



The World's Largest Solar Simulator Provides New Testing Opportunities

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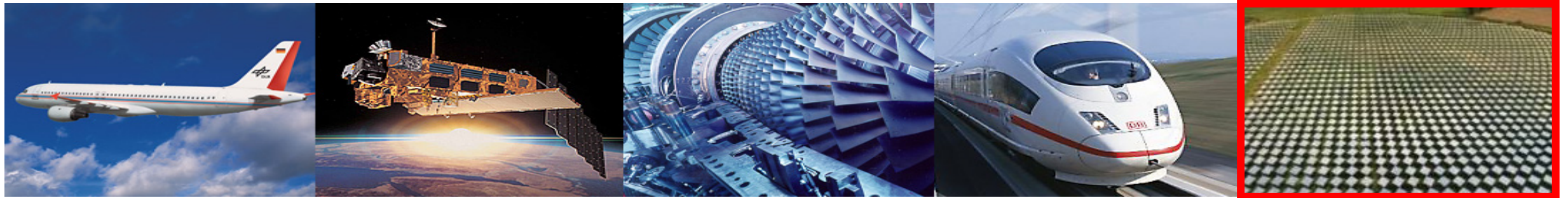


Knowledge for Tomorrow



German Aerospace Center (DLR)

- Research Institution, Space Agency and Project Management Agency
- Research Areas: Aeronautics | Space Research and Technology | Transport | **Energy** | Defence and Security
- 8000 employees across 32 institutes and facilities at 16 sites in Germany
- Total income ~€1000 Mio/a



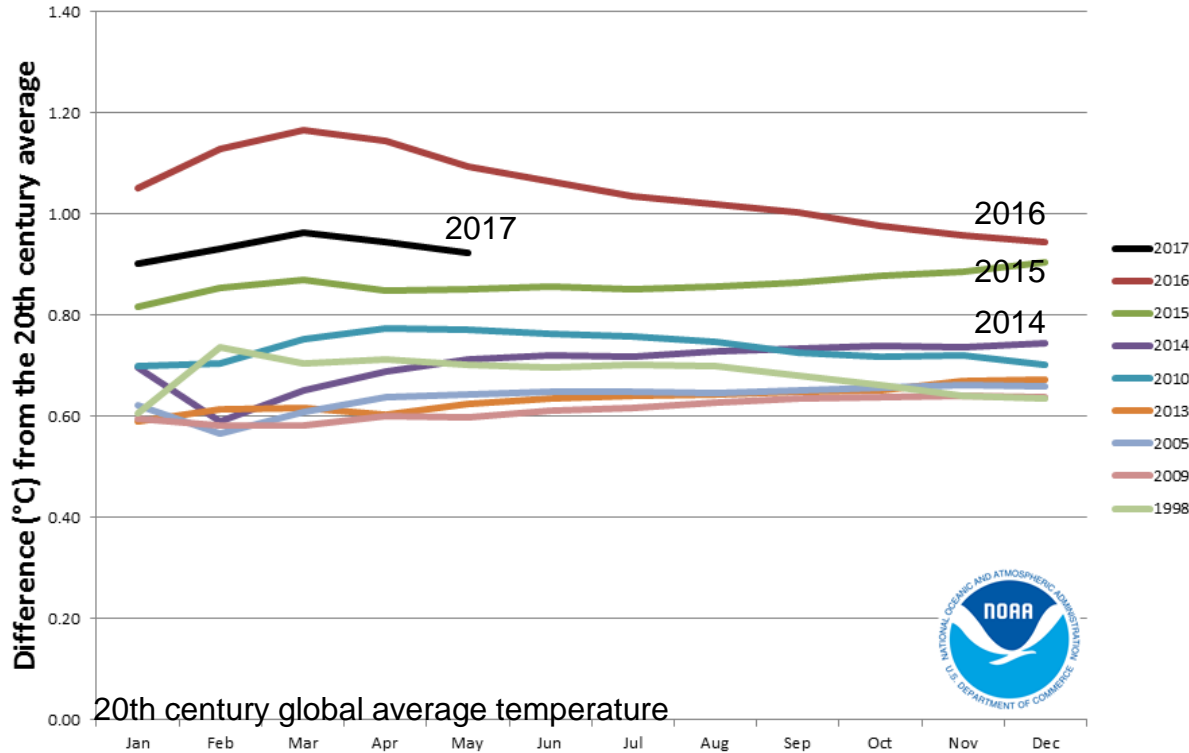
Institute of Solar Research

- Global Leadership in Concentrating Solar Power (CSP) systems for power, heat and fuel generation
- Fundamental research up to services and consulting for industry clients
- 160 employees at the four sites Cologne, Jülich, Stuttgart, Almería (Spain)



