Taking Control of Risk in Solar Investments

Boris Farnung, May 10, 2022

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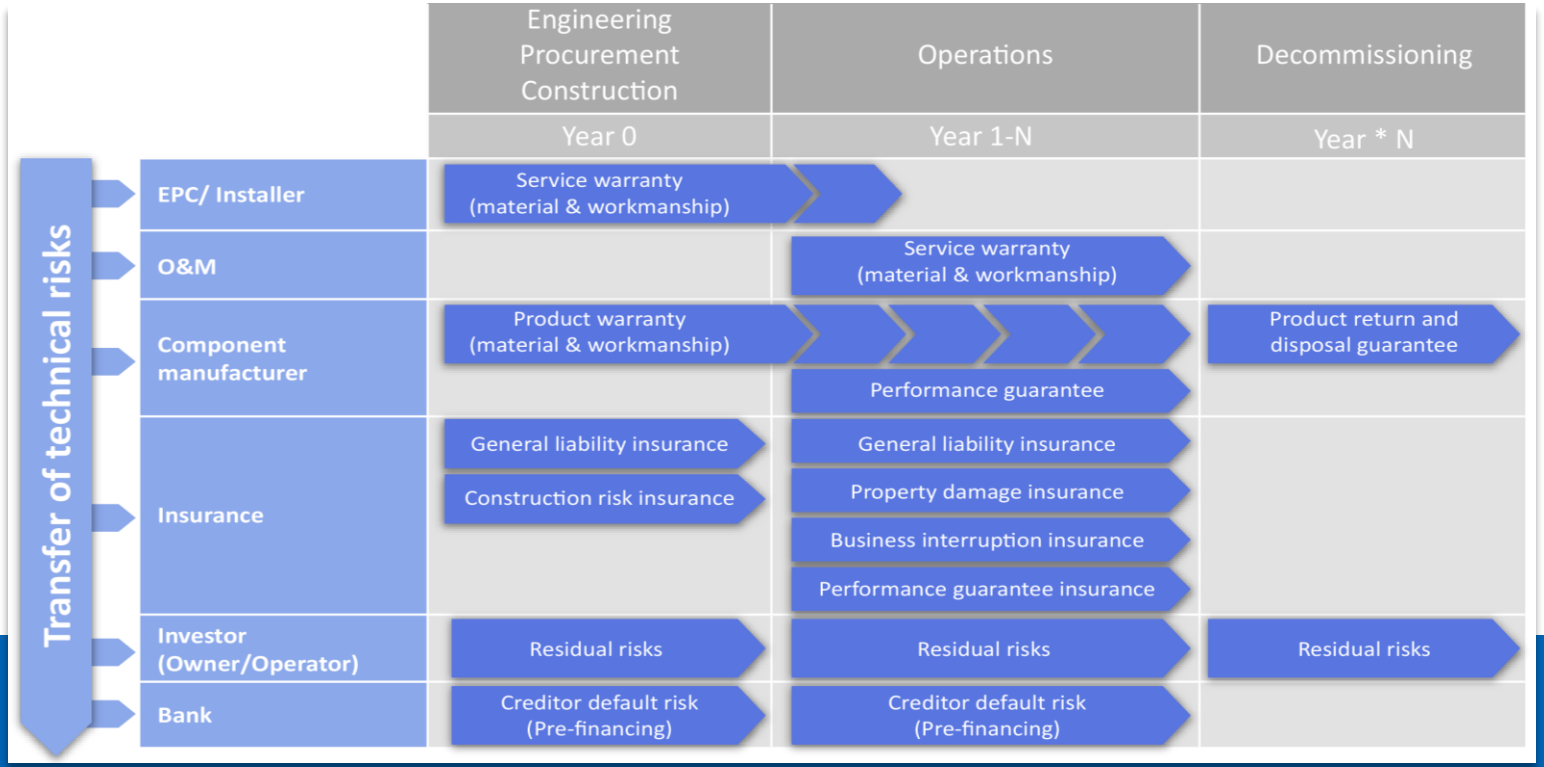
Potential Plan to transfer technical PV Project Risk



M. von Armansperg et al., “Technical Bankability Guidelines - Recommendations to Enhance Technical Quality of PV Investments,”, Feb. 2017

