

General introduction CSP Technologies and grid management

Bernhard Hoffschmidt, DLR Institute of Solar Research



Knowledge for Tomorrow



Outline

1. CSP Technologies
2. Characteristics of CSP
3. Market und Cost Development
4. Benefits for a Mix of PV und CSP
5. Conclusions



Outline

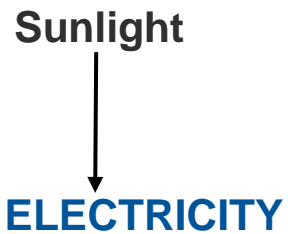
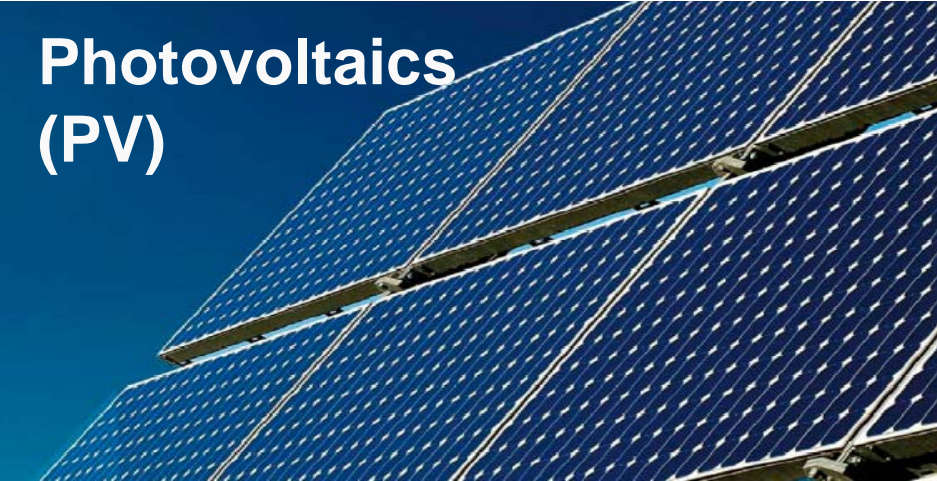
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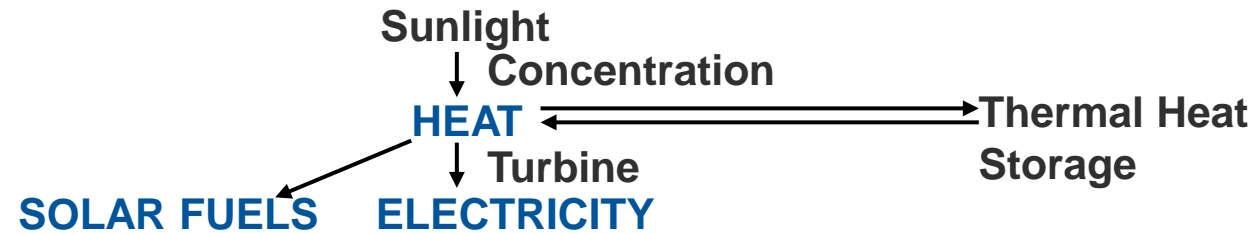
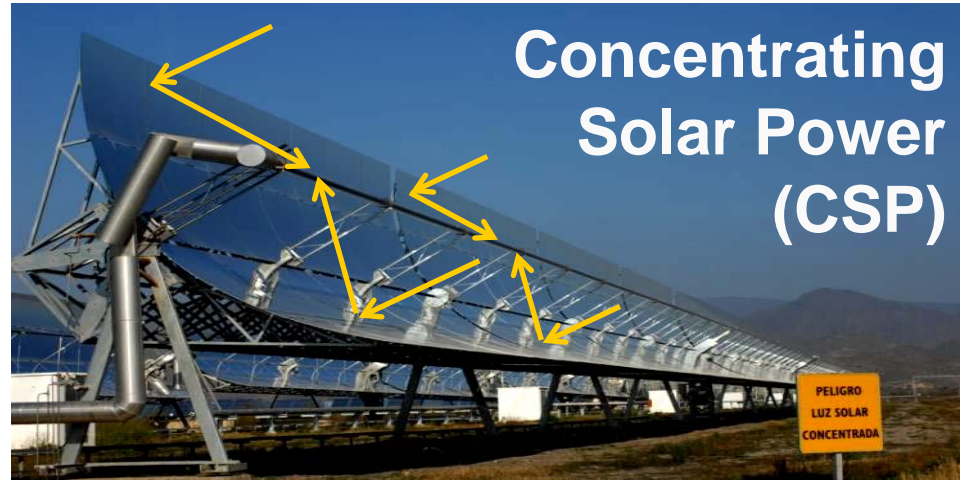