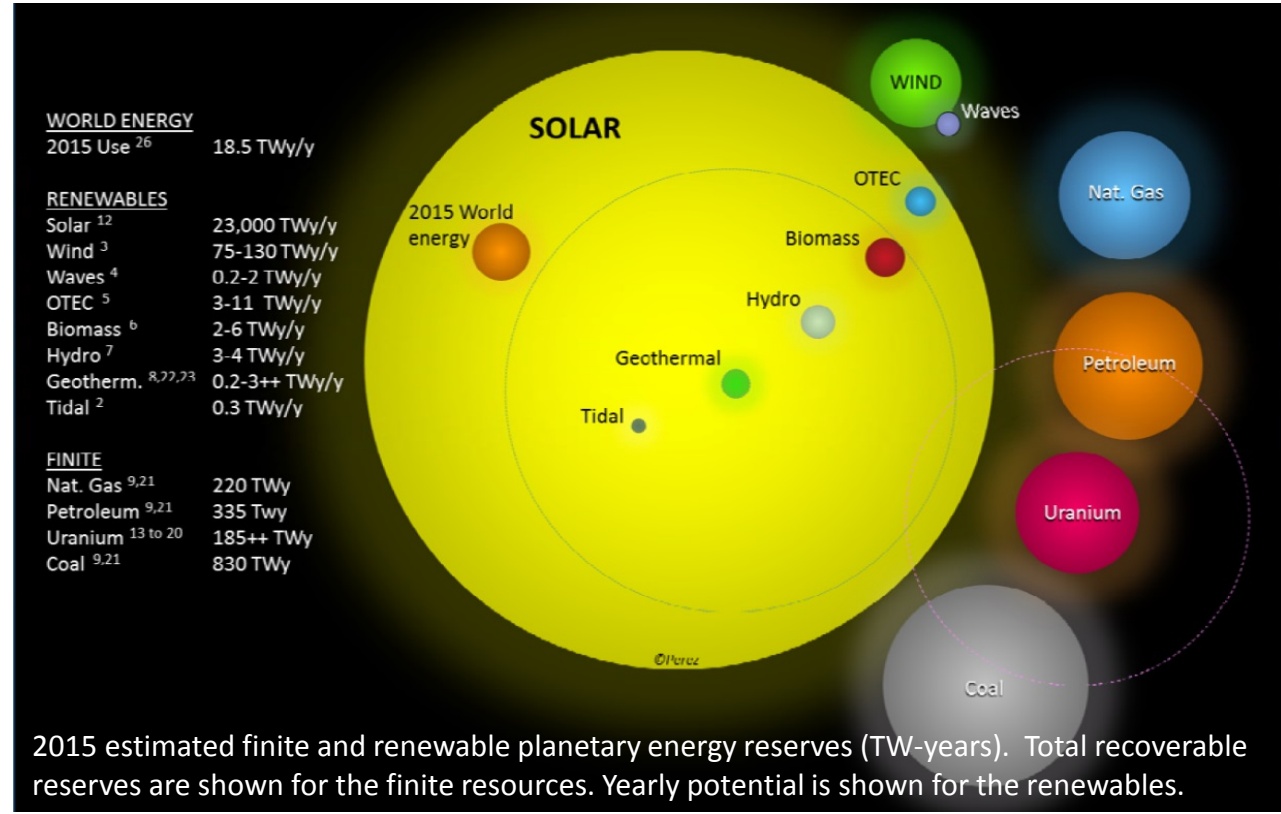
Motivation for Use of Solar Energy

Year-to-Date Global Temperatures for 2017 and the other eight warmest years on record



Source: US Government, Dept. of Commerce (June 2017)
<https://www.ncdc.noaa.gov/sotc/global/2017/05/supplemental/page-1>

