

HEVEL Solar

Unfolding Russian Solar Potential

First International workshop of RUSTEC

November 15-19, 2010
Arizona State University

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What is Hevel Solar?



- US\$ 24.77bn
- Power sector
- Oil (TNK-BP)
- Aluminium
- Other



51%



RUSNANO
Russian Corporation of Nanotechnologies

49%

- US\$ 5 bn
- Know-how
- Technology development

Motivation

- Power sector
- Solar
- TF Silicon / Oerlikon Solar
- Russian market

Motivation

- Nanotechnology
- Strategic investments
- Know How/Russian R&D



VISION: Be the leading supplier for the Russian and certain solar markets with Thin Film Silicon technology

Hevel Solar: company at a glance



Stage I



St.Petersburg

Joint R&D Center

- Pilot line equipment
- Technology updating

2010

Know-how implementation



Novocheboksarsk

Production Facility

- New-gen Oerlikon equipment
- 130 MW / year

2011

Stage II



Moscow
Headquarters



Production facility



<i>Location</i>	Novocheboksarsk, Chuvash Republic, Russia, 500 km from Moscow
<i>Facility area</i>	28,000 sq. m.
<i>Product</i>	125 Wp TF silicon PV modules
<i>Production capacity</i>	130 MWp per year
<i>Equipment</i>	New-gen Oerlikon micromorph® turnkey FAB



construction starts

Q2 2010

production starts

December 2011

end of ramp-up

July 2012



- More than 1,000 researchers
- Over 90 years of leadership in science (since 1918)
- Worldwide recognition in scientific research

R&D center

Know-how implementation

Production facility

Research results to be transferred to production line easily

Main R&D directions

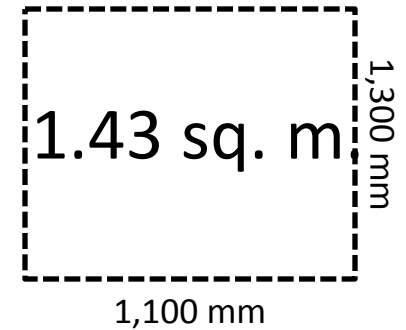
- Reduction in production costs
 - Thorough testing of materials and consumables (gases, glasses, junction boxes etc.) of different suppliers
 - Increase of throughput by increasing deposition rates and decreasing Si layer thickness
- Nanostructured Si materials (pm-Si or pc-Si) for the top cell
- Intermediate reflector between top and bottom cells = reduction of top cell thickness
 - Creates better stability
- Application of Ge alloys in modules with triple structure
 - using of lower band gap Ge alloys result in higher absorption
- R&D collaboration
 - **Searching for partners to implement YOUR ideas**

New-gen product



Micromorph® PV modules

Nominal peak power (P_{mpp})*	125 W_p for 1.4 sq. m.
Length	1,300 mm
Width	1,100 mm
Thickness	6,8 ± 0,4 mm
Surface area	1.43 m ²
Weight	26 kg



Initial Efficiency	8.9%	125 W _p
Target Efficiency	11.0%	155 W _p

Next-gen micromorph® module: Low voltage module design

Supplier	Technology	V _{mpp}	V _{oc}	I _{mpp}
Oerlikon	Micromorph today	103	129	1.0
Hevel Solar	Micromorph next-gen	37.8	52.4	3.3
First Solar	CdTe	69.4	92	1.08
Typical c-Si	Mono/poly	24-40	30-50	8.5

- More solar modules per string are possible: lower cable and wiring cost
- More flexibility to fit in voltage specification of inverters
- Similar to crystalline electrical characteristic (>80% market share)
- Best match to market standards

Micromorph[®] - leading thin-film technology



- Low price (per watt)
- Low cost (per kilowatt-hour) (LCOE)
- High return on investments in solar installations



- Performs good under high temperature conditions (*than other technologies*)
- High efficiency in low or diffused light conditions (*without tracking system*)

