

# Safeguarding Solar PV Revenues



## PV Modules Degradation, O&M Costs and LCOE

Learn how to avoid the high cost of module degradation

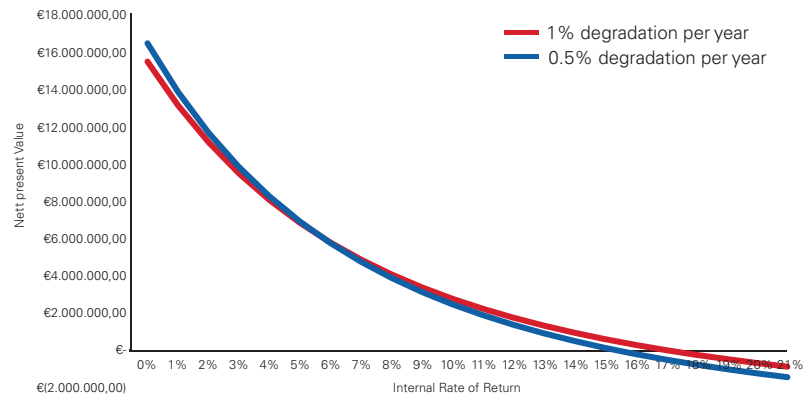
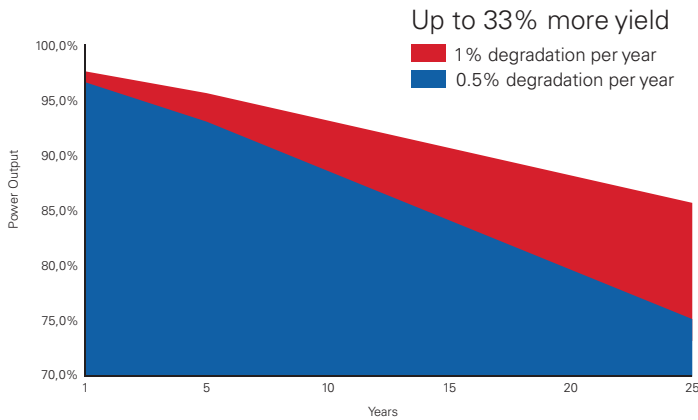
Insights from Marcello Passaro



# Safeguarding Solar PV Revenues



Bright solar PV future



**Less degradation generates more yield**

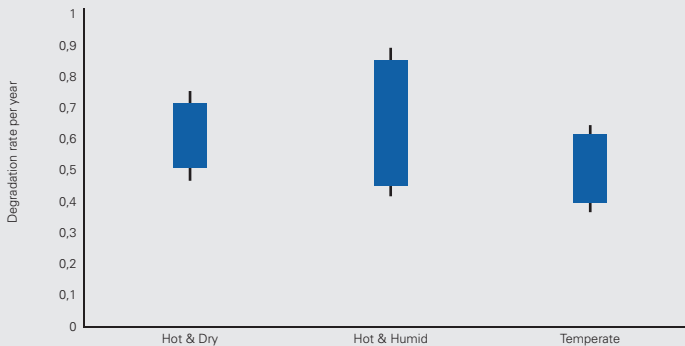
**5.4% higher Net Present Value from 1% to 0.5% annual degradation**

# Safeguarding Solar PV Revenues

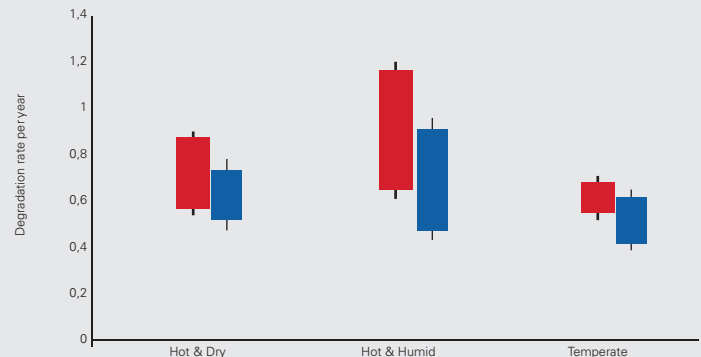


To profit you must mitigate technical risks

**"Median degradation is 0.57%"**



**Degradation varies by climate**



**Up to 23% higher degradation rates with hot spots**

**Note:** hot spots are the leading failure mode in PV modules over time (see poster #2-2021)

Variations depend on bill of materials, age of system, type of technology, production quality, installation quality, maintenance, handling, LID/LeTID & PID impact, site conditions & climate.

# Safeguarding Solar PV Revenues



As it may result in extensive losses

**No** mitigation measures may lead up to **8% more LCOE\***



Up to **0.0002437** LCOE delta between 1% vs 0,5% degradation

\*Levelized cost of energy [EUR/kWh] = (CAPEX+OPEX/Lifetime kWh)

***True LCOE calculations should incorporate operational lessons learnt***

# Safeguarding Solar PV Revenues



## Case Study

**"PV module degradation may not always be linear; impacting operations & maintenance. In turn, lowering gross revenue and shrinking O&M budgets"**

**Note:** degradation modes may compound and exacerbate the overall degradation rate

# Safeguarding Solar PV Revenues



Mitigate these risks by:



Batch Testing



Site Specific Testing



Accelerated Lifetime Testing



LID/PID/LeTID testing



Pre-Shipment Inspections



O&M Selection

# Safeguarding Solar PV Revenues



Added value of mitigating risks

Up to  
**3.2**  
EUR/kWp/year  
**SAVED**

# Safeguarding Solar PV Revenues



Find out how Kiwa can be your partner in progress for safeguarding long term solar investments



[solar@kiwa.com](mailto:solar@kiwa.com)



[www.kiwa.com](http://www.kiwa.com)

Subscribe to newsletter



## Sources:

Solar Bankability, Minimizing Technical Risks in Photovoltaic Projects, 2017

NREL, Photovoltaic Failure and Degradation Modes, 2014

EEE, Impact of Degradation Rates on Solar PV Financing, 2017

University of Huddersfield, Photovoltaic Degradation Rate Affected by Different Weather Conditions, 2020

IEA PVPS, Review of Failures of Photovoltaics Modules, 2014

NREL, Technology and Climate Trends in PV Module Degradation, 2012

OSTI, Photovoltaic Failure & Degradation Modes, 2017

IEA PVPS, Technical Assumptions Used in PV Financial Models, 2017

Utrecht University, An Analysis of Degradation Rates at System Level, 2013

Kiwa field experience and data analytics

PVEL data analytics & testing

Co-written with:



#03- 2021