P E A R L P V

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

INTRODUCING 'PEARL-PV': PERFORMANCE AND RELIABILITY OF PHOTOVOLTAIC SYSTEMS - EVALUATIONS OF LARGE-SCALE MONITORING DATA

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https://www.pearlpv-cost.eu

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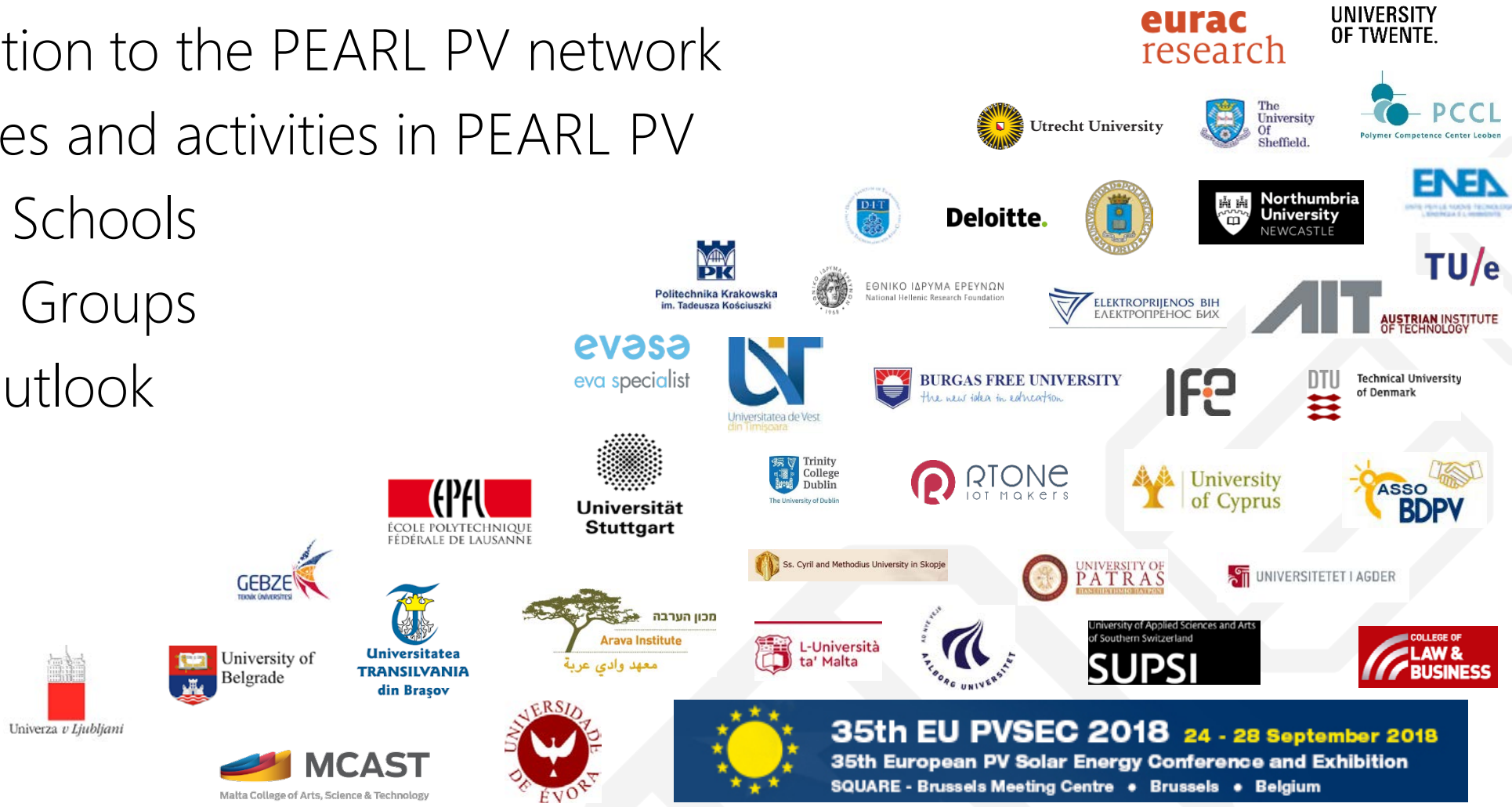
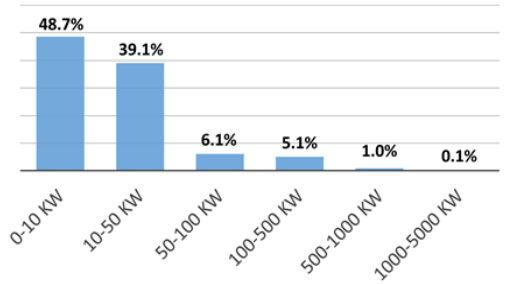


Why PEARL PV?

