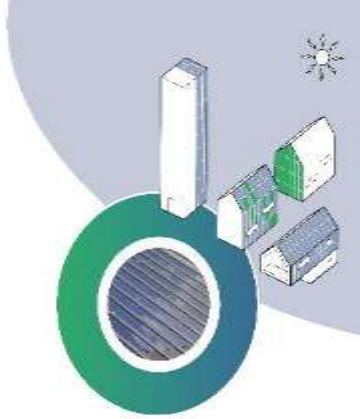
SUSTAINABLE PLACES 2020
October 27-30, 2020
Digital Event

BIPV – Workshop
Building Integrated Photovoltaics



PVadapt

Combined innovations in modular construction and modular photovoltaics

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 818342

SET-Plan TWP PV Implementation Plan

- Reduce turn-key system costs by at least 20% by 2020 as compared to 2015;
- Reduce turn-key system costs by at least 50% by 2030 compared to 2015 with the introduction of novel, potentially very-high-efficiency PV technologies manufactured at large scale;

PVadapt

Main Features

1. **PV/T:** integration of flat heat pipes with PV Module
2. **Prefabrication and Modularity**: customizable and flexible system tailored to the end-users' needs
3. **Smartness:** Smart Envelope System for load prediction and shifting and for predictive maintenance
4. **Circularity:** promoting environmentally and financially viable technology by closing loops and giving new value to waste

PVadapt concept

High efficiency solar/thermal collector

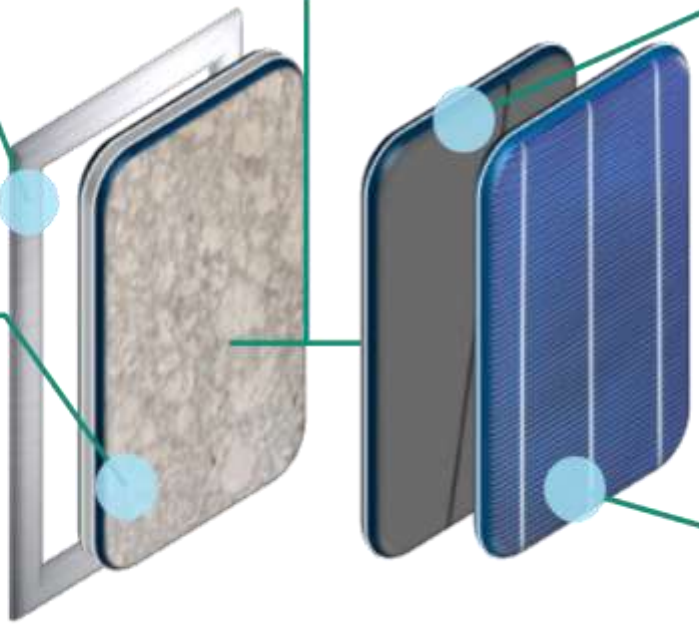
Steel frame

Steel cladding attached to the envelope or as building block for new construction

Joining process (conducted on site)

Heat Mat Component

- Heat recovery from the PVs
- Efficient cooling of PVs
- Defrosting capabilities
- Building functionalities



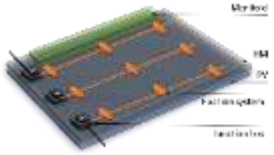
Thermal Component

Waste material components

PV module

Integration of PVs and the Hear Mat in a single production line

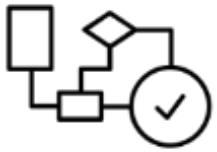
What Pvadapt is trying to Achieve?



