in Greece accounted 6.7% of the annual consumption in the interconnected power system, while for 2014 and 2015 it was estimated that it covered more about 7.1% of the total annual electricity consumption in Greece.

Table 1: Statistics on PV electricity generation and power consumption in Greece for the year 2014.

Statistic	Value
Installed PV capacity nationwide, 12/2014	2.596 GWp
Installed PV capacity (interconnected system), 12/2014	2.436 GWp
Peak load (interconnected system, 2014)	9.263 GW
Total energy consumption in 2014 (interconnected system)	50.742 GWh
Total energy generated by PV in 2014 (interconnected system)	3558 GWh
Share of generated PV electricity to energy consumption (interconnected system), 2014	7,01 %
Share of installed PV capacity connected to HV level, 2014	2,2%
Share of installed PV capacity connected to MV level, 2014	45,6%
Share of installed PV capacity connected to LV level, 2014	52,2%

## 2. NEW ENERGY POLICY DEVELOPMENTS

As the Energy Union strategy [2] places consumers at the core of the EU energy policy, encouraging them to get involved in the energy transition, to benefit from new technologies to reduce their bills and participate actively in the market, while ensuring protection for vulnerable consumers. At the same time, the achievement of the Energy Union requires a fundamental transformation of Europe's energy system. Renewable energy is essential for this transformation to take place as it contributes to all of the Energy Union objectives:

- the delivery of security of supply,
- a transition to a sustainable energy system with reduced greenhouse gas emissions,
- industrial development leading to growth and jobs and lower energy costs for the EU economy.

Thanks to technology development and innovation driven by EU and national policies, over the last few years we have seen the realization of attractive renewable energy technologies, for both large and small-scale use, alongside considerable cost reductions such as the PV modules decreasing in cost by 80% between 2008 and 2012. As a result, businesses and households can increasingly produce and consume, some or all, of their own electricity, either instantaneously, by synchronizing their consumption, or in a deferred manner through decentralized storage, behind the connection point with the grid (i.e. the electricity meter). Through the process of 'self-consumption', passive consumers are therefore becoming active 'prosumers', therefore producers and consumers of renewable energy.

## 3. FEED-IN-PREMIUM SCHEME IN GREECE

A proposal for a new support scheme for RES was submitted in February 2016 for consultation by the Hellenic Ministry for Energy and Environment regarding financial support and operation of the renewable energy and combined heat and power (CHP) systems. The goal of the proposal is to establish a new support structure for renewable energy projects in Greece following the EU Guidelines on State aid for environmental protection and energy 2014–2020 (“EEAG 2014-2020”), which requires the gradual phasing-out of subsidies and a move to a market-based system from 2017 and on. The public consultation period ended on March 2016. Once the new support scheme for renewable energy projects in Greece is finalized then it must be approved by the European Commission prior to any legislation being proposed to the Greek Parliament.

In this context, for the development of renewable energy technologies an important parameter in the energy

system design is the establishment of a secure investment climate with concrete implementation schedules and support for the energy generated by these technologies and the implementation of a support scheme through market-based mechanisms achieving an optimal relationship of cost to benefit for the society.

Given the ongoing process to develop a new market model for electricity in Greece, which is expected to be completed by the end of 2017, the national strategic objective is to protect consumers from a higher than required support level regarding the renewable energy generation. The objective is the new market model to allow both new investments that will exploit the significant domestic renewable energy (RE) resources for electricity generation and the progressively greater involvement and commitment of these new RE systems at the electricity market level, as well as monitoring the average electricity production costs of renewables in order to avoid unnecessary aid in their operation.

Moreover, from January 1, 2017, the Greek State is planning to adopt a support scheme through competitive submission tenders in order to identify the optimal level of support that generated electricity from RES plants requires in order to meet the national energy objectives.

It is noted, that the new annual installed capacity of RES for the following years it expected to range between 400 and 500MW.

So far in Greece, the support scheme was organized in the context of a compensation scheme for electricity with a fixed tariff (Feed-in-Tariffs). The new proposed support scheme for RES and CHP energy will be based on the development of a mechanism supporting the operation of these units (operating aid), providing a premium, on top of the price of the defined wholesale electricity market. This price premium will be guaranteed for the period of validity of the feed-in premium contract of each electricity RE system, depending on the RES technology. The financial support is provided in the form of a supplementary price (Feed-in-Premium = FiP), taking into account the income from the participation in the electric power market.

From now on, all the new photovoltaic projects with an installed capacity more than 500kWp will be supported exclusively through competitive bidding procedures. These procedures will start in the second half of 2016 and within the year 2016 it is expected to have at least two different bidding rounds with available power significantly greater than that defined as a minimum for the pilot procedures of about 5% of new renewable power installed in the period 2015-2016. Therefore, it is expected that the power capacity to be launched for competitive bidding will be of the order of 200 MW per year.

