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PV-MARKET 2016: ROOM FOR INNOVATIONS !

RCT solutions

PV already cheapest energy source in 2016

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Lowest ever solar bids submitted in Abu Dhabi

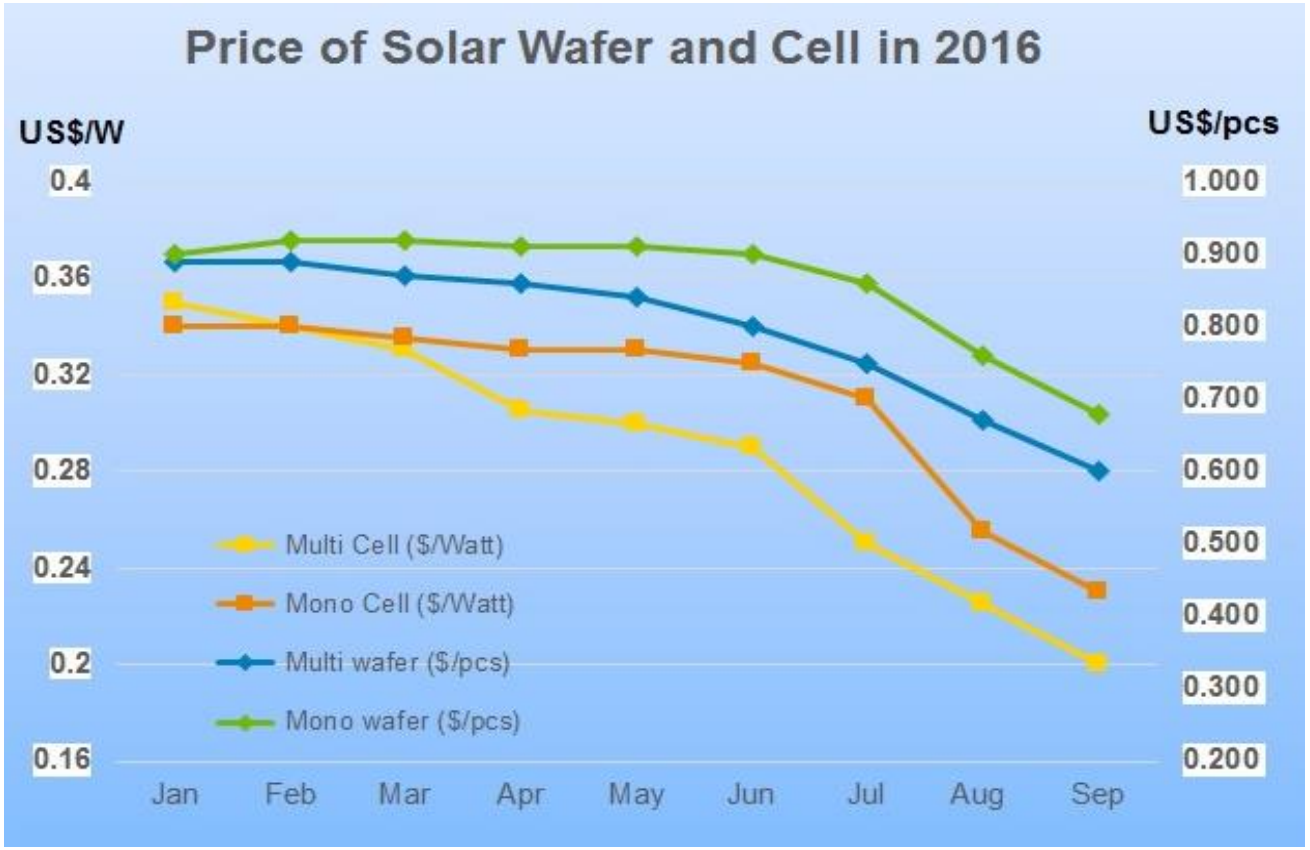
By Tom Kenning | Sep 20, 2016 11:43 AM BST | 0 | Share

Consortium of Marubeni and JinkoSolar has submitted the lowest bid for solar PV capacity. Offering In Sweihan, United Arab Emirates

a 350 MW solar plant for 2.4 $ct/kWh

www.
PV-tech.org/

But: Another PV crisis in 2016…



www. **pvinsights**.com/

- Prices dropped since mid of 2016
- PV in crisis again
- Cell and module manufacturers produce at low capacity utilization
- Many modules on stock, many companies in trouble

PV Systems: Levelized Cost of Electricity (Systems >100kWp)

Calculated LCOE values for different insolation conditions. Financial conditions: 80% debt, 5%/a interest rate, 20-year loan tenor, 2%/a inflation rate, 25 years usable system service life.