Global energy resources and consumption

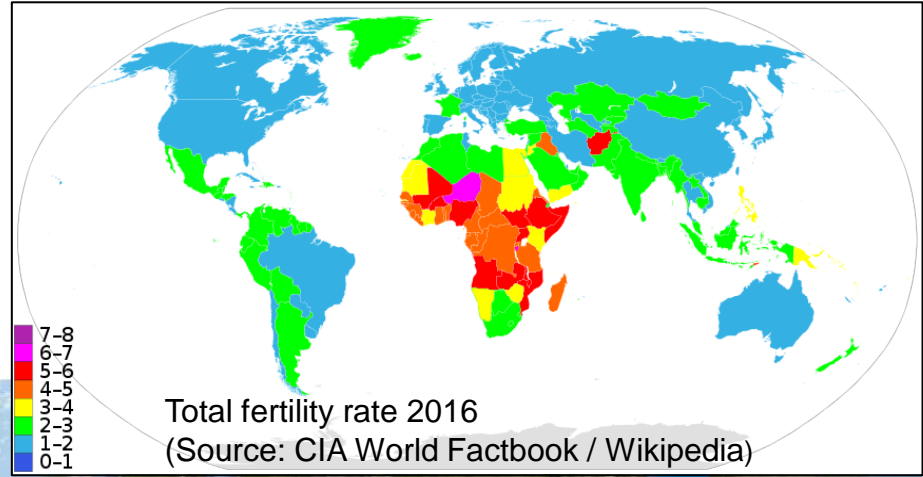
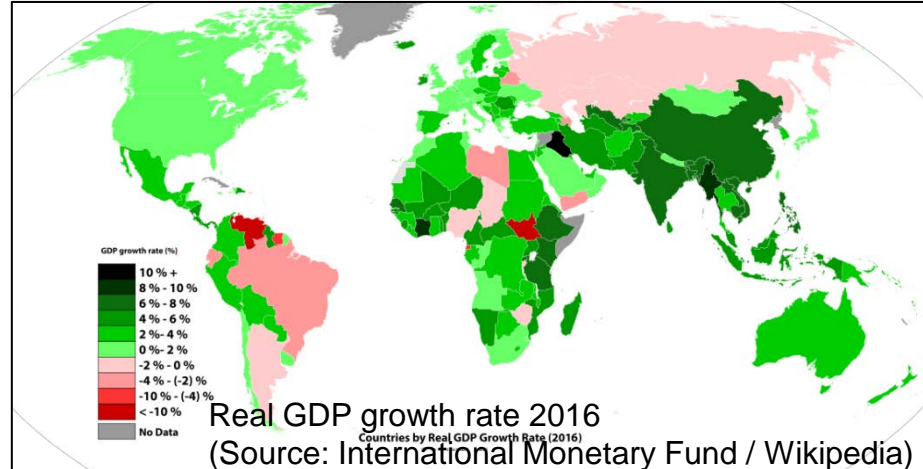
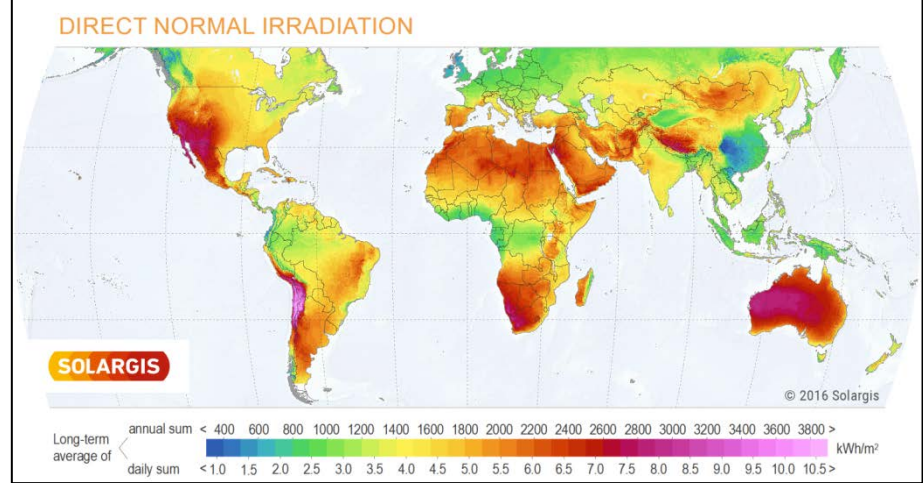
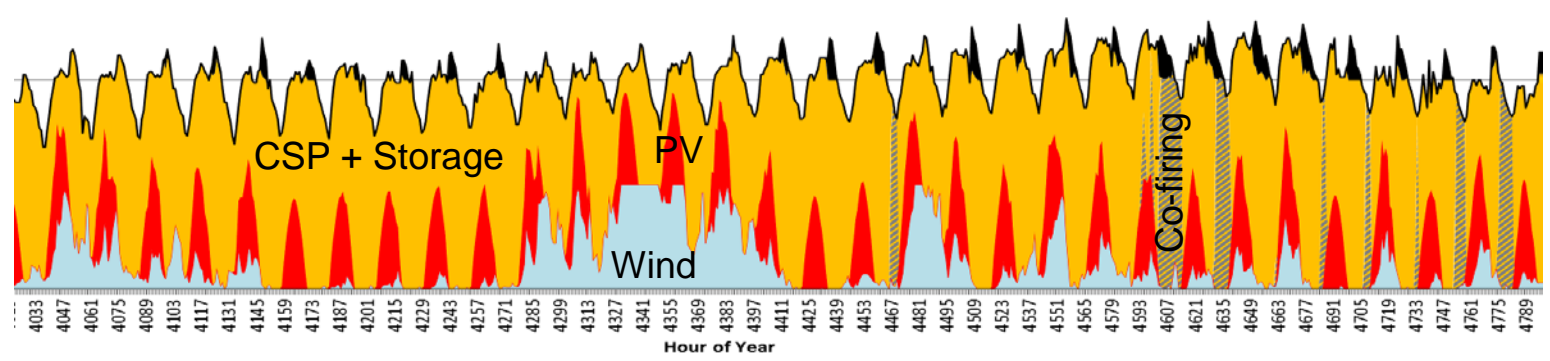
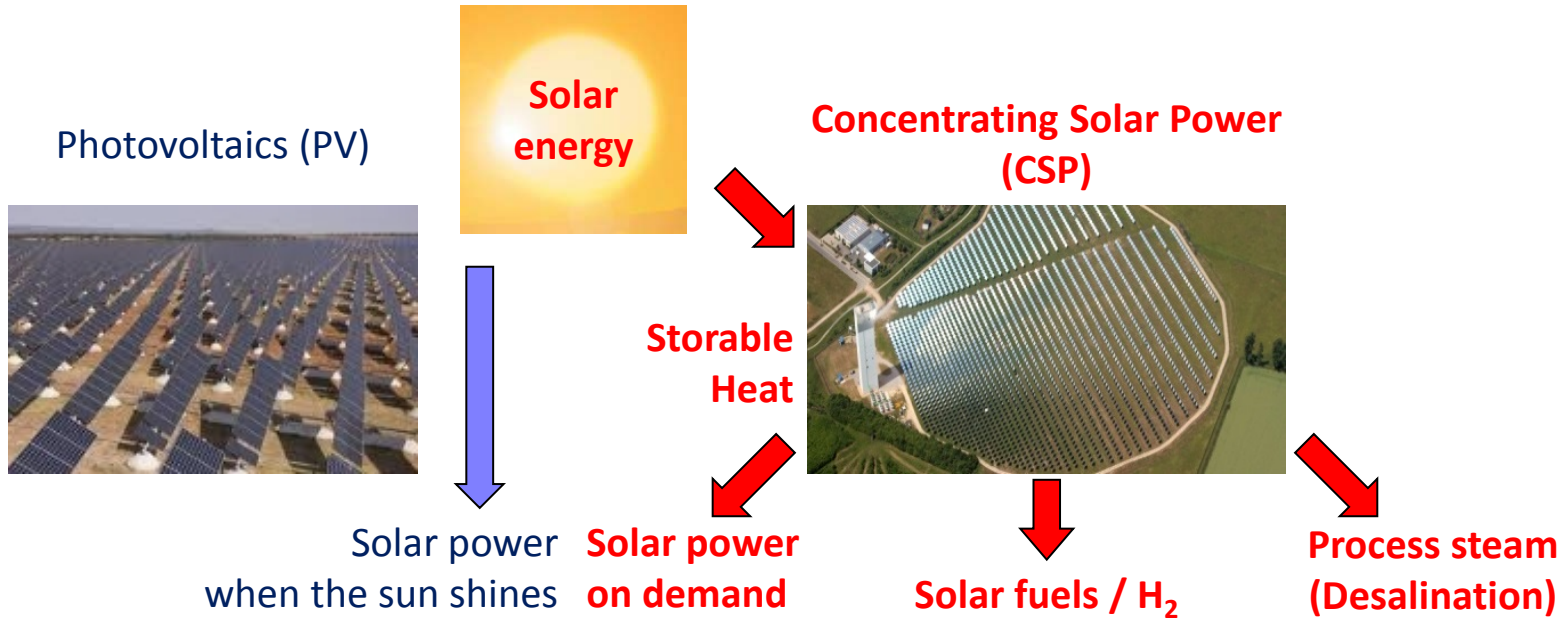


2015 estimated finite and renewable planetary energy reserves (TW-years). Total recoverable reserves are shown for the finite resources. Yearly potential is shown for the renewables.