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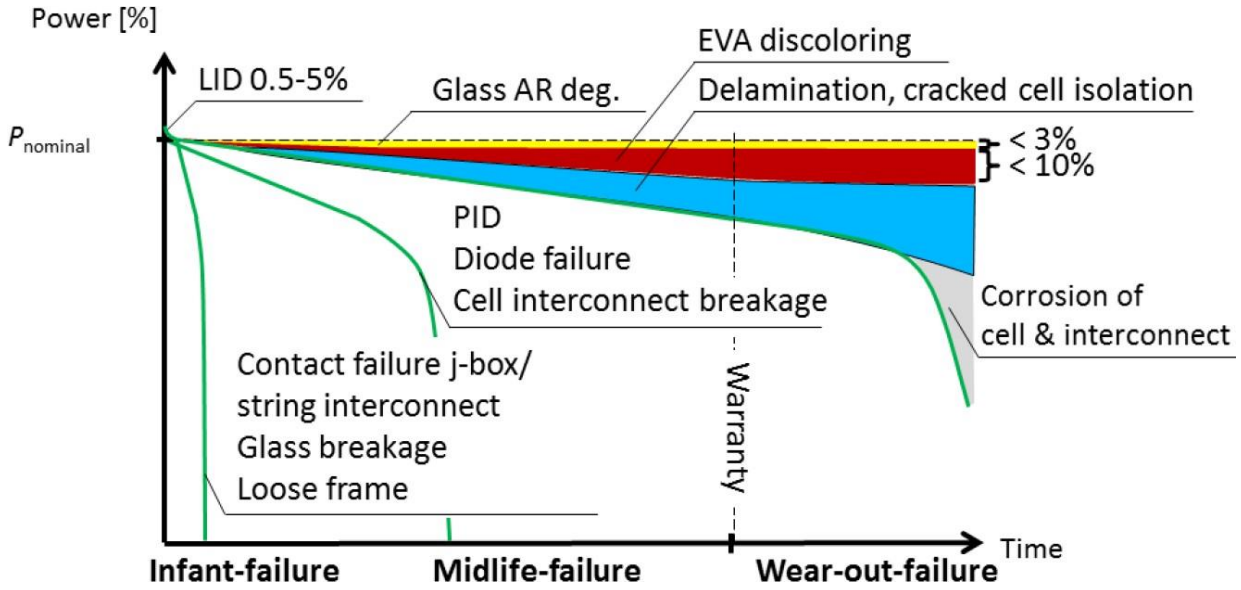
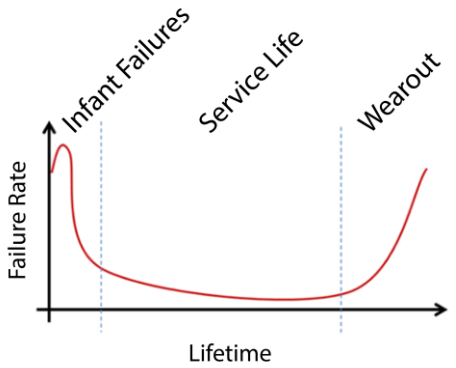
Durability: Failure scenarios of crystalline silicon PV modules





M. Köntges, S. Kurtz, C. Packard, U. Jahn, K. Berger, K. Kato, T. Friesen, H. Liu, and M. van Iseghem, "Review of Failures of Photovoltaic Module". Report IEA-PVPS T13-01:2014