Source: ITRPV roadmap

- LCOE reduction = key for future success of PV
- LCOE
  → 2016: 4.4 - 9 $cent
  → 2026: 3.1 - 6 $cent
  are expected
- Extended service life to 30 years
  → further LCOE reduction expected

Chance of crisis

Production lines working not on full capacity.
That's the chance and time to

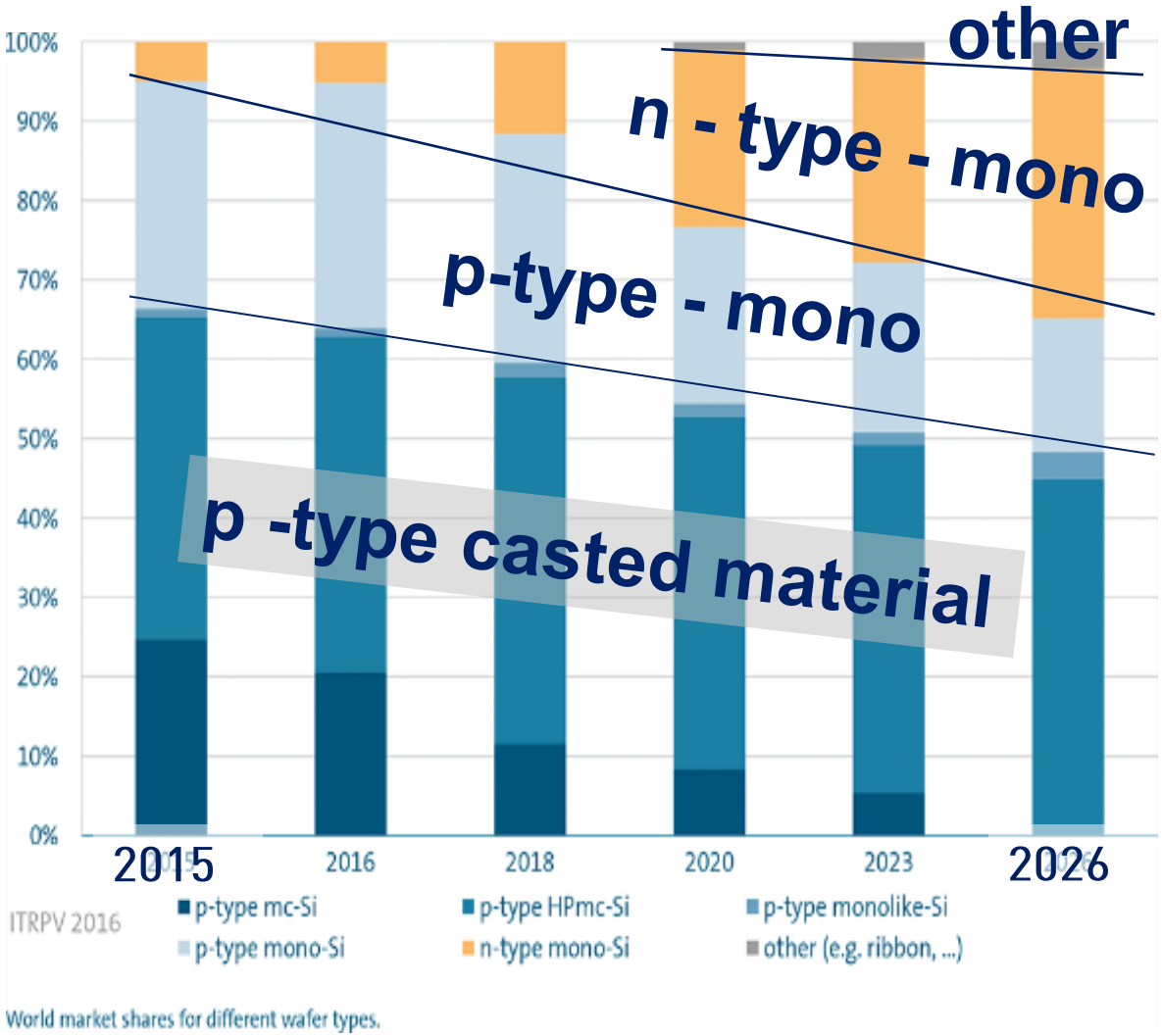
→ **Improve the lines**

