The EU PV Cluster

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1. *The EU PV Cluster*

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The EU PV cluster has been launched in Oct. 2010

The four main goals of the EU PV Cluster:

• To give a complete overview of the entire portfolio of projects on photovoltaics (PV) in the different European Framework Programmes.

• To bring forward the global picture of PV research and innovation in Europe and highlight the impact of Key Enabling Technologies in this area.

• To enable the PV communities in Europe to identify joint collaboration and application areas, and gain new contacts and new ideas for strategic industrial partnerships.

• To make key recommendations on future research needs in the PV domain to contribute to the set-up of a materials/nanotechnology/process roadmap to foster the development of PV in Europe.
The today global PV project portfolio is composed of 45 projects organised in 7 thematic areas or sub-clusters:

Materials and processes:

Crystalline silicon (7 projects)
First generation semiconductor PV cells: crystalline, wafer-based solar cells mainly made from silicon materials, i.e. semiconductor wafer-based Si PV technologies.

Thin film technologies (8 projects)
Second generation PV cells: thin film solar cells, including amorphous or microcrystalline silicon, CIGS, kesterites...

Third generation: OPV & DSSC (13 projects)
PV cells based in nanometric dyes, organic/polymer materials and hybrid organic-inorganic concepts including perovskites

Third generation: Novel concepts (6 projects)
PV cells obtained through the application of advanced concepts and materials, including nanowires, quantum dots, nano-platelets and bio inspired molecular concepts
The today global PV project portfolio is composed of 45 projects organised in 7 thematic areas or sub-clusters:

**Systems:**

**Concentrator Photovoltaics** (3 projects)
PV generation based on optical concentration and tracking.

**Innovative installations** (6 projects)
Photovoltaics for distribution systems, BIPV systems and demonstrators

**Industry support** (3 projects)
Addressing infrastructure, market, quality, legal and training aspects of PV.
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Projects portfolio

What do we have?

CPV

Crystalline silicon

Innovative installations

Novel concepts

OPV & DSSC

Thin film technologies

Industry support


CPVMatch
COGEM CPVTM
CABRISS
EPISIL-IBC
QUOKKA MATURATION
BFIRST
E2VENT
ETFE-MFM
NANO HARVEST
NANOSOLAR
PHOEBUS
SUNFLOWER
ARTESUN
SOLPROCEL
MATHERO
BORCOM
PLIANT
GREENANOFILMS
KESTCELLS
cSiOnGlass
ARCIGS-M
STEEL PV
EUROSUNMED
Projects portfolio

45 projects from 9 different programmes

Budget: 192,3 M€
What do we have?

Efficiency targets and demo activities proposed by the nano PV projects

Some examples:

• NANOPV
  – Crystalline silicon efficiency >20%
  – Thin film silicon efficiency > 15%
  – Potential energy cost <€1/W
  – Demonstrated (by April 2014) at proof of concept level

• NASCENT
  – Silicon tandem solar cells with efficiency of >30% are claimed to be achievable
  – Demonstrated (by September 2013) at proof of concept level

• NANOSPEC
  – Improvement of efficiency of silicon solar cells by 10 – 20% by enhanced light harvesting
  – Demonstrated (by July 2013) at a laboratory scale proof of concept level

• SNAPSUN
  – Demonstration of enhanced cell efficiency using band-gap engineering
  – Potential energy cost < €0.5/W
  – Demonstrated (by June 2013) at a laboratory scale proof of concept level
Photovoltaics and nanotechnology: from innovation to industry

Report from the first European Photovoltaic Clusters Workshop

Edited by

Sophia Fantechi

What do we have?
The EU PV Cluster is a cluster set up in 2010 by the European Commission to regroup all European projects on photovoltaics, and to highlight the key enabling role of nanotechnology for photovoltaics.

**Project portfolio** (last update April 2017):

<table>
<thead>
<tr>
<th>Project acronym</th>
<th>Topic</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPV MATCH</td>
<td>CPV</td>
<td>Ongoing</td>
</tr>
<tr>
<td>COGEMCPVTM</td>
<td>CPV</td>
<td>Ongoing</td>
</tr>
<tr>
<td>DNICAST</td>
<td>CPV</td>
<td>Ongoing</td>
</tr>
<tr>
<td>CABRISS</td>
<td>Crystalline silicon</td>
<td>Ongoing</td>
</tr>
<tr>
<td>HISTORIC</td>
<td>Crystalline silicon</td>
<td>Ongoing</td>
</tr>
<tr>
<td>NEUTRONOPV</td>
<td>Crystalline silicon</td>
<td>Ongoing</td>
</tr>
<tr>
<td>EPISIL-IBC</td>
<td>Crystalline silicon</td>
<td>Ongoing</td>
</tr>
<tr>
<td>GLODIA MATURATION</td>
<td>Crystalline silicon</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
Link to Cordis project web page

