HEVEL Solar

Thin-film photovoltaic modules

Company presentation

1st Energy Symposium

Nicosia, Cyprus

HEVEL SOLAR

Who we are?

RENOVA GROUP OF COMPANIES

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

51%

RUSNANO Russian Corporation of Nanotechnologies

49%

- US$ 5 bn
- Searching for Know-Hows
- Technology development

interest:

- *Investments in power sector*
- *Committed to TF Silicon/Oerlikon*
- *Strong position on Russian market*

HEVEL SOLAR

interest:

- *Investments in nanotechnology*
- *Strategic investments in Know How/Russian R&D*

Our Mission:

To be the leading supplier for the Russian and overseas solar markets of Thin Film Silicon technology

Production facility

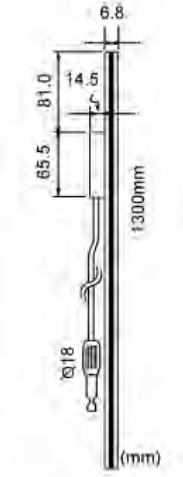
Location	Novocheboksarsk, Chuvash Republic, Russia, 500 km from Moscow
Facility area	28,000 sq. m.
Product	125 Wp TF silicon PV modules
Production capacity	130 MWp per year
Equipment	New-gen Oerlikon micromorph® turnkey FAB

production starts
1Q 2012

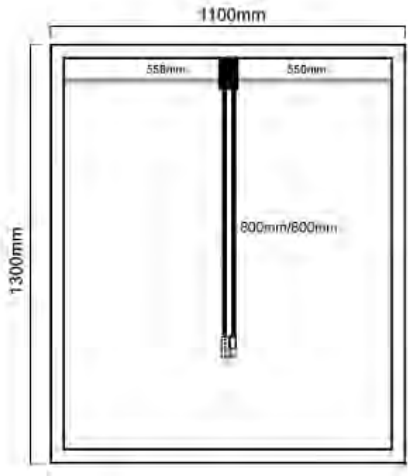
end of ramp-up
End of 2012

Product: Design & Specs

Thin-film Silicon (micromorph®) photovoltaic modules



Side view



Back view


Front view

Electrical data at standard test conditions*	
Nominal peak power (±3%) [Wp]	**125**
Voltage at nominal power [V]	**100**
Current at nominal power [A]	**1,25**

Mechanical Characteristics	
Length [mm]	**1300**
Width [mm]	**1100**
Thickness [mm]	**6,8 ± 0,4**
Surface area [m²]	**1,43**
Weight [kg]	**26**

Initial efficiency	8.9%	125 W

Target efficiency	11.0%	155 W

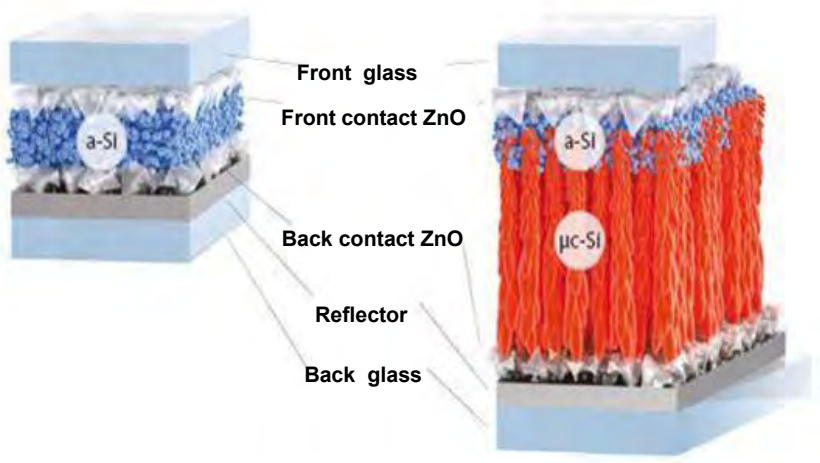
* electrical data are given at standard test conditions (STC): 1000 W/m², AM (air mass) 1,5 and a module temperature of 25 °C, direct irradiation, optimized module incline and stabilized module state.