- Example: 1750 PV systems installed in South Tyrol in a period of 2006 until 2016 show relatively large differences in performance.
- How comes?
- What are the reasons for such large differences in performance of individual PV systems?
- How can we avoid performance loss and degradation?
- What's the best way to analyze this?
- How do these results relate to other locations - with other climates - in Europe?
- … to installed capacity?
- … to type of components?



Source: Belluardo et al. Statistical analysis of the performance loss rate of PV plants distributed in a region: a real-case study in South Tyrol, 2017

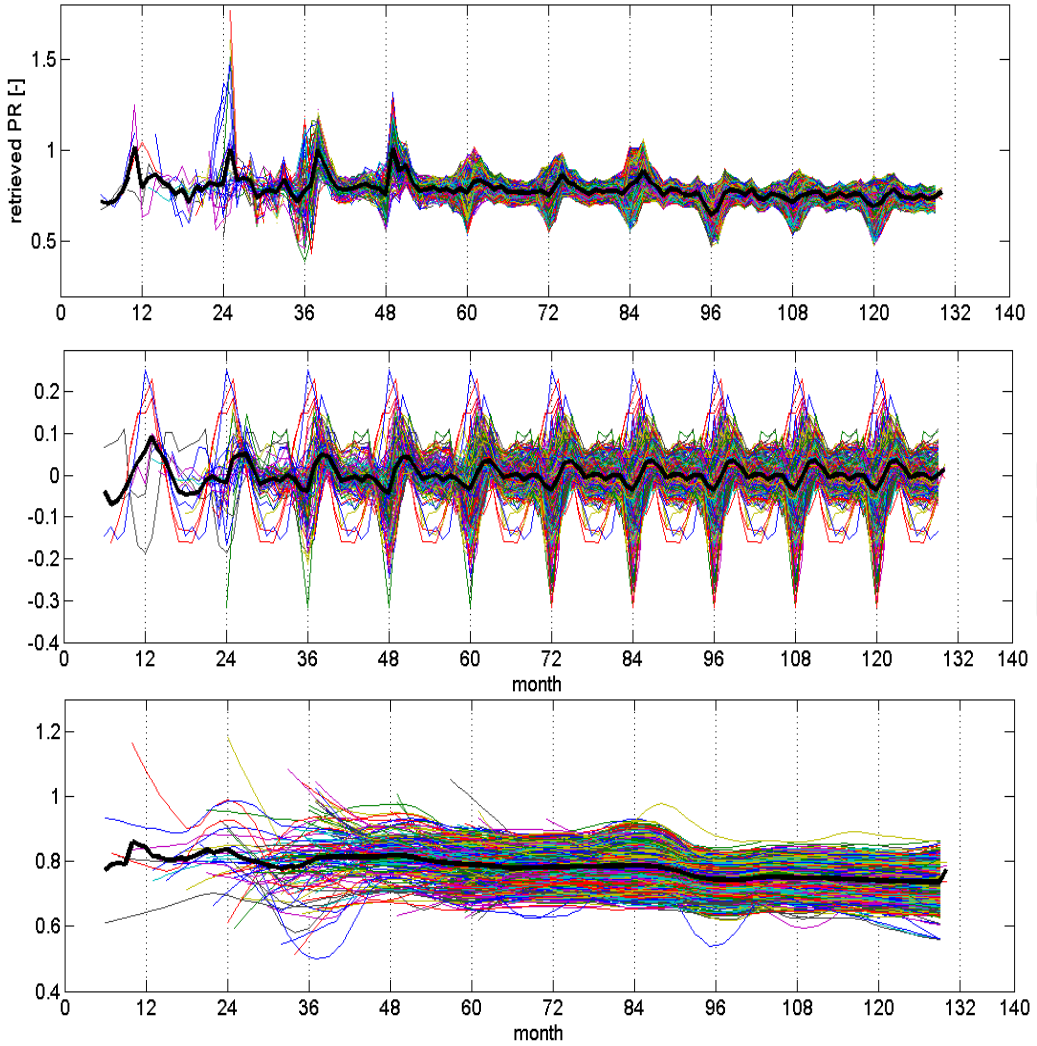
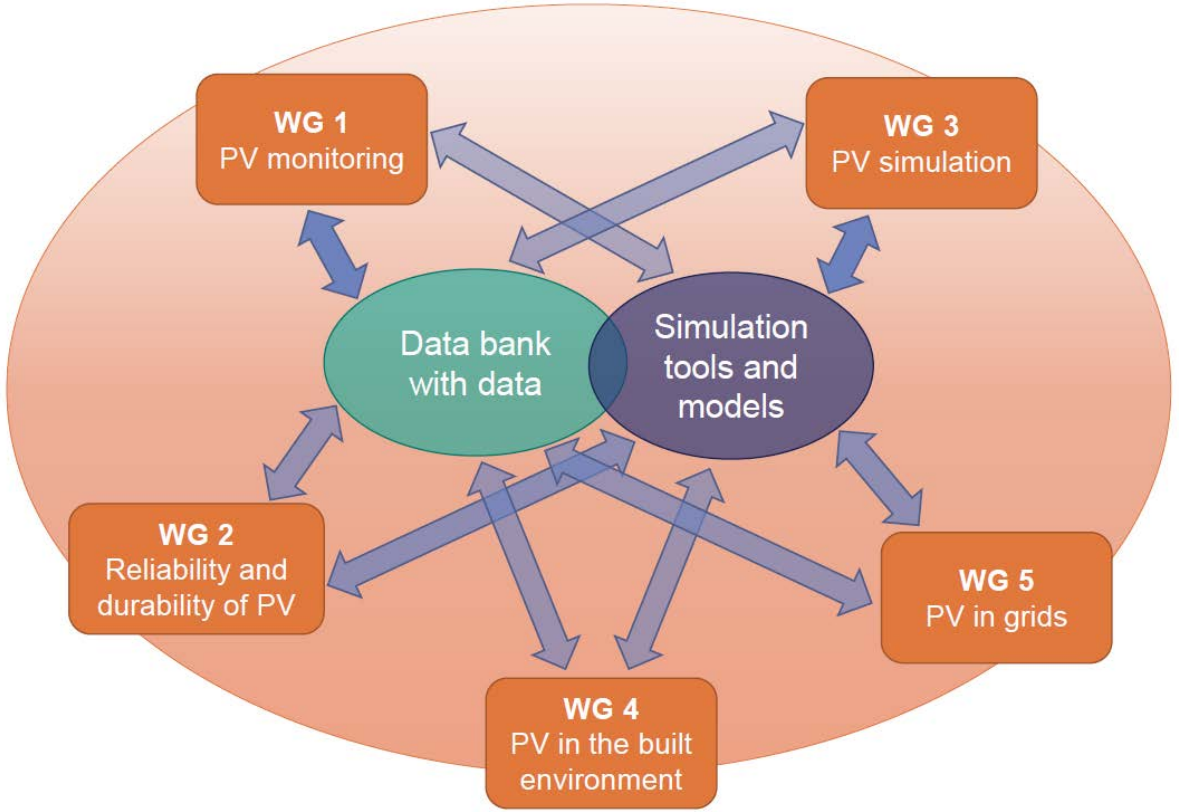