What do we have?

www.eupvcluster.eu (www.namec-cluster.org)
Activities of the EU PV cluster

Workshops and schools

Progress in Photovoltaics and Nanotechnology: from FP7 to Horizon 2020
The EU PV Clusters 2nd Workshop and General Assembly

The Workshop intends to build on the success of the first Workshop held at Aix-en-Provence, France, in October 2013 to:

1. Highlight key results of the projects in the EU 7th Framework Programme for Research and Technological Development (FP7) and their technology readiness level in a value-chain approach.
2. Identify common research and innovation priorities for bridging the gap between nanochip-based knowledge production to space projects and the successful commercialisation of products enabled by these developments.
3. Show an updated overview of the activities in the photovoltaics sector at the final stage of FP7 in order to bring forward the global picture of PV research and innovation in Europe and highlight the impact of nanotechnology on the market.
4. Enable the nanotechnology and PV community in Europe to consolidate joint collaboration areas for strategic industrial partnerships to give key recommendations on future research and innovation needs in the PV domain.
5. Review the existing nanotechnology and PV industrial roadmap for the development of PV in Europe, to implement them in Horizon 2020, the EU new Framework Programme for Research and Innovation 2014-2020.

How to design regional policies in the energy sector?
Changing technical & market scenarios, monitoring, long-term efficiency

Debt: 2.6.2015
Venue: www.solarpointclublakawon.com
Pot za Brdami 4 • Ljubljana, 1000 • Slovenia

In the SOLARIX "Regions of Knowledge" project, eight European regions collaborate in order to keep innovative capacities in the photovoltaics (PV) sector. PV clusters from Navarre (Spain), Rhône-Alps (France), Central Germany, Slovenia, Austria, Lithuania, Belgium and Netherlands (in their trans-border collaboration as ELAT region), and the Norwegian research institute SINTEF address the most
What do we have?

2nd EU PV Cluster Workshop special issue: “Advanced Materials and Nanotechnology of Photovoltaics”


Guest Editors: Veronica Bermudez, Sophia Fantechi, Bertrand Fillon, Alejandro Pérez-Rodríguez, Alexander G. Ulyashin
Info on Workshops (including summary report for past workshops) available at web site:

EMIRI Tech Talk & European workshop on nanotechnologies and advanced materials for photovoltaics and concentrated solar power
June 1, 2017

The EMIRI Tech Talk & European workshop on nanotechnologies and advanced materials for photovoltaics and concentrated solar power, organized by EMIRI and the EU PV Cluster, with the support of the European Commission, will be held in Brussels on October 24-25, 2017. Do...

EU PV Cluster 3rd Workshop
May 26, 2016

The EU PV Cluster 3rd Workshop was held on May 25-26, 2016. Download: agenda, summary report and presentations.

EU PV Cluster & SCALENANO Workshop
September 18, 2014

The EU PV Cluster & SCALENANO Workshop was held on September 17-18, 2014. Download: summary report.
Members

What do we have?

• The EU PV Cluster: http://www.eupvcluster.eu/

• The European Technology and Innovation Platform http://www.etip-pv.eu/

• Solar Power Europe, the new EPIA (European Photovoltaic Industry Association) http://www.solarpowereurope.org/

• The Knowledge and Innovation Community (KIC) of the EIT “InnoEnergy” and the “Solar Co-location Centre” http://www.kic-innoenergy.com/

• The European Energy Materials Industrial Research Initiative (EMIRI) https://emiri.eu/
Example of last workshop objectives: EU PV Cluster 3rd Workshop and General assembly (Barcelona, Spain, May 25-26 2016)

1. Highlight key results of the research and innovation (R&I) projects supported by various programmes of FP7 and Horizon 2020 in the field of Photovoltaics (PV) and review their technology readiness level (TRL) in a value-chain approach.

2. Highlight key needs of the Nanofutures, Sunpower association (roadmap), EMIRI.

3. Identify common R&I priorities for bridging the gap between advanced materials and nanotechnology-based innovation and the successful commercialisation of innovative products and industrial technologies.

4. Enable the materials, nanotechnology & PV communities in Europe to develop strategic collaborations and industrial partnerships.
Workshop key results

**Crystalline Silicon:**
- Heterojunction modules with 330W with cells having 22.5% efficiencies in the **Hercules** project
- Aims to demonstrate of circular economy approaches to end of life PV cells in the **Cabriss** project

**Thin Film Technologies:**
- Demonstration of 22% efficiency on CIGS cells, with a target above 24% by the end of the **Sharc25** project
- Achievement of 11-12% efficiencies in kesterite solar cells and a world record 9.1% for electrodeposited kesterites in the **Kestcells** project
- Optimisation of metallic substrates via intermediate layers have been validated in OPV and a-Si technologies in the **Steel PV** project