Concentrating Solar Technologies

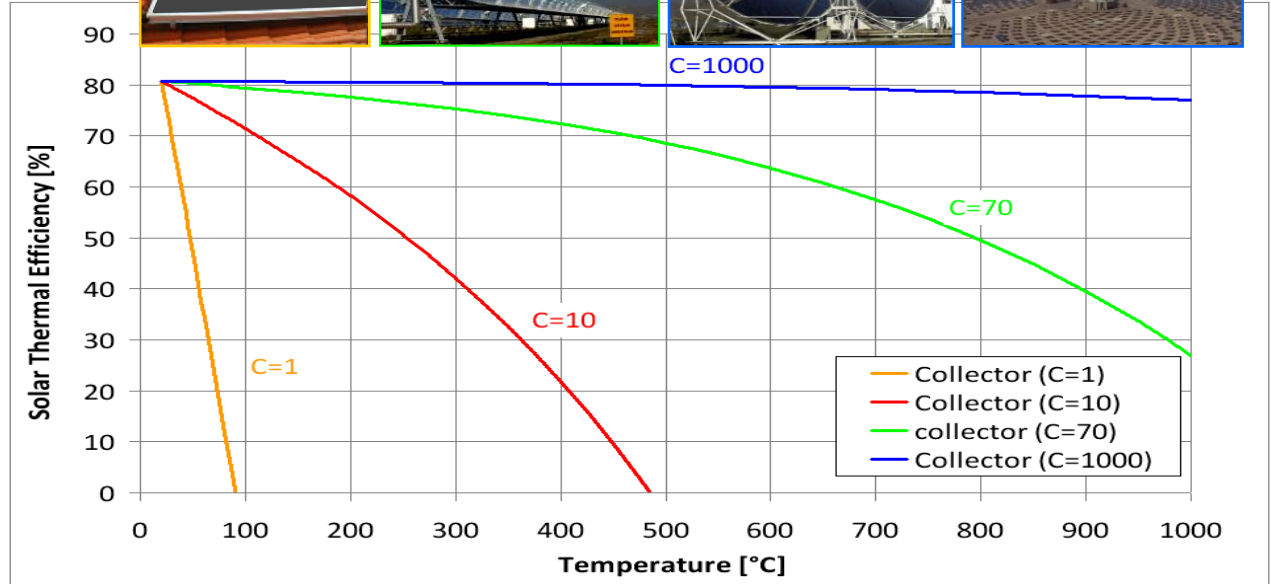
Photovoltaics (PV)



Concentrating Solar Power (CSP)



