AtaMoS-TeC Project: The bifacial institute for desert PV

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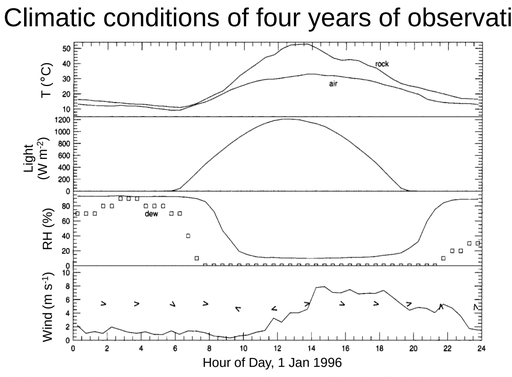
The Atacama Desert

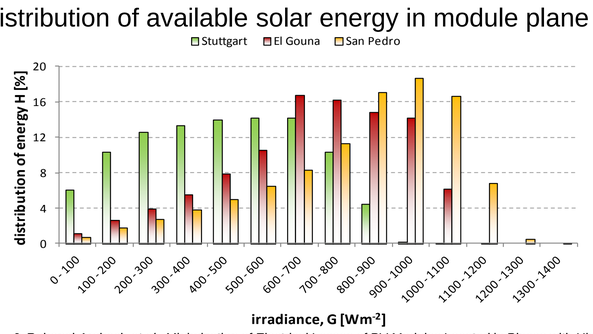
International Standard for PV technologies such as IEC and UL have not been developed for specific applications like extreme climates such as the Atacama Desert, which is well known for extremely high irradiation levels and specific solar spectrum (in particular in the UV-B range), large amount of sun hours per day, clear-sky conditions, low ambient temperature, corrosive environment, partial high humidity ("camanchaca") and a sticking fine dust ("chusca"). Therefore the PV system performance and longevity is strongly affected, and the Standards are only partly applicable to determine the module reliability and durability against climatic impacts. The high albedo of desert sand in combination with the high levels of solar irradiation, makes bifacial glass-glass modules a very promising option.

Climatic conditions of four years of observations



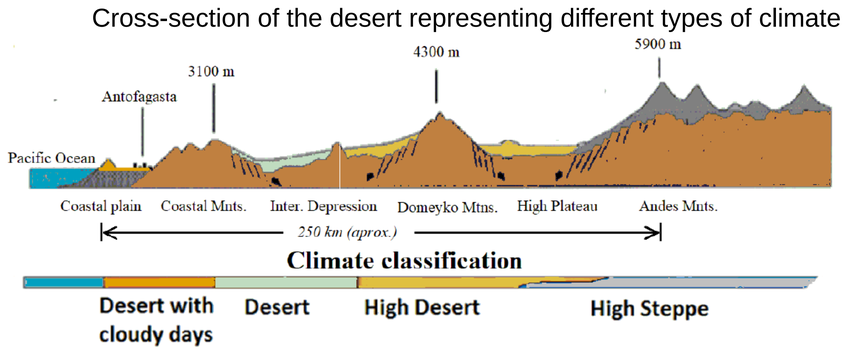
C. P. McKay, C. P. *et al.* Temperature and moisture conditions for life in the extreme arid region of the Atacama desert, *Astrobiology* **3,** 393–406 (2003).