Develop building elements producing both thermal and electrical energy

Forecast generation and demand per building

Deliver new green construction components able to be adapted on BIPV elements



Establish management algorithms to better match energy supply and demand

Create aggregator software tool that could be used for balancing thermal and electrical networks

Develop user interface able to support alternative business cases

Develop viable business models and exploitable results

Conforming to existing standards and informing the creation of new standards

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Objectives:

(O.1) Production of energy active HM/PV modules

- (O.1.a) Modification and production of Heat Mat (HM) components for integration in PV modules
- (O.1.b) Modular production of PV modules for BIPV integration with integrated HM cooling components and customisable interlocking Plug&Play elements

(O.2) Modular integration of functional layers to BIPV products

(O.3) Production of passive multifunctional components for integrated BIPV products

- (O.3.a) Fiber reinforced geopolymers
- (O.3.b) Bio waste based Oriented Strand Boards
- (O.3.c) Expanded perlite

(O.4) Deploying the Smart Envelope System (SES)

(O.5) Optimizing the life cycle of produced components

(O.6) To enable accelerated decision making and installation operations through implementation of Integrated Project Delivery (IPD)

(O.7) To ensure that the activities and results of the project adhere to EU and member state legislations and regulations and to identify and incorporate in the methodology EU and national energy efficiency and refurbishment incentives

(O.8) To demonstrate the applicability and efficiency of the PVadapt system in a wide spectrum of application

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Year 1	Year 2	Year 3	Year 4

Design and development

- BIPV requirements
- Business cases scenarios and evaluation procedure
- Test for each sub element

Performance analysis

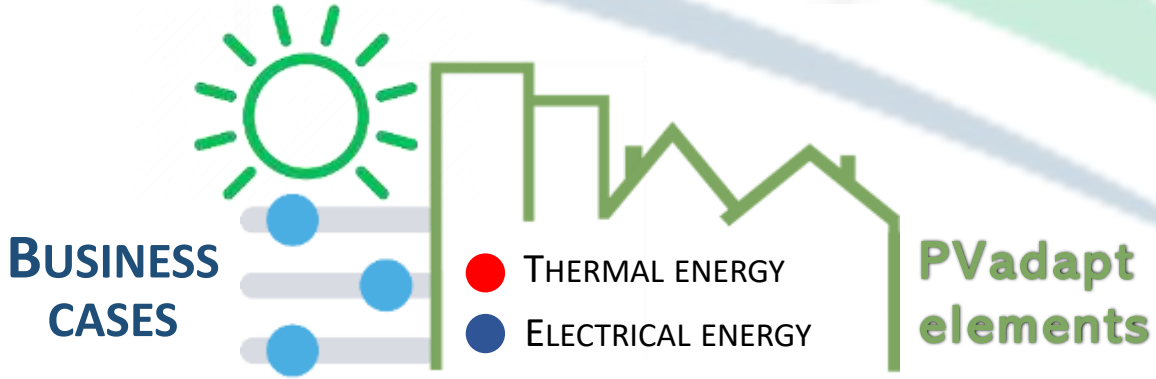
- Performance reference vs scenario
- Initial results form real test lab environments
- Input findings into preparation of physical test sites

Physical test site deployment

- Redesign/change of operations following lab environments
- Input into validation and audit process
- Energy/carbon validation and end user response to technology

Project insights

- Technology deployment barriers and opportunities
- Understanding how the market can support deployment and benefit from PVadapt
- Recommendations on standards and legislation that supports PVadapt



BIPV requirements

PVadapt approach, includes cost-efficient production techniques and demonstrates these concepts into a BIPV energy system that guarantees the building functionalities and energy needs on a life-cycle basis. Photovoltaic systems are considered to be building-integrated if the PV modules they utilize fulfil the criteria for **BIPV- modules as defined in EN 50583 Part 1 and 2** and thus form a construction product **providing a function as defined in the European Construction Product Regulation CPR 305/2011** and this approach was followed for the PVadapt proposed solution. **EN 50583 was the core document for IEC 63092 which specifies BIPV architectural applications on roof and façades**.