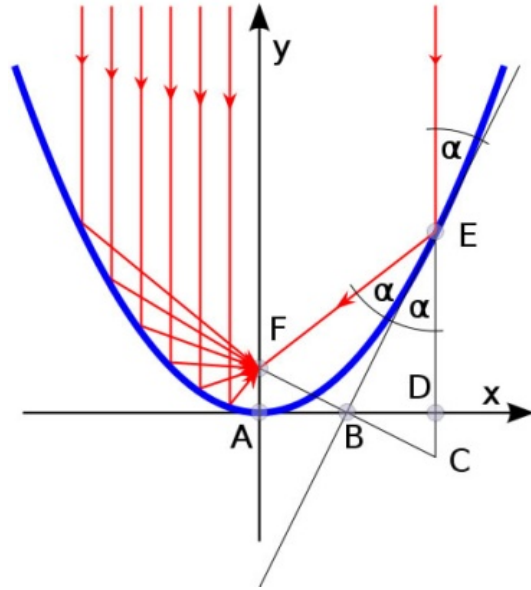
Source: International Energy Agency (IEA, 2015)
<https://www.iea-shc.org/data/sites/1/publications/2015-11-A-Fundamental-Look-at-Supply-Side-Energy-Reserves-for-the-Planet.pdf>



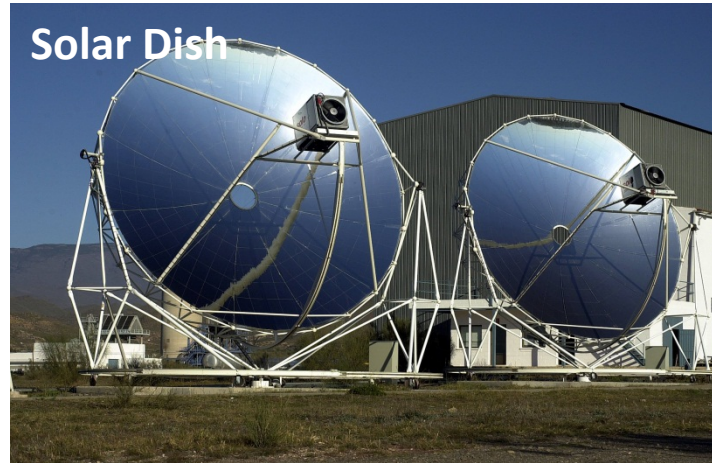
Solar Power Technologies



Four CSP Technology Families



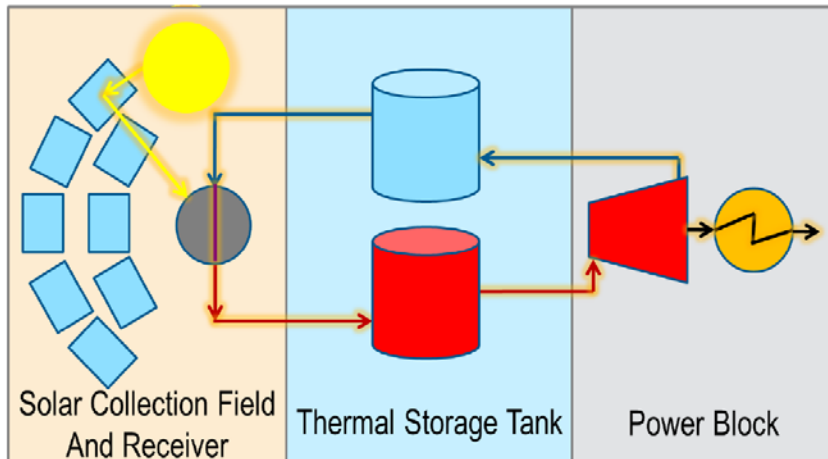
Point Focus:
Higher concentration &
two axis sun tracking



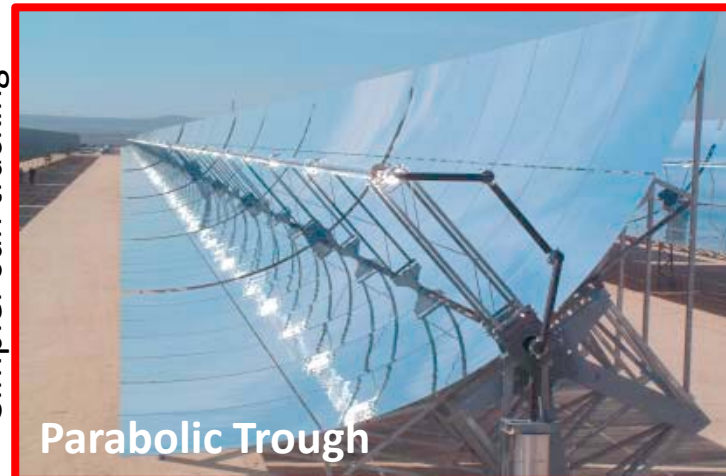
Mobile Receiver:
Higher optical efficiency