Figure: (top) Monthly PR series calculated for 1750 PV plants; (center) monthly series of PR_{trend} and (bottom) monthly series of PR_{seas} after the application of the locally weighted scatterplot smoothing technique (SLT). Black lines show the average quantities.

Objectives of PEARL PV activities

To **improve** the **energy performance** and **reliability** of PV systems leading to (i) **lower costs** by a higher yield, (ii) a **longer life time** and (iii) a **reduction of perceived risk**;

- By analyzing data of the long time monitored long-term performance of PV systems and of their defects and failures;
- To quantitatively determine the absolute influences of (i) components' rated performance, (ii) system design, (iii) installation type, (iv) operation and maintenance practice, (v) interactions with grids, (vi) geographic location and (vii) weather and climate conditions, on performance degradation over time and failure modes;
- To (i) improve the electrical design of PV systems, (ii) achieve optimal sizing via the use of simulation models, (iii) enhance expected system efficiency, (iv) ease maintenance, (v) achieve high reliability and (vi) demonstrate excellent durability.



PEARL PV Member Countries

At present
31 Countries
- 29 European Countries
- 1 International Partner County
- 1 Near Neightbour Country

165 members
- 50 MC members
- 37 MC Substitutes
- 77 Regular members

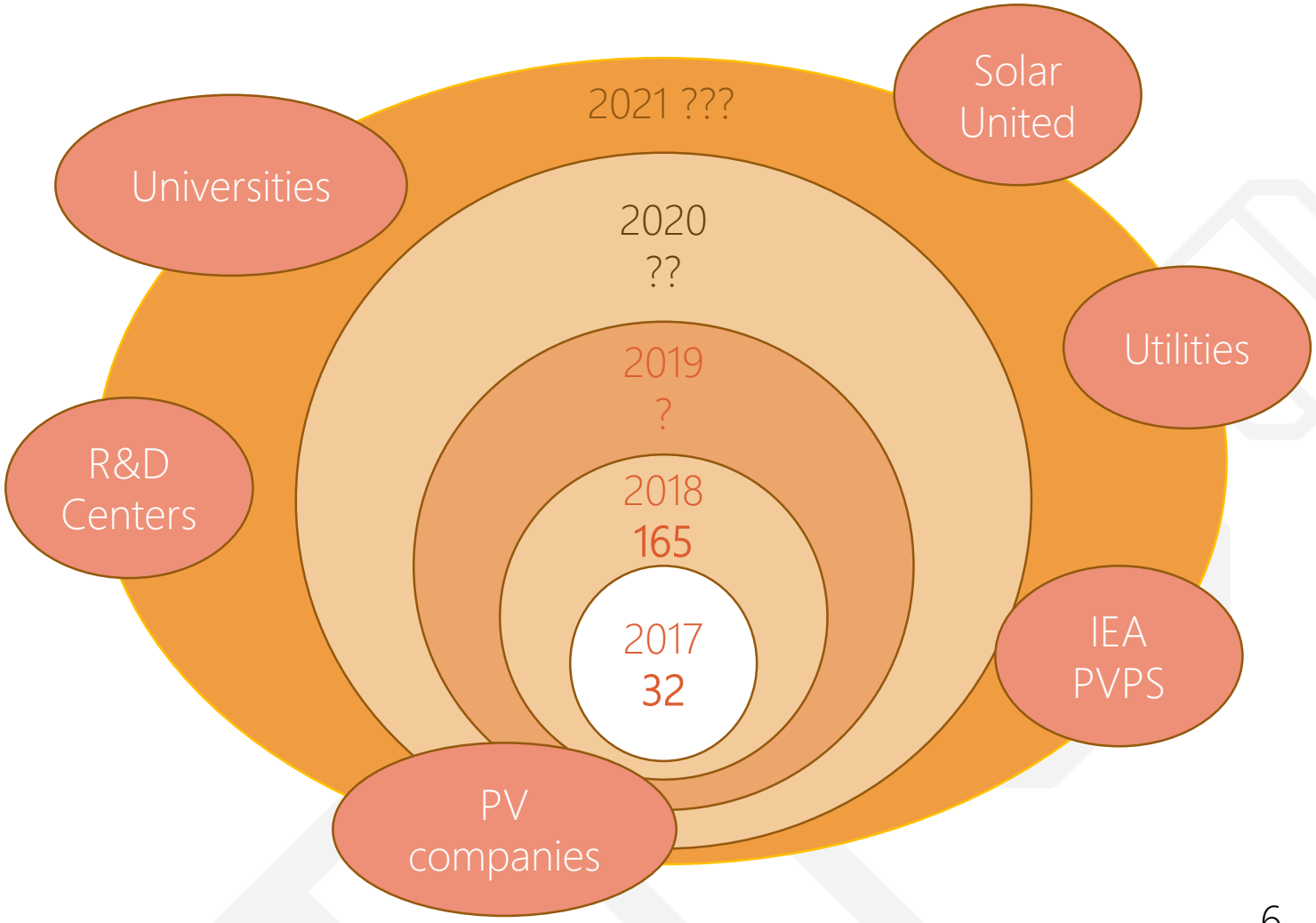
Start of PEARL PV on 05/10/2017
Running until 4/10/2021

Growth of the PEARL PV network

- **COST policy**: gender, ITC and ECI

- **Aim to network**
- Training Schools
- Seminars & Workshops,
- STSM grants
- ITC conference grants

- **Aim to collaborate**
- Surveys
- Joint papers and other publications
- Joint research proposals
- Shared data bank