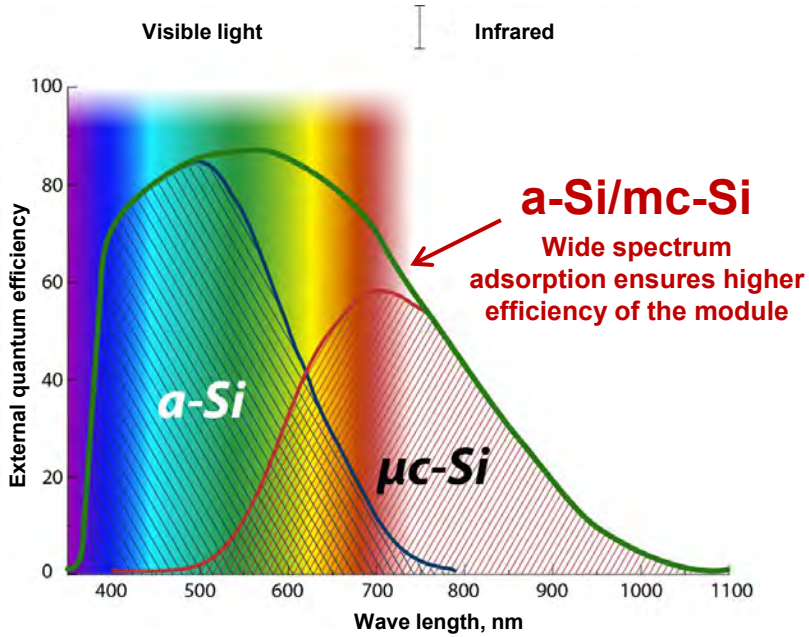
Advanced technology

Micromorph® - new generation of thin-film PV modules based on micromorph silicon

Amorphous single-junction (ASI cell structure)

Micromorph tandem-junction (MSI cell structure)