Distribution of available solar energy in module plane

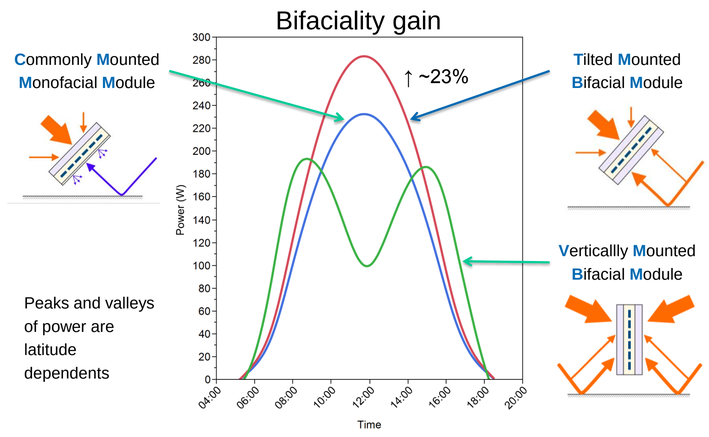


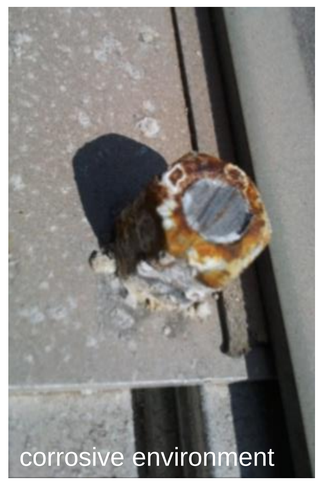
J. Rabanal-Arabach *et al.*, Minimization of Electrical Losses of PV Modules Located in Places with High Solar Irradiance. *Energy Procedia* **77,** 402–406 (2015).

Cross-section of the desert representing different types of climate

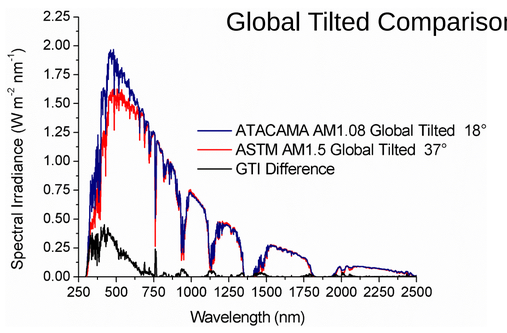


Bifaciality gain





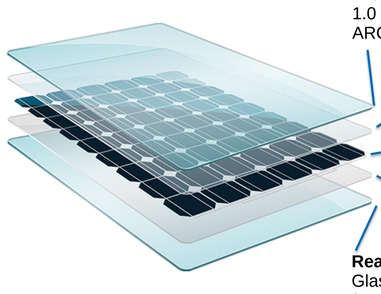
Global Tilted Comparison



A. Marzo *et al.*, Standard or local spectrum. Implications for solar technologies studies, *Renewable Energy* **127**, 871–882 (2018)

Work Packages

- WP0: Coordination
- WP1: Module Development
- WP2: Module Performance Assessment and Labeling
- WP3: Balance of System Component Development
- WP4: O & M Component Development
- WP5: Territorial Characterization
- WP6: Demonstration of PV Systems Under Desert Donditions
- WP7: Optimization and bankability
- WP8: Exploration Models, Entrepreneurship and Technology Transfer
- WP9: Education, Training and Dissemination



Front Glass (mm)
1.0 / 2.0 / 3.2
ARC/ASC/ Holographic Technology

Encapsulant
TPO/ Silicone / no encapsulant

Cells
Bifacial cells
Full / Half / Shingle
nPERT, HET, PERC+

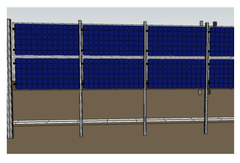
Encapsulant
TPO/ Silicone / no encapsulant

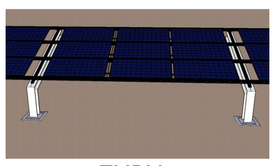
Rear cover
Glass: 1.0 / 2.0 / 3.2
/Transparent Backsheet (TBS)
ARC/ASC/ Holographic Technology

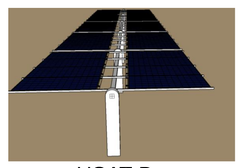
Tasks:
WP1.1 Benchmarking
WP1.2 Interconnection studies
WP1.3 Glass and ARC & ASC optimization
WP1.4 Encapsulation tests and optimization
WP1.5 Frame impact and junction box design
WP1.6 Future module concepts
WP1.7 Module Recycling Concepts
WP1.8 PV module virtual prototype

Requirements for the PV module

Front and back covers	High UV stability	High transmittance	Resistant to abrasion and corrosion	Enduring ARC	Extremely low or null MVTR
Encapsulant	High UV stability	Low light absorption	No formation of acid		
Frame and j-box	Resistant to abrasion and corrosion	No additional optical losses	Proper heat management (j-box)		