Training Schools

- PEARL PV will organize every year a Training School aiming at knowledge dissemination and networking among young researchers and seasoned experts.
- Topics that have been identified for 2018 to 2021:
- Fall 2018: **Monitoring and Simulation of the Performance and Reliability of PV in the Built Environment.** This Training School will be held in Cyprus. For more information see here: https://www.pearlpv-cost.eu/event/cost-training-school/
- 2019: **Evaluation of the performance degradation of PV-systems** – influence factors, failure modes and their detectability and affect on economic viability
- 2020: **Simulation tools and models for the forecast of system efficiencies of PV plants** – with focus on environmental and integration aspects
- 2021: **Potential of monitoring tools and advanced operation and maintenance practice for security and predictability of PV performance**

Introduction to PEARL PV's working groups

- With regards the data bank:

We already received data donations: thank you!

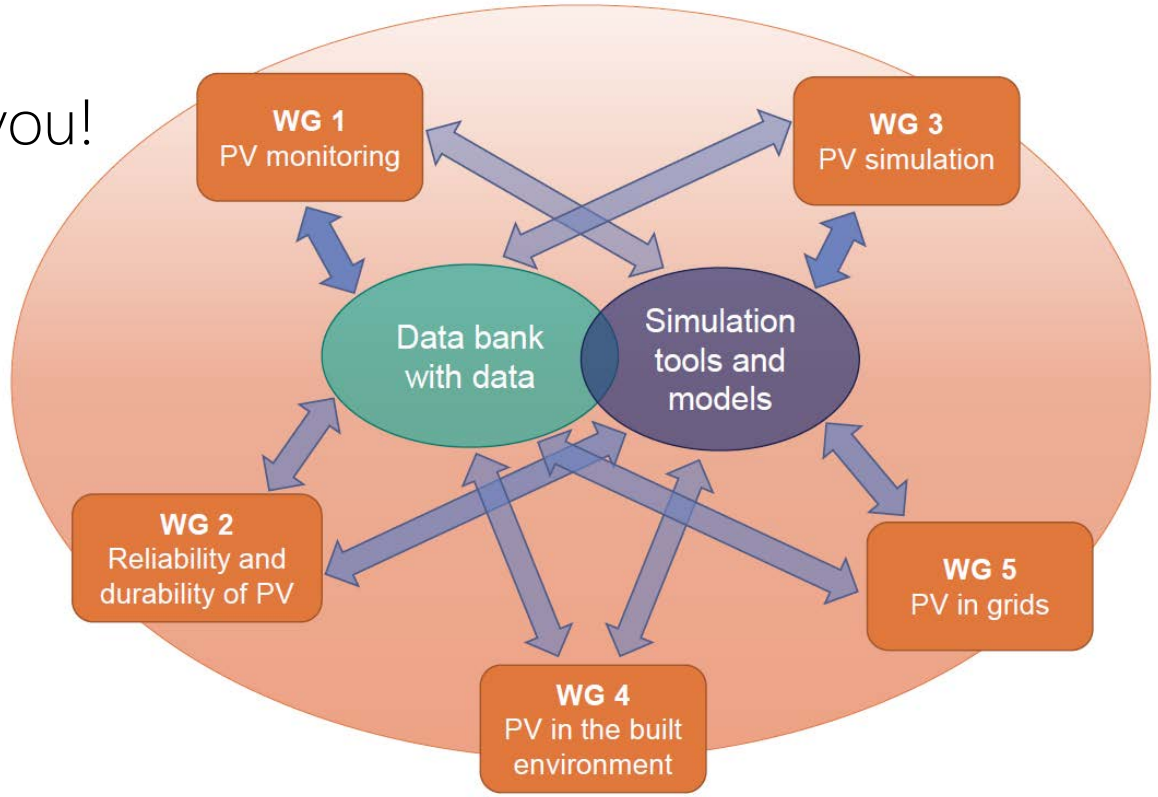
Data so far:

-Period 2006-2018

-Recording interval: second to month

-Mostly 1 to 15 minutes

Feel invited to donate data as well!