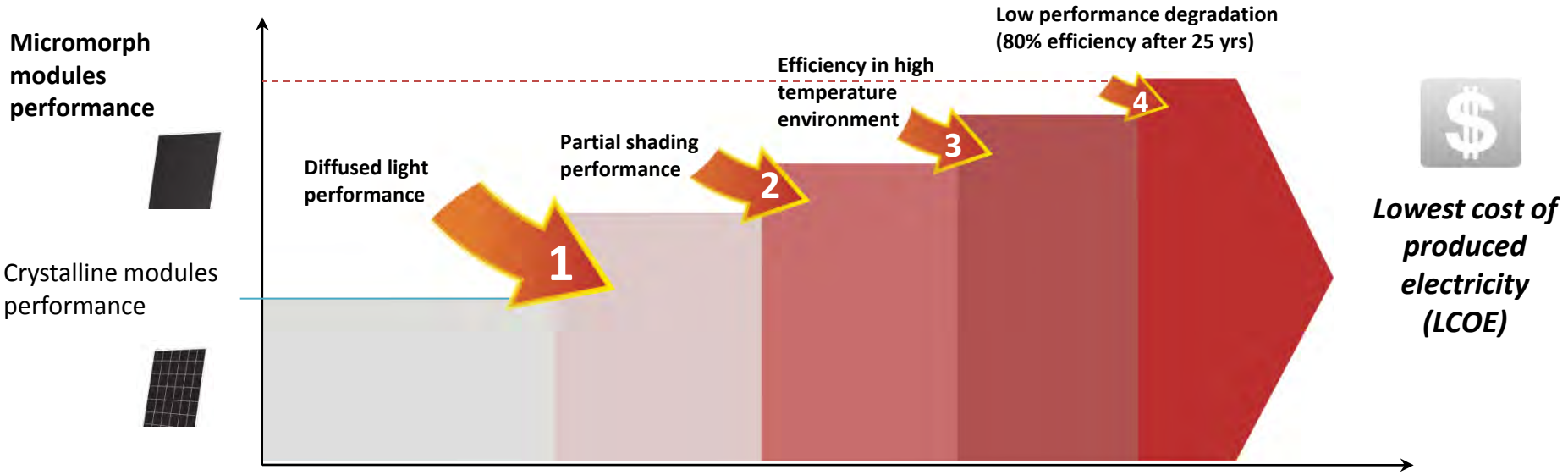


Micromorph tandem-junction (MSI cell) structure with additional microcrystalline layer enables to adsorb sunlight both in visible and infrared range ensuring more than 30% yield increase

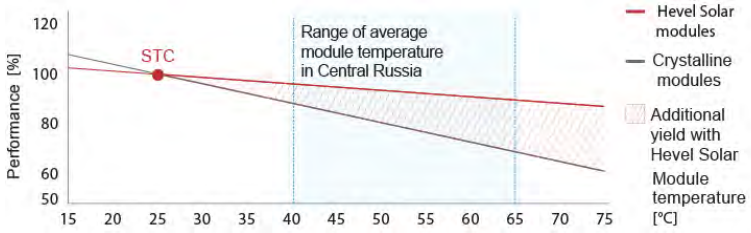
Source: Hevel LLC

Key advantages: performance

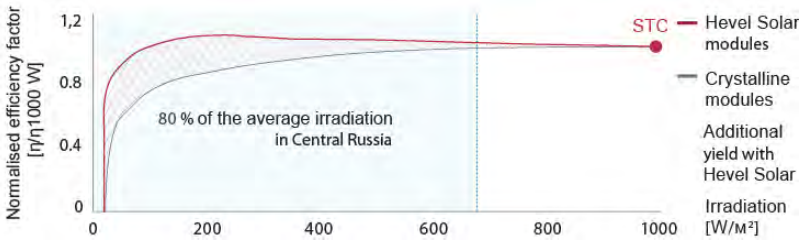
Micromorph modules have 10-20% energy yield bonus



High temperature performance of micromorph modules



Diffused light performance of micromorph modules



Source: Oerlikon/Inventux

Key advantages: environment friendly

Micromorph® helps to minimize the negative environment impact even during the production and recycling

✓ **Shortest payback of the energy spent during production (EPBT)**

- Due to energy-efficient automated production PV module returns the energy spent on its production in less than 1 year of operation (the best result among other PV technologies)

✓ **Raw materials availability**

- The main raw material - silicon which is the most abundant element on Earth

✓ **Recycle-friendly**

- Solar modules can be treated as ordinary glass used in building (does not require any special expensive method of processing)

✓ **No toxic materials**

- No toxic materials are used during production and hence the product is safe for the environment throughout all its life cycle

Source: OC Oerlikon, TUV Rheinland, Inventux

R&D Center

Member of Skolkovo Innovation Center

R&D Center based on Ioffe Phisical Technical Institute ensures efficient implementation of know-how into mass production

R&D Center → **Know-how implementation** → **Production facility**

Ioffe Physical Technical Institute

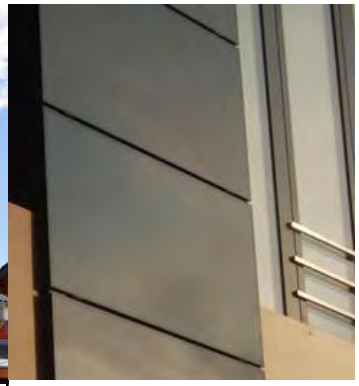
- 2 Nobel Prize Winners in physics
- more than 1000 researchers
- Worldwide recognition in scientific research

Main R&D directions:

- **Reduction in production costs:**
  - Testing of new materials and consumables
  - Increase of throughput by increasing deposition rates and decreasing Si layer thickness
- **Thin-film micromorph module efficiency increase:**
  - Intermediate reflector between layers
  - Application of Ge alloys in modules with triple structure
- **Collaboration with other R&D centers**
  - Implementation of technical solutions to mass production

Source: Hevel LLC, R&D Center

Product: Applications

Solar Farm	Large rooftop	Small rooftop	BIPV
Free field installations	Rooftop systems installed on commercial real estate	Rooftop systems installed on residential housing	Building Integrated PV
			
>1 MW	10-1000 kW	<20 kW	<100 kW
Effect of scale	Fast and easy to install on the existing roofs		Modern architecture solutions

Off-Grid - systems not connected to the grid

Free-field solar parks

System capacity: **1 - 100 MW**
Required area: **2.5 ha / MW**

- **Installation requirements:**
  - Flat area.
  - South orientation installation
  - angle 20 – 25 degrees

- **Soil requirements :**
  - Any ground is allowed, but the cost of under-structure may vary.

Commercial rooftop installations

System capacity : **10-1000 kW**
Required surface: **~ 17 m2/kW**

- **Space requirements:**
  - Flat roof
  - South oriented installation
  - Installation on existing roof cover is possible.

- **Roof requirements:**
  - Additional roof weight load up to 20 kg/m2

Residential rooftop installations

System capacity: **1-20 KW**
Required surface: **~17 m^2/KW**

- **Installation requirements:**
  - Flat or inclined roof
  - South oriented installation

