

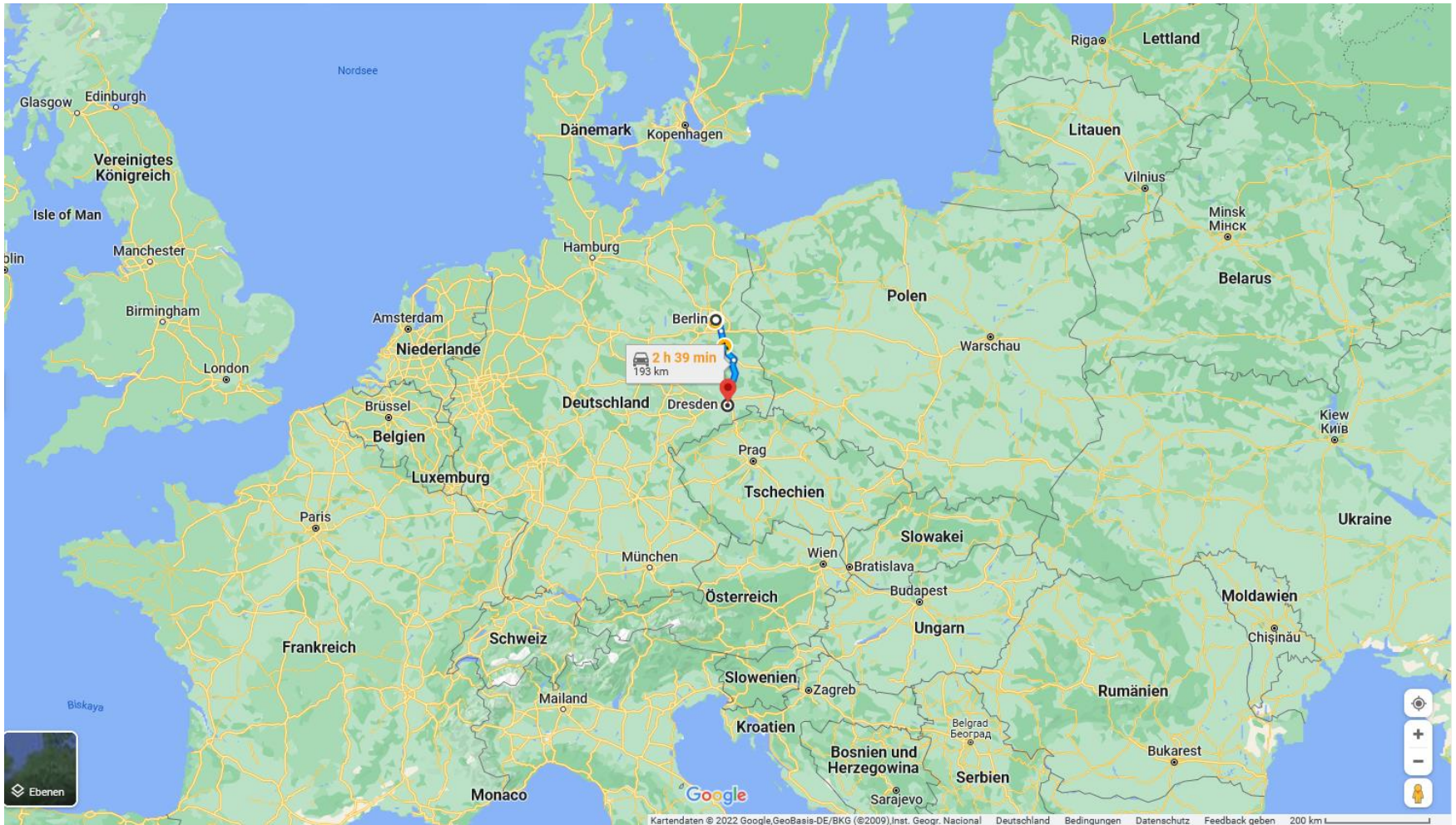


CTF Solar GmbH

6th CdTe workshop in Toledo (USA)