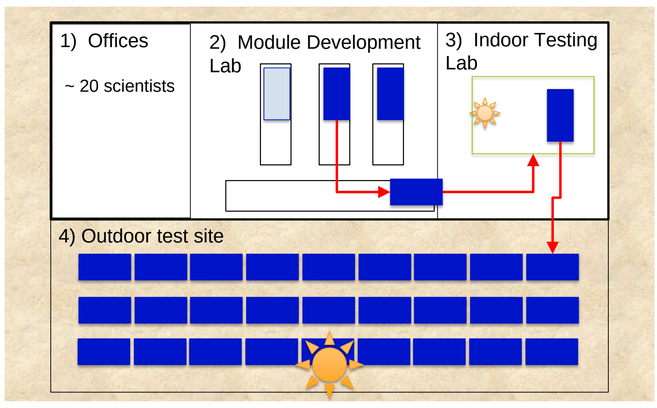

VMBM


TMBM

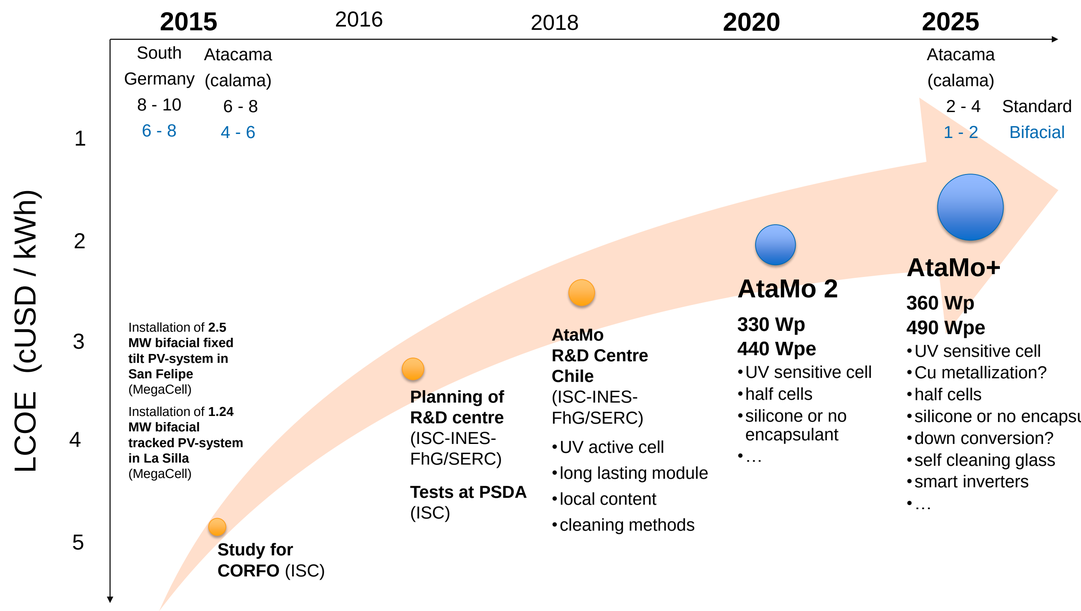

HSAT-B

- Evaluation of 3 different bifacial technologies (**nPERT, HET, PERC+**) installed in 3 types of different structures: **vertical, tilted and one-axis tracker**
- **90 modules of 72 cells based on nPERT, HET, PERC+** and PERC mono (as reference) technologies installed in the **PSDA before December 2018**
- **40 modules of 4 cells based on nPERT and HET** technologies with different types of configurations: Soldering vs gluing, Half vs Full cell design, different encapsulants and glasses, with and without ARC / ASC installed in the **PSDA before December 2018**.
- Other **40 Modules** manufactured for **ultra accelerated indoor tests** to simulate the climatic conditions of the Atacama desert

First bifacial desert PV institute for module and system development



Roadmap



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PROGRAMA ENERGÍA SOLAR
Proyecto apoyado por: CORFO