- **Roof requirements:**
  - Additional roof weight load up to 20 kg/m^2

- **Off-grid systems are applicable**

Building integrated photovoltaics

Built-in modules can play major role for architecture of the future

*micromorph® technology

Reference projects*

Reference Projects

Saarbrucken, Germany
2.77MW
June 2010

Source: Oerlikon

Reference Projects

Zahna,
Germany
3.36 MW
December
2010

Source: Oerlikon

Reference Projects

Spain
0.4MW

Cadiz,
Spain
6.2MW

Source: Oerlikon

Reference Projects

Kassel, Germany
1.22MW

BIPV

Source: Oerlikon

Reference Projects

Puglia, Italy
1MW
2009

Marcianise, Italy
0.4MW

Source: Oerlikon

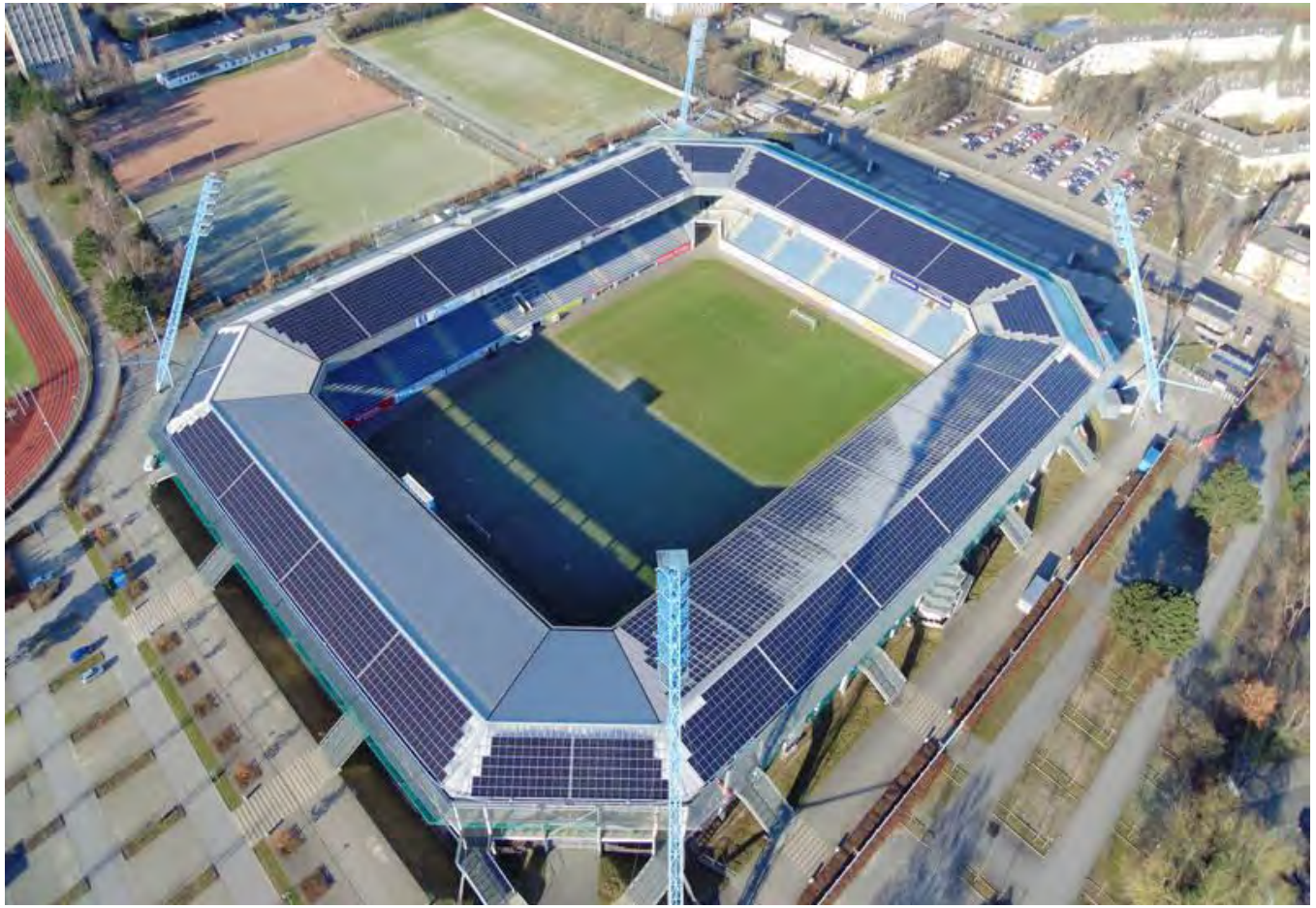
Reference Projects

Mugello Route, Ferrari tribunes; <u>252 KW</u>
2011

Source: Oerlikon

Reference Projects

Stadium Rostok, Germany 700 kW, 2011



Reference Projects

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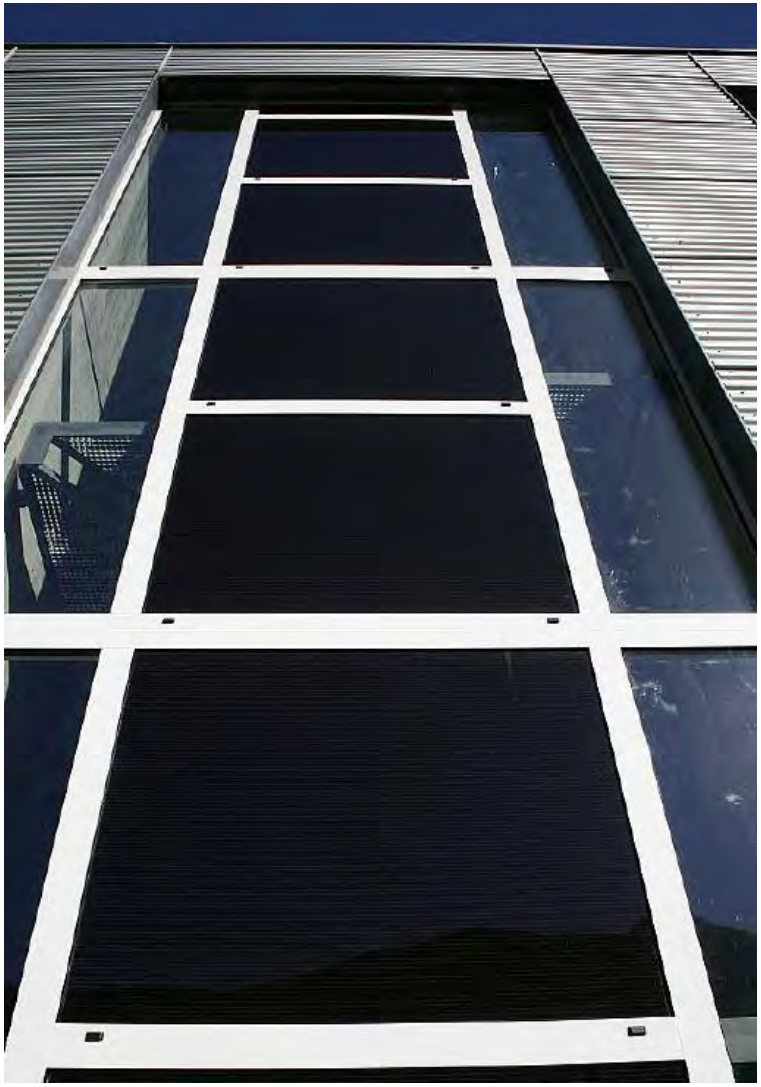