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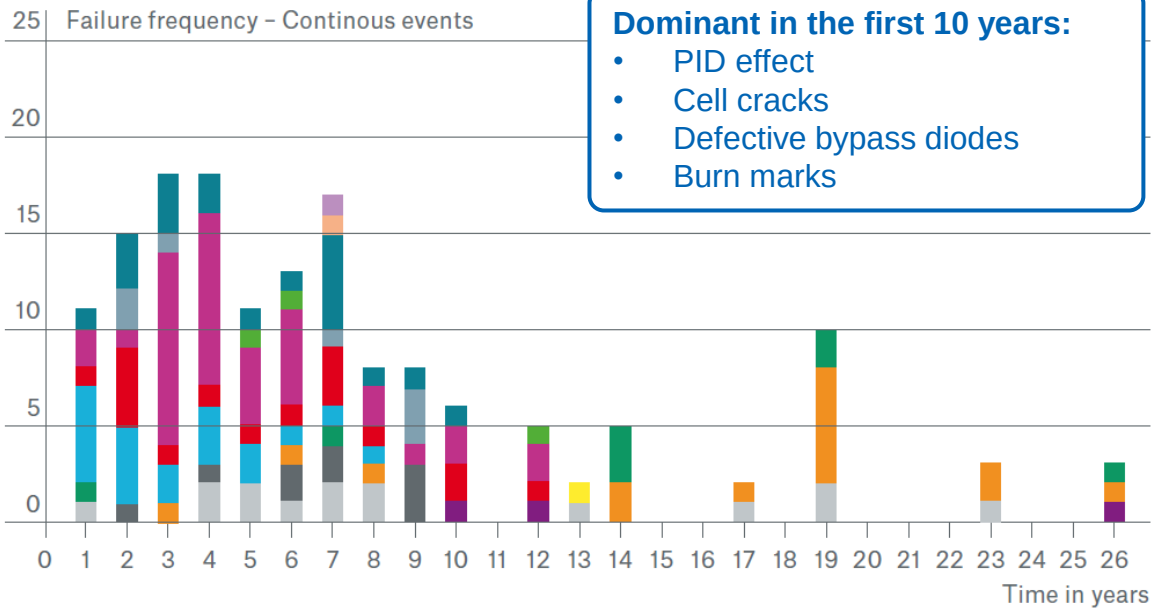
Frequency of PV module failures affecting system performance

- Delamination
- Defect backsheet
- Defect junction box
- Junction box detached
- Discolouring of pottant
- Cell cracks
- Burn marks
- Potential included shunts PID
- Potential included corrosion
- Disconnected cell or string
- Defective bypass diode
- Corrosion/abrasion of AR coating
- Isolation failure
- CdTe: back contact degradation



Dominant in the first 10 years:

- PID effect
- Cell cracks
- Defective bypass diodes
- Burn marks

M. Köntges, G. Oreski, U. Jahn, M. Herz, P. Hacke, K. A. Weiss, G. Razongles, M. Paggi, D. Parlevliet, T. Tanahashi and R. H. French. “Assessment of Photovoltaic Module Failures in the Field”. Report IEA-PVPS T13-09:2017

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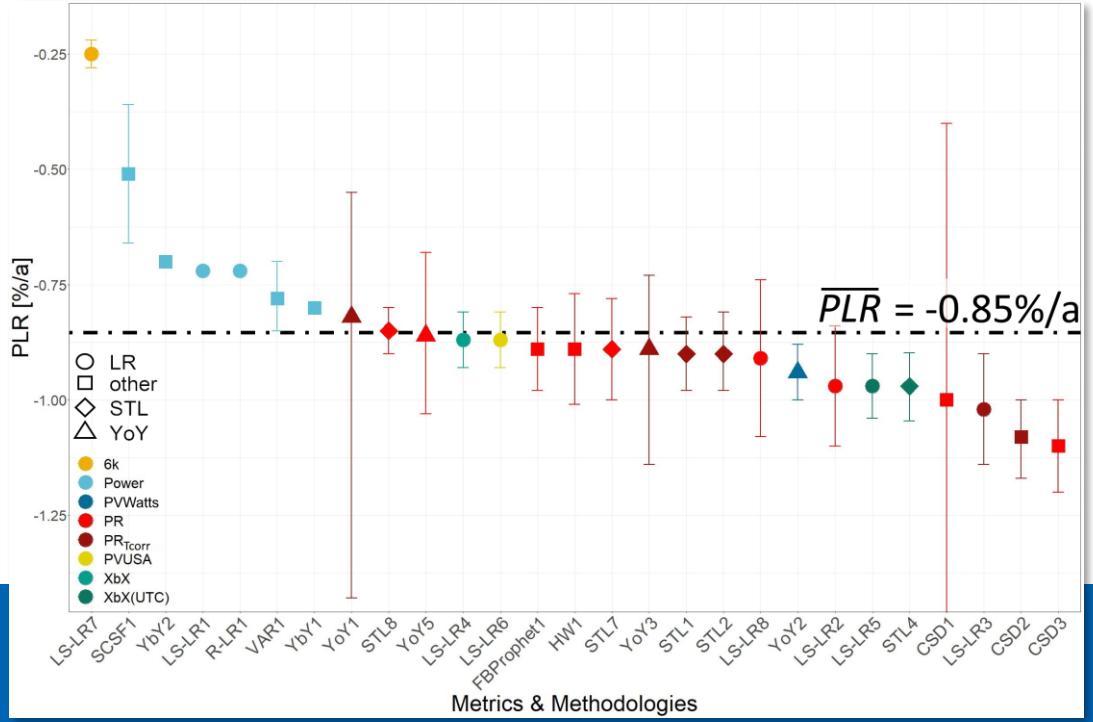
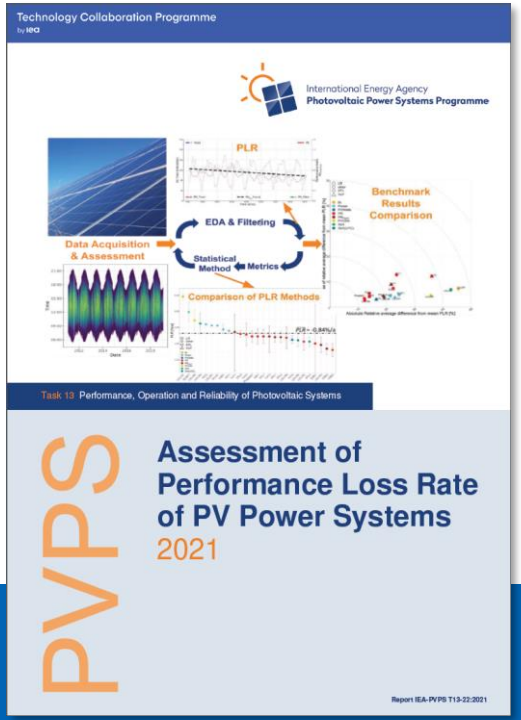
Detection methods – Performance Loss Rate (PLR)