Fixed Receiver:
Easier transport of collected heat



Line Focus:
Simpler sun tracking



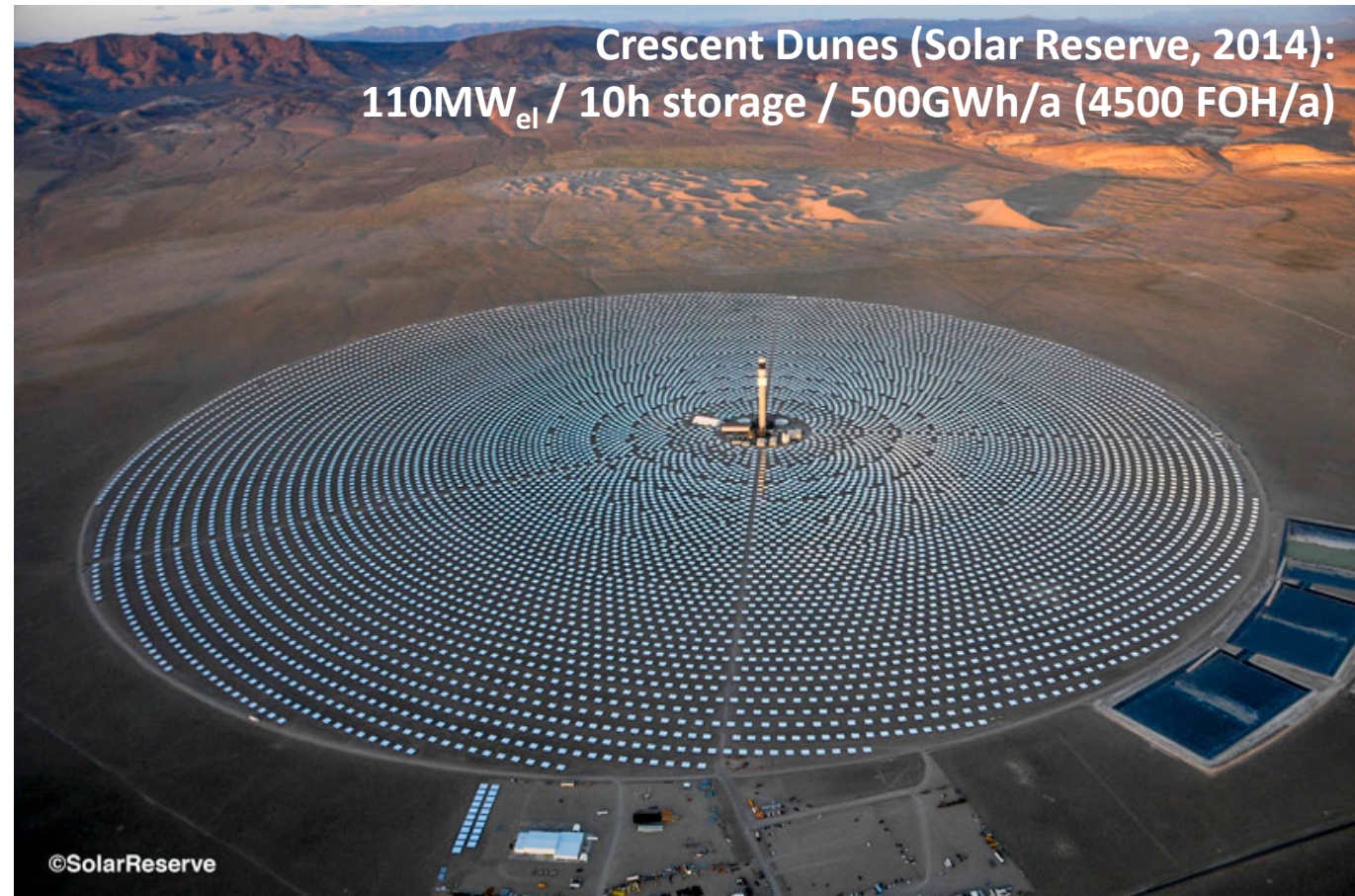
State of the Art: Large Commercial Parabolic Trough Plants with Molten Salt Thermal Storage

Solana Power Plant (Abengoa, 2013)

- 2.2 km² solar field on 12 km² area
- 6h storage
- 2 x 140MW_{el}
- 980 GWh/a power production (3500 FOH/a)



Solar Towers with Molten Salt Storage - The Future CSP Standard?



Jülich Solar Tower Demonstration Plant





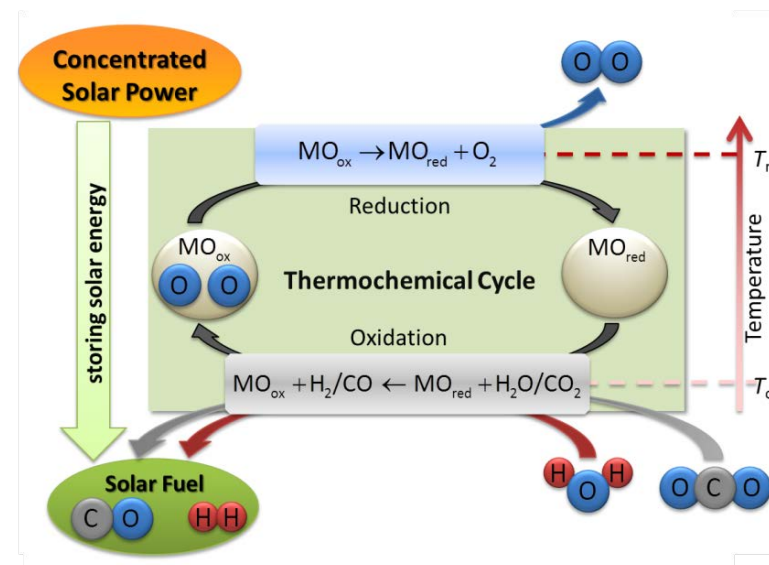
synlight Large-Scale Solar Simulator (“Artificial Sun”)

Purpose:

Generation of precisely adjustable and consistent sunlight in a new magnitude for research and industry

Application: Testing and qualification of

- Thermochemical processes and reactors for solar fuels
- CSP components (receivers)
- Components exposed to high solar / UV radiation
- Applications for highest temperatures up to 3000°C

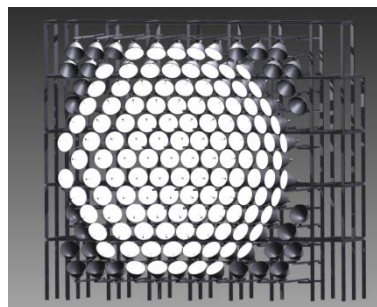


Bridging solar laboratory scale with research platforms and demo plants for **faster technology developments**