- With regards simulation tools:

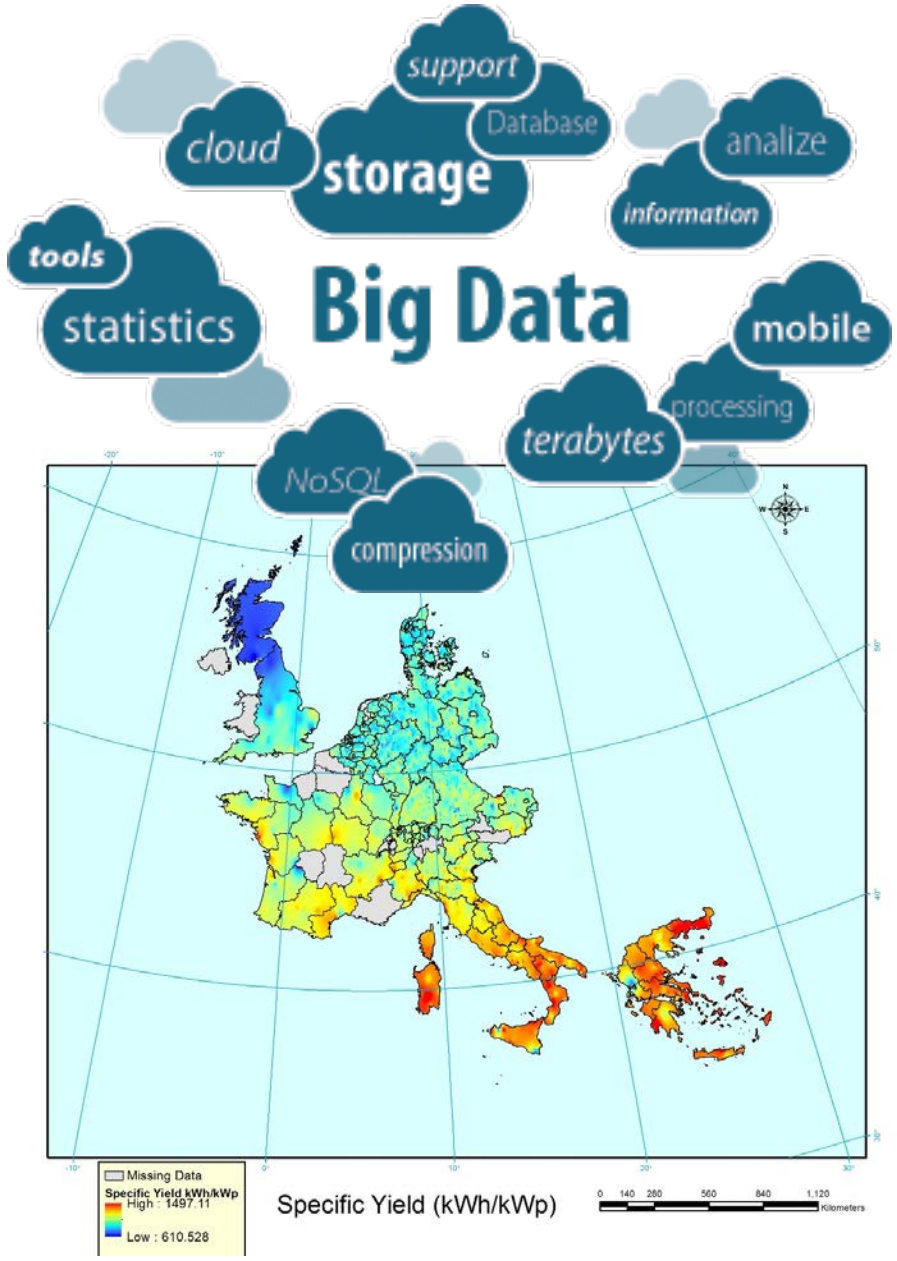
Please fill out the survey:

https://www.pearlpv-cost.eu/activities/contibute-to-pearl-pv-surveys/

WG1: PV Monitoring

- Objectives
  - Identification of relevant data to be collected to properly assess PV *performance* of installed PV systems in the field and on rooftops
  - Design guidelines for data collection and analysis
  - Set-up a database and design guidelines for database access
- WG leader: Wilfried van Sark
  - 30 members

