

IEA PVPS Task 13

Reliability and Performance of Photovoltaic Systems

Gabi Friesen, Senior Researcher, SUPSI-PVLab
IEA PVPS Task 15 Workshop, BIPV beyond Task 15, SUPSI, 23 November 2021

Technology Collaboration Programme
by IEA

8 Active PVPS Tasks...



- Task 1 - Strategic PV Analysis and Outreach
- Task 12 - PV Sustainability
- **Task 13 - Reliability and Performance of Photovoltaic Systems**
- Task 14 - Solar PV in the 100% RES Power System
- Task 15 - Enabling Framework for the Acceleration of BIPV
- Task 16 - Solar Resource for High Penetration and Large Scale Applications
- Task 17 - PV and Transport (new 2018)
- Task 18 - Off-Grid and Edge-of-Grid Photovoltaic Systems (new 2019)

... and how they address the TW challenge

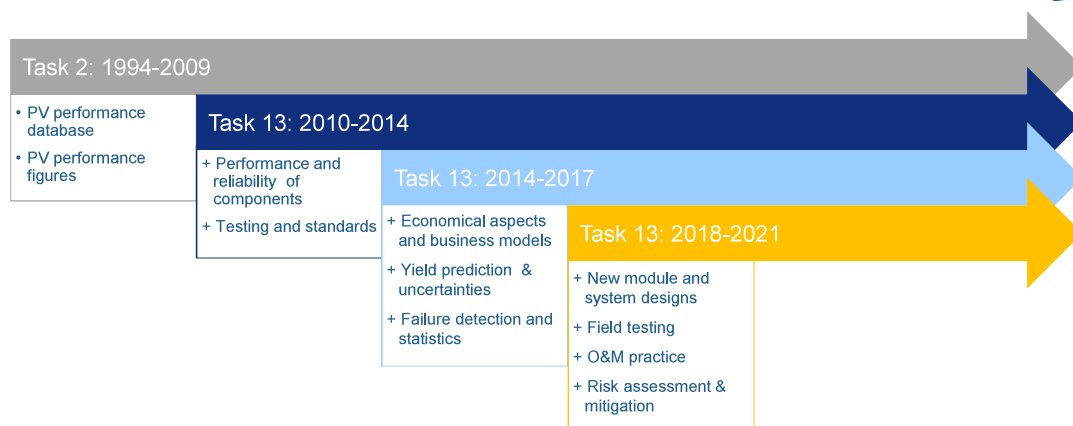


- Task 1 - Understanding markets, business and policy
- Task 12 - Providing facts about PV sustainability
- **Task 13 - Tracking and securing quality and reliability**
- Task 14 - Preparing for 100% renewable energy systems
- Task 15 - Understanding the BIPV market and promoting its dynamics
- Task 16 - Enabling predictable PV production
- Task 17 - Studying an important new field of applications
- Task 18 - Addressing the off-grid challenges

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Task 13 History



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Task 13 History



Task 13: 2018-2021

- + New module and system designs
- + Field testing
- + O&M practice
- + risk assessment & mitigation



<https://iea-pvps.org/research-tasks/performance-operation-and-reliability-of-photovoltaic>

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Task 13 History



Task 2: 1994-2009

- PV performance database
- PV performance figures

Task 13: 2010-2014

- + Performance and reliability of components
- + Testing and standards

Task 13: 2014-2017

- + Economical aspects and business models
- + Yield prediction & uncertainties
- + Failure detection and statistics

Task 13: 2018-2021

- + New module and system designs
- + Field testing
- + O&M practice
- + Risk assessment & mitigation

Task 13: 2022-2025

- + New materials & applications (IPV)
- + Digitalization
- + Climate/environment specific design/testing
- + Techno-Economic key performance indicators
- + Second Life PV
- + PV & storage

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New Task 13 Structure/Consortium (2022-2025)

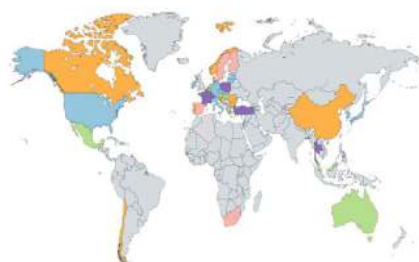


Reliability and Performance of PV Systems

ST1: Reliability of novel PV materials, components and modules

ST2: Performance and durability of PV applications

ST3: Techno economic key performance indicators



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50 other organizations from 21 countries