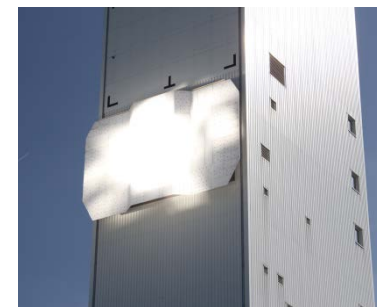
— Factor ~10 →

DLR High-Flux Solar Simulator, Cologne, up to 20 kW_{rad}



— Factor ~10 →

Synlight, Jülich, up to 300 (400) kW_{rad}

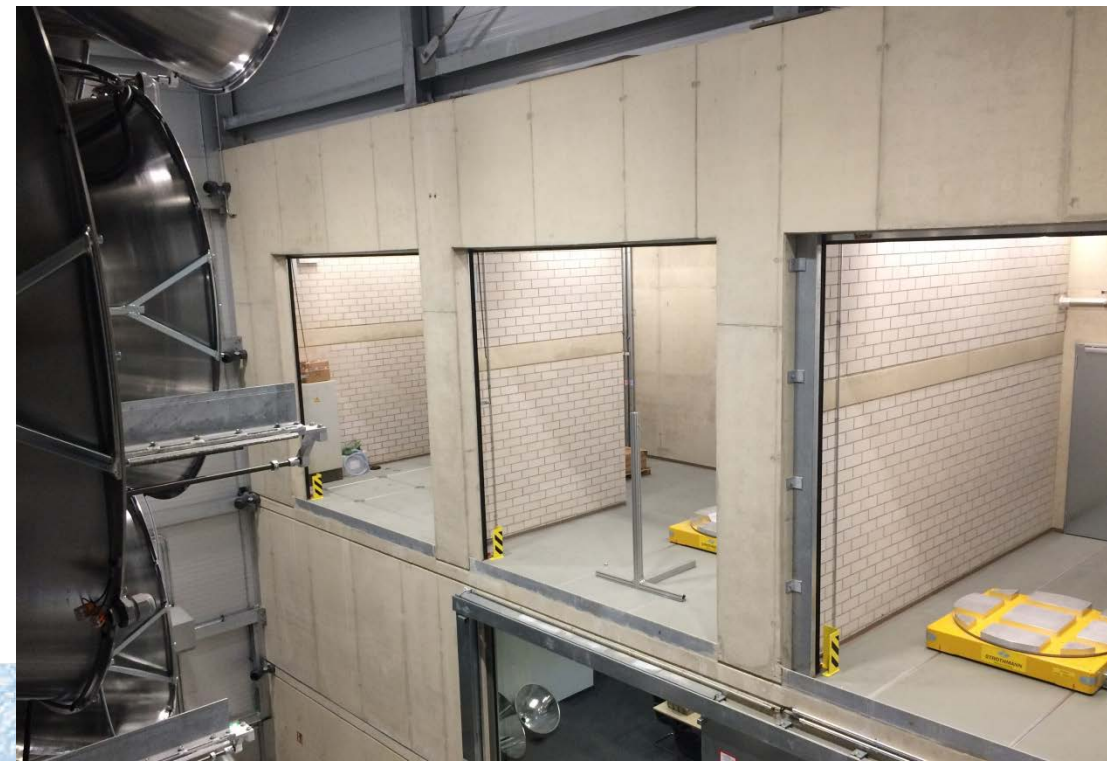
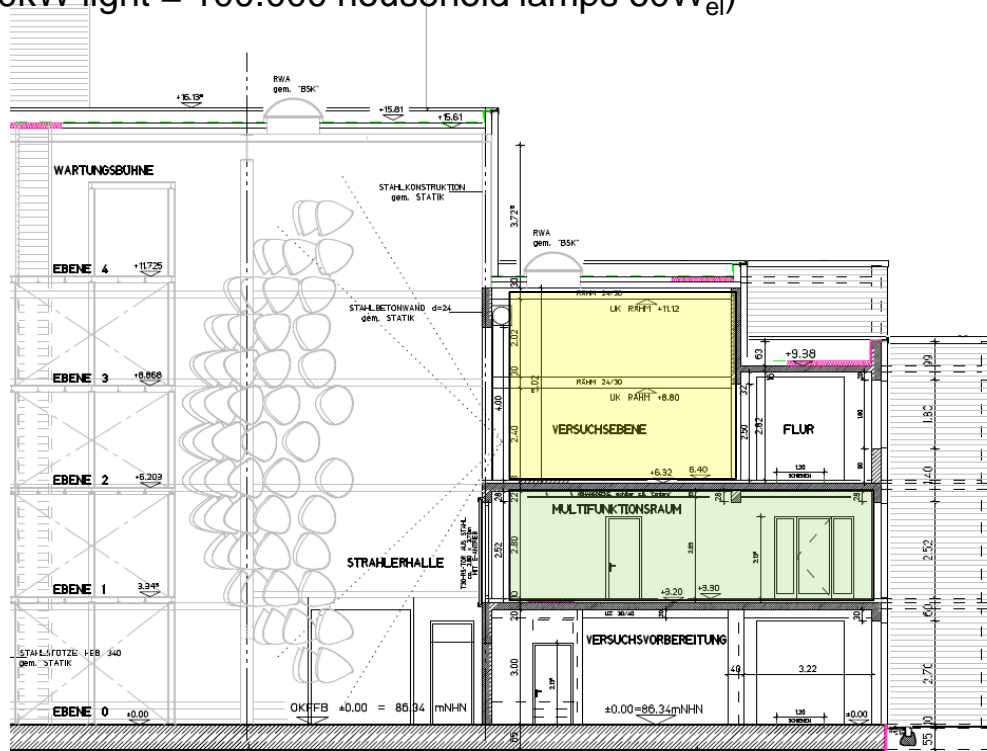
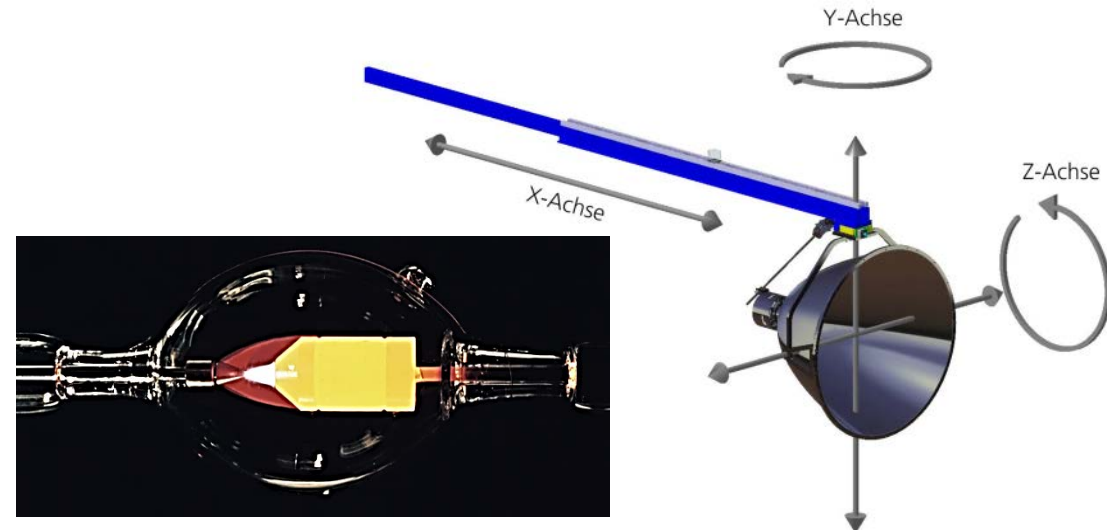


