

EUROPEAN COMMISSION

RESEARCH, DEVELOPMENT AND DEMONSTRATION ACTIVITIES ON PHOTOVOLTAICS SUPPORTED BY THE EUROPEAN COMMISSION
 PIETRO MENNA, RESPONSIBLE FOR THE SOLAR ELECTRICITY SECTOR, EUROPEAN COMMISSION, DG ENERGY AND TRANSPORT
 DAVID ANDERSON, SCIENTIFIC OFFICER, EUROPEAN COMMISSION, DG RESEARCH

GENERAL FRAMEWORK

Climate change, increasing oil and fossil fuel dependence and rising energy prices: all these factors are rendering Europe increasingly vulnerable. The key to a sustainable future must involve renewable energies. As part of its Energy Policy for Europe¹, the European Commission has put forward a proposal for a long-term Renewable Energy Roadmap². The proposal includes an overall binding 20 % renewable energy target and a binding minimum target of 10 % for transport biofuels for the EU by 2020, and a pathway to bring renewable energies in the fields of electricity, heating and cooling and transport to the economic and political mainstream. Like many of the renewable energy sources, solar photovoltaics is still relatively new to the market. This is why there is a need for a targeted legislative and commercial infrastructure to encourage rapid market growth. At the same time, there is still a need for high profile research development and demonstration and promotional activities to raise the confidence of investors. The European Commission is therefore active in both these areas, with the clear purpose of increasing the share of renewable energy sources in the energy portfolios of the EU Member States.

PHOTOVOLTAICS RTD AND DEMONSTRATION PROGRAMME

Through a series of RTD framework programmes (FP), the Commission has maintained long term support for research development and demonstration in the PV sector providing a framework within which researchers and industrialists could work together to develop new applications for PV technologies. In terms of research objectives, a combination of actions needed to address the PV sector, are primarily related to cost reduction: (1) fundamental research aimed at achieving progress either through reducing manufacturing costs or through increasing the efficiency of PV cells, and (2) integrated research and demonstration, including the development of system design options and concepts, with a view to expanding the market and providing a basis for economies of scale in PV module production.

RTD AND DEMONSTRATION WITHIN FP5 (1998–2002)

The 5th Framework Programme, coordinated by the European Commission, was organized into short to medium term and medium to long term activities for demonstration and research respectively in the photovoltaic sector. In total almost 100 PV projects were launched between 1999 and 2003. For more information, the reader is referred to the Project Synopses, collecting a two-page description of each project [3].

6th FRAMEWORK PROGRAMME (2003–2006) (FP6)

The transition from FP5 to FP6 was marked by an increased awareness of the need to reduce the fragmentation in European research and improve the exploitation of the results. This is why the research actions supported under FP6 have been focused at the development and demonstration of integrated approaches to new system design options and concepts, with a strong emphasis on cost reduction.

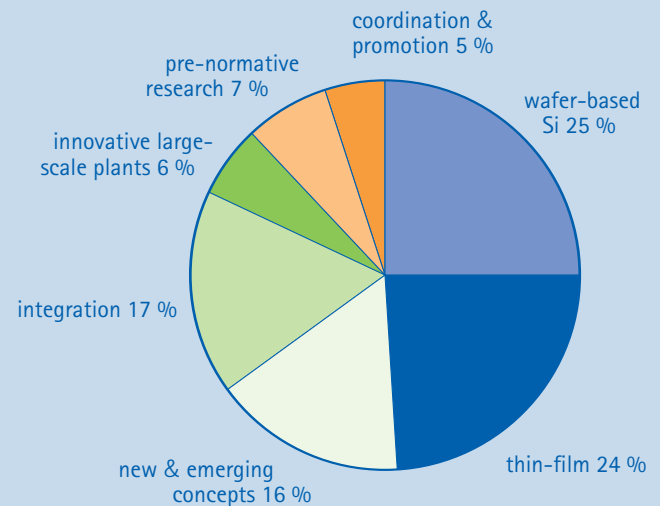


Fig. 1 - Distribution of EC contribution (104,8 MEUR) in FP6 across research areas.

The short to medium term activities emphasize mostly demonstration aimed at accelerating the market penetration of more cost-effective PV technologies. More specifically, the priority has been given to innovative production concepts for high efficiency cells/modules to be integrated into larger scale photovoltaic production facilities to lower the cost; and including low cost integrated components or devices for PV generators; large area, low cost photovoltaic modules for building integrated PV and autonomous solar electricity generation systems.

The medium to long term part of the programme has focused on cost reduction of crystalline silicon; innovative concepts and fundamental materials research for the next generation of PV technologies; thin film PV technology; PV processing and automated manufacturing technologies; PV components and systems; and research for innovative applications of PV in buildings and the built environment.

