EVALUATION OF THE IMPLEMENTATION OF PV FEED-IN LAW IN PORTUGAL

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ABSTRACT: In April 2008 a new feed-in law for the installation of micro-generation photovoltaic systems took off in Portugal. The program includes a generous feed-in tariff, yearly adjusted depending on the success of the program. The program was accompanied by the introduction of a novel online process for the registration, licensing and inspection of small PV installations that reduces the delay between application and connection to the grid to about 6 months. The aim of this paper is to evaluate the implementation of this new program including an analysis of the payback time and a discussion of the main administrative and technical challenges to the implementation of both the feed-in law and the simplified registration process
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1 INTRODUCTION

A new feed-in law for the installation of photovoltaic systems took off in Portugal in 2008. The Renewables-on-Demand program, published as Law Decree 363/2007 [1], replaced the unsuccessful Independent Power Producer (IPP) scheme which included a feed-in tariff guaranteed for 15 years (44.7c€/kWh for PV systems below 5kW and 31.7c€/kWh for larger systems and a special tariff for BIPV: 46.9 c€/kWh for small systems and 35.4c€/kWh for systems above 5kW) for a total nationwide PV cap of 150MW. Under the Renewables-on-Demand framework, there are two distinct regimes:

- the general regime applicable to any type of micro-generation (or co-generation) source, limited to 5.75kW (25A single-phase) interconnection power; the feed-in tariff is the regulated tariff (true net metering) defined annually by the National Energy Regulator;
- the special regime exclusively for renewable sources: solar PV, wind, hydro, biomass, fuel cells (provided the hydrogen is produced from renewable energy sources), limited to 3.68kW (16 A single-phase) interconnection power.

The PV feed-in tariff for the special regime is initially set to 65c€/kWh and revised to 95% of its previous value every time an additional 10MW capacity is attained (overall micro-generation installations, not exclusively PV). Wind, hydro and biomass systems benefit from lower tariffs, respectively 70%, 30% and 30% of the PV tariff. The feed-in tariff is guaranteed for the first 5 years (plus the months left in the installation year) after which, during the 10 following years, the applicable feed-in tariff will be the one actually in force, revised according to the 95% rule mentioned above. The initial annual cap is 10MW/year, yearly increased by 20%/year.

This new framework requires all the produced energy to be sold to the electricity supplier. Under the special regime, with the exception of biomass, the installation of a solar water heating system (minimum $2m^2$) is mandatory. For condominiums, an additional energy audit is required along the implementation of all identified energy saving measures with payback time below 2 years.

With the stated goal of simplifying and accelerating the bureaucratic process of setting up small PV installations, the publication of the new feed-in law was accompanied by the introduction of a novel web-based platform [2] with the goal of reducing the time for the implementation of a fully operating system to about 6 month. This platform permits the registration, licensing and request for final inspection of small PV installations.

The aim of this paper is to evaluate the implementation of this new program. The approach is two-fold. Firstly (section 2), an analysis of the conditions of the tariff is performed to determine the expected financial payback time for small PV installation under this program. Secondly (section 3), the main administrative and technical challenges to the implementation of both the feed-in law and the simplified registration process are discussed. Conclusions are drawn in section 4.

2 FEED IN LAW

As mentioned above, the reference feed-in tariff, is initially set to 65c€/kWh and then, assuming that the annual cap is fulfilled, suffers a 5% annual reduction. The red line in Fig.1 shows the expected value of the reference tariff. For a PV installation, the initial rate is guaranteed for the first 5 years. Then, the feed-in tariff follows the reference tariff. This is shown in green in Fig.1. Considering an average annual irradiation level of 1.5MWh/kW/year and typical 2008 installation costs the payback time is of the order of 6 years. The Renewables-on-Demand law facilitates credit loans for PV installations, which may extend the payback time to about 8 years.

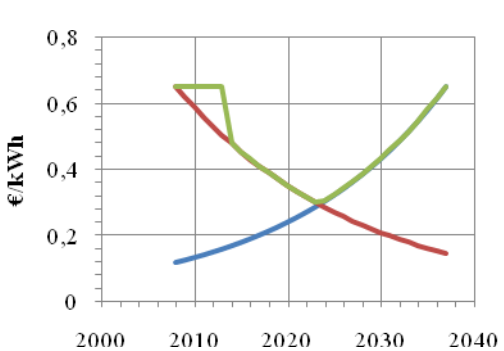

Fig. 1 – Red line shows the variation of the expected reference feed-in tariff with time. Blue line shows electricity prices. Green line shows the actual feed in tariff for projects starting in 2008.

Assuming a 4.3% yearly increase of electricity price, it is expected that the value of the feed-in tariff will have reached grid parity by 2023 (c.f. blue line in Fig. 1).

The annual cap is initially set to 10MW and, if fulfilled, increases annually by20%. This annual revision will lead to a total installed power of about 1GW after 15 years, when grid parity is achieved. Fig. 2 shows the cumulative installed power (red line). Due to the decreasing reference rate and the effect of the increasing electricity price the program investment per kWh (supported by electricity consumers) will steadily decrease for 15 years, reaching parity by 2023, with an overall cost of about 1G€, and therefore the overall average subsidy corresponds to about 1€/W.