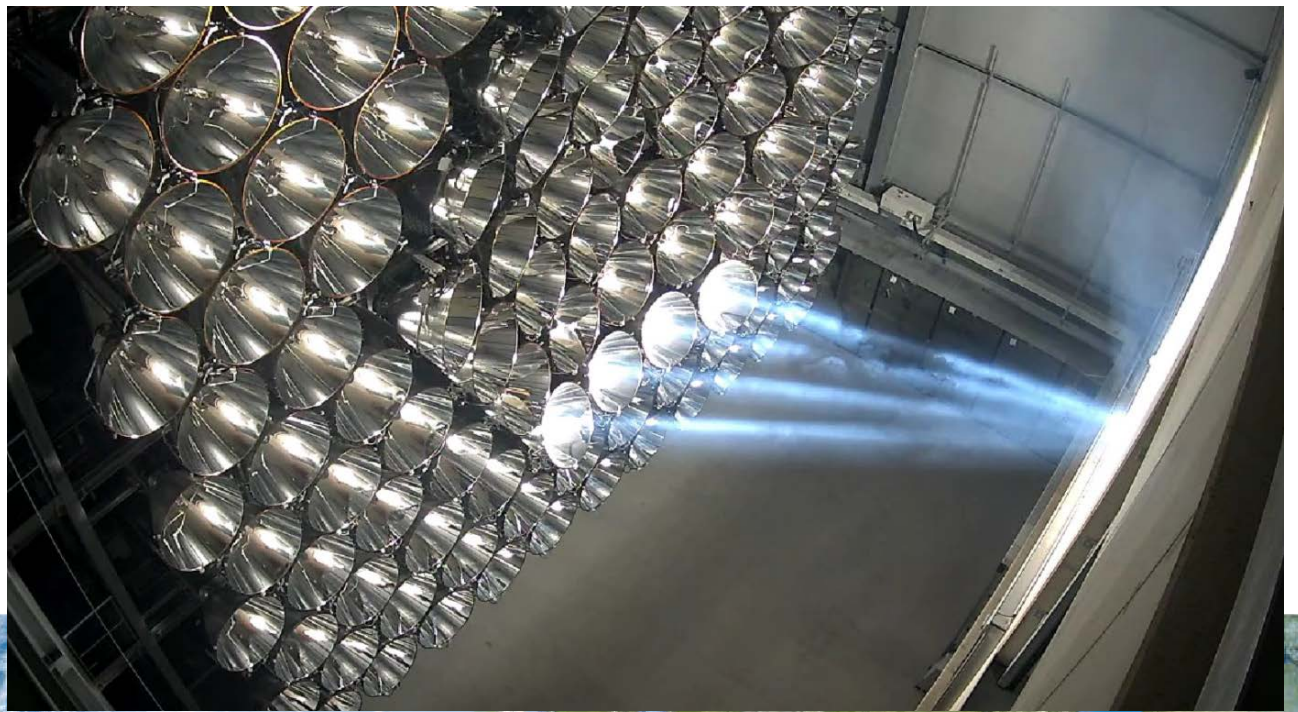
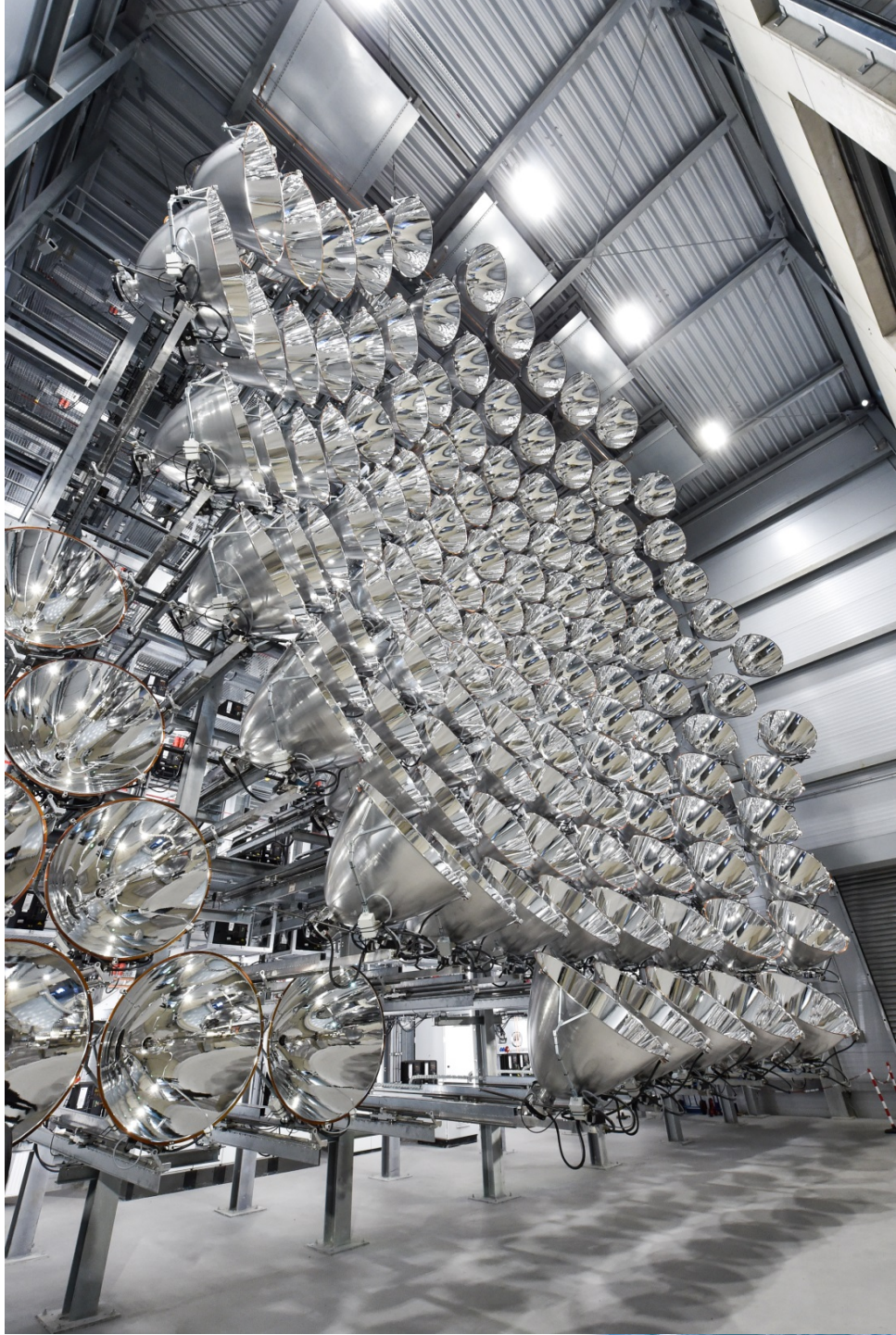
Research platforms of Jülich Solar Tower and a future 2nd tower, up to 1000 / 2000 kW_{rad}