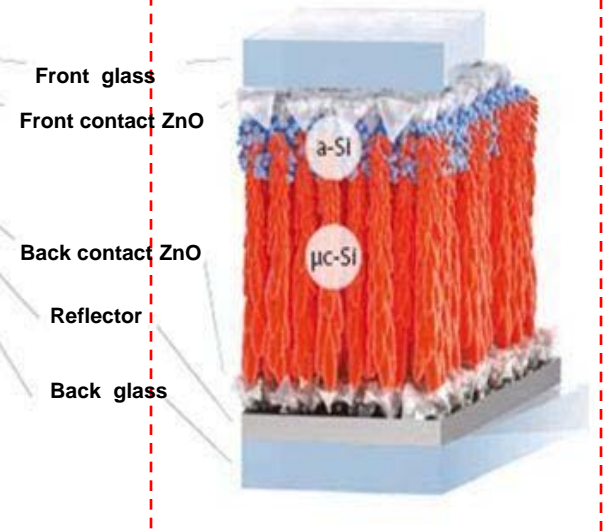


- Guaranteed quality assurance:
 - 90% efficiency 90% in 10 years
 - 80% efficiency 80% in 20 years
- Pollution-free and environment-friendly

Amorphous single-junction
(ASI cell structure)



Micromorph tandem-junction
(MSI cell structure)



Additional microcrystalline layer gives up to 50% more energy yield

LAB

- standardized conditions (STC)
- “label” value of module



Outdoor

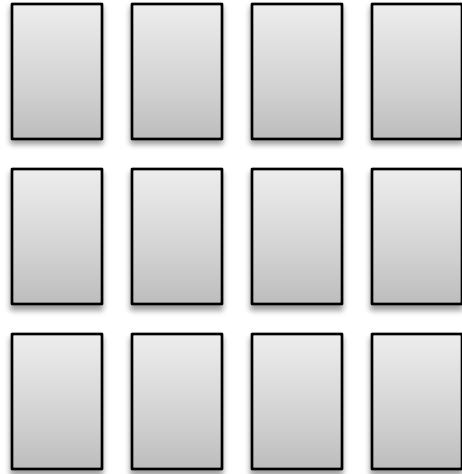
- particular location and sun irradiation
- daytime variation
- seasonal variation
- varying temperature
- varying weather
- different characteristics of PV technologies



$$\text{Performance} = \frac{\text{Real outdoor energy output}}{\text{Label value at standard conditions}} = \frac{\text{KWh}}{\text{KWp}}$$

How much power/energy do we really get out of a Watt of installed power?

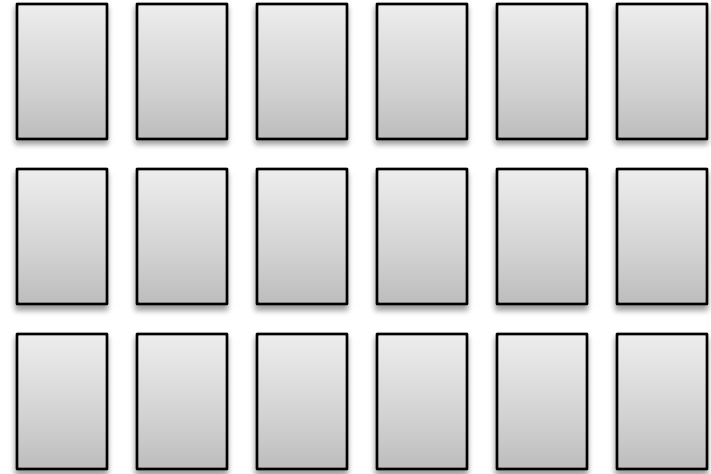
Performance measurement (2)



1MW c-Si
efficiency: 15%

10.000 sq.m.

1400 MW/year



1 MW TF Si
efficiency: 10%

15.000 sq.m.