The PV market is generally divide in 3 segments, see Table 2, in the segments above and under 500 kWp and the PV systems on buildings under 10 kWp. For the category of photovoltaic systems up to 500kW it was decided to further analyze the prices resulting from the application of competitive processes that will take place within 2016 and not to fix at this point in time the tariff. Therefore, the feed-in tariff (FiT) for this PV system category of projects (<500 kWp), will be maintained for the time being at the level of existing support. The

existing methodology for determining the feed-in tariff value is calculated each year by taking the average of last years' Marginal System Price and multiplying by a factor of 1.1. This results in a FiT of about 55.5 Euro/MWh, a compensation that is not considered viable by the PV market actors. The new procedure for competitive bidding that are going to be launched in 2016, will reenergize the national PV market and representative PV system costs will be available to decide on the new FiT support, or reference tariff (RT), as will be called from now on, for the under 500 kWp PV segment. In each case, the systems of this PV market segment will be also eligible for inclusion in the self generation and consumption scheme with electricity price compensation that is usually more attractive than the FiT or the expected RT, while it is also planned to have the option for participation in the competitive bidding process, even for this PV system segment.

Table 2: Proposed reference tariffs for various PV system segments.

PV system category	Reference Tariff Euro/MWh	Project IRR
PV sys. > 500 kWp	Competitive bidding process	-
PV sys. ≤ 500 kWp	2015 tariff (60-70 Euro/MWh) *	-
PV sys. on Buildings < 10 kWp	110	10%

\* New tariff by the end of 2016

For the 32 independent electrical power systems of the islands that are not connected to the mainland power system the daily electricity markets is not going to be established now. These island electricity markets will start operating after the development of the necessary infrastructure, which is planned to be completed in stages over the next three years. Consequently, for the non-interconnected islands all new electricity generation projects from renewable energy sources and CHP will fall into the support scheme based on feed-in tariffs (FiT) until the completion of the necessary infrastructure and the gradual entry into full operation of the daily electricity market by the end of 2019.

From now on, all new RES and CHP plants will be subject to the new mandatory support scheme in the form of additional supplementary revenues (Feed-in Premium) received from participating in the wholesale electricity market, even if their contract was put into effect before the transition to the new electricity market model. These new plants will have the obligation to undertake all the balancing services foreseen for these units when the complete market model will be put into operation.

#### 4. CONCLUSIONS

Regarding the sustainability of the PV market in Greece it is noted that as the FiT for 2016 will be 1.1 to 1.2 times the average System Marginal Price in the previous year (2015), which was about 50.4 €/MWh. Therefore, FiTs of

55.5 to 60.5 €/MWh are very low tariffs for the new investments under current cost of money and the difficult economic environment in Greece. Therefore, the FiTs should be reconsidered in order to render the investments in PV systems attractive. This is expected to happen at the second half of the year 2016 after the launch of the competitive bidding procedures when representative PV system costs and economic conditions will be known to decide on the new FiT support level. In comparison, it is mentioned that the FiTs for wind and other mature RES technologies range between 82 and 105 €/MWh in the mainland, depending on installed system capacity and whether there is a subsidy on initial investment or not. On the other hand, the new Net-Metering PV program, as proved by the study cases [3], is considered attractive and given the right economic environment it could become a significant market segment in the following years. The existing experience and know how of member states with on-line information platforms and application procedures for small scale RES projects should be investigated.

The Net-metering program is under amendment allowing legal entities of public or private law with activities of public interest, as well as entities registered in the Register of Farmers and Farm exploitations of Law 3874/2010, exclusively for farming activities, to apply the virtual net-metering scheme which permits compensation of energy produced by the photovoltaic power system with the power consumed at the auto-producer plants, of which at least one is not in the same or adjacent area with the solar system, and can be supplied from different grid connection points. Virtual Net-metering concerns photovoltaic systems installed in the same prefecture of the electricity consumption facilities to which they are assigned and linked to the same Interconnected Network.

In the non-interconnected islands, the PV systems will be installed in the same prefecture and at the same electrical system with consumption facilities to which they are assigned for virtual Net-metering.

As consumers have an interest in maximising the rate of energy self-consumption in order to increase their energy savings and reduce their exposure to electricity prices, preference for self-consumption motivated over simple net-metering schemes should be widely incentivized in the future. In the context of a smart grid environment, self-consumption has the potential to drive consumers' uptake of flexibility measures, while at the same time help facilitating the system integration of variable renewable energy.

Finally, attention and a special FiT should be given to the developing sector of Building Integrated PV systems (BIPV). The integration gives added value to the PV system and promotes the involvement of architects, 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 on buildings.

#### 5. REFERENCES

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