

Extended degradation tests of NICE modules to investigate long term reliability

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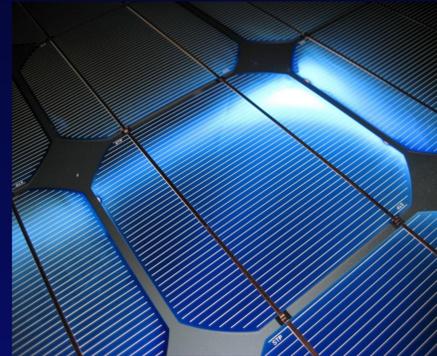
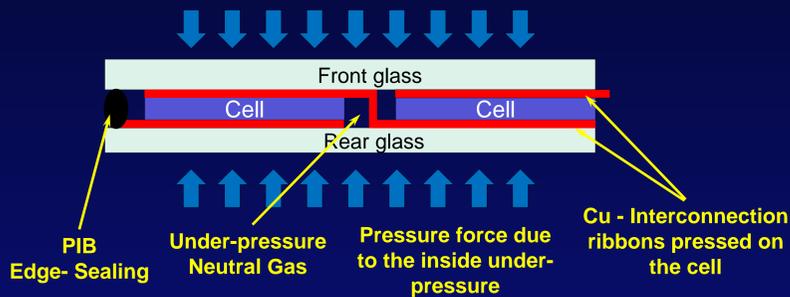
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NICE Module Technology – Overview:

- ❑ Reduced module production costs
- ❑ Expected increased module lifetime: >30 years
- ❑ Compatibility with high efficiency cells

Key benefits :

- ❑ No EVA
- ❑ No Soldering
- ❑ Cost effective
- ❑ Ag-busbar free cells
- ❑ Short production cycle time
- ❑ Full automation
- ❑ Low footprint requirement
- ❑ Low Module R_s



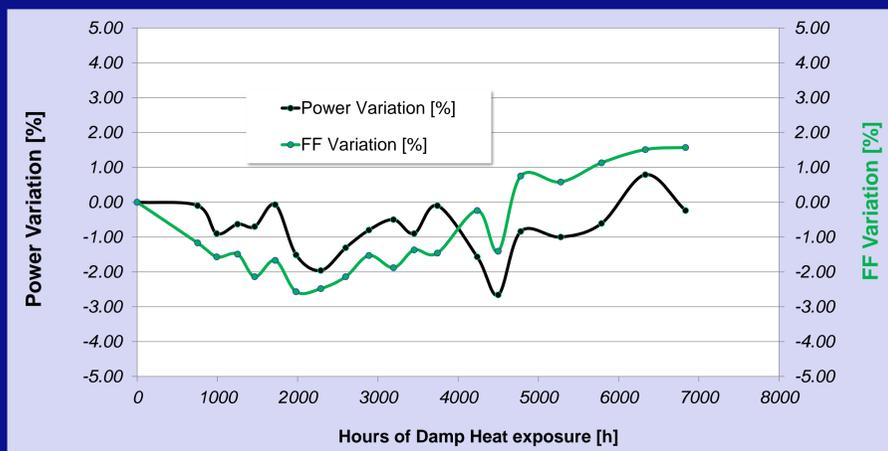
Purpose of this ongoing work:

- Identification and understanding of potential failure modes, particular to NICE modules
- Most suited (combined) degradation tests for NICE modules

Extended Damp Heat Test

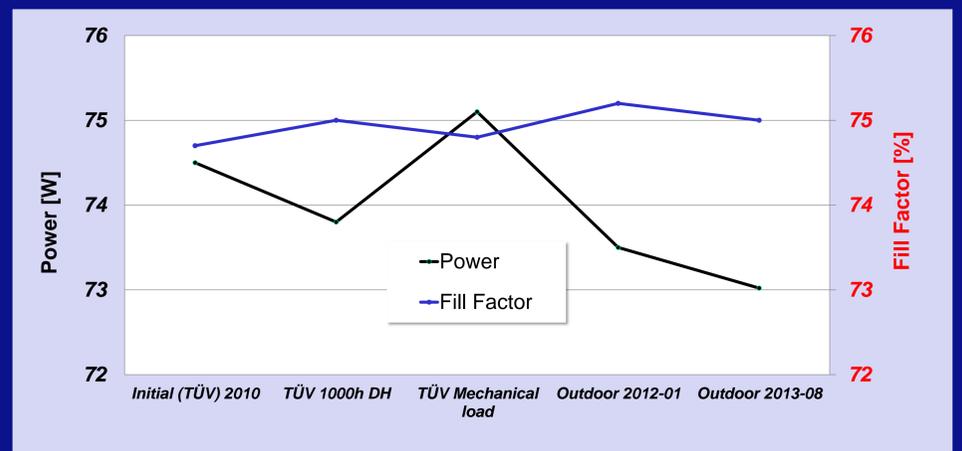
(Collaboration with CEA -INES)