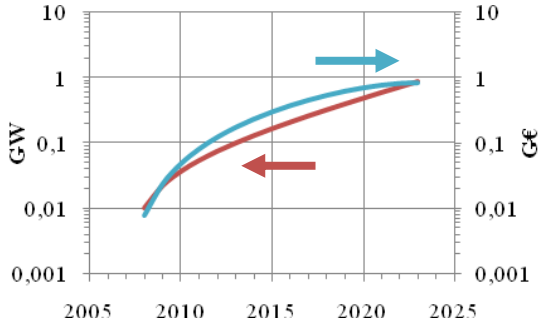

Fig. 2 – Cumulative installed power (red line) and program investment costs (blue line) during the first 15 years.

3 IMPLEMENTATION OF FEED-IN LAW

3.1 Public acceptance

The Renewables-on-Demand program was enthusiastically embraced by the general public. The system servers for the online application were successively overwhelmed by applicants and the monthly quota of 2MW was repeatedly fulfilled within a couple of hours from the opening call. There have been loud complaints from smaller companies that have not been able to secure grid connections for their costumers allegedly due to faster and more powerful internet connections on the part of well established larger companies.

According to the data publically available [2], the first 10MW were all used up after the 10th call (February 2009). The average number of applications for this first phase (with maximum tariff) was about 730 per call, corresponding to 2.5MW.

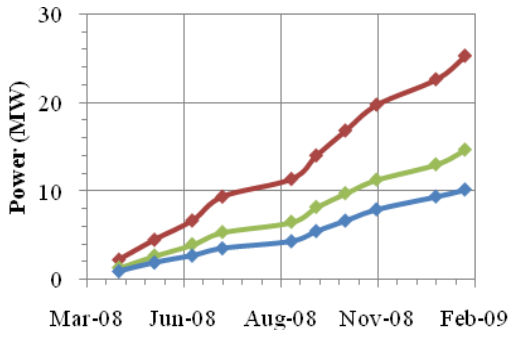

Fig. 2 – Cumulative online requests (red line), confirmed requests (green line) and inspection requests (blue line) during the first phase of the program.

Only 58% of these applications were confirmed (i.e. the registration payment of 250€ was performed within a 5 days deadline). The number of inspections (the final step before grid connection, an indicator of the number of PV systems that were actually installed) averaged about 40% of the total number of applications. These results are summarized in Fig. 3.

The interest for the following call, in April 2009, already with a reference rate of 61.75c€/kWh, did not decrease. At the time of writing this paper the average number of requests has actually increased to about 1000 per call, although there are no data on systems actually installed.

3.2 Technical challenges

One of the goals of the Renewables-on-Demand program is the development of a mature industry for PV systems installations. In fact, in spite of formidable solar resources [3] the Portuguese photovoltaic market has been particularly lethargic, with an accumulated installed power of only 68MW [4] dominated by a handful of large solar power plants, such as those in Amareleja (46MW) and Serpa (11MW), and merely a residual market of small scale PV installations. Therefore, there has never been the opportunity for the development of a sustainable PV installation industry (not to mention PV equipment manufacture industry with a couple of exceptions, supported by exportation markets) which is obviously a required premise for the large scale dissemination of PV in the country.

The Renewables-on-Demand PV systems installation procedure requires the pre-registration of system installation companies on an online database. At the time of writing this paper there are over 300 companies registered at the renovaveisnahora.pt site to choose from. The installation guidelines were defined by *Certiel* in articulation with the General Directorate of Energy and Geology [5] and, at least during the first 10MW, all installations were audited, although it is defined that, for a given installer, after five successful installations the system auditing should be performed by sampling.

According to PV systems installation companies, the most common non-conformities identified during systems' auditing involved deficiencies in the access to the electricity meter, inappropriate signaling (durable and clear alert/danger signs), lack of suitable solar water heating system (not always connected to piping!) and unavailability of instructions manual for the user[6]. One anecdotal situation refers to telecommunication stations that already had PV modules and requested grid connection under this micro-generation program. The mandatory solar water heating system seemed unsuitable for this genre of application but the installers decided to install the solar heating system connected to a heat pump in order to cool some of the hardware, thus contributing to the energy efficiency of the station.

4 CONCLUSIONS

In conclusion, the Renewables-on-Demand law introduced a generous feed-in scheme that created the conditions for the development of a small-scale PV system market in Portugal. The definition of the value of the feed-in tariff and its yearly adjustments lead to a payback time of about 6 years. Considering a conservative model for the evolution of the cost of

electricity, the end of this program is expected to be reached in 2023. By then, it is expected that the program will have enabled the installation of a total of 1GW at a cost of 1G€.

One of the goals of the program was to increase the installed power of small PV systems in the country; after one year of implementation we may conclude that it has been successful in disseminating the interest for photovoltaics.

The program was also designed to develop a trained and experienced PV installation industry in Portugal and, in spite of its short-comes and challenges, it has been successful in this goal. There is evidence of a significant improvement in the standard level of installation of the PV systems.

5 AKNOWLEDGEMENTS

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6 REFERENCES

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