Concentrating Solar Technologies

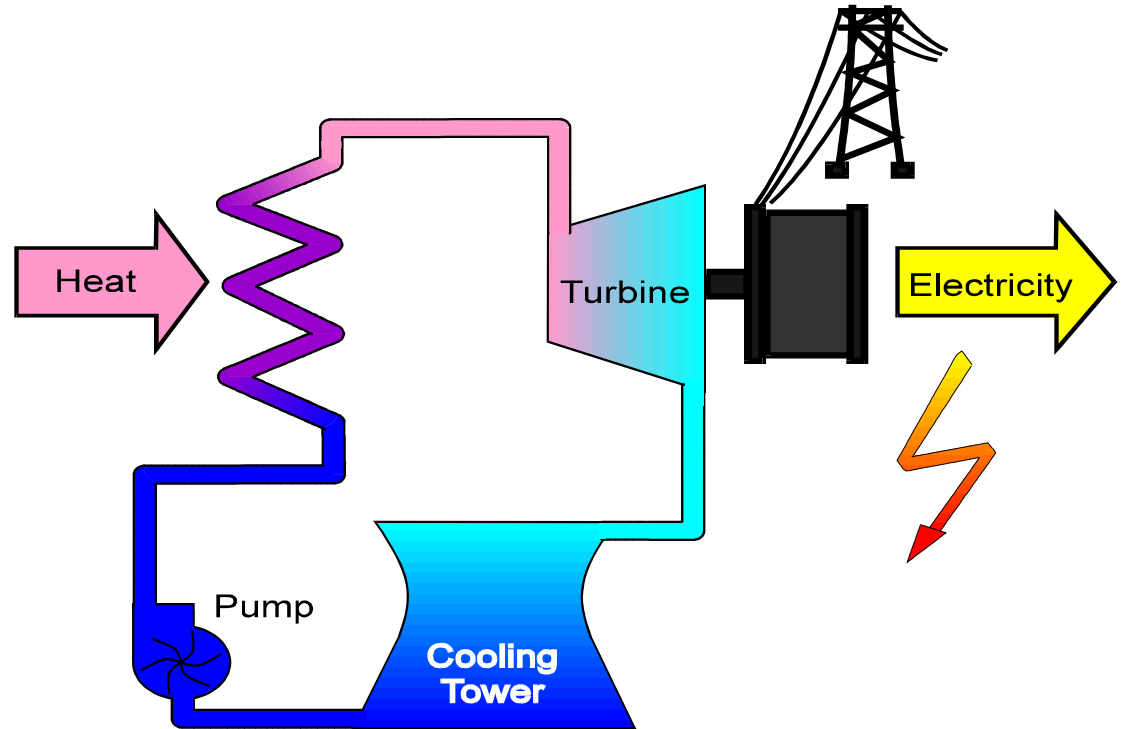


Solar Concentrating Technology is able to produce clean **PROCESS HEAT** at any temperature

CSP-System



Solar thermal power plants

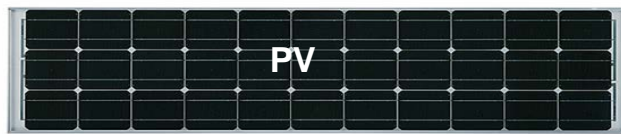


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Characteristics



Solar Resource

Direct und diffuse Radiation

Direct Radiation

Block size

mWatt to some 100 MW

10 MW to some 100 MW

Installation:

everywhere (roof top etc.)

flat unused land

Capacity :

700 – 2000 full load hours

2000 – 7000 full load hours

Back-up Capacity

external (e.g. gas turbine)

therm. Storage / fossil backup

Inst. Power (2015)