→ **Implement and qualify new cheaper technologies**

Bifacial is one of them

look to ITRPV

Wafer types



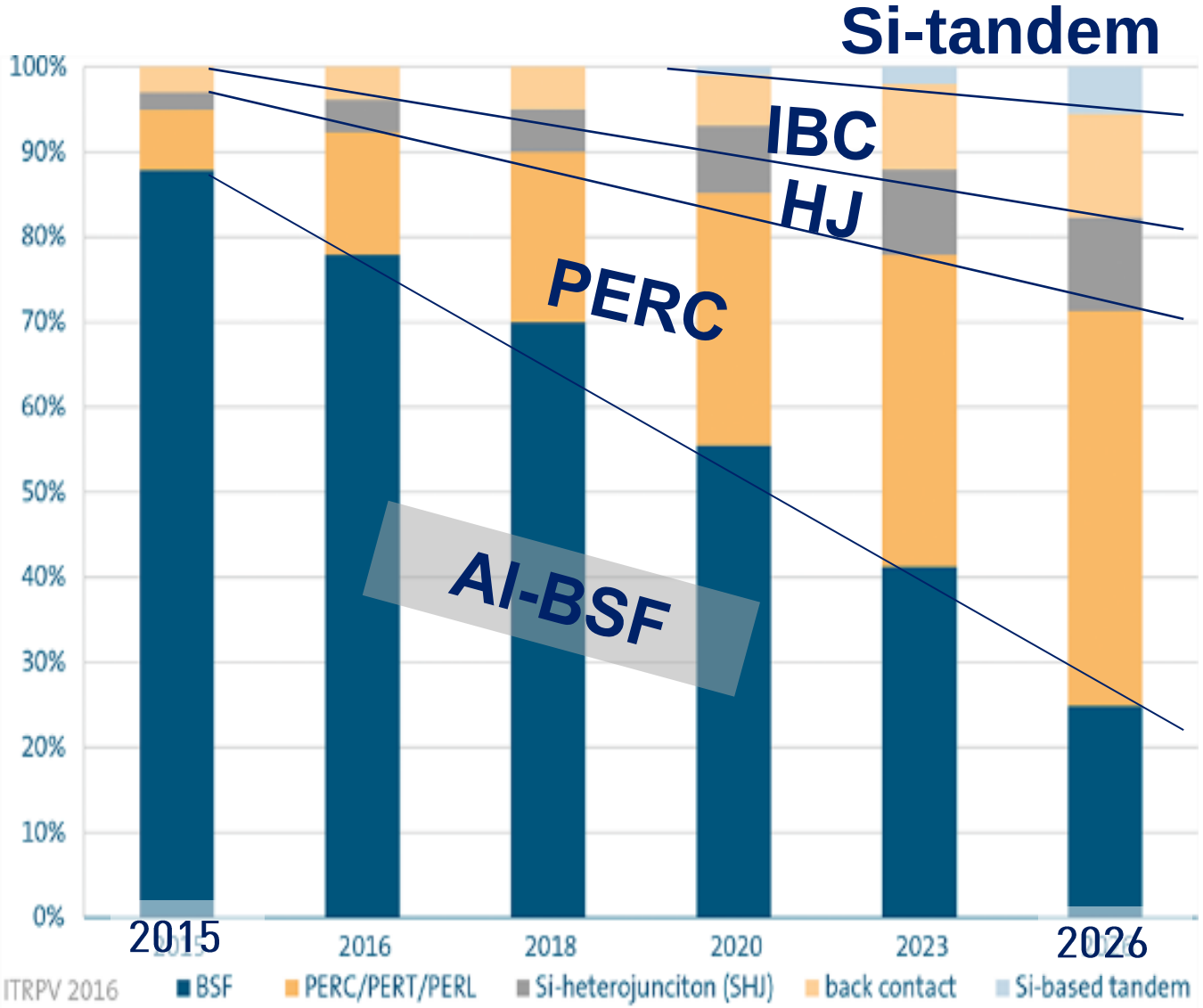
World market shares for different wafer types.

Source: ITRPV roadmap

ITRPV

- Casted material is dominating today with >60%
- Mono share is expected to increase (driven by n-type)
- p-type material is expected to dominate