Task Manager

Ulrike Jahn
Boris Farnung

VDE RENEWABLES

Subtask leaders

ST1 Marc Köntges

ISFH

ST2 Anna Heimsath

Fraunhofer
ISE

ST3 David Moser

eurac
research

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New Task 13 Workplan + Task 15 Synergies



Subtask / Activity

Subtask 1: Reliability of novel PV materials, components and modules

ST1.1 Degradation modes in new PV cell and module technology

ST1.2 Performance and Reliability of Second Life PV

ST1.3 Impact of Testing Strategies including application specific load conditions

ST1.4 Reliability of PV+Storage

Subtask 2: Performance and Durability of PV Applications

ST2.1 Floating PV

ST2.2 Agrivoltaics

ST2.3 Bifacial Tracking Systems

ST2.4 Digital Integration and Digital Twinning

ST2.5 Module Power Electronics Performance and Shading

Subtask 3: Techno-Economic Key Performance Indicators

ST3.1 Severe weather and its impact on PV performance

ST3.2 Guideline for the optimisation of KPIs for specific climatic or environmental conditions

ST3.3 Impact of decisions in PV projects economic KPIs

ST3.4 Mapping economic and reliability KPIs

 Synergies with Task 15

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ST1.1 Degradation modes in new PV cell and module technology



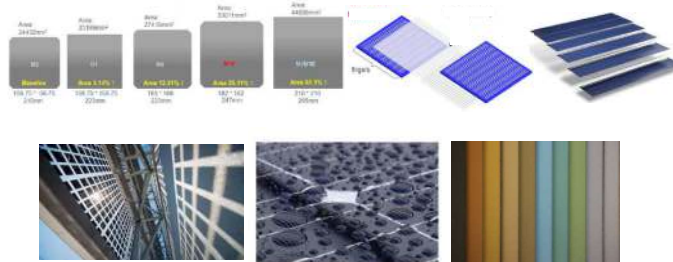
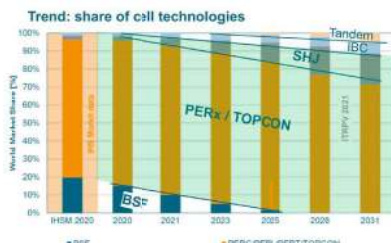
Lead: **Marc Köntges** (ISFH, DEU) Co-Lead: **Jay Lin** (PV Guider Consultancy, TWN)

Contributors: AUT (AIT, OFI, PCCL), BEL (IMEC), CHN (IEE-CAS), DNK (Sicon), FIN (TUAS), FRA (EDF, CEA INES), DEU (TUV), NOR (IFE), CHE (BFH, CSEM, SUPSI), USA (CWRU, NREL, SNL)

Activity focus:

Degradation modes of new materials and technological changes

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ST1.3 Impact of load factors. The future of accelerated testing



Lead: **Karl Anders Weiß**, (FH-ISE, DEU) Co-lead: **Laura Bruckman** (CWRU, US)

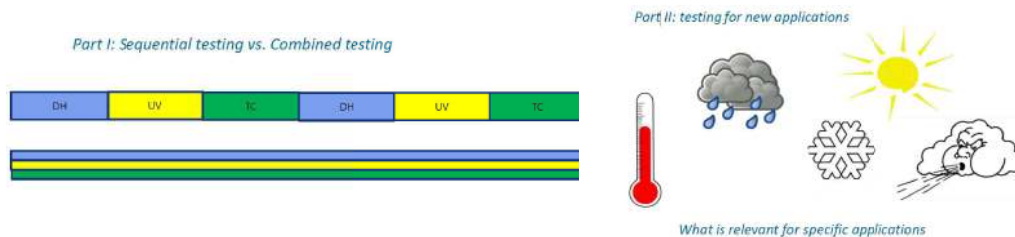
Contributors: AUT (AIT, OFI, PCCL), FIN (TUAS), FRA (CEA INES, EDF), ITA (EURAC), JPN (AIST), NLD (UU), NOR (IFE), CHE (SPF, CSEM, SUPSI), USA (CWRU, DuP, NREL, SNL)

Activity focus:

Provide a global survey of technical efforts aimed to:

- improve testing strategies and significance of tests.
- define tests for emerging PV applications with specific load conditions.