**Third Generation PV Cells – OPV and DSSC**
- Over 9% efficiency in OPVs demonstrated in the **MatHero**, **Mujulima** and **Sunflower** projects
- High efficiency perovskites solar cells concepts demonstrated. Record efficiency lab scale cell >20% (MESO) and monolithic tandem perovskite/heterojunction c-Si solar cells with over 21% efficiency (CHEOPS)
- Large scale R2R produced OPV with 3.9% efficiency in the **Smartonics** project
Common Research Priorities (from EU PV Clusters Workshop Initial Report)

- Optimising light capture and management using techniques such as surface texturing and photonic structures
- Improving TCO and barrier properties
- Encapsulation process development
- Understanding behaviour at interfaces and structures and modelling heterostructures
- Development of new device architectures (e.g. fewer materials layers or the incorporation of nanostructures) to optimise solar cell performance
- Developing and applying advanced characterisation methods to support performance assessment and quality control
- Developing standard methods and formal standards to support assessment and quality control
- High productivity deposition technologies with reliability – especially those that work at atmospheric pressure and at lower temperatures
**NAMEC**: overarching cluster successfully set up in 2016 by the Industrial Technologies programme of Directorate-General for Research and Innovation of the European Commission, in order to regroup all European projects focused on nanotechnologies and advanced materials for low carbon energy, energy storage and energy efficiency technologies.

NAMEC started in 2016 with clustering of European projects from the NMBP programme of Horizon 2020 (Industrial Technologies), but to date also gathers together relevant projects from other programmes (European Research Council; Future and Emerging Technologies; Marie Skłodowska-Curie actions; Secure, Clean and Efficient Energy; Smart, Green and Integrated Transport; etc.) and funding instruments (EIT RawMaterials, EIT Innoenergy).
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What to do next?

- **General assembly and thematic workshops** to highlight new results from existing EC project and identify common bottlenecks.
- **Numerous opportunities for the NMBP, ENERGY Programme** to further support European industry to develop competitive PV technologies.
- **The Solar Europe Industrial Initiative** identifies development needs in all key technology areas. There is a strong emphasis in these requirements on applied development and innovation, i.e. a focus on optimising commercial technologies and associated manufacturing processes, rather than developing longer term novel technologies.
- **A “SET Plan Material Roadmapping exercise”** includes a Chapter on PV technology:
  - proposals of critical R&D actions in the next 10 years with market implementation horizons for both 2020/2030 and 2050
  - a roadmap for nanomaterials, materials and processes for PV
Planned activities 2017

➢ NEXTGEN 2017 International School & Workshop
   Palma de Mallorca, Spain, September 2017:

   http://www.nextgennanopv.com/

➢ European Workshop on Advanced Materials & Nanotechnologies for PV & CSP (in conjunction with EMIRI Tech Talk), Brussels, Belgium, October 24-25 2017
Nextgen 2017
Nanotechnology and Next Generation High-Efficiency Photovoltaics
International School & Workshop
Palma, Mallorca, Spain
September 12 – 15, 2017

http://www.nextgennanopv.com/
Save the date
On October 24th 2017 from 10:00 to 13:00 incl. networking lunch
At Science 14 Atrium, Rue de la Science 14b, 1040 Brussels
For more information - fabrice.stassin@emiri.eu

EMIRI holds its ‘EMIRI Tech Talk’ on PV & CSP (photovoltaics & concentrated solar power)
The objective of EMIRI Tech Talk is to offer EMIRI Members an updated overview of insights on ...

- Technology
- Key players
- Markets
- EU Policies

Are invited to attend EMIRI Members, EU Commission officials as well as other selected stakeholders

Participants to the ‘EMIRI Tech Talk’ are also invited to the ‘European Workshop on Advanced Materials & Nanotechnologies for PV & CSP’ following the ‘EMIRI Tech Talk’ (October 24th & 25th at Science 14 Atrium)
The Workshop is organized by EU PV Cluster with support of CEA, IREC, LEITAT, IK4-TEKNIKER, EMIRI and EU Commission DG R&I. It will include presentations of FP7 & Horizon 2020 projects by their project coordinator and will give participants an overview of EU projects (current status and R&I needs)

During workshop, input will also be gathered to provide recommendations to EU Commission on how to approach R&I funding (on Advanced Materials & Nano) for PV & CSP in forthcoming FP9 with a focus on EU-based manufacturing.

EMIRI represents more than 60 organizations (industry, research, associations) active in Advanced Materials for low carbon energy technologies. The association contributes to industrial leadership of developers, producers and key users of Advanced Materials by shaping an appropriate innovation, manufacturing and energy policy framework at European level. In frame of Horizon 2020, EMIRI collaborates with European Commission to develop the Innovation Pillar on Advanced Materials for low carbon energy proposed in the EMERIT Industry-Driven Initiative
Thank you for your attention!