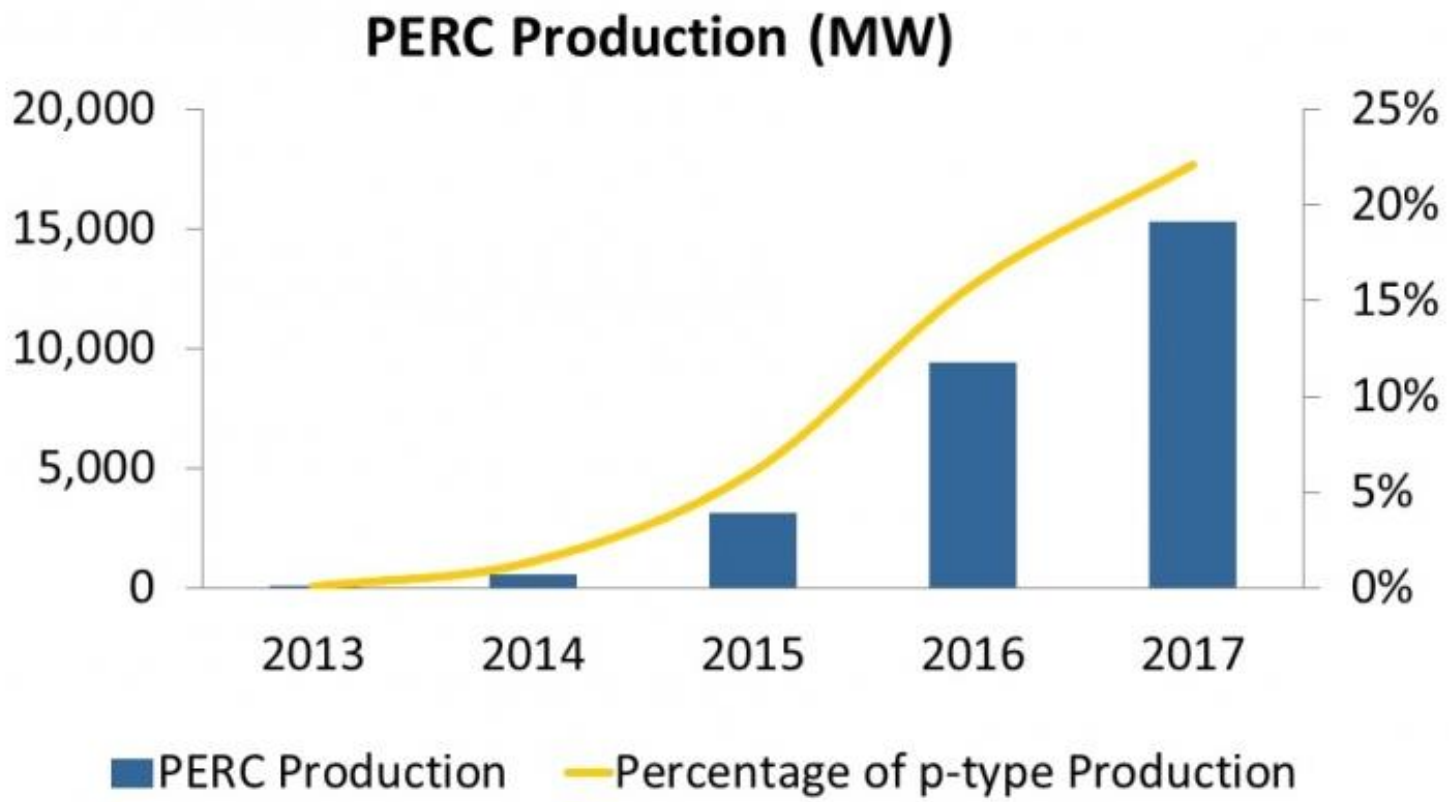
Cell types



ITRPV

- New structures slowly expand
- PERC market share increase
  - \+ More efficiency
  - – More effort
- Al-BSF loose market share

