JRC's structure

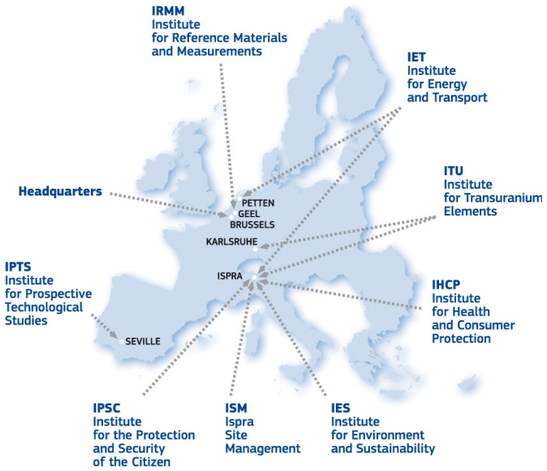
The JRC's headquarters are in Brussels, in close proximity to many of its most important stakeholders. These include the policy-making Directorates-General of the European Commission and other institutions, in particular, the European Parliament.

Most of the JRC's scientific work is carried out in JRC's institutes, located on specialist sites in five countries with the main site located in Ispra, Italy.

Facts & figures about the JRC

- Established in 1957
- 2822 scientific and technical personnel
- 7 scientific institutes
- 1433 publications in 2012

JRC - The European Commission's in-house science service



JRC Sites

Serving society
Stimulating innovation
Supporting legislation

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European Commission

Solar Energy:
Capturing the benefits of photovoltaics

Photovoltaics (PV) a fast growing green energy technology

Photovoltaics (PV), the direct conversion of sunlight into electricity, exploit our most abundant renewable energy resource and are a key clean energy technology supporting Europe's fight against climate change. Rapid technological developments over the last 20 years coupled with a dramatic decrease in costs have opened the way for large-scale deployment. The production and installation of PV systems is now one of the world's fastest growing industries.

The JRC's European Solar Test Installation (ESTI) provides a unique reference facility for testing emerging PV technologies and developing the international standards needed to ensure market transparency, reliability and safety. With its online photovoltaic geographical information system (PVGIS), the JRC also produces maps and location-specific information on both the solar energy resources and the potential electricity output of PV technologies for Europe and Africa.

In addition, every year the JRC makes an independent assessment of the PV developments in its dedicated Status Report.

ESTI: the European Solar Test Installation

The European Solar Test Installation was created in 1979 and the early 1980s saw the construction of facilities for characterisation of photovoltaic devices, including solar simulators and climatic chambers. ESTI is now one of five laboratories worldwide for calibrating record breaking devices, as well as providing a service to industry to check the power performance and degradation resistance of new prototypes and products. The work directly addresses the EU's single market objectives and is an enabler for the implementation of EU policies to increase the share of renewable energy in electricity production and to improve the energy performance of buildings.
ESTI is formally accredited under ISO 17025 for calibration of PV devices. The laboratory has experience with a large variety of PV technologies: mono- and multi-crystalline silicon, thin film (amorphous silicon, cadmium telluride, copper indium-(gallium)-di selenide) and multi-junction concentrator systems. The measurement capability covers cells of a few mm^2 up to modules of several m^2.

A JRC technician sets up the reference sensors for measuring solar radiation intensity. The final precision of the power values declared on calibration certificates provided by ESTI depends intimately on the accuracy of these instruments.

JRC: The European Commission's in-house science service

Joint Research Centre

The European Solar Test Installation (ESTI) laboratory provides support to EU policies that will help enable the EU to meet its target of increasing renewable energy use to 20% of total energy consumption by 2020.

The growth in PV is linked with rapid technological development, not just scaling up. In fact, photovoltaics have enormous scope for improving energy conversion efficiency, as witnessed by the gap between the efficiency of current commercial products (10-20%) and the theoretical potential for efficiencies of over 60%. Independent reference laboratories such as ESTI are needed at European level to develop and improve traceable, accurate measurement techniques for new technologies, based on a full understanding of the technical issues.

At the forefront of developing standards

Since its launch in the 1970s, ESTI played a key role in developing the international standards for electrical performance that now underpin an industry with a turnover of the order of tens of billions of euros per year.

ESTI's measurements feed directly into the ongoing improvement of the standards development process, which is critical to ensuring that the benefits of innovation can be quickly translated into commercial products in an open and transparent market.

ESTI has already played a major role in developing the existing body of international standards on the PV field. ESTI has full participation rights (but not the right to vote) in the International Electrotechnical Commission and contributes extensively to its Technical Committee on photovoltaics. It participates in the following working groups: WG2 Solar Cells and Modules, WG3 PV Systems and WG7 PV Concentrators. For the European Committee for Electrotechnical Standardisation (CENELEC), ESTI staff act as the Commission's non-voting technical representative to the committees dealing with norms for photovoltaics and it is convenor of Working Group 1 – Wafers, Cells and Modules.

By the early development and harmonisation of standards, the JRC aims to accelerate market introduction and innovation, and to address the EU single market objectives and renewable energy goals in the context of Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Furthermore, PV products dovetail with the development of smart grids and the future development of low/zero net-energy buildings.

