A Quest for Quality – From Technology to Energy Systems

Becquerel Prize Acceptance - Ulrike Jahn

38th EU PVSEC, 6th September 2021
Solar PV is now the cheapest source of electricity in most countries in part due to low cost financing and is set to triple before 2030 under current and proposed policies, with the potential to grow much faster.
Working along the value chain

PVPS expertise & outreach

1. Concepts
2. Technologies
3. Solutions
4. Applications

Research | Components | Systems | Integration | Market
Task 2
15 MW/a

Task 13
139 GW/a

Approximate efficiency potential for cells and modules in commercial production

©Michael Woodhouse, Launch Webinar of the 2021 ITRPV report, April 29th 2021
PV towards decreasing record prices and LCOE

Impact of reliability on LCOE

Which are the drivers for cost-effective increase of performance & reliability?

Impact of weighted average cost of capital, capital expenditure, and other parameters on future utility-scale PV levelised cost of electricity

Graph courtesy of Dr. David Moser, Eurac research
Early Movers: Task 2 in 2001

5th IEA PVPS Task 2 Experts’ Meeting
Yokohama, Japan, 19-22 September 2001:
10 experts from 6 countries
... Task 13 delivering technical reports

17th IEA PVPS Task 13 Experts’ Meeting, Cologne, Germany, October 2017: 45 experts from 20 countries
Technical Reports (2018-2021)

Uncertainties in Yield Assessments and PV LCOE 2020

Climatic Rating of Photovoltaic Modules: Different Technologies for Various Operating Conditions 2020

Assessment of Performance Loss Rate of PV Power Systems 2020

Bifacial Photovoltaic Modules and Systems: Experience and Results from International Research and Pilot Applications 2021

Performance of New Photovoltaic System Designs 2021

Designing New Materials for Photovoltaics: Opportunities for Lowering Cost and Increasing Performance

Qualification of Photovoltaic (PV) Power Plants using Mobile Test Equipment

Service Life Estimation for Photovoltaic Modules 2021

Quantification of Technical Risks in PV Power Systems 2021

Guidelines for Operation and Maintenance of Photovoltaic Power Plants in Different Climates 2021

Challenges for new materials and components

External and internal stress factors influence performance and long-term reliability of PV modules.

The materials in PV modules have to withstand extremely challenging micro-climatic conditions.

Challenges for new materials and components

- Adhesion - delamination
  - Long-term stability is determined by bill of materials and their material interactions.
  - Each material combination to be tested thoroughly before introduction into the market
  - Single stress testing does not reveal certain degradation modes observed in the field.

- Backsheet yellowing

- Corrosion

Constant need for adaption of test methods and standards

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Technical Reports (2018 - 2021)

- Uncertainties in Yield Assessments and PV LCOE
  2020

- Climatic Rating of Photovoltaic Modules: Different Technologies for Various Operating Conditions
  2020

- Assessment of Performance Loss Rate of PV Power Systems
  2020

- Bifacial Photovoltaic Modules and Systems: Experience and Results from International Research and Pilot Applications
  2021

- Performance of New Photovoltaic System Designs
  2021

- Designing New Materials for Photovoltaics: Opportunities for Lowering Cost and Increasing Performance through Advanced Material Innovations
  2021

- Qualification of Photovoltaic (PV) Power Plants using Mobile Test Equipment
  2021

- Service Life Estimation for Photovoltaic Modules
  2021

- Quantification of Technical Risks in PV Power Systems
  2021

- Guidelines for Operation and Maintenance of Photovoltaic Power Plants in Different Climates
  2021

Quantification of Technical Risks

Review methods to compare and assess common practice

Key Definitions

Semi-Quantitative Methods

Quantitative Methods

Risk Mitigation Measures

Limitations and Challenges

Common Practice

Risk Analysis

Cost-Benefit Analysis

Quantification of Technical Risks

Create and maintain a technical risk database

- Overview of technical risks
- Definition of failure fact sheets (PVFS)
- Empirical risk data
- Statistical risk data
- Modeling approaches

Common Practice

Risk Analysis

Cost-Benefit Analysis

Quantification of Technical Risks

Assess the economic impact of risks and the effectiveness of mitigation measures

Overview of O&M measures

Costs of O&M measures

Strengths and weaknesses

Quantification of the effectiveness

Common Practice

Risk Analysis

Cost-Benefit Analysis


Setting the scene: PV is moving in ...

Digitalization is the driver to ensure cost-effective increase of quality

Solar Bankability must be data-driven

Data-driven evaluation of techno-economic performance indicators
Challenge 2 – Lifetime, reliability and sustainability enhancements

- Reliable generation of TWh of electricity for an extended lifetime.
- Ensure sustainability from energy, environmental and investment viewpoint.
- Circular economy and renewable, clean energy need to go hand in hand.
- Higher performance and reliability in the field is a constant demand from the industry.
- Updated solutions and services to capture innovation trends.
- New technologies may introduce new degradation modes once in the field.

Lead: David Moser, Andreas Wade
Thank You
Thank You

Task 13 Online Meeting 2020: 60 experts from 24 countries
Thank you
Thoughts to share

- A crucial time when PV really matters
  - for climate change: climate neutrality by 2050
  - for future generations: 100% Renewables (Act NOW!)

- PV is the key for the sustainable energy transition:
  - support the development of production capacities "made in Europe"
  - develop circularity of the PV systems’ various components
  - make solar PV readily available for a range of applications

- “Solar Energy = the Citizen’s Energy…” ¹)

¹) Prof. A. Goetzberger; Keynote Speech of Becquerel Prize awardee, 1997
PV to bring electricity to rural and urban households

Electricity is a crucial for
- poverty alleviation
- economic growth
- improved living standards

PV to provide minimum level of electricity for
- health facilities
- small enterprises
- education & information

770 million people without access to electricity in 2019 (10% )
Thank You

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