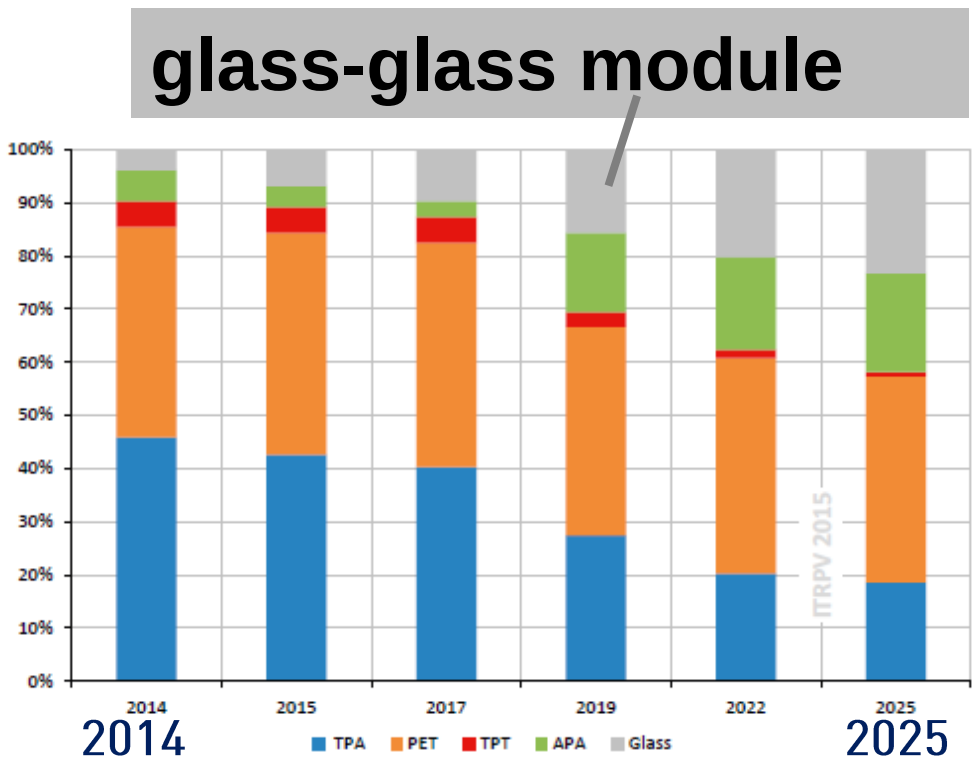
PERC production

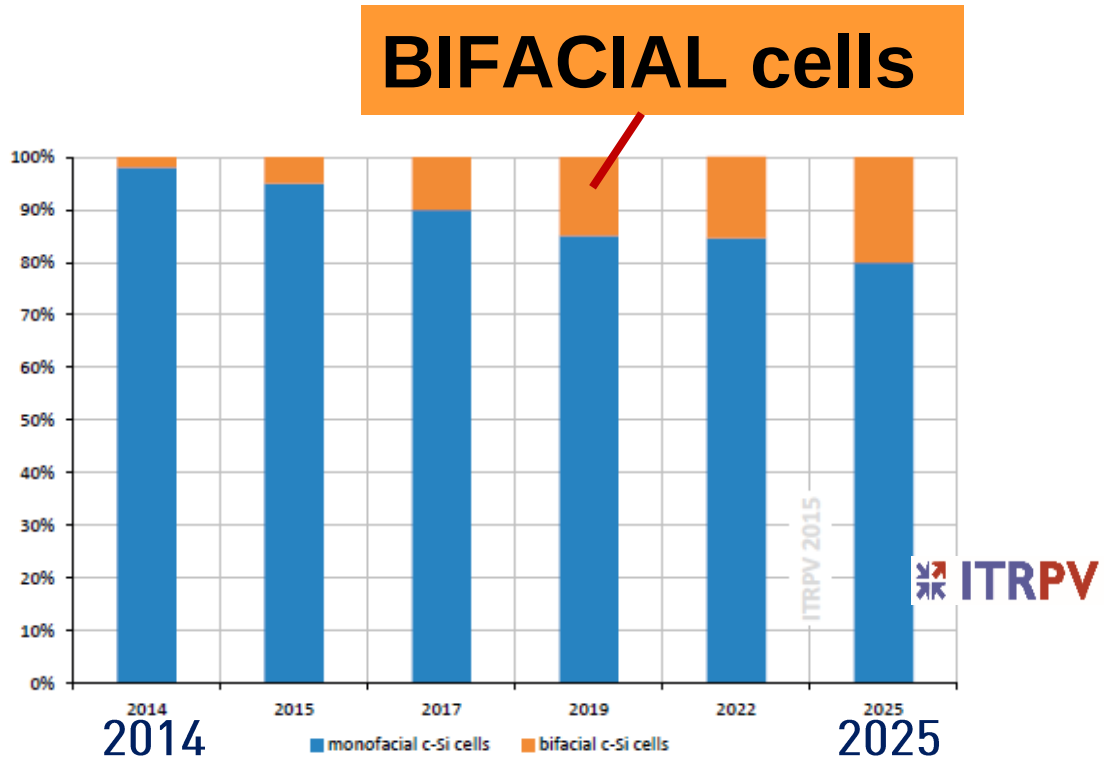


Source: Solar Media PV Manufacturing & Technology Quarterly report, July 2016 release

Prediction of BIFACIAL future

- Glass–glass modules are entering the market
- Market share of BIFACIAL cells is increasing





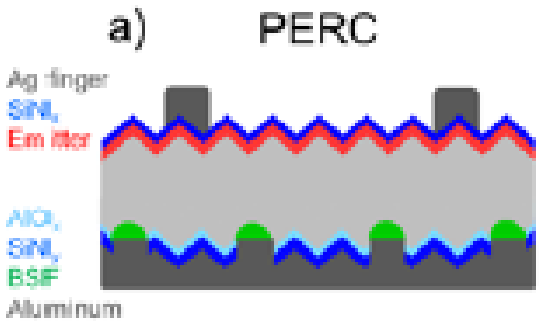
Prediction of BIFACIAL future

Bifacial is the next logical step

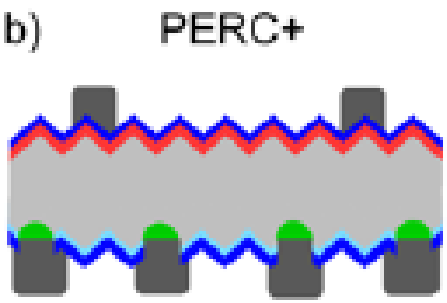
- PERC and other rear side passivated cells increase market share
- PERC can be designed BIFACIAL
- Glass–glass modules are entering the market

