

# ITALY

## PV TECHNOLOGY STATUS AND PERSPECTIVES

S. CASTELLO, ENEA

S. GUASTELLA, CESI RICERCA

### GENERAL FRAMEWORK

Although in Italy during 2007 a doubling of the total installed capacity up to the end of the previous year has been recorded, this result has not been adequate to the very high public demand and to the real availability of prosperous feed-in tariffs of the "conto energia" Programme first phase, nor to the ambitious target of the last feed-in decree. The licence trade effect that has negatively characterized the first phase of the programme, some bureaucratic issues related to installation permission as well as a tariff reduction for large free standing plants introduced by the last decree, seems to be the main causes of the present Italian context.

### NATIONAL PROGRAMME

The Italian feed-in programme has been deployed through three governmental decrees. The first two, emanated in July 2005 and in February 2006, have defined the criteria for promoting the production of electricity from photovoltaics, providing a strong expectation in the Italian PV market. The support scheme foreseen by these decrees was composed by a feed-in tariff for the whole electric energy produced by the PV plant (ranging from 0,445 EUR/kWh to 0,490 EUR/kWh depending on plant size), and by the value of the electricity which can be partially or totally sold to the local electric Utility.

In the framework of these two decrees, projects for a total power of about 388 MWp have been positively evaluated, but only a small fraction of the admitted projects (corresponding to about 50 MWp) has been effectively realised and put in operation by the end of 2007 while a total power of about 200 MWp (only 1/2 of the admitted projects) is expected to be installed within 2008. The reasons that have strongly limited the realization of the approved projects can be essentially ascribed to administrative barriers, problems or delays with the Utilities for the connection of plants to the grid and, above all, to the so called "licence trade" effect consisting of the admissions to benefit feed-in tariff.

In order to overcome such obstacles, in February 2007 a new edition of the feed-in decree was established:

- an increase of the national objective from 1 GW to 3 GW by 2016;
- an increase of the supported capacity from 500 MW to 1 200 MW to which must be added the power of plants that will be built within 14 months after the supported capacity has been reached;
- the elimination of the annual limit (85 MW) and of the plant upper size limit (1 MW);
- simplified procedure: applications for admission to feed in tariffs must be submitted only after the start of plant operation;
- no permission necessary for plant installation, at least in areas without environmental constrains;
- Utilities compelled to pay penalties for delays in regard to grid connection of PV systems.



Fig. 1 – Italian Feed-in Programme: 40 kW PV plant in Narni, Terni (photo GSE).

The new tariffs result increased in values, if compared with the previous decrees; accordingly the PV integration in buildings (up to 49 cEUR/kWh), higher for small size plants and reduced for large plants (especially free standing 36 cEUR/kWh). Tariffs remain valid for a period of 20 years at constant remuneration and decreased by 2 % each calendar year, for applications submitted after 2007.

A further novelty regards the energy efficiency in buildings: in these cases tariffs are increased up to 30 %, depending on the energy saving level achieved. Finally, a 5 % tariff increase is instead allowed to self-producers, public schools and hospitals, small Municipalities or in case of asbestos roofs substitution. In the framework of this last decree, since May 2007, about 2 000 plants have been put in operation, corresponding to a total power of 10 MW.

### RESEARCH, DEVELOPMENT AND DEMONSTRATION

Research, development and demonstration activities on photovoltaic devices and systems are mainly conducted by ENEA (the Italian Agency for New Technology, Energy and the Environment), CESI RICERCA (a research company owned by ENEA and CESI, the Institute for Research and Certification of Electric Components and Systems), some Universities, CNR (the National Council for Scientific Research) and private Laboratories.

As far as ENEA activities, the most significant ones concern the setup and optimization of fabrication processes of several kinds of innovative cells through laser assisted processes, buried contact, selective emitter technology and advanced screen-printing. Other important activities concern the optimisation of high efficiency crystalline silicon cells (EU Project), the development of thin film cells for BIPV as well as Cu<sub>2</sub>O solar cells research. As far as thin

films, microcrystalline Si devices are still a main line of activity with the aim of improving the stabilized efficiency of integrated large area modules. Last, but not least, ENEA is working on the PhoCUS (Photovoltaic Concentrators to Utility Scale) Project, aimed at investigating concentrators technologies and to assess the technical and economical feasibility of this application.

