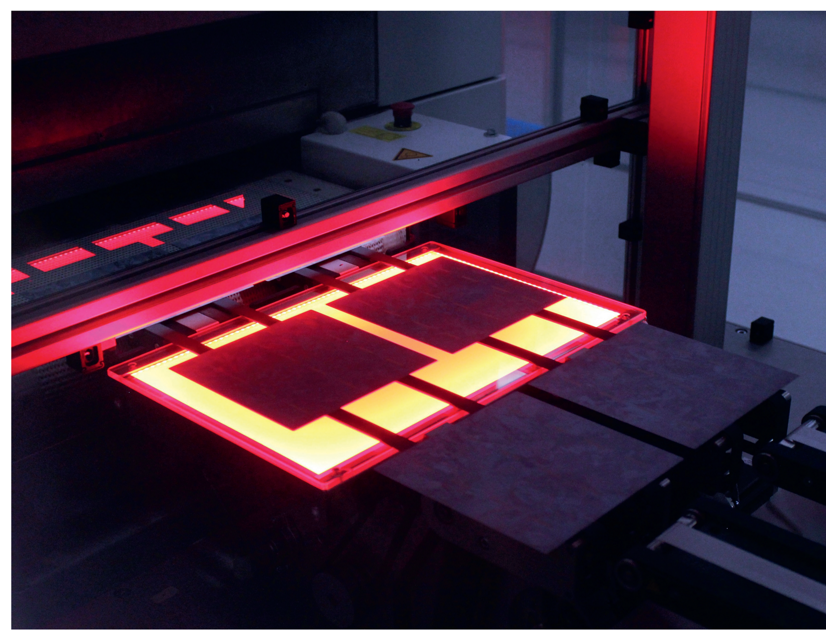
SuperPV: Cost reduction & enhanced performance of PV systems

SUPER PV

Project Purpose

Today photovoltaics (PV) has become one of the most cost-effective forms of electricity production globally and in some regions is already the most competitive unsubsidised form of electricity. Despite positive cost and growing developments, European PV manufacturers are facing a decline in production due to competition from third countries. The fragmentation of the value chain compared to competing actors is believed to be the major factor for this decrease in the competitiveness.

SUPER PV is a **collaborative European-funded project** initiated in 2018 by **26 partners** in reaction to this trend. Together, they target a significant LCOE reduction (26%-37%) for European-made PV by adopting a hybrid approach combining technological innovations and data management methods. Introducing **superior quality PV systems** will create conditions **for accelerating large scale deployment in Europe and help EU PV business to regain leadership on world market**.



Scope

To achieve ground breaking impact on cost reduction, the project concept tackles in an **integral way three cornerstone** steps impacting PV system performance and, thus, LCOE:

a) Module;
b) Power electronics (PE);
c) System integration/O&M.

PV module innovations introducing and combining five PV module innovations applied to c-Si based bifacial modules and CIGS modules.

Module Level **Power Electronics** (MLPE) developments ensuring higher power output, performance monitoring and data collection on string level, and long term stability of operation.

PV system integration and process innovation, developing a new digital and holistic process: PIM (PV information Modelling/Mgmt.)

Impact

Expected **Reduction of LCOE** for proposed innovations:

	LCOE (life time costs/energy production)
PV Modules	7 - 14 %
Power Electronics	4 - 5 %
System Integration, O&M	12 - 18 %
Industry 4.0 Internet of Things (IoT) Data Management Manufacturing	Additional Reduction