Dr.-Ing. Bastian Siepchen, October 2022

CTF SOLAR @ Dresden, Germany



Company proprietary



Outline

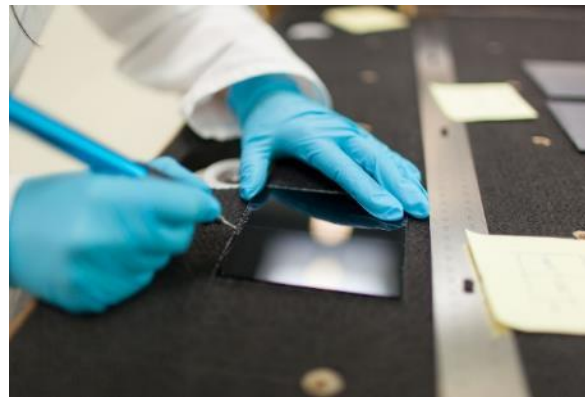
- History of CTF SOLAR
- Production technology and factory projects
- Research and development

Company proprietary



CTF SOLAR

CTF Solar – CdTe Solar glass innovation with a long history, a CNBM company



- 1969 World's first working cadmium telluride (CdTe) cell by Dr. Dieter Bonnet
- 1993 Start of industrialization; predecessor ANTEC GmbH
- 2012 Take-over by CTIEC, part of CNBM group
- 2015 Dresden R&D Center established, 15,2% cell efficiency
- 2017 Start of production in first Factory Chengdu
- 2020 Upgrade of Dresden pilot line at new location, > 50 R&D staff
20.0% cell efficiency.
Start of production Handan factory

Company proprietary



Production Facility

- ⊗ Proprietary CdTe module technology
- ⊗ 100 to 300 MWp production capacity possible
- ⊗ 288 Wp modules at 15% efficiency (as a starting point)
- ⊗ 1200 mm x 1600 mm x 7 mm modules
- ⊗ coating technology by CTF Solar
- ⊗ 24/7 operation, 1 production line
- ⊗ 65 modules per hour
- ⊗ 95% yield
- ⊗ zero-emission design



CdTe factory, internal view of site with one production line

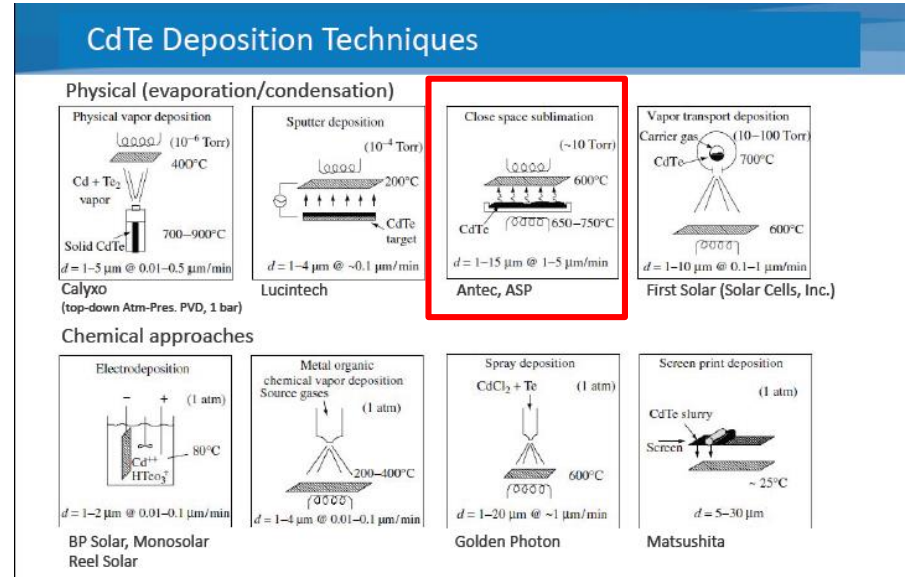
- **Cell research to development of full factories**
- **CTF does not own factories**
- **Factories are offered world wide**



CTF SOLAR

CNBM

Proprietary CSS semiconductor deposition technology on glass



Source: M. Reese NREL

CSS (Close Spaced Sublimation) deposition technology in pure vacuum compared to others