Link to the report: https://www.vde.com/renewables/newsroom/iea-pvps-task-13/performance-loss-rate-pv-power-systems

A. J. Curran, T. Burleyson, S. Lindig, D. Moser and R. H. French, (2020). "PVplr: Performance Loss Rate Analysis Pipeline." R package version 0.1.0. https://CRAN.Rproject.org/package=PVplr

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Detection methods

When a failure occurs, e.g. performance deviation beyond allowed threshold or inverter error code generated. **An alarm is triggered**

Acknowledgement of the fault by the O&M Contractor. **A maintenance ticket is opened**

The technician arrives on-site with all the tools and spare parts needed to fix the problem

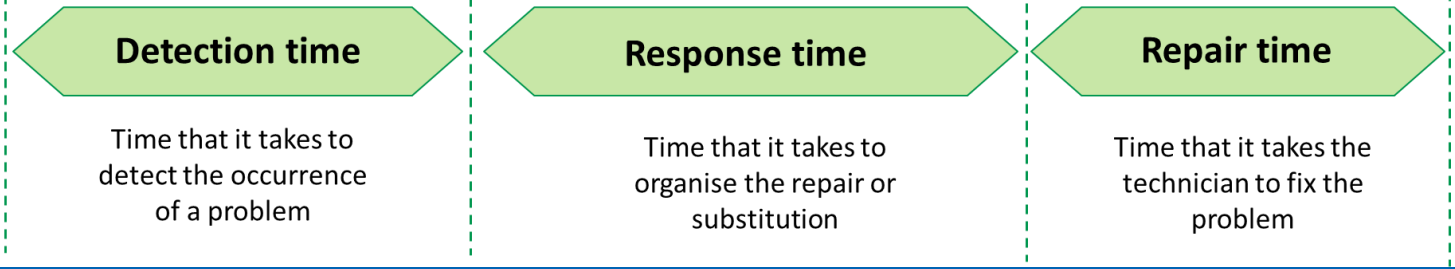
Problem fixed and acknowledged by the O&M Contractor. **The maintenance ticket is closed**