227 GW

5 GW

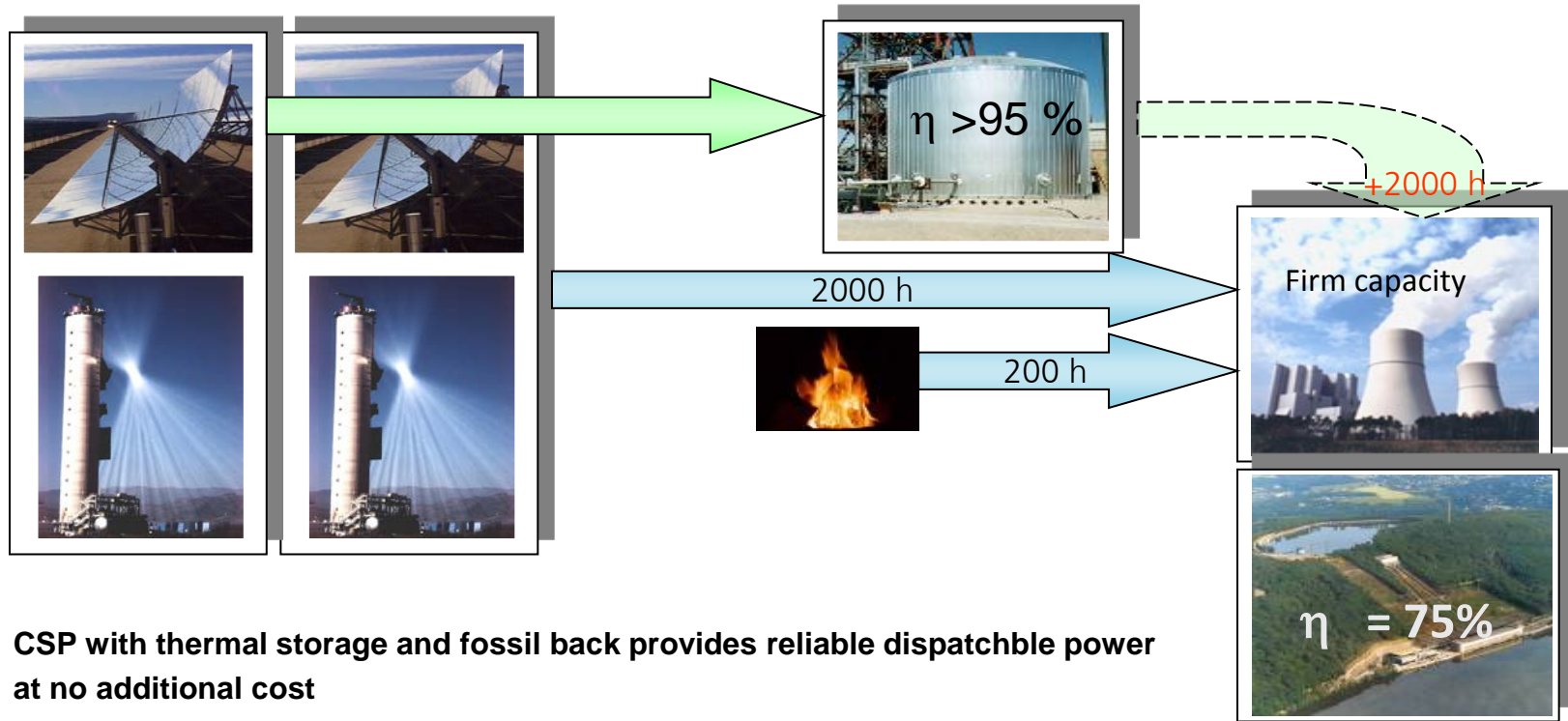
LCOE

0,03 – 0,13 €/kWh

0,06 – 0,20 €/kWh



Thermal Storage vs. Electric Storage

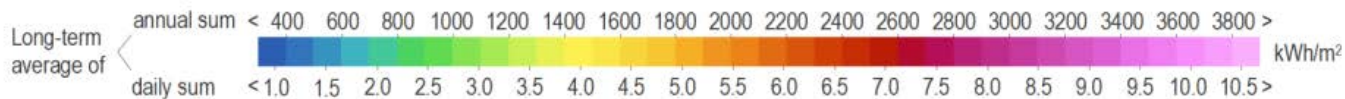
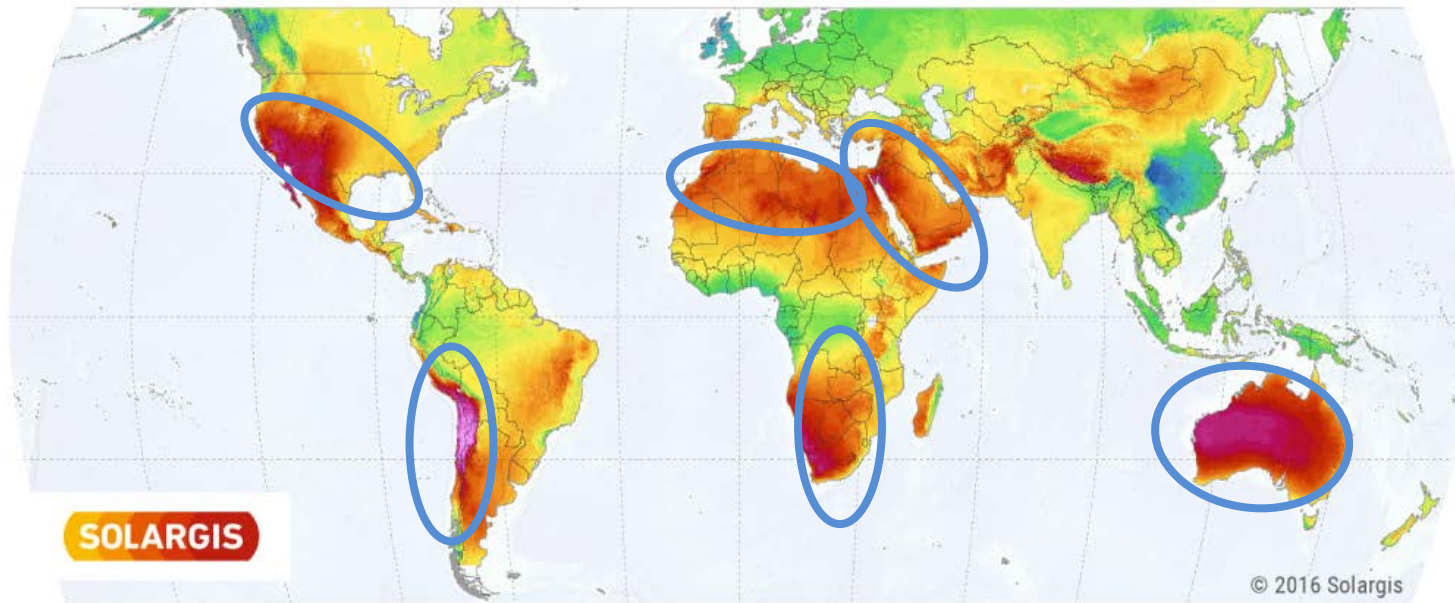