Fully automated and reliable – less than 5 hours from glass to solar glass

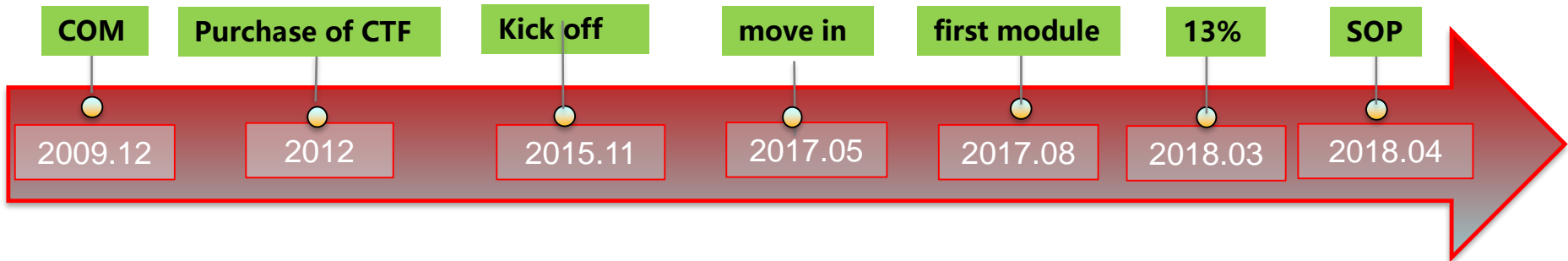
1,92 m² glass-glass module design

15 joint patents CTIEC / CTF

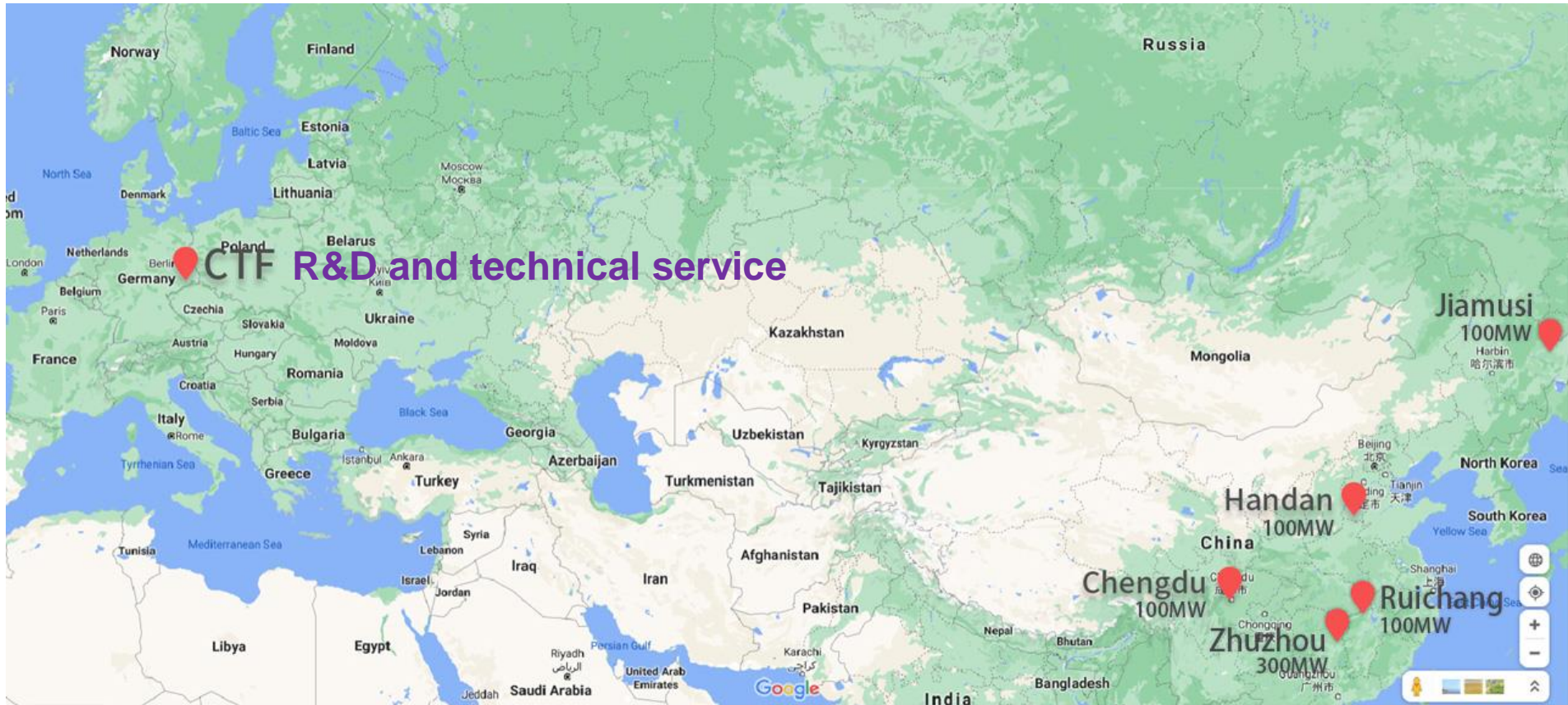
Company proprietary



Chengdu: First factory



CNBM CdTe business



Factories

Chengdu



Jiamusi



Handan



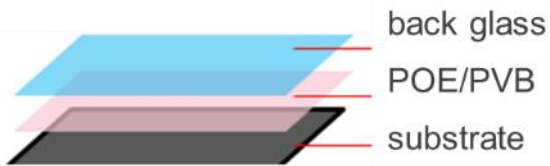
Zhuzhou



Ruichang



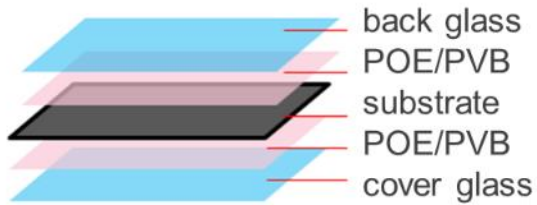
BIPV products



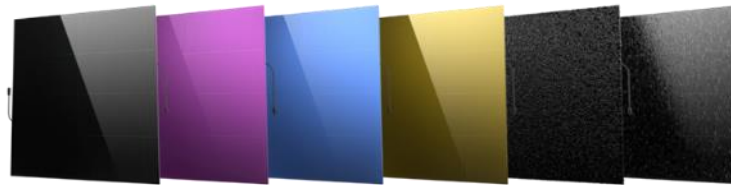
Double glass module



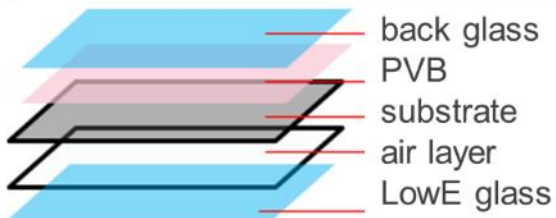
Black, semi-transparent