failure time

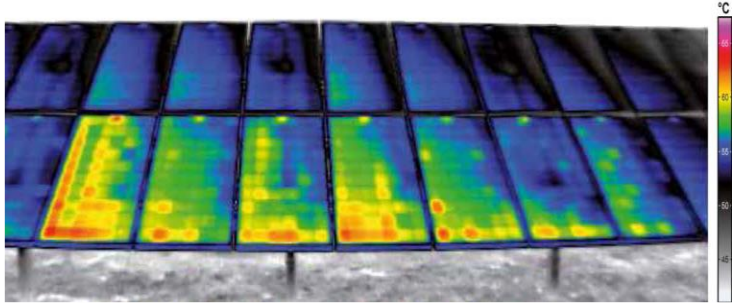
acknowledgement time

intervention time

resolution time



Detection methods in the field



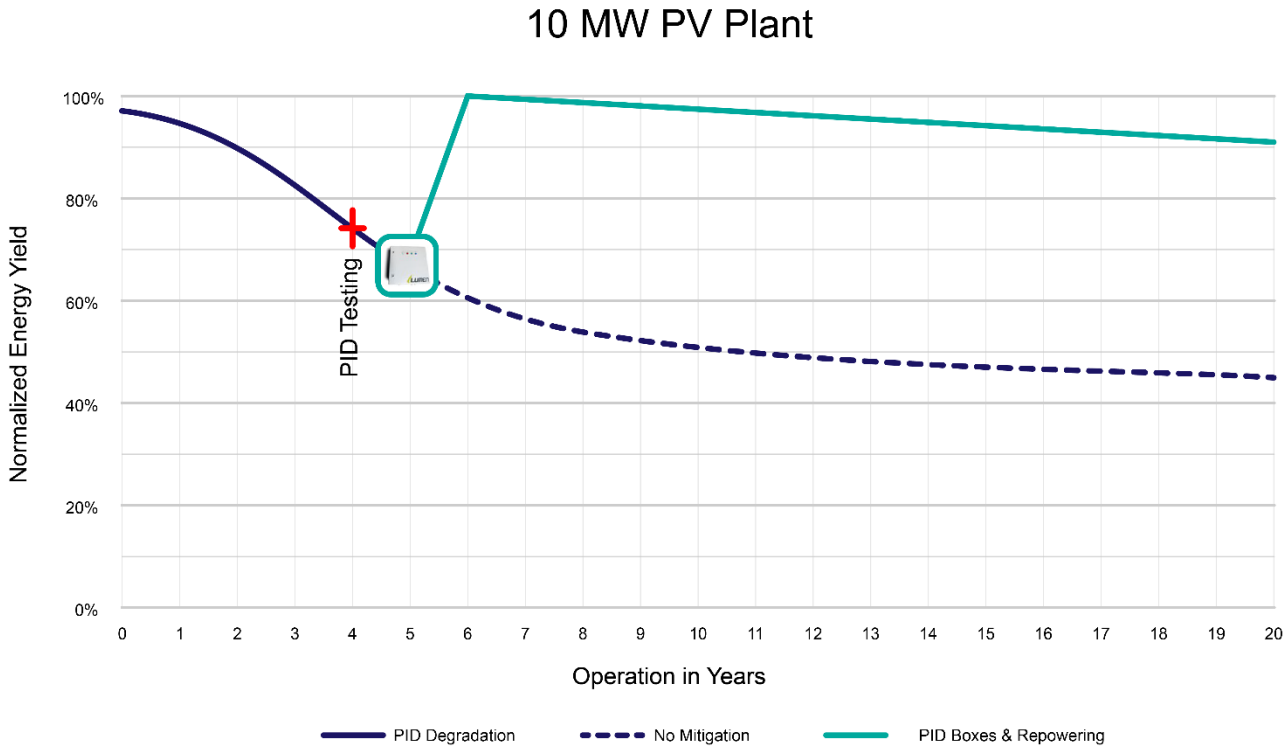
(Quelle: SOLON)

Drone-mounted
IR & EL imaging of
PV modules & arrays

Outdoor PL imaging
of PV modules

M. Herz, G. Friesen, U. Jahn, M. Köntges, S. Lindig, D. Moser, “Quantification of Technical Risks in PV Power Systems”. Report IEA-PVPS T13-23:2021. ISBN 978-3-907281-11-6.