PERC bifacial

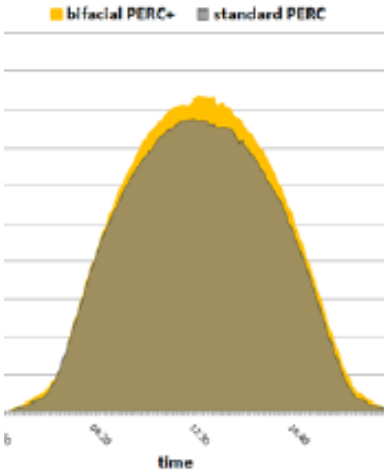
Example:
Laboratory
ISFH



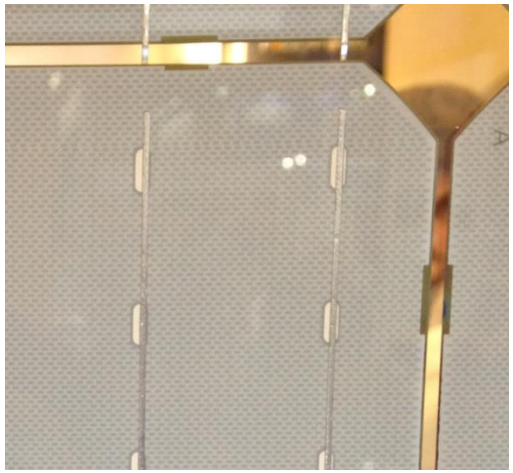
Full aluminium rear side

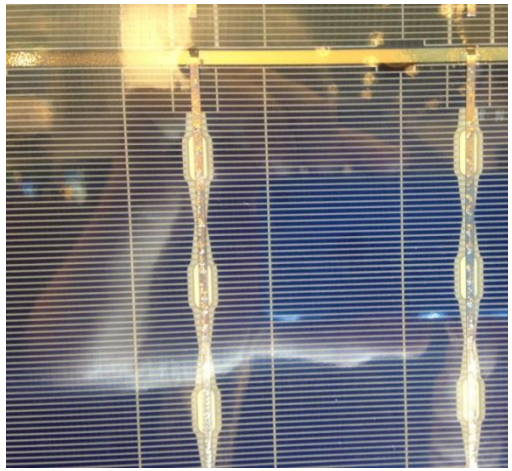


Aluminium grid



Example:
Solarworld´s
bifacial PERC

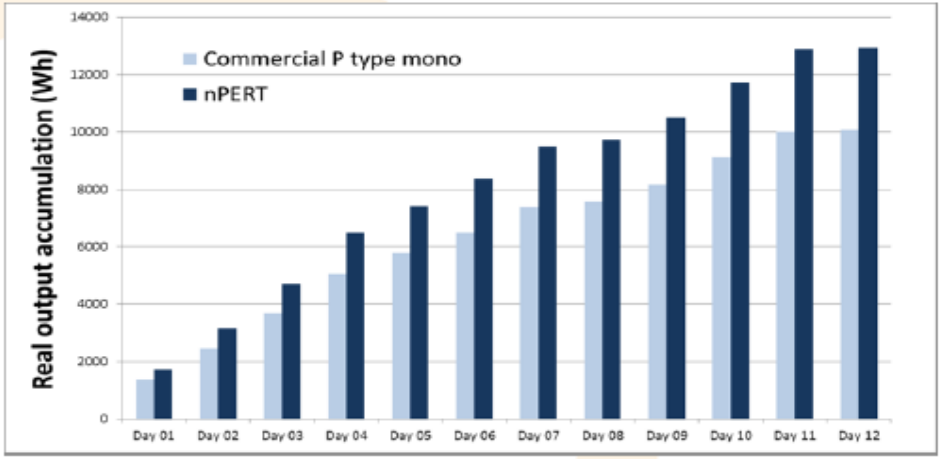




Bifacial due to rear side aluminum fingers

4 example of
Bifacial pilot installations

n-PERT Bifacial Module

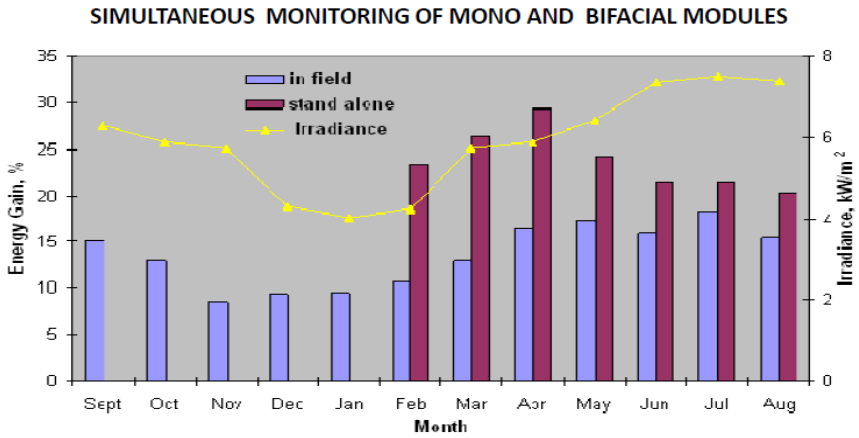


- ~30% output gain for nPERT bifacial module (60 cells):
  320W effective output as compared with p-mono reference module.