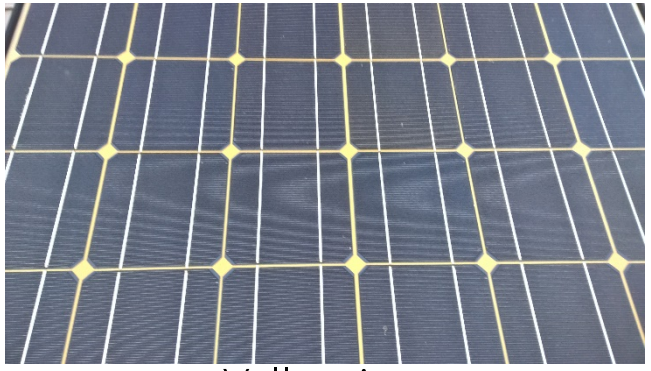
→ Database with open data running end Q4-2018: Please contribute with data



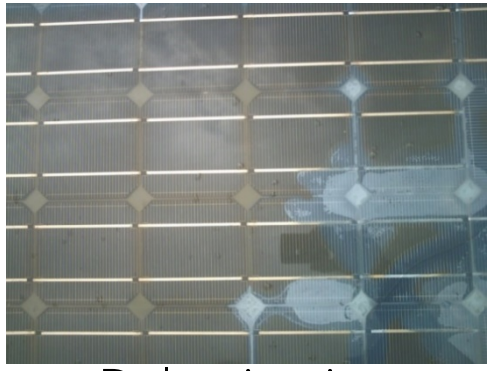
Annual yield map

WG2: Reliability and durability of PV

- Objectives
  - Definition of reliability and durability metrics for PV modules, components and systems
  - Identification of relevant data to be collected to measure reliability and durability
- WG leader: Gernot Oreski, 30 members



Yellowing



Delamination

- Problems/research questions that will be addressed:
  - Definition of reliability and end-of-life considering different views of PV stakeholders and different technologies
  - How to test reliability?
  - Can reliability, lifetime or end-of-life be modelled from short term testing?
  - Can available models for single effects or single materials be combined to an comprehensive PV module lifetime assessment method?

→ Extensive Review Paper until 2020. Contributions are welcome!!

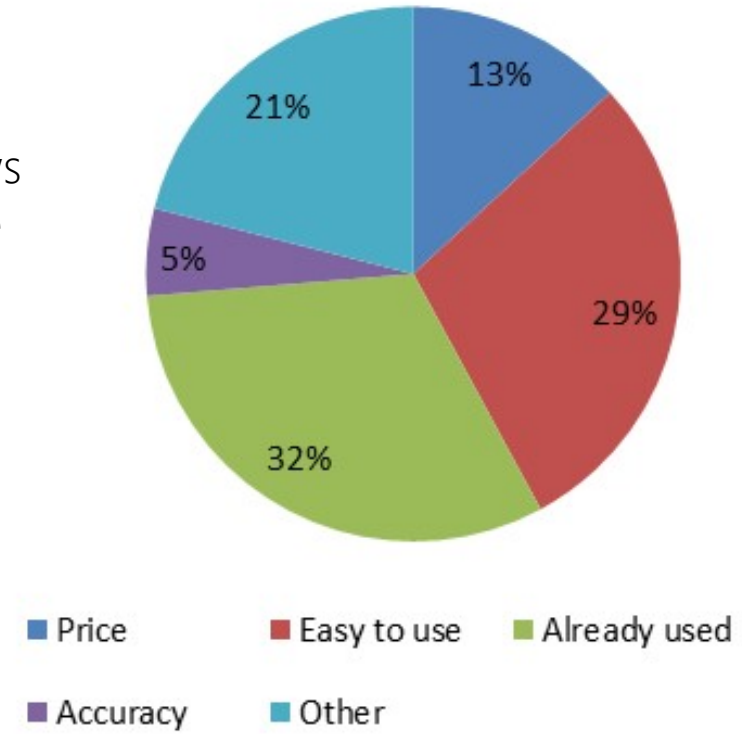
WG3: PV Simulation

- Objectives
  - Identification and classification of simulation and modelling tools by scope and usage
  - Comparison of software tools to meet the needs of performance prediction and assessment

- WG3 leader: Nicola Pearsall
  - 7 members (additional members welcome)
  - To access the software survey, https://www.pearlpv-cost.eu/activities/contibute-to-pearl-pv-surveys/

- The first activity has been a software usage survey, including identification of packages, reasons for use, developments required etc.