Methodology

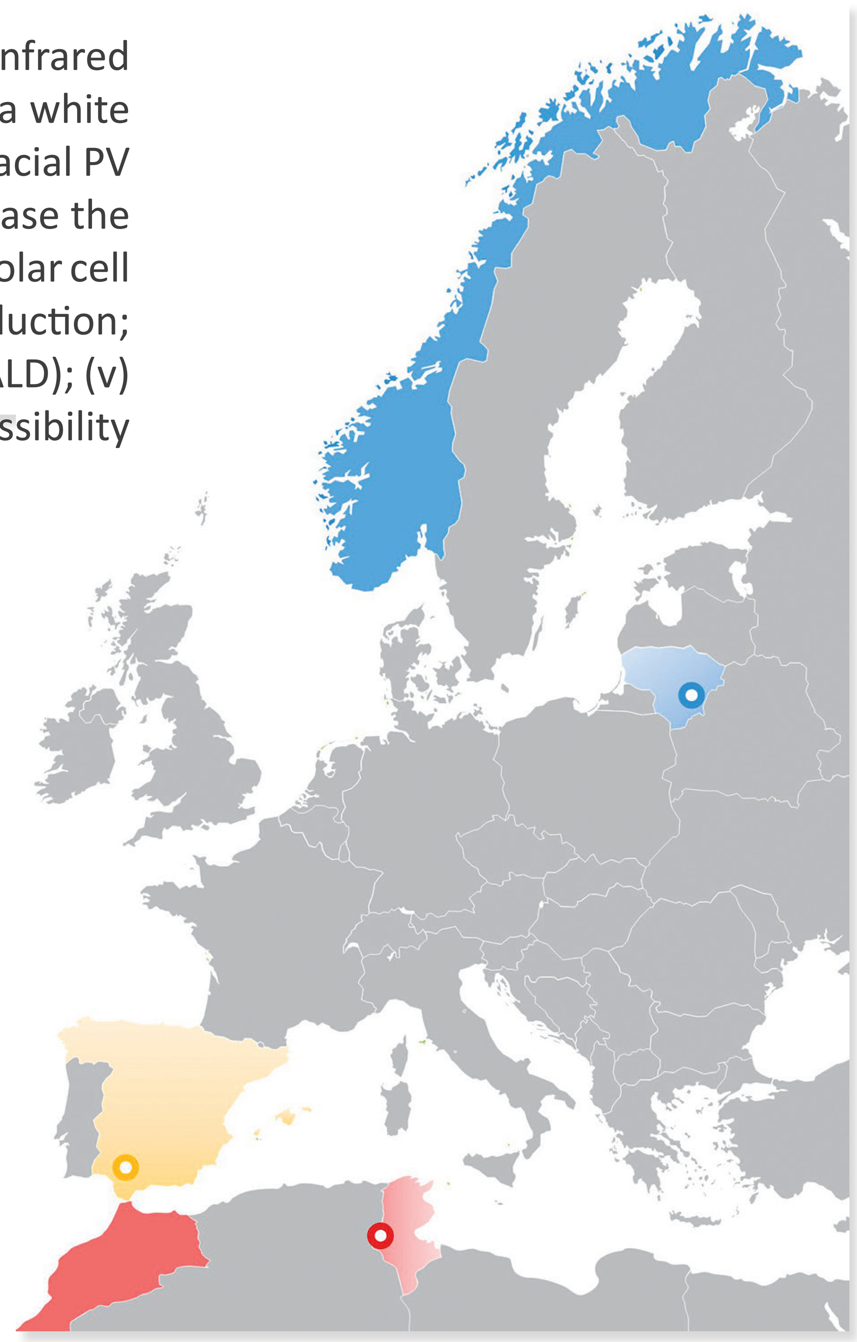
Development of technology innovations and novel data management tools → Testing of he innovations and methods in real conditions → Evaluation of the effectiveness of the proposed solutions

Description of the proposed innovations

PV module innovations: Proposed innovation are (i) a combination of anti-Soiling (AS), anti-reflection (AR) and infrared (IR) reflection coating based on nanoparticles, which aims to increase the annual yield of the PV modules; (ii) a white reflector applied to the module's rear glass within the cell gaps, which improves the light harvesting for the bifacial PV modules, and a deeply structured rear glass to increase light collection from the module rear side and to increase the thermal convection cooling to the surrounding air; (iii) implementation of in-laminate bypass diodes made with solar cell processing machines, which allow omitting the junction box and requiring fewer materials for the module production; (iv) application of Aluminium oxide (Al2O3) gas barrier coatings deposited by spatial atomic layer deposition (SALD); (v) demonstration of a laboratory-recycling tool for all considered module types (c-Si and CIGS) to evaluate the possibility to recycle and re-use the module materials.

PE developments: Proposed hardware level innovations are (i) micro-inverters with advanced switching elements based on GaN; (ii) micro-inverters with smart functionality such as active/reactive power generation; (iii) fault-tolerant converter topologies and converter algorithms; (iv) MPP Optimizers or Smart Boxes with Rapid Shut Down (RSD) functionality that represent dramatic increase of Power Plants fire safety, long-term energy yield, module reliability and PV power plant design flexibility, modularity and longer operation times without maintenance.

Integrated Process and Information Management: The main objectives to implement innovation will be (i) to adopt digital software and hardware tools ensuring integrated information flow through the PV value chain this way reducing costs related to the PV projects implementation and operation; (ii) the development of a digital platform for design, simulation and operation supporting the cost reduction of PV systems; (iii) the development of a tool for extending the PIM-based platform functionalities for O&M operations through a Digital Twin Model, continually updated to include the events sustained while in use, thanks to a sensor-enabled digital model that simulates the object in a live setting.



Demo Sites

Project results will be tested in demonstration sites in the **markets of primary importance** for European PV producers:

- European market where roof top market is recently becoming more and more important.
- Regions where solar irradiation and average temperature are high

Testing will be performed in **three different climatic regions** of extreme conditions.

Temperate (cold/wet) climate
- Norway
- Lithuania: Vilnius

Tropical (hot/wet) climate
- Spain: Sevilla

Desert (hot/dry) climate
- Morocco
- Tunisia: Tozeur

The Consortium

SOLITEK R&D, proTECH, MAScIR, Université Mohammed V de Rabat, SUPSI (University of Applied Sciences and Arts of Southern Switzerland), ISFH, TECNAN, IREC (Catalonia Institute for Energy Research), Flisom, ayesa, Universität Konstanz, TNO innovation for life, Becquerel Institute, CADCAMation, LOSER Chemie, WIP, éolane, cea, COSYLAB, APOLLON SOLAR, Lurederra centro tecnológico, masen, SINTEF, University of Ljubljana Faculty of Electrical Engineering, ANME, BNW ENERGY

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