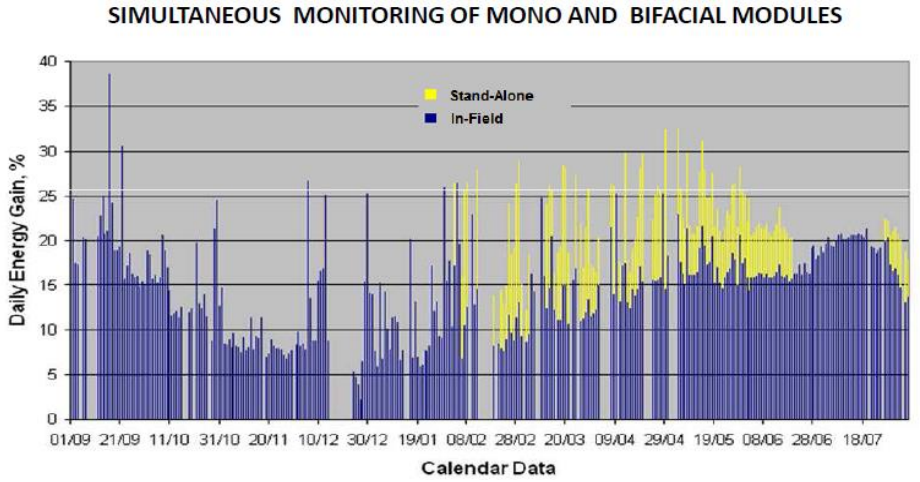
Simulation/Field Test: Field Test
Company, Institute: bSolar
Duration: 1 year
Number of Modules: 12
Location/Latitude: Jerusalem / 31.78 N
Standard Power Output: 175 Wp Suntech
Bifacial Power Output: 170 Wp bSolar
Height: 0.7 m (lower edge)
Module Distance: 1.5m NS, 0.2m WE
Module/Cell: Module
Ntype or Ptype: Ptype
Structure: PERT

