

# ITALY

## PV TECHNOLOGY STATUS AND PERSPECTIVES

S. CASTELLO AND S. LI CAUSI, ENEA

S. GUASTELLA AND F. PALETTA, CESI RICERCA

### GENERAL FRAMEWORK

Photovoltaics is becoming more and more important in Italy. The feed-in programme "Conto energia" seems to ensure a stable situation providing the basis for the expansion of PV market in Italy followed by an adequate growth of the national PV industry. A preliminary evaluation of PV power installed in Italy during 2008 sums up to about 180 MWp, even if it is foreseen that additional power (i.e. 30-40 MWp) could be still counted. Then the total installed and operating power in Italy at the end of 2008 should result in about 300-330 MWp with an increase around 150-180 % with respect to the previous year.

In this growing contest only public budget for research and demonstration initiatives remain essentially flat with respect to the previous years and not adequate to market stimulation resources.

### NATIONAL PROGRAMME

The Italian feed-in programme started with a first phase, which has been defined through two governmental decrees issued in 2005 and in 2006 and has resulted at the end of 2008 in about 5 000 PV plant's installations (corresponding to about 120 MWp). This first phase is expected to obtain a further 20 MW PV installations by its end, stated in April 2009.

The second phase has been defined through a governmental decree issued in February 2007 and resulted in setting in operation about 18 000 plants, corresponding to about 110 MW. More specifically, it is to highlight that both phases of "Conto energia" incentive have recorded a remarkable success among the citizens (which represent the greater part of feed in tariff beneficiary) as well as among the private companies (with a share in power of about 64 %).

According to data supplied by GSE (the institutional manager of "conto energia" programme), the geographical distribution of PV installations at the end of 2008 consists of about 50 % of the total power installed in the northern part of Italy and almost 30 % in the north-east area, while only the 23 % of PV installations has been counted in the south Italy (islands included), in spite of higher solar radiation availability in these areas.

An analysis of the kind of PV installations demonstrates that a large use of areas not differently utilisable (i.e. roof tops) has been done. In fact, the installation of small and medium size PV plants resulted, typically, on the roofs of industrial structures, private houses, as well as schools, public and company buildings, hotels and farmhouses), whereas large size PV plants resulted as usually installed on the ground by fixed or sun tracking module supporting structures. As a consequence of these plant locations, a low environmental impact has been obtained.

As far as module manufacturers, larger quantities have been supplied by Japanese, German and Chinese companies, while only 15 % of the installed modules have been fabricated in Italy, also due to a limited capacity in 2008 (about 350 kW) .

Concerning component and system costs, economic data highlighted that the turnkey cost of plants range from 4 EUR/W to 6 EUR/W, while the cost of medium and large size plants (>50 kW) decreases



Fig. 1 - Sun tracking 1 MW PV plant, Roccastrada (GR) (photo GSE).

to 4-5 EUR/W. Moreover average share cost of modules is around 68 % of the total plant cost, while the share of inverters is only 10 %. The remaining 22 % is due to installation and engineering activities as well as cables and supporting structures.

### 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) and CESI RICERCA (a research company owned by ENEA and CESI, the Institute for Research and Certification of Electric Components and Systems). Additional contributions have been supplied by some Universities, CNR (the National Council for Scientific Research) and few private Laboratories.

ENEA is the main PV Research organization operating in Italy. Its most significant fields of interest regard: crystalline silicon,  $\text{Cu}_2\text{O}$  solar cells, microcrystalline Si devices, micromorph tandem solar cell as well as concentrators technologies. In this last contest, ENEA is carrying out experimental activities on standard units of 5 kW, in order to assess the technical and economical feasibility of this application.

CESI RICERCA is carrying out activities in research and development on high efficiency single and triple junction solar cells (InGaP/InGaAs/Ge) for terrestrial and concentrator applications, in the frame of the Italian electric system research programme (RdS - Ricerca di Sistema) and in the European project (APOLLON).

Furthermore, CESI RICERCA is involved in components' characterization and performance evaluation of PV systems, as well as in research and demonstration activities for electrification of remote communities, in the frame of the RdS programme.

Public budget for R&D and market incentives totalled about 25 MEUR in the year 2008. In particular, expenditure on PV research and demonstration has been about 5 MEUR, remaining essentially flat with respect to the previous years.



Fig. 2 - Building integrated 13 kW PV plant, Gavardo (BS) (photo GSE).

### IMPLEMENTATION OF SYSTEMS

As previously mentioned, a total capacity of about 300 MWp is installed and operating in Italy at the end of 2008, according to a preliminary evaluation. Taking into account that during this year about 180 MWp have been installed, the annual growth recorded has been more than 150 %.

This increase has been driven by the support mechanism of on-grid distributed systems market, that now account for about 95 % of the total photovoltaic installed. The installations in Italy in the four significant sectors of PV power system applications are as follows:

- off-grid domestic systems:  
amounting to 5 MW (mainly promoted in the eighties);
- off-grid non-domestic systems:  
amounting to 8 MW;
- on-grid centralized systems:  
amounting to about 88 MW (installed at the beginning of 1990's and increased due to the feed-in tariffs;
- on-grid distributed systems:  
amounting to about 200 MW (dominating Italy's cumulative installed photovoltaic power).

### INDUSTRY STATUS AND MARKET DEVELOPMENT

At the industrial level, about 25 producers of crystalline silicon cells and finished PV products can be identified in Italy. Beyond the two historical companies, Enipower and Helios Technology, other emerging producers of solar cells are now operating (i.e. Omnia Solar and Xgroup) and are strongly determined to expand their production facilities in the next years. Further companies assembling and encapsulating standard, or tailor-made modules, can be found in Italy (i.e. Solon, Solarday, Xgroup, Solsonica).

On the whole, the total capacity sums up to about 300 MW at the end of 2008, while for the next year the production capacity could reach more than 450 MW, according to declarations from the operators.

During last year, neither ingots nor wafers have been produced in Italy, although three new companies (Estelux, Silfab, Italsilicon, Depasol Silicon and Xgroup) have announced an annual total capacity of about 10 000 t by the end of 2010. Finally, regarding thin films technology initiatives, the Italian Ministry of Environment, Land Protection and Sea and Regione Lombardia have promoted a project aimed at developing a pilot plant for CdTe module production. The production capacity will be around 18 MW/year and the manufacturing facility will be realised within 2009.

As far as BOS components, in Italy about 10 companies manufacture inverters for on-grid and off-grid applications. Some of these have experience in inverters for large PV power plants, while others have produced 1,5 -10 kVA inverters under Electric Utilities' specifications for the connection to the grid. About 45 % of the inverters installed in 2008 have been produced in Italy while the same figure has been exported. As a consequence, about 140 MW of inverters have been produced in Italy during 2008.

### FUTURE OUTLOOK

The national initiatives and the increased participation of operators have made Italian people more and more aware of PV technology utilization. With the feed-in decree, the largest obstacles for the growing market seem to be smoothed out and the tariffs introduced seem to be adequate for small plants as well as for large plants, particularly in the sunny Southern Italian region. As a consequence, the current feed-in supporting scheme seems to ensure a stable PV situation in Italy, providing the basis for the expansion of PV market and, then, for an adequate growth of the national PV industry.

In this contest, counting on a growth of up to 180 MW in 2008 and of about 300-400 MW in the following year, Italian producers of crystalline-silicon cells and modules are planning to extend their capacities in the next year to up to 400-500 MW/year. Moreover, some initiatives have been announced to realize production lines of thin films modules, as well as production of silicon ingots.