ESTI reloaded

PV is a strategic element in reaching the EU's longer term objectives for a low-carbon society (cutting carbon emissions and energy consumption by 20%, and increasing the use of renewable energy to 20% by 2020). As ESTI is one of the JRC's key laboratories in realising these goals, it had become essential to raise the level of its facilities correspondingly.

Key improvements were introduced and include:

- A continuous solar simulator, capable of lighting a 2m x 2m area in a specially designed dark room (approx. 100 m^2 floor area x 8 m high). This is a new ESTI facility and it is unique of its type in Europe.
- A set of modern flash solar simulators with state-of-the-art light spectral quality and stability, replacing existing 20-year old equipment.
- Climatic chambers capable of performing accelerated ageing or stress tests outside the limits foreseen in existing standards.

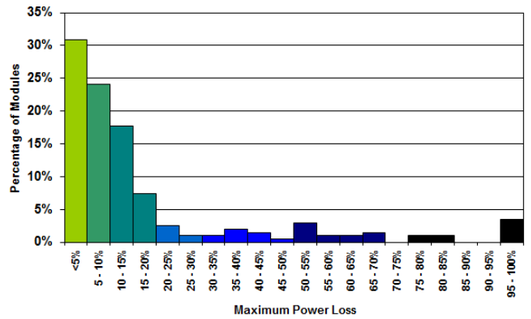
Through this modernisation project ESTI will maintain and extend its role as a European reference laboratory. The upgrading puts it in a strong position to address future standardisation issues accompanying the rapid expansion of the PV market. These include, for example, power calibration for thin film, concentrated and organic PV and other emerging products; extension of life-time guarantees up to 40 years; standard procedures for energy output rating, etc.

ESTI's new large-area steady state simulator opens a range of possibilities for studying the electrical performance of new module technologies with long response times.

ESTI's large-scale outdoor photovoltaic test field

A large-scale outdoor test field was set up in 1987. Outdoor testing at ESTI consists of investigating the long-term exposure of PV modules with periodic performance checks, and verifying the energy rating under different intensity, spectral and temperature conditions.

ESTI is a pioneer in the studies involving accelerated ageing tests as well as long-term outdoor exposure under realistic operational conditions. Indeed, these tests provide valuable information on the degradation processes that determines the economic lifetime of PV devices. The results of these studies are part of the body of data that underpins the extension of commercial module lifetime guarantees from 20 to 25 years. Further work on better understanding and quantifying the degradation processes aims to extend this lifespan to 30 years or more.



Results of over 20 years of outdoor exposure; power loss was lower than 10% for more than half of the 204 modules tested.

ESTI also determines the electric energy yield of PV technologies as this is useful information for investors since the return on investment is directly linked to the kWh produced. ESTI's energy rating model uses a 'performance surface' to represent the conversion efficiency of different PV technologies, with the module temperature and incident irradiance as independent variables. The model is implemented in ESTI's online Photovoltaic Geographical Information System (PVGIS).

Analysis results from measurements of photovoltaic receiver under concentrated light (500 suns).

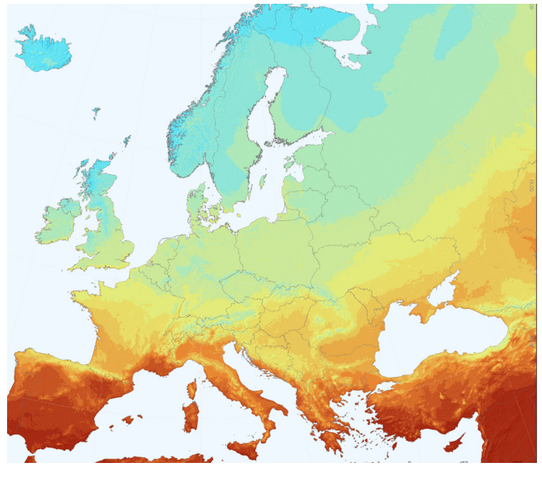
PVGIS: ESTI's Photovoltaic Geographical Information System (PVGIS)

ESTI researchers use satellite images to produce solar radiation maps of Europe and Africa. Their accuracy is backed up by checks with ground-station data. In this respect, ESTI is actively working to improve the reliability of measurement techniques by providing technical support and reference instruments that allows the comparison of results from different European laboratories.

Making reliable, independent information publicly available is a very effective tool to support the EU goals for renewable energy. The JRC's Photovoltaic Geographical Information System (PVGIS) produces solar radiation maps of Europe and Africa that show how much sunshine is available at a given location and how much electricity could be produced by a photovoltaic system. It is freely accessible online and helps investors, industry and individuals to make investment decisions and supports policy-makers with data to design policies for PV deployment. This tool has become one of the most popular of its type in Europe, with more than 500,000 hits annually. It has also been used in techno-economic contexts, for instance to study the competitiveness of small off-grid PV systems in Africa compared to diesel generators.

Find the tool online at:
http://re.jrc.ec.europa.eu/esti

Information for any location can be queried by browsing thematic maps or searching with place names or the geographical coordinates.



Photovoltaic-Geographical Information System (PVGIS): yearly average global irradiation on optimally inclined modules in the Mediterranean and Africa [kWh/m²].