Demonstration Sites Design

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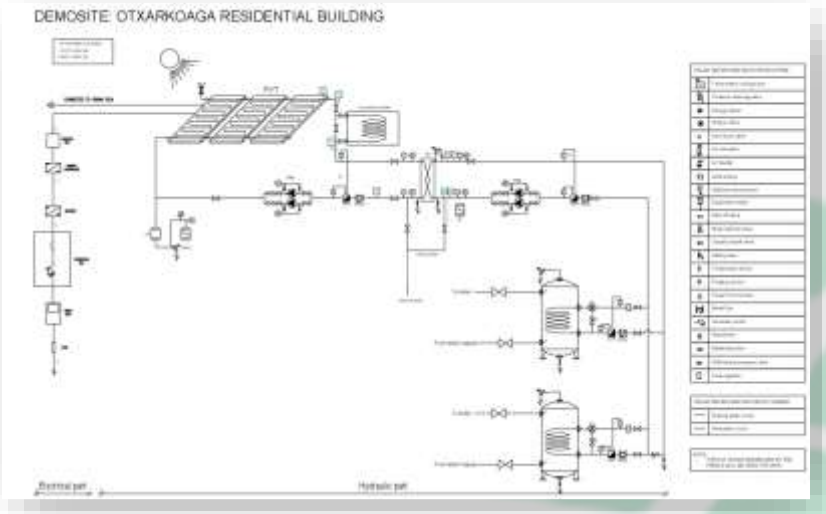

