Instituto de Energía Solar - Universidad Politécnica de Madrid (coordinator)
www.ies.upm.es

Projektgesellschaft Solare Energiesysteme mbH
www.pse.de

Fraunhofer Institut Solare Energiesysteme
www.ise.fhg.de/III-V

Ioffe Physico-Technical Institute
www.ioffe.rssi.ru

CEA-Départment pour les Technologies des Energies Nouvelles
www-leti.cea.fr

RWE - Space Solar Power
www.rwe.com

Philipps University of Marburg
www.ub.uni-marburg.de

Paul Scherrer Institute
www.psi.ch

University of Glasgow
www.elec.gla.ac.uk

Instituto de Catálisis y Petroleoquímica. Consejo Superior de Investigaciones Científicas
www.icp.csic.es

Energy Research Centre of the Netherlands
www.ecn.nl

University of Utrecht
www.uu.nl

Imperial College of Science, Medicine and Technology
www.ess.ph.ic.ac.uk

Fraunhofer-Institut fuer Angewandte Polymerforschung
www.iap.fhg.de

Solaronix
www.solaronix.com

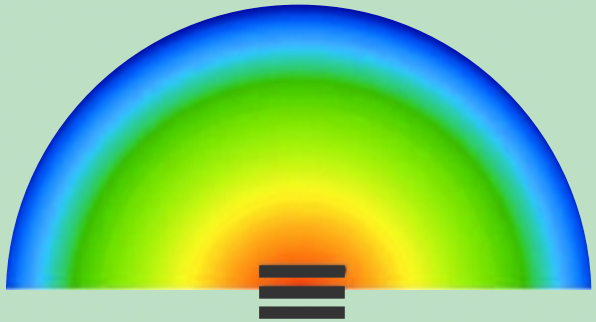
ISOFOTON S.A
www.isofoton.es

INSPIRA S.L
www.inspira.es

Joint Research Centre - Institute for Environment and Sustainability
ies.jrc.cec.eu.int

University of Cyprus
www.ucy.ac.cy

A new PV wave making more efficient use of the solar spectrum!

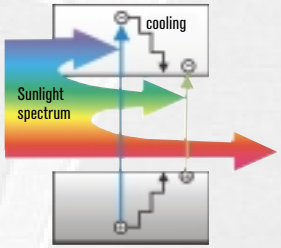


FULLSPECTRUM

www.fullspectrum-eu.org

Integrated Project sponsored by the

European Commission

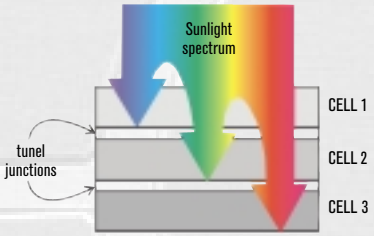


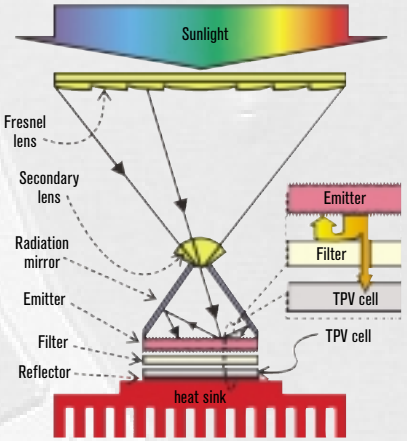
The conventional single-gap solar cell makes poor use of the solar spectrum. On the one hand, sub-bandgap photons cannot be absorbed. On the other hand, high-energy photons generate electron-hole pairs whose energy excess over the gap is lost through phonon emission.

The FULLSPECTRUM project, supported by the European Commission, aims to make better use of the solar spectrum. There are five lines of research.

Multijunction solar cells (MJC)

A multijunction solar cell is a stack of single-gap solar cells. Cell "1", placed on top, has the broadest of the gaps. The rest of the cells are ordered with decreasing gaps. Each of them absorbs those photons within the range of its own gap and the one of the cell in front of it.



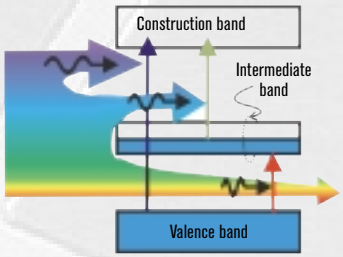


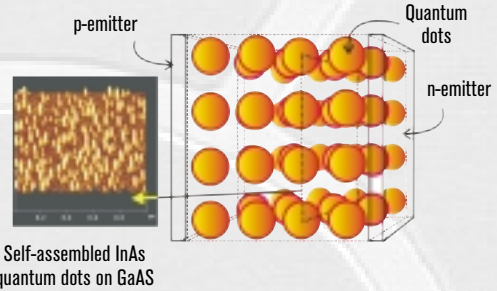
Thermophotovoltaic (TPV) converters

A thermophotovoltaic converter operates in the following way. The unit made up of the lenses and the radiator mirror concentrates the Sun's energy on a material called "emitter". This absorbs the concentrated light and re-emits its energy at a spectrum close to that of a blackbody. The part of the radiation emitted towards the TPV cell is filtered so that only those photons whose energy is close to and above its gap reach the cell. The remaining photons are reflected back to the emitter, where they are absorbed heating it..

Intermediate band (IB) materials and cells

An intermediate band cell (IBC) aims to exploit the two-step absorption of sub-bandgap photons via a half filled intermediate band (IB) located within the semiconductor gap: the absorption of photon "1" excites an electron from the valence band (VB) to the intermediate band, while the absorption of sub-bandgap photon "2" pumps an electron from the IB to the conduction band (CB).



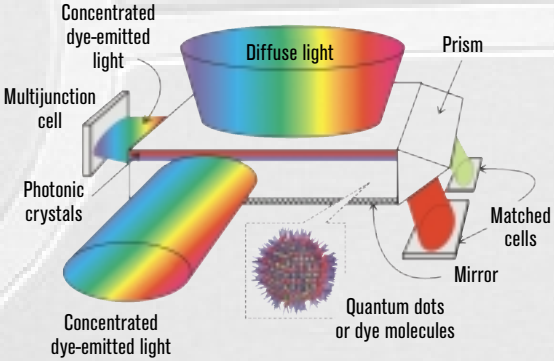


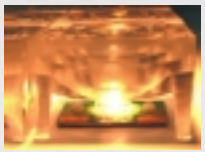
A feasible implementation for the IBC consists of using quantum dots (QDs). Since a QD is able to produce an electron level within the host semiconductor, a QD superlattice is expected to produce an IB.

Molecular-based concepts

Luminescent dye molecules absorb light and re-emits it at the corresponding wavelengths. By an appropriate combination of photonic crystals and a rear mirror, this light is concentrated and emitted onto multijuncion cells.

In addition, dye-molecules using two-photon mechanisms will be sought for pumping electrons to a high-energy electronic band.





Manufacturing techniques and development of pre-normative work (MFG)

The development of appropriate manufacturing technologies for the aforementioned concepts will be carried out.

Novel non-imaging optics allows both light concentrators and cells to be integrated within a flat module. Non-imaging optics is aimed at transferring radiant energy rather than image formation. Appropriate cells for these system are MJCs and IBCs.

A prenormative activity is expected to lead to the definition of a standard rating for MJC systems.