At the end of 2006, FP6 came to an end. At the time of this writing, the European Commission has provided a contribution of 104,8 MEUR for supporting PV R&D in FP6 (Figure 1: Distribution of contribution under FP6), thus continuing a 30-year tradition of co-financing the development of solar electricity in Europe (Figure 2: Contribution of the EU Research Programme to the activities in the photovoltaic field during the years 1975–2006). Some of the projects supported under the CONCERTO initiative (launched with the FP6 TREN 2nd Call) include the demonstration of innovative PV systems, for a total of 2,9 MW of power.

¹ The word "research" used in the general sense refers to research, technological development and demonstration activities

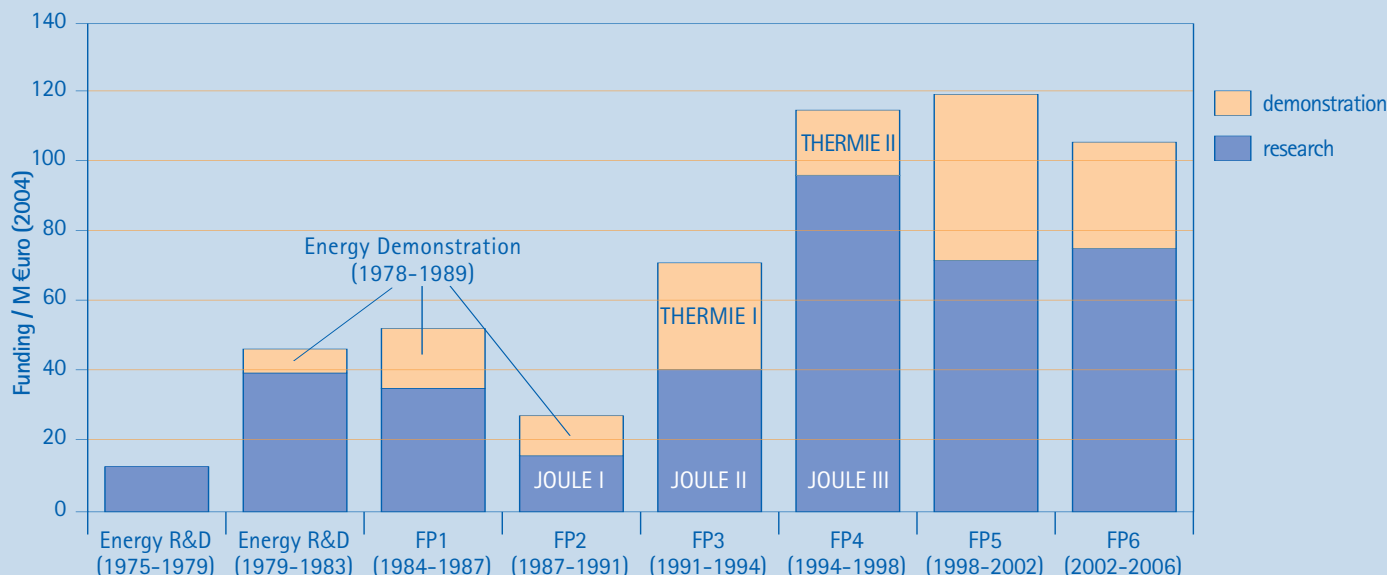


Fig. 2 - Contribution of the EU Research Programme to the activities in the photovoltaic field during the Years 1975-2006 (ME 2004).

To provide some examples of the projects launched under FP6, it is worth to start with the activities on feedstock material which represents an appreciable share of the production cost, and has traditionally been sourced from the electronics industry. The SISI and FOXY projects are exploring alternative routes for solar-grade silicon, through carbothermic reduction of quartz and refining of metallurgical-grade silicon, respectively.

In spite of the feedstock shortage, crystalline silicon has actually increased its market share in recent years, and is expected to remain the dominant technology for many years to come. The largest PV project under FP6 is *CrystalClear*. The project has the goal of defining a manufacturing process for crystalline silicon capable of realising a production cost of 1 €/W (see also website <http://www.ipcrystalclear.info/default.aspx>). The BITHINK project aims to develop and demonstrate new thin bifacial modules, manufactured by an integral screen-printing technique and using a BSF structure. The project aims to obtain low-cost crystalline technology in a multi-megawatt facility. The Lab2Line project aims at taking solar cell processes and materials successfully developed within previous research projects to manufacturing level. In particular, the project will address low-cost options for the laser-grooved solar cell and manufacturing issues related to the use of n-type multi-crystalline silicon.