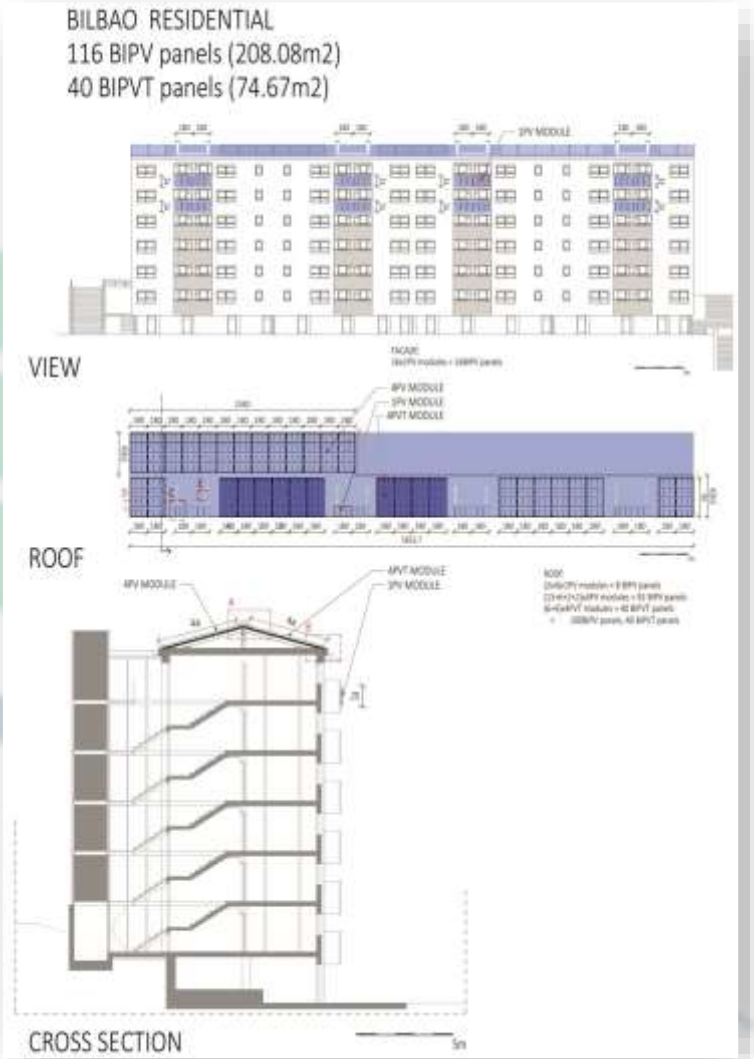

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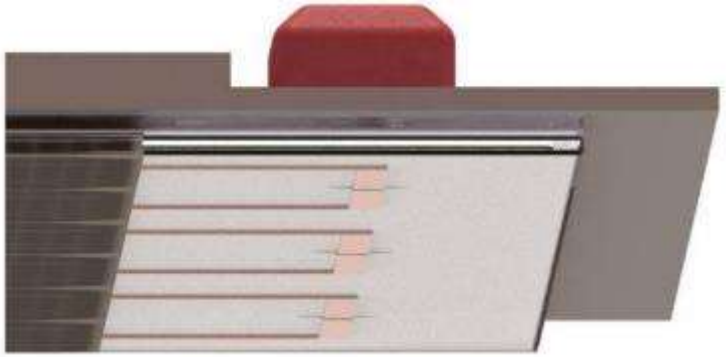
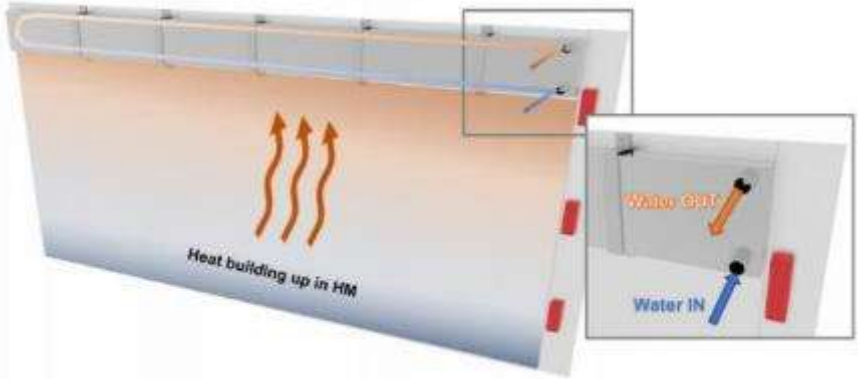


HM between the glass and the JB and the HM thinned region