- Conditions:
- Standard NICE Module with Heterojunction solar cells
 - Damp Heat test + regular monitoring (IV, EL)



Field data – longest serving NICE module

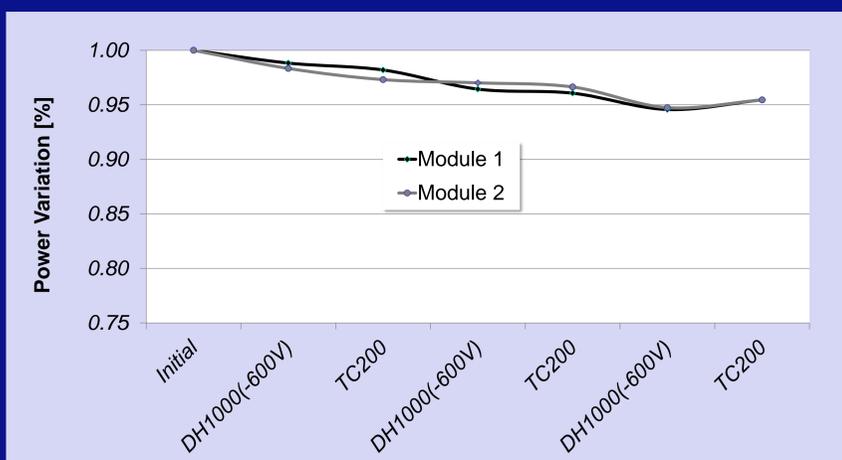
- Conditions:
- 36 cells (multi-c) Module from 1st NICE generation
 - Damp heat and static mechanical load test during TÜV Certification
 - Outdoor exposure for 3 years in France



NREL test-to-failure protocol (PID)

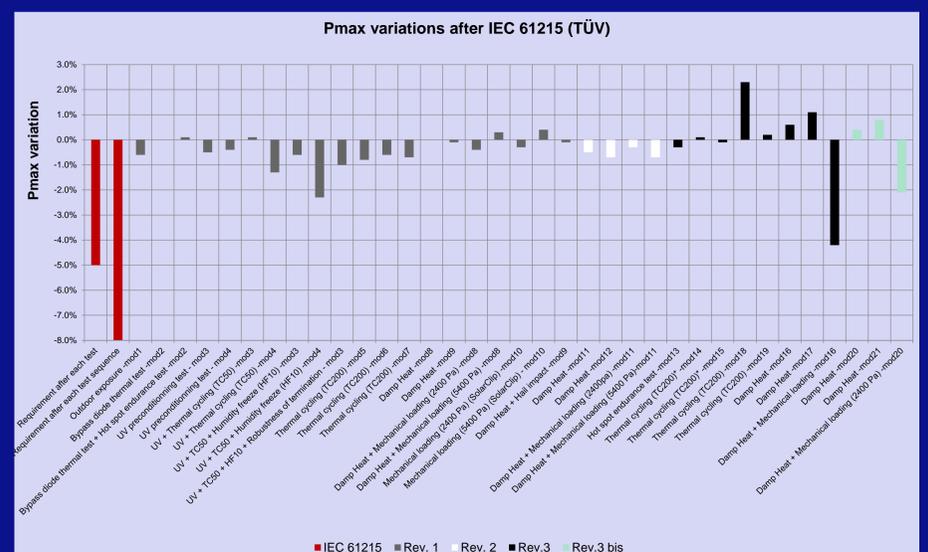
(Collaboration with NREL)

- Conditions:
- 2 NICE 60 cells (multi-c) under test
 - Alterations between 1000 hours Damp Heat @-600V and 200 Thermo Cycle tests (-40°C -> +85°C)
 - Total of 6 rounds during 1 year



Accelerated Ageing Tests/ Certification

- Conditions:
- Different Revisions of NICE modules (rev.2 & 3bis frameless)
 - Cumulated TÜV Certification results according to IEC 61215 and 61730 parts 1 & 2



Conclusion and outlook

- ❑ Moisture ingress and PID excluded as dominating degradation mode on NICE modules
- ❑ More and extended field testing under different extreme climatic conditions foreseen
- ❑ Different combined tests are planned for further investigation of potential degradation modes
- ❑ CEA -INES and NREL are acknowledged for carrying out degradation tests and fruitful discussions