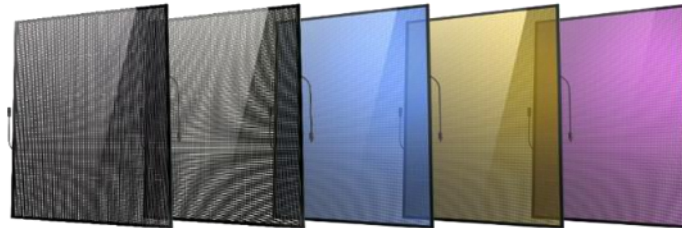
Triple glass module



Black, colour



Double glazings



Semi-transparent, colour, black



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BIPV examples



Company proprietary



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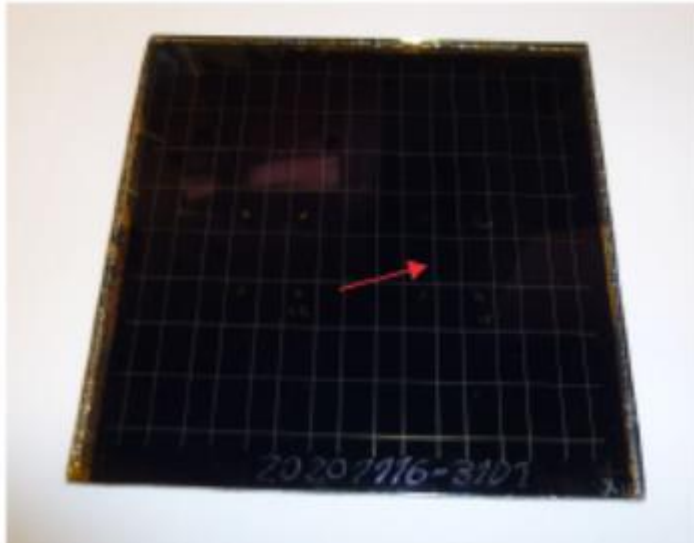
CNBM

Transparent solar glass examples

Transparent CdTe solar glass



Current status is represented by 20,0%
champion cell efficiency confirmed by ISFH



20.0% power conversion efficiency

based on 0,495 cm² rear metallization area

Internal cell record 20.65% (2022/10)