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ST2.4 Digital Integration and Digital Twinning



Lead: **Christian Schill** (ISE, DEU) Co-Lead: **David Moser** (EURAC, ITA)

Contributors: MU (AUS), EDF (FRA), ISFH (DEU), HZB (DEU), EURAC (ITA), IFE (NOR), RSE (SWE), checkwatt (SWE), ZHAW, SUPSI, BFH (CHE), KMUTT (THA), CWRU (USA)

Activity focus:

- Agree on definition, methodologies which lead to interoperability between platforms and data repositories
- The role of digitalization in the PV sector
- Digital Twinning of PV Power Plants as a concept to support O&M

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ST2.5 Module power electronics performance and shading

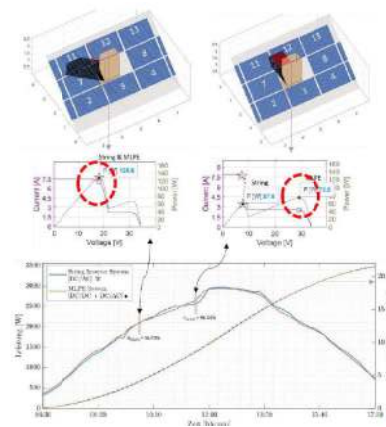


Lead: **Franz Baumgartner** (ZHAW, CHE) Co-Lead: **Roland Bründlinger** (AIT, AUT)

Contributors: Uni Utrecht (NDL), RISE, CHECKWATT (SWE), SUPSI (CHE), NREL (USA)

Activity focus:

- Concepts of system performance comparison of MLPE and string inverter
- Simulation of typical shading PV systems
- Indoor laboratory measurement concepts
- Comparison of PRO and CONS beyond performance (reliability, costs (link to ST3), etc.)



F. Baumgartner, EUPVSEC 2021

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ST3.2 Guideline for the climate specific optimisation of PV system KPIs



Lead: **Gabi Friesen** (SUPSI, CHE) Co-Lead: **Gernot Oreski** (PCCL, AUT)

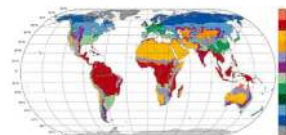
Contributors: AUT (AIT, OFI), CHL (ATAMOSTEC), DEU (ISE), SWE (MDH, RISE), CHE (BFH), USA (CWRU, SNL)

Activity focus:

- Classification of PV climates and environments (micro-climates)
- Listing of standard key performance indicators (E, PLR, LCOE, O&M costs, ...)

Review of climate/micro-climate specific:

- KPI's beyond electrical performance, reliability and costs
- weaknesses in module/system design which influences the KPIs
- strategies for the optimisation of KPIs with examples/case studies



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ST3.3 Impact of decisions in PV projects economic KPIs



Lead: **Ulrike Jahn** (VDE, DEU) Co-Lead: **David Moser** (EURAC, ITA)

Contributors: BEL (tractebel), DNK (SiCon), FRA (CEA INES), DEU (ISE, TUV), ITA (GSE), ESP (UJAEN), SWE (MDH), USA (SNL)

Activity focus:

- Identification of decision steps along the value and supply chain
- Definition of techno-economic KPIs
- Creation of decision matrices of typical economic and technical key performance indicators
- Assessment of the value of digitalisation in PV projects
- Identification of high/low performing assets and try to understand the impact of decisions on economic KPIs

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Task Collaboration



Persons

- Joint members

AIST, AIT, ENEA, EURAC, FH-ISE, IFE, MDU, OFI, RISE, SUPSI, TNO, UU,

Meetings/Events

- Organization of joint Task meeting in 2023
- Organization of joint topic-specific workshops

Technical Reports

- Early share of report production plans (index)
- Cross-referencing of reports
- Cross reviews of technical reports

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Thank you for your attention



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