Back of the PVadapt module with the brackets holding the water manifold

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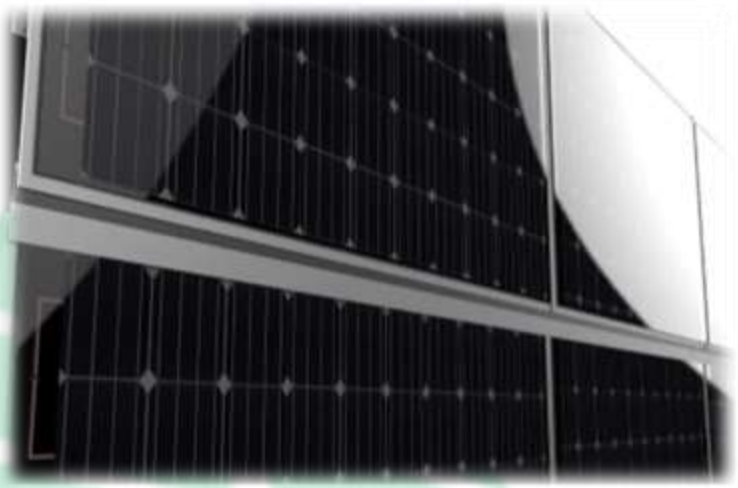
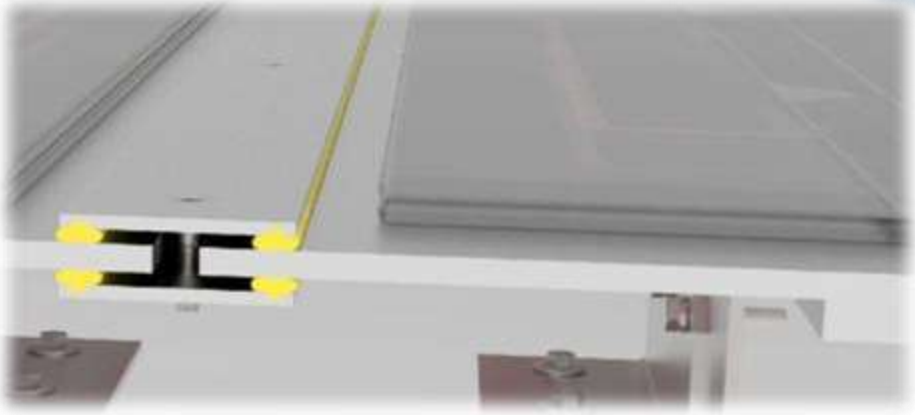
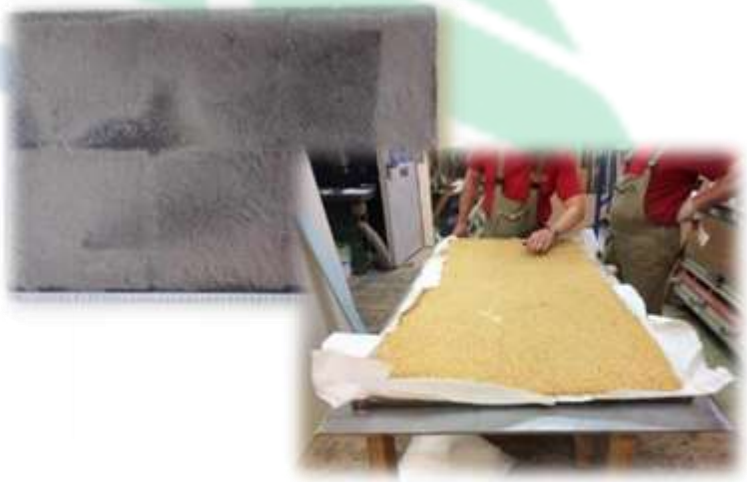