Source: ISFH callibration report: 12520Z_05,2

Company proprietary



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CTF R&D: Pilot CSS

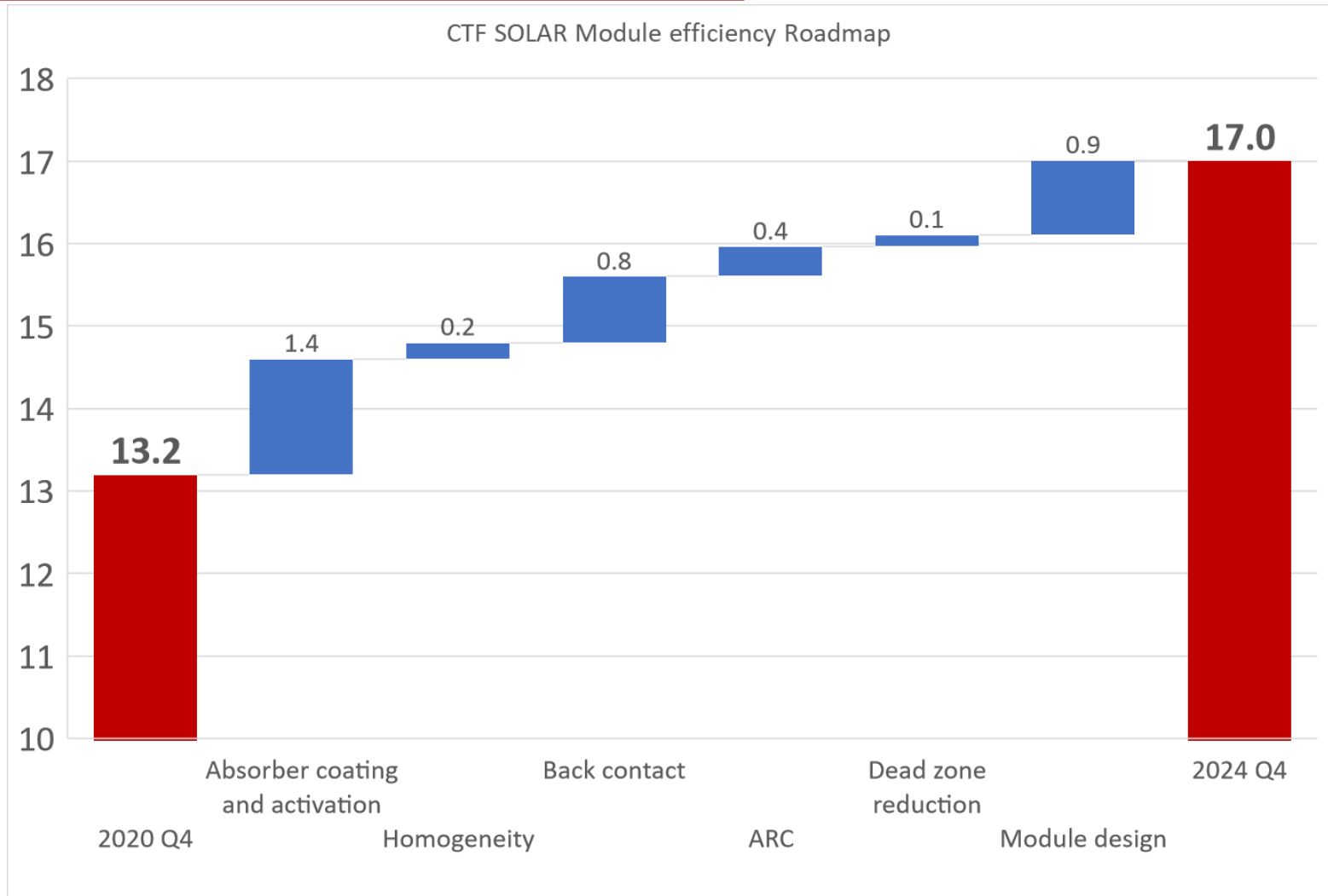


Format: 30x40 cm²
Dynamic CSS coating
Similar to full size production process



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Efficiency Roadmap



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R&D demands to the CdTe community

- Fundamental research of new processes towards 25 % cell efficiencies
- Development of advanced characterization methods, e.g.
 - ERE
 - TEM-CL
- Aligned certified IV measurements (optimized for CdTe thin film cells)

Thank you!

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