For thin-film technologies, the focus has been on thin-film silicon and copper-indium-diselenide (CIS) technologies. Notably, 2006 saw the launch of the ATHLET project, with a total budget of 20,8 MEUR and an EC contribution of 11 MEUR. The project will target high-efficiency laboratory cells, module issues, analysis and modelling and environmental aspects. There are also two vertical approaches orientated along the value chain: large-area chalcopyrite modules and the industrial up scaling of silicon tandem cells. The consortium comprises well-known research institutes and solar cell producers and includes also several equipment manufacturers. The main

objectives of the project are to improve existing thin-film PV technologies towards module costs of 0,5 €/W (see also <http://www.hmi.de/projects/athlet/>). HIGHSPEEDCIGS is an innovative project which aims to demonstrate the economical production of CIGS solar cells by batch processing of many small circular substrates through a small vacuum chamber. The approach will incorporate high-speed automation techniques and experience from the optical disc industry. Furthermore, for its considerable potential for economic mass production, the European Commission is co-financing several projects in the area of flexible thin-film silicon, prepared in a roll-to-roll environment.

In addition to crystalline silicon and thin-film technologies, the European Commission is also supporting new and emerging concepts – comprising both high-efficiency and low-cost approaches. The FULLSPECTRUM project brings together several of these concepts which have the common aim of making fuller use of the solar spectrum (see <http://www.fullspectrum-eu.org/>). The multi-junction activity aims to progress as much as possible towards 40 % efficiency, and last year the partners achieved a new European record of 35,2 % at 600-suns concentration. Other activities include thermo-photovoltaics, intermediate band gap cells, diffuse-light concentrators and up/down converters. Also working on multi-junction technology, the HICONPV project aims to develop, set up and test a new cost-effective, high-concentration (1000-suns) system. The cost goal for the proposed type of system is 1€/W by 2015. Exploring the low-cost route, the MOLYCELL project aims to improve the lifetime and efficiency of organic solar cells (see also <http://www-molycell.cea.fr>).

As the photovoltaic market continues to mature, the importance of standardisation is coming to the fore. The European Commission is co-financing a large pre-normative project called PERFORMANCE, which aims to improve the understanding of measurement issues, and to harmonise procedures for testing, PV-system Monitoring and labelling. The project, which started in January 2006, receives a

contribution of 7 million Euro (see also <http://www.pv-performance.org/>).

At the systems level, the PV-MIPS project aims to significantly reduce the cost of grid-connected PV through the development and demonstration of PV modules with integrated inverters.

The cost targets for production are 0,3 €/W for the inverter and 3 €/W for the complete PV system.

(See also <http://www.pvmips.org/over.html>).

The photovoltaic activities also extend to coordination and support actions. The PV-ERA-NET project is a four year initiative which aims to improve networking and integration of national and regional RTD programmes (see <http://www.pv-era.net>). The PV-CATAPULT project consists of ten diverse work packages, centred on a common goal of accelerating the development of the photovoltaic technology towards market deployment. The PV-Employment project addresses the strategic objectives of analysing the net amount of jobs created by the European PV industry up to 2020, together with the required qualification profiles of employees to produce recommendations to the policy makers and to the educational sector. Finally, the European Commission is financing the secretarial support for the Photovoltaic Technology Platform (described below).

PHOTOVOLTAIC TECHNOLOGY PLATFORM

The Photovoltaic Technology Platform, which was designed in 2004 to implement the "PV Vision" of the Photovoltaic Technology Research Advisory Council (PV-TRAC), is now fully operational, following the constitution of the Mirror Group at the end of 2005. Main aim of the Mirror Group, composed of representatives of the EU Member States and Associated States, is to improve the coordination among the PV research programmes at National and European level.

The Platform is steered by a Committee of 20 members, representing the different European PV sectors. It is composed of four working groups (policy, market, research and developing Countries) and is supported by a secretariat, funded by the Commission. The working groups formed at the beginning of 2005, have prepared documents and action plans on policies, socio-economic and research and technological issues.

In particular a Strategic Research Agenda has been drafted to provide advice to PV research policy-making, at European level, including the seventh Framework Programme and the Competitiveness and Innovation Programme, as well as national and regional level, via the PV-ERA-NET and the Mirror Group.

For further information, see <http://www.eupvplatform.org/>.

7TH FRAMEWORK PROGRAMME 2007-2013 (FP7)

The first call for proposals under the FP7 has been launched on 22 December 2006⁴. Work includes development and demonstration of new processes, standardized and tested building components, demonstration of additional benefits of PV electricity and longer term strategies for both high-efficiency and low-cost photovoltaic routes. The eleven topics open for proposals have the ambition to cover the whole value chain of the technology, in both the short-medium term and the medium-long term research domain.

REFERENCES

- ¹ The relevant documents are available at the following internet address: http://ec.europa.eu/energy/energy_policy/index_en.htm
- ² Communication from the Commission: - A Renewable Energy Roadmap: paving the way towards a 20 % share of renewables in the EU's energy mix by 2020. COM(2006) 848 Final
- ^[3] European Photovoltaics Projects 1999-2002, European Commission (2003), http://ec.europa.eu/research/energy/pdf/european_photovoltaics_en.pdf
- ^[4] All the information is available at the following website: http://cordis.europa.eu/fp7/home_en.html