In the field of photovoltaics, CESI RICERCA is carrying out activities in the development of concentrating system (CPV) based on III-V compounds solar cells. In this frame, CESI RICERCA is supporting ENEL (the Italian main Electric Utility) in a pre-feasibility study for the realisation of a concentration photovoltaic power plant to be installed in the south of Italy. Moreover, CESI RICERCA is involved with ENEA in a Photovoltaic National Platform (Fotoenergia Project), supported by MIUR (the Italian Minister for University and Research), for the development of photovoltaic devices to be transferred to the industry. CESI RICERCA has just concluded the negotiation phase of a large integrated project with the European Commission, which concerns the development of "point focus" and "dense array" solar concentrating systems (known as the Apollon project).

Industrial manufacturing of high efficiency solar cells both for space and terrestrial applications is carried out by CESI, while CPower is manufacturing CPV system based on silicon cells and it is developing CPV systems based on solar radiation splitting, supported by Ferrara University.

Furthermore both ENEA and CESI RICERCA are involved in components' characterization and performance evaluation of PV systems.

### IMPLEMENTATION OF SYSTEMS

At the end of 2007, a total capacity of about 100 MWp was installed and operating in Italy. Taking into account that during this year about 50 MWp have been installed, the growth recorded has been about 100 %.

This increase has been driven by the support mechanism of on-grid distributed systems markets, that now account for about 75 % of the total photovoltaic installed. In particular, four significant sectors of PV power system applications can be identified in Italy:

- off-grid domestic systems (5,3 MW), mainly promoted in the eighties;
- off-grid economic industrial applications amounting to 6,7 MW;
- on-grid centralized systems (25 MW), installed at the beginning of 1990's and expected to be increased due to the feed-in tariffs;
- on-grid distributed systems, growing to over 63 MWp over the last years and dominating Italy's cumulative installed photovoltaic power.

### INDUSTRY STATUS

At present, four producers of cells and modules and some companies assembling finished PV products can be identified in Italy. The two historical producers of cells and modules are Enipower (formerly



Fig. 2 – Italian Feed-in Programme: 50 kW PV plant in Brentonico, Trento (photo GSE).

Enitecnologie), owned by ENI Italian oil company and Helios Technology (Kerself group). Their manufacturing facilities have a production capability of about 10 MWp/year each.

Both single-crystalline and multi-crystalline silicon cells are currently produced from wafers imported from the international market. Two other emerging producers of cells are now operating: namely Ominia Solar and Xgroup; both strongly determined to expand their production facilities in the next years.

Further companies assembling and encapsulating standard or tailor-made and especially designed modules can be found in Italy. During last year, the module production capacity of such companies totalled to be about 45 MWp per year.

Furthermore, a new initiative has been announced regarding the production of multi-crystalline silicon. The line will produce about 250 t/year and will be powered by means of green electricity. As far as thin films, the Ministry of Environment has promoted a project aimed at developing a pilot plant for CdTe modules fabrication with a production capacity of about 18 MW/year. On the whole, counting on a market growth of about 150 MW/year, Italian firms are planning to extend their capacities up to 200 MW/year while foreign companies are establishing on-site settlements.

### FUTURE OUTLOOK

Photovoltaic is becoming more and more important in Italy as also proved by a government call for ideas, launched last year in order to contribute to the definition of the future strategic lines for the development of the Italian productive system in the field of renewables and energy saving. The financial support of innovative industrial projects is foreseen, with the aim to increase the competitiveness of Italian industry and create new enterprises and employment. Within the more than 1 000 submitted ideas, PV technology has been one of the most considered; with 125 proposals and an increase in research activities is expected.

Moreover, with the new feed-in decree, the largest obstacles for the growing market seem to have been overcome and the tariffs introduced seem to be adequate for small plants, as well as for large plants, but only in the sunny southern region of Italy.

In this contest, Counting on a growth up to 50 MW in 2007 and of about 150 MW in the following years Italian firms are planning to extend their capacities in the next years up to 200 MW/year; while foreign companies are establishing on-site settlements.