1540 MWh/year






TF Si provides 5-15% more yield depending on conditions

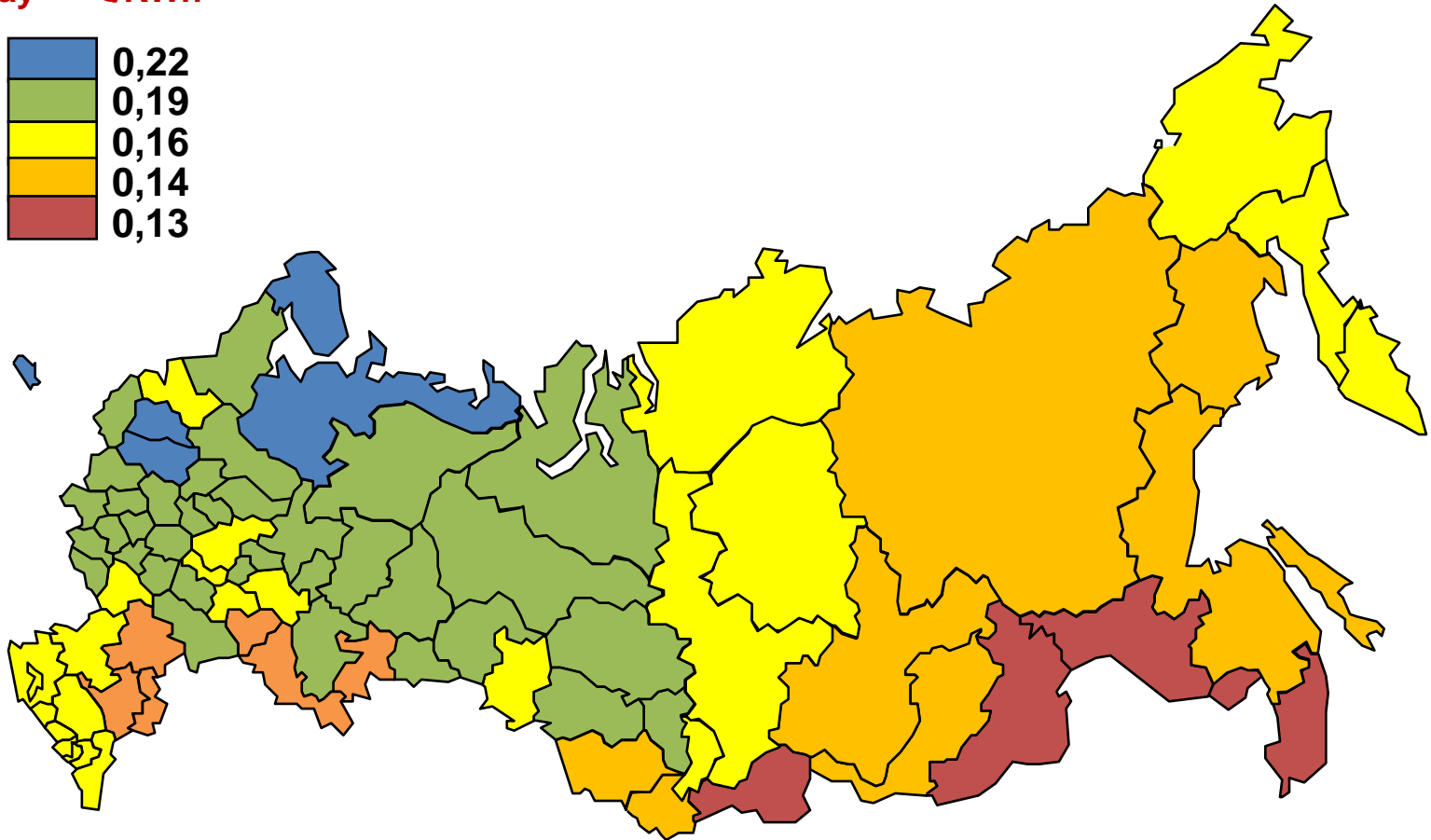
Russia: large solar potential at home



Insolation
KWh/m2/day

LCOE*,
€/KWh

below 3		0,22
3 - 3,5		0,19
3,5 - 4		0,16
4 - 4,5		0,14
4,5 - 5		0,13



RUSSIA: High insolation level over large areas with high electricity demand

Thank you!



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