Case study: PV power plant with PID-affected PV modules



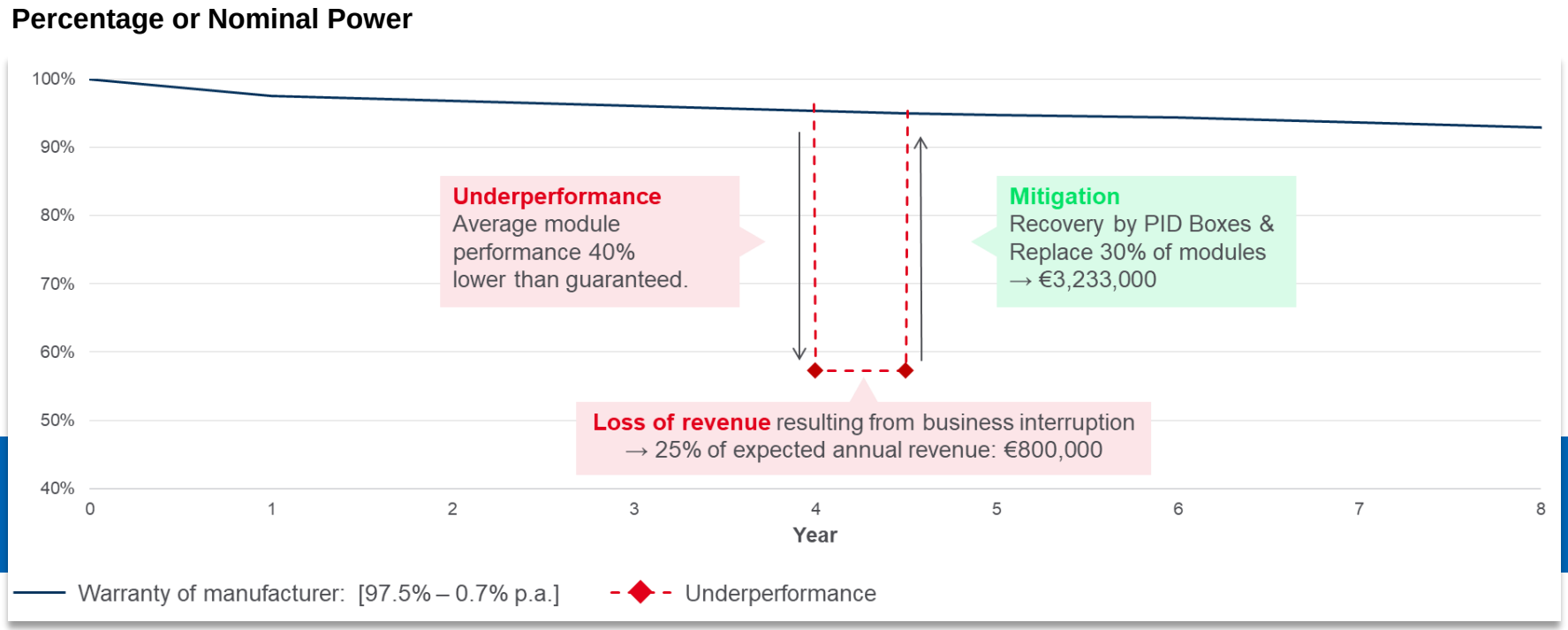
Mitigation measures:
MM1 = PID boxes
MM2= Repowering (30% PV modules)

Calculated energy yield in 20 years:
45% of rated energy output

M. Herz, G. Friesen, U. Jahn, M. Köntges, S. Lindig, D. Moser, “Quantification of Technical Risks in PV Power Systems”. Report IEA-PVPS T13-23:2021. ISBN 978-3-907281-11-6.

Case study: PV module warranty, losses and mitigation costs

Munich RE



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Ulrike Jahn, Dr. Ronald Sastrawan, Simone Steinbach: How to safeguard the long-term profitability of solar PV investments with quality assurance and PV Warranty Insurance; 04/2022

Case study: What is the loss covered under the warranty?

Maximum eligible loss amount

Munich RE

Depreciated value of all defective modules

Park value		Defective modules		Depreciation		
€16m	×	30%	×	(1 – 4 years × 4%)	=	€4,032,000