PVadapt standard module assembled on a wall and prototyping realisation





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Load profile forecast from the Machine learning algorithm for one week

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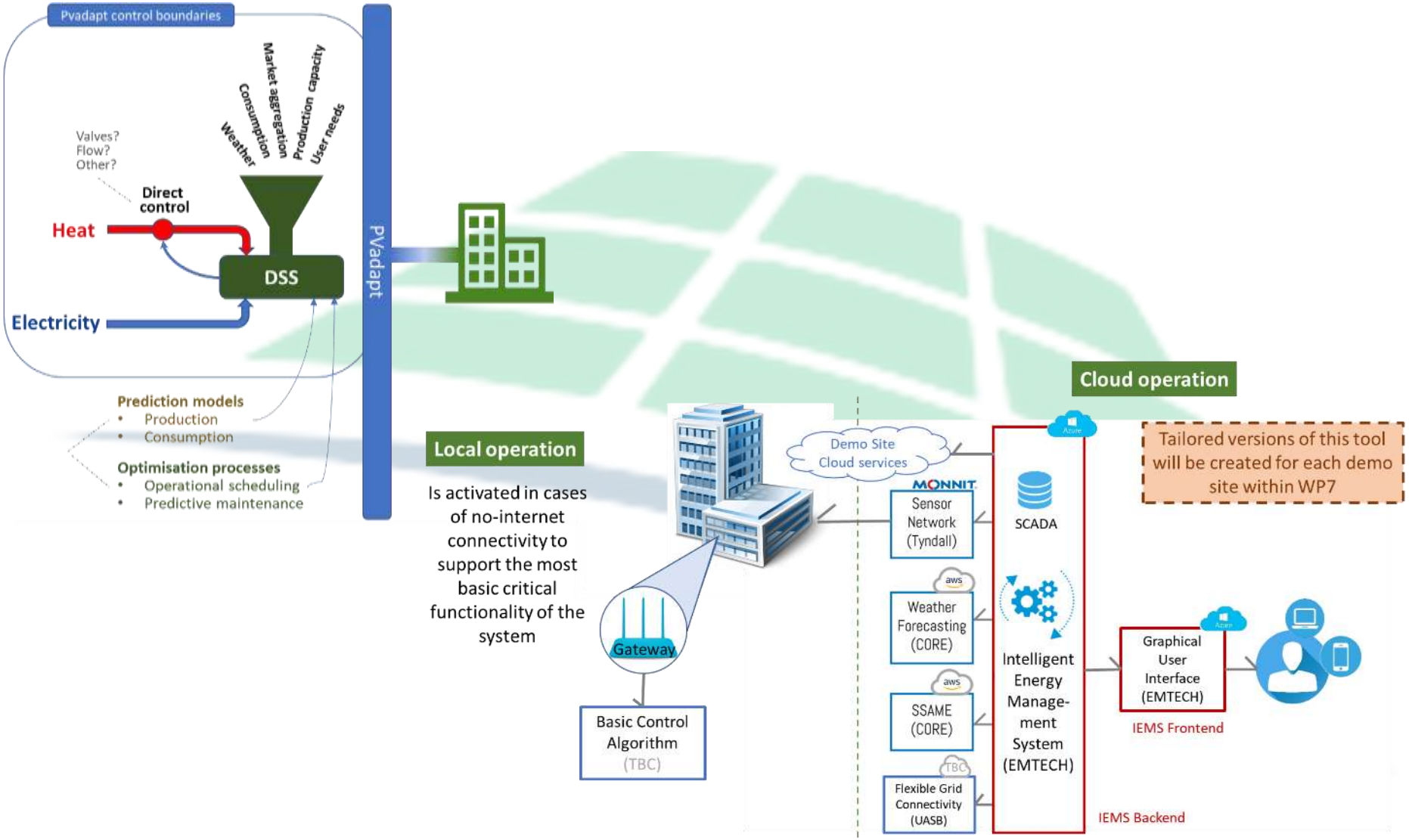
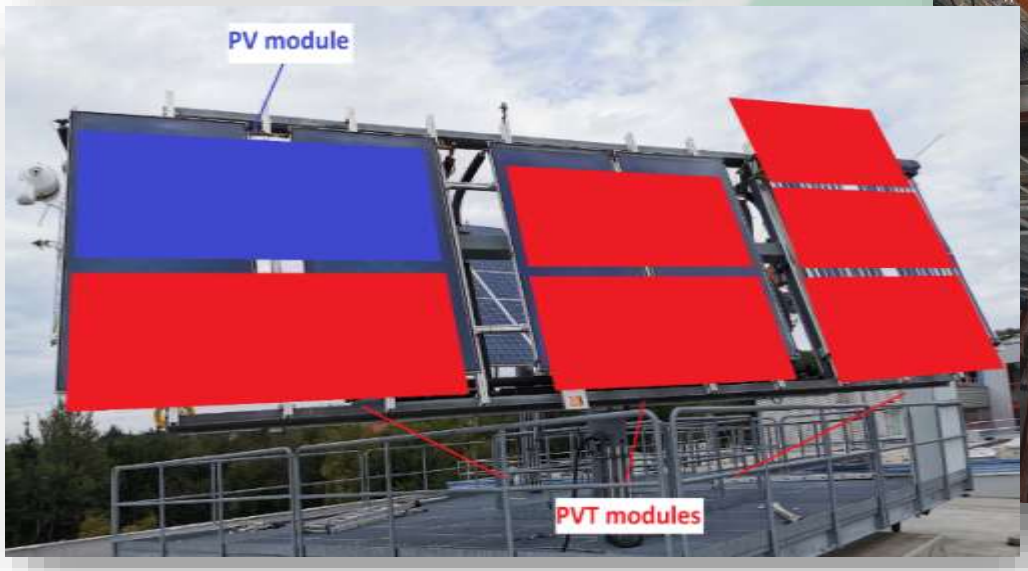