bSolar

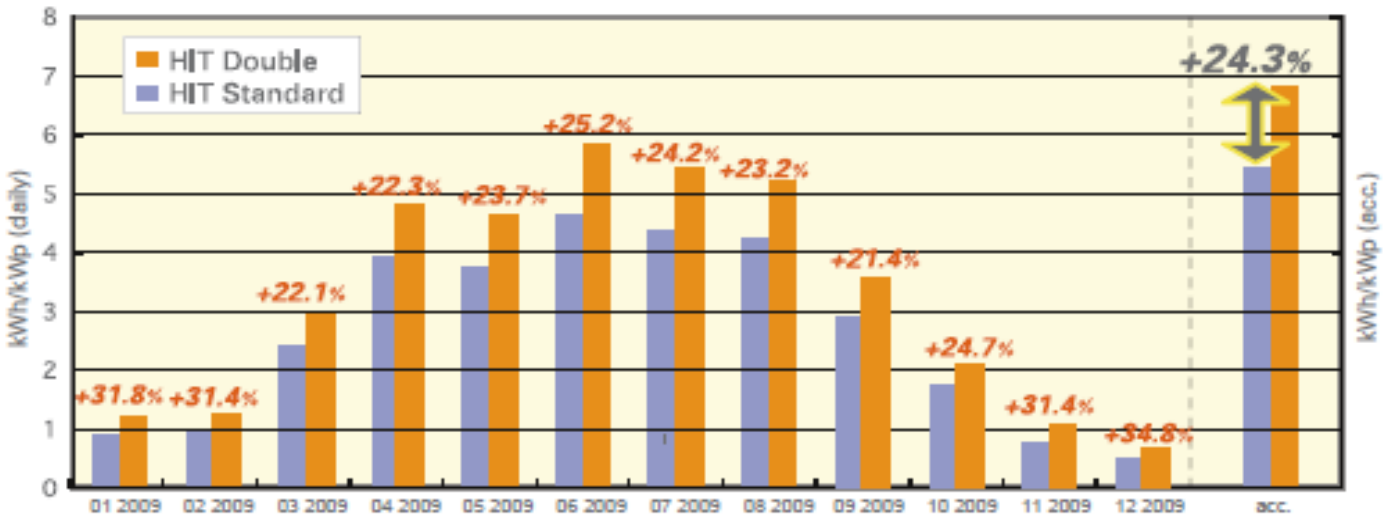
3. TEST RESULTS



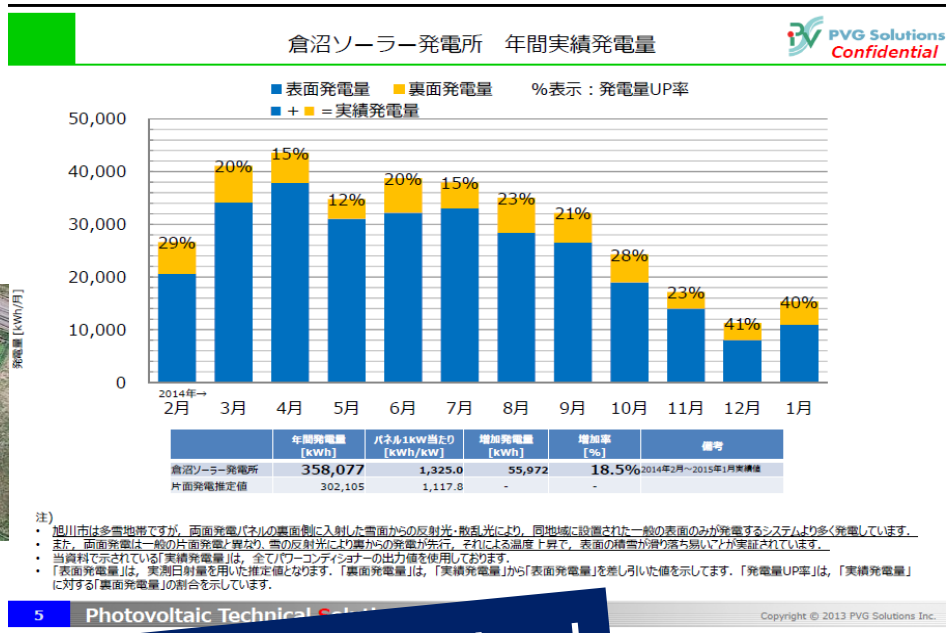
Monthly energy gain of a bifacial vs. a mono-facial module



Simulation/Field Test: Field Test
Company, Institute: Sanyo, Fraunhofer ISE
Annual Energy yield: 24.3%
Duration: Jan 2009-Dec 2009 (1 year)
Number of Modules: 10 (estimate)
Albedo (Type) : 64%
Location/Latitude: Geilenkirchen / 50.96 N
Annual Standard Energy : 939 kWh/kWp/a (estimate)
Annual Bifacial Energy: 1176 kWh/kWp/a (estimate)
Standard Power Output: 2.10 kWp
Bifacial Power Output: 2.00 kWp
Fs/Bs Power: 210 W/147 W
Bifaciality: 70%
Tilt Angle: 20 degrees S
Height: 30 cm
Module/Cell: Module
Ntype or Ptype: Ntype
Mono or Multi: Mono
Structure: HIT



Simulation/Field Test: Field Test, Kuranuma Solar Power Plant
Company, Institute: PVG Solutions, Nishiyama Sakata Denki Co Ltd
Location/Latitude: Asahikawa-shi, Hokaido, Japan 43.50 N
Duration: Feb 2014-January 2015 (1 year)
Number of Modules: 1064 panels
Estimated Energy production: 300,000 kWh
Annual Bifacial Energy Production: 358,077 kWh
Energy Production Per 1kW Panel: 1,325 kWh/kWp
Annual Frontside Energy Production: 302,105 kWh
Annual Backside Energy Production: 55,972 kWh
Annual Bifacial Energy Gain: 18.5%
Area: 6,021 m2
Number of Cells per Module: 60
Backsheet/Glass: 2mm glass/ 2mm glass
Bifacial Power Output: 250 kW (front)
Tilt Angle: 40 degree South
Average Module Pmax: 254W
CTM Loss: 5.2%
Fs/Bs Efficiency: 19.5%/18.7%
Fs/Bs Power: 4.66W/4.47W
Bifaciality: > 95%
Module/Cell: Module
Ntype or Ptype: Ntype
Mono or Multi: Mono
Structure: EarthON, PERT



More such large examples neded

Bifacial innovations

Examples for bifacial innovations:

- „N-type-world“
- Bifacial aluminum rear side grid for P-Type
- Bifacial cell IV measurement equipment and standards
- Bifacial module flasher and standards
- Power earning prediction and guarantee
- Optimized module mounting
- Module lifetime investigations
- Low shadow junction boxes...

Bifacial innovations

Example: Low shadow junction boxes

…. there is a lot of room for further innovations…

Thank you for your attention