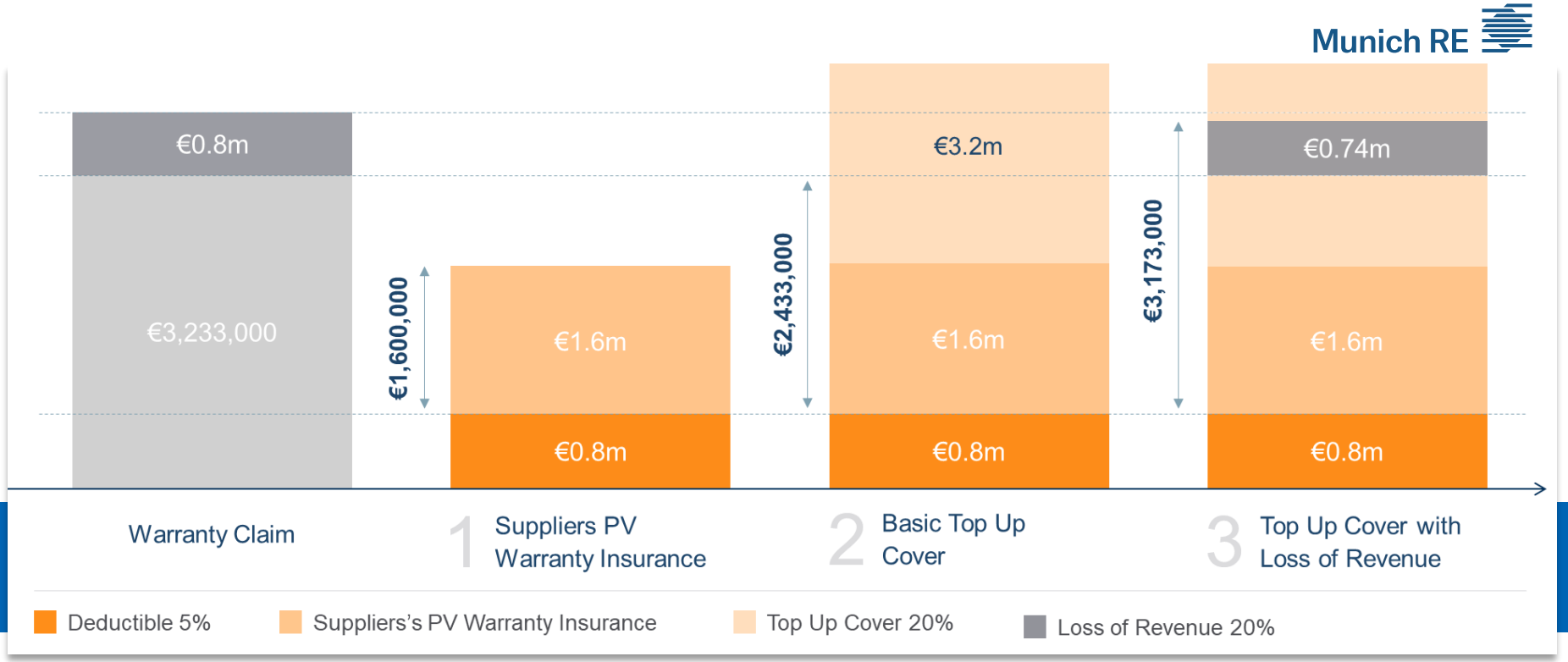
Costs of purchasing additional modules to compensate under-performance

Guaranteed Wp in Year 4		Underperformance below warranty		Market price per Wp in Year 4		
9.54 MWp	×	40%	×	€0.97	=	€3,701,520

Mitigation measure costs of **€3,233,000** are covered under the maximum warranty payout of **€3,701,520**

Ulrike Jahn, Dr. Ronald Sastrawan, Simone Steinbach: How to safeguard the long-term profitability of solar PV investments with quality assurance and PV Warranty Insurance; 04/2022

Case Study: Different insurance structures support in risk mitigation



Ulrike Jahn, Dr. Ronald Sastrawan, Simone Steinbach: How to safeguard the long-term profitability of solar PV investments with quality assurance and PV Warranty Insurance; 04/2022

Takeaways

to reduce technical risks and ensure investor's return

Independent quality assurance is key in preventing technical risks arising from the enormous cost pressures along the entire PV value chain.

Monitoring, inspection and regular PV module testing during the operational phase are crucial for early detection of underperformance of the PV plant.

The economic impact of technical risks on PV project business models can be quantified not only to determine the impact of failure, but also to assess the effectiveness of mitigation measures.

Insurance provides a benefit for project developers and investors as it reduces the risk substantially as shown in the case study, by asking the right questions.

Thank You
for Your Attention!

Your Contact:

Boris Farnung

Head of Division
Power Plants and Systems

Tel. +49 170 57 63 795
boris.farnung@vde.com

Visit us at

inter solar
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