The pie chart shows the reasons for use given for the first choice software identified in the survey



WG4: PV in the built environment

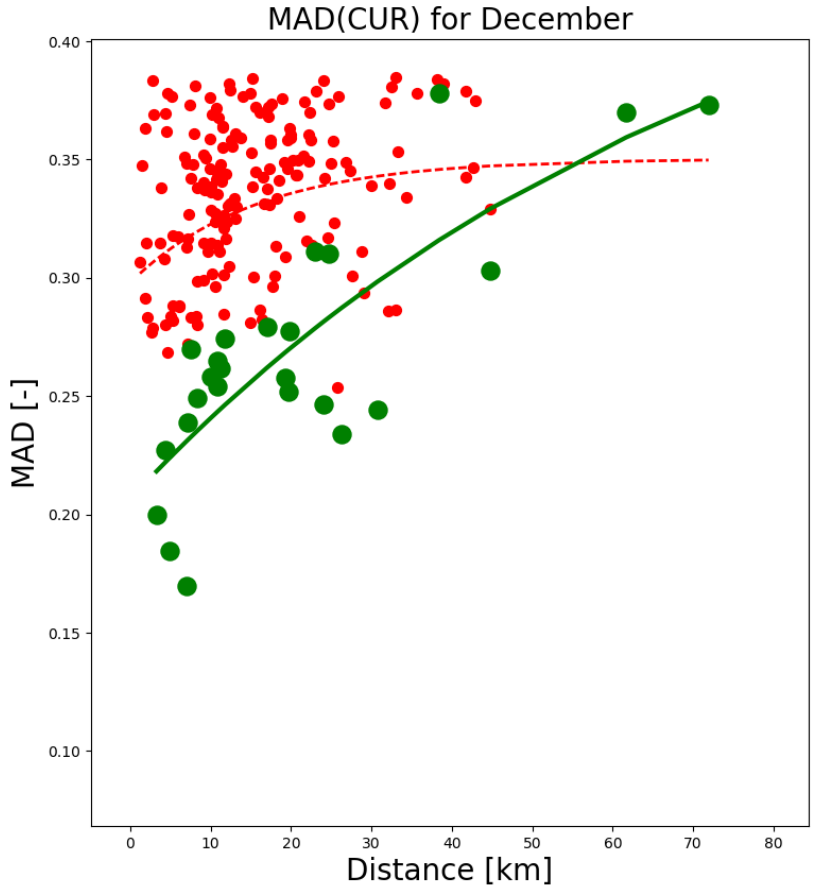
- Objective:
- Identification of required data and appropriate simulation models to be used in the framework of PV systems in the built environment

- WG leaders: Alessandra Scognamiglio, Francesco Frontini
- 20 members

- An example of complex photovoltaic façade in the built environment.
- Toshima Ward Office, Tokyo (JP), 2015. Design: Kengo Kuma & Associates. Picture: ©Kawasumi, Kobayashi Kenji Photograph Office.

WG5: PV in grids

- Objectives
  - Contribute towards PV systems that are better integrated into the grid, that perform better, and whose operation under real-world conditions is better understood.
- Research topics
  - PV power forecasting
  - PV power fluctuations for grid operators
  - PV power quality in the grid
  - PV energy storage and management strategies
  - PV performance and fault detection
- Team
  - Leader: Jonathan Leloux
  - 27 members



Median Absolute Deviation (MAD) of Capacity Utilization Ratio (CUR) between PV production of neighbouring installations

Future outlook

- **Workplans** for each Working Group soon available at website
- **Setup of data bank** before end of 2018
- **Seminar** on "**Matching PV data and PV performance research questions**" on 22 October 2018 in Cyprus
- **Training School** on "**Monitoring and simulation of the performance and reliability of photovoltaics in the built environment**" from 23-26 October 2018 in Cyprus
- **Workshops** scheduled from 25 February to 1 March 2019 in Lisbon
- Contribute to **survey on PV simulation tools** through weblink at website:

https://www.pearlpv-cost.eu/activities/contibute-to-pearl-pv-surveys/

Want to join PEARL PV?

- Then please fill out the registration form at the website https://www.pearlpv-cost.eu/about/registration/

- Or contact these key persons directly by email:

WG1: Wilfried van Sark, WG2: Gernot Oreski, WG3: Nicola Pearsall, WG4: Alessandra Scognamiglio, WG5: Jonathan Leloux,

Chair: Angèle Reinders, Vice Chair: David Moser

All contact information can be found at https://www.pearlpv-cost.eu/

Newsletter can be downloaded from https://www.pearlpv-cost.eu/dissemination/newsletter/

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Thanks to all.

In particular thanks to all volunteers who execute PEARL PV with great enthusiasm!

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