synlight Technical Implementation

- 149 identical modules, computerized adjustable in 3 axis
- 7kW_{el} - (10kW_{el} -) Xenon cinema lamps as light sources with a light nearly equal to the solar spectrum
- Light concentration up to 10.000 times / $>3000^{\circ}\text{C}$
- Building with 3 test chambers, independent operation, specially equipped
- Radiation powers: 240kW / 300kW / 240kW (maximum with 10kW_{el} bulbs: 320kW / 400kW / 320kW)
(Note: 300kW light = 100.000 household lamps 60W_{el})

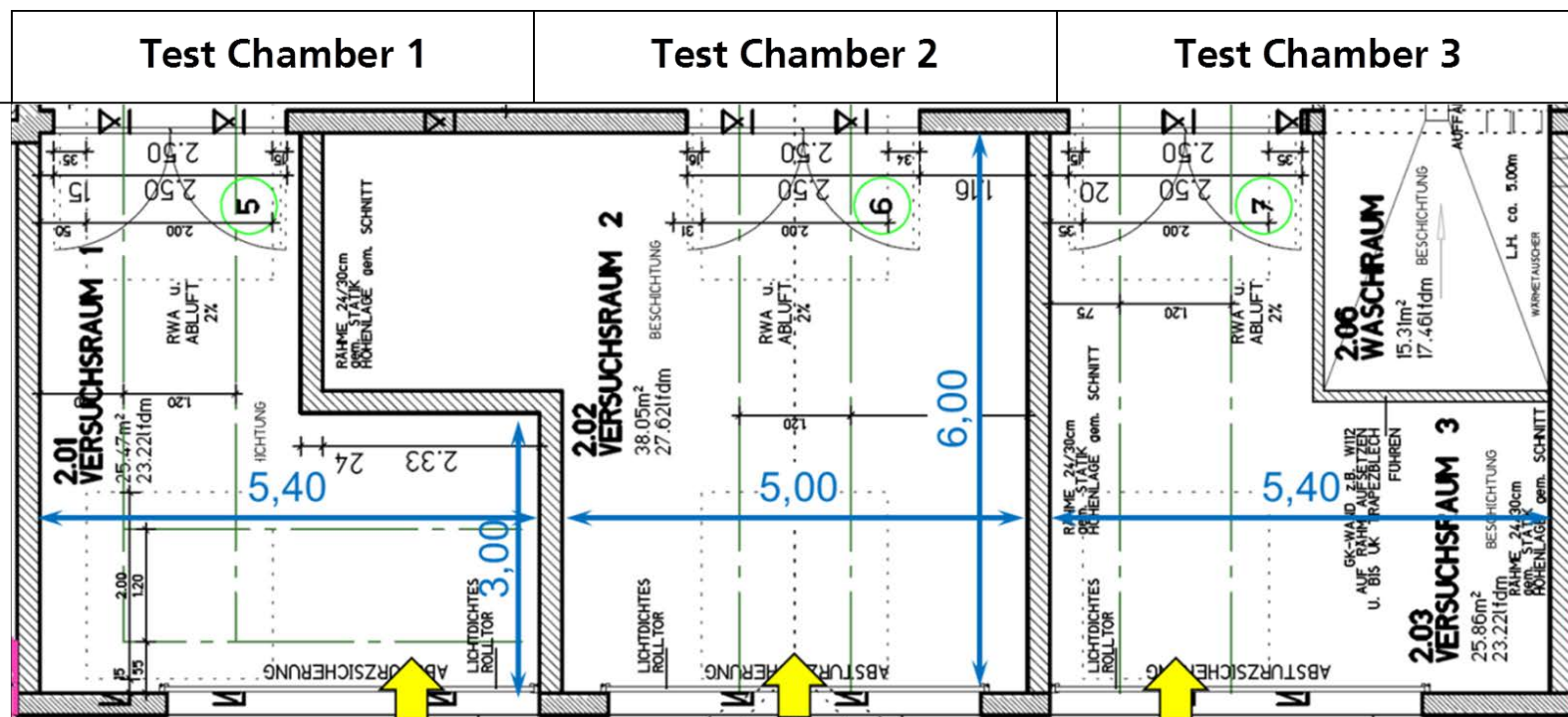




synlight

Technical Profile

Floor plan



Max. solar power	240kW* (320kW*)	300kW* (400kW*)	240kW* (320kW*)
Peak flux	>8MW/m ² *	>11MW/m ² *	>8MW/m ² *
Max. aperture	2m x 2m (4m x 4m)		
Chamber space	25m ² x 4,5m	38m ² x 4,5m	26m ² x 4,5m
Max. test object	2,5t (>4t)	2,5t (>6t)	2,5t (>4t)
Cooling	air cooling up to 5m ³ /s per chamber, additional cooling water supply		
Connections	power 400V/63A and 230V/16A, water 100L/min, Ethernet 1Gbit/s		
Special feature	high UV proportion	equipped for solar-chemical applications	

* Predicted values. Parameters in brackets () exceed the current standard and can be realized with some additional effort.



synlight

Die größte künstliche Sonne der Welt

Gefördert durch:

Ministerium für Klimaschutz, Umwelt,
Landwirtschaft, Natur- und Verbraucherschutz
des Landes Nordrhein-Westfalen



Gefördert durch:



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des Deutschen Bundestages