Testing Procedure



Overall

Sustainability Index

Function of 3 KPIs

- Environmental
- Social
- Economic

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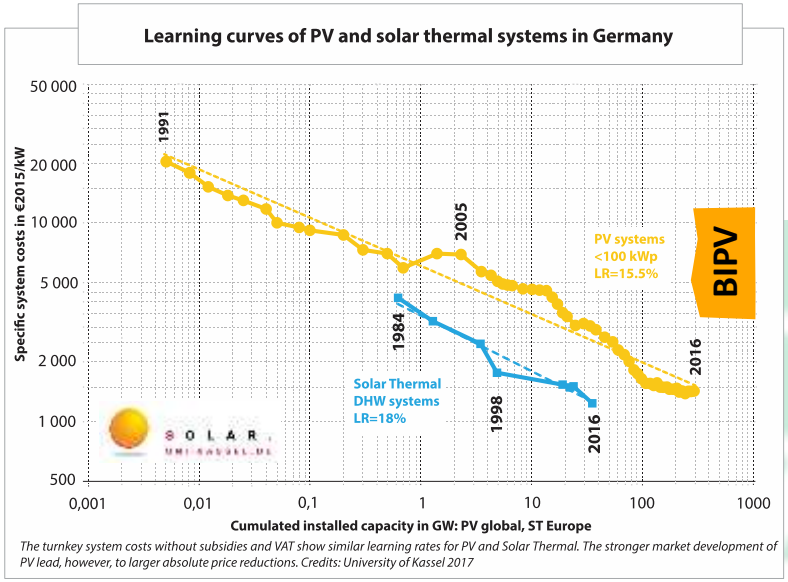
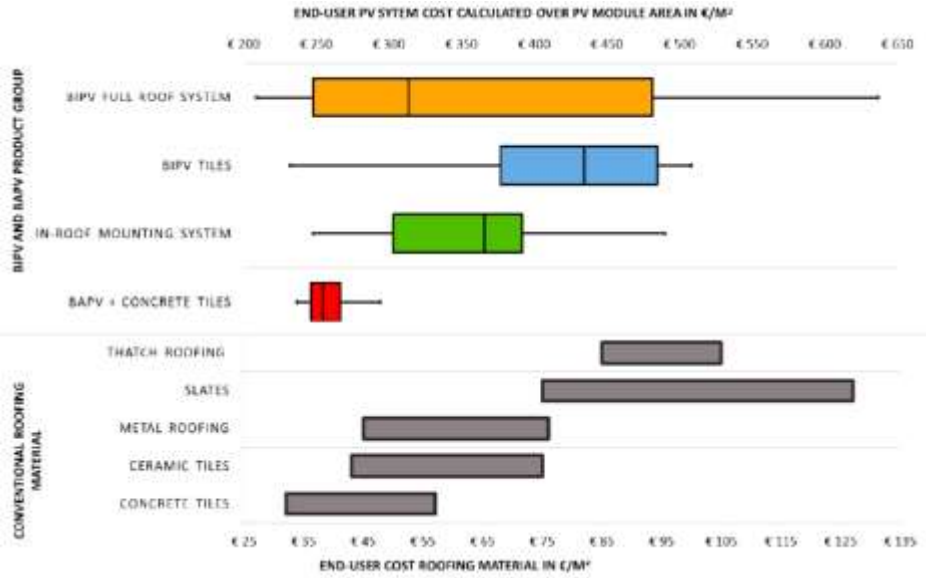


The turnkey system costs without subsidies and VAT show similar learning rates for PV and Solar Thermal. The stronger market development of PV lead, however, to larger absolute price reductions. Credits: University of Kassel 2017



Average values for *PV perspective* (A) and *building perspective* (B) costings of BIPV projects*

	(A) €/kWp	(B) €/m²
Opaque cold façade	~7.900	~ 850
Semi-transparent roof-façade	~5.100	~ 500
External device	~4.900	~ 500
Opaque tilted roof	~4.400	~ 600

* https://www.buildup.eu/en/node/57570

In fact, the BIPV system capital cost lays in an acceptable range and it is even **cheaper than some standard passive building materials** (e.g. glazed curtain walls, stone and others)

PVadapt

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