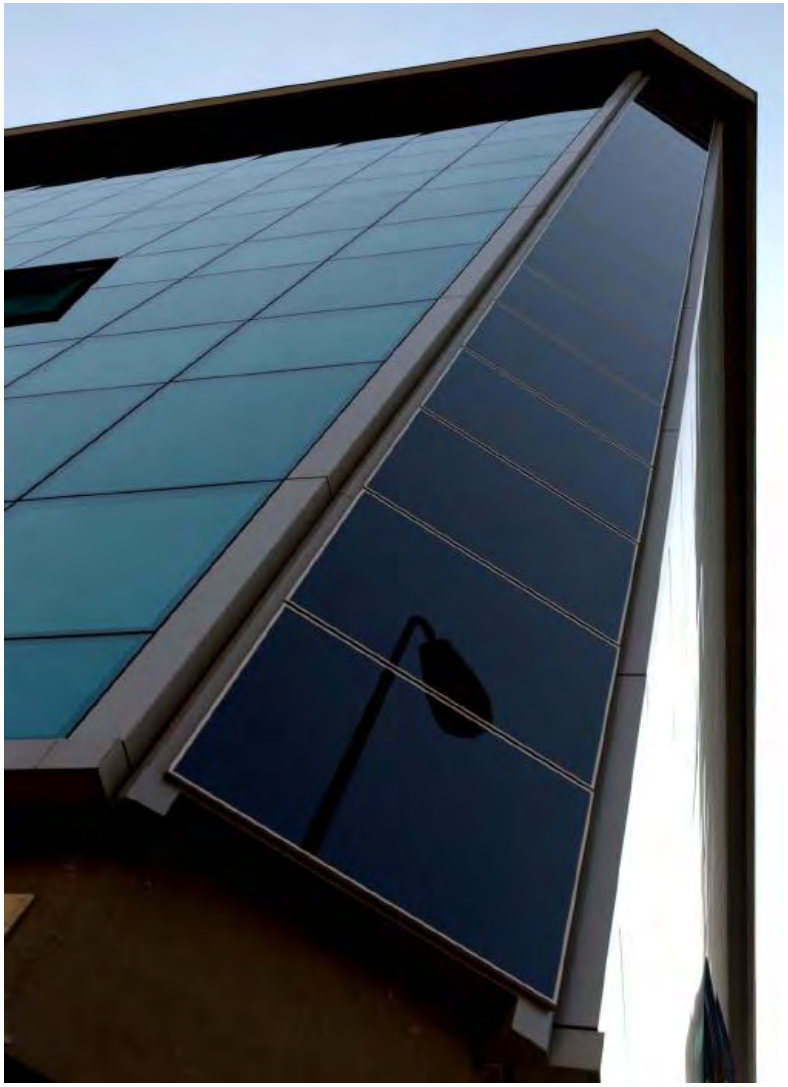

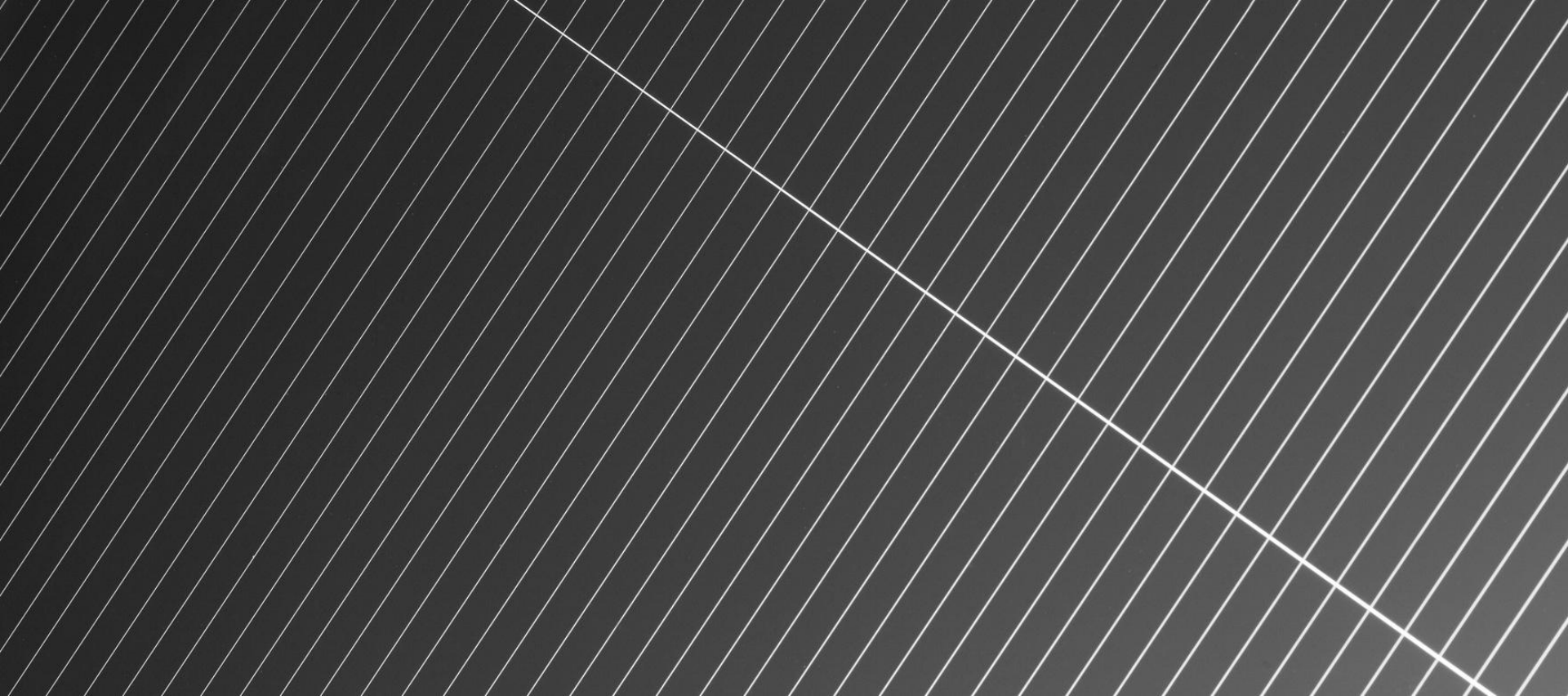

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Thank you!

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