CSP with thermal storage and fossil back provides reliable dispatchable power at no additional cost



CSP only suitable in areas with high direct normal radiation

DIRECT NORMAL IRRADIATION

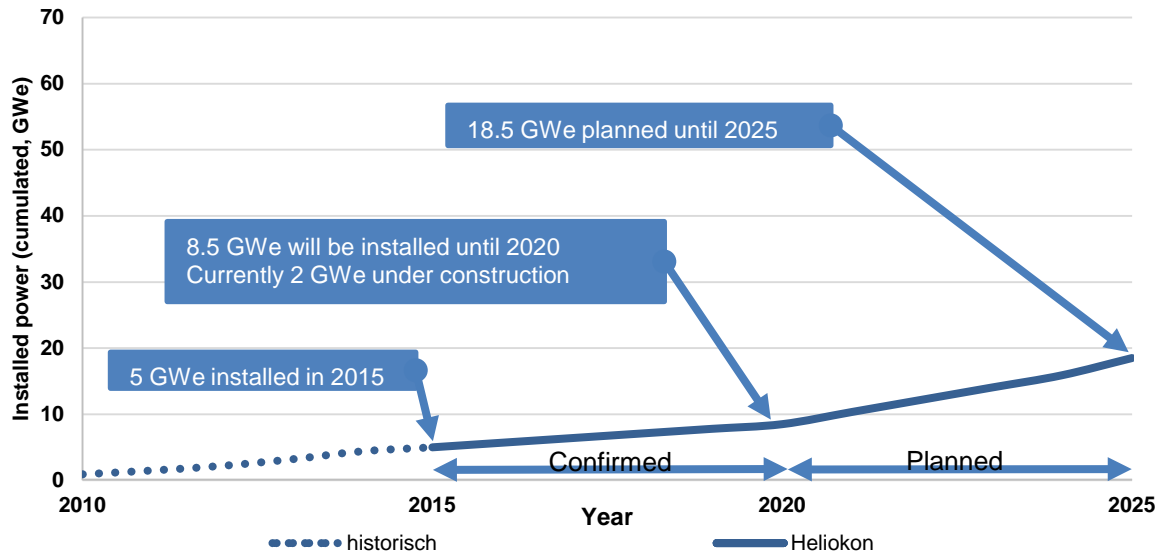


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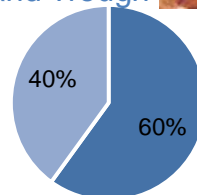
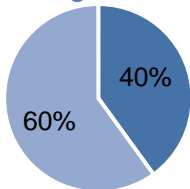


Market forecast CSP 2025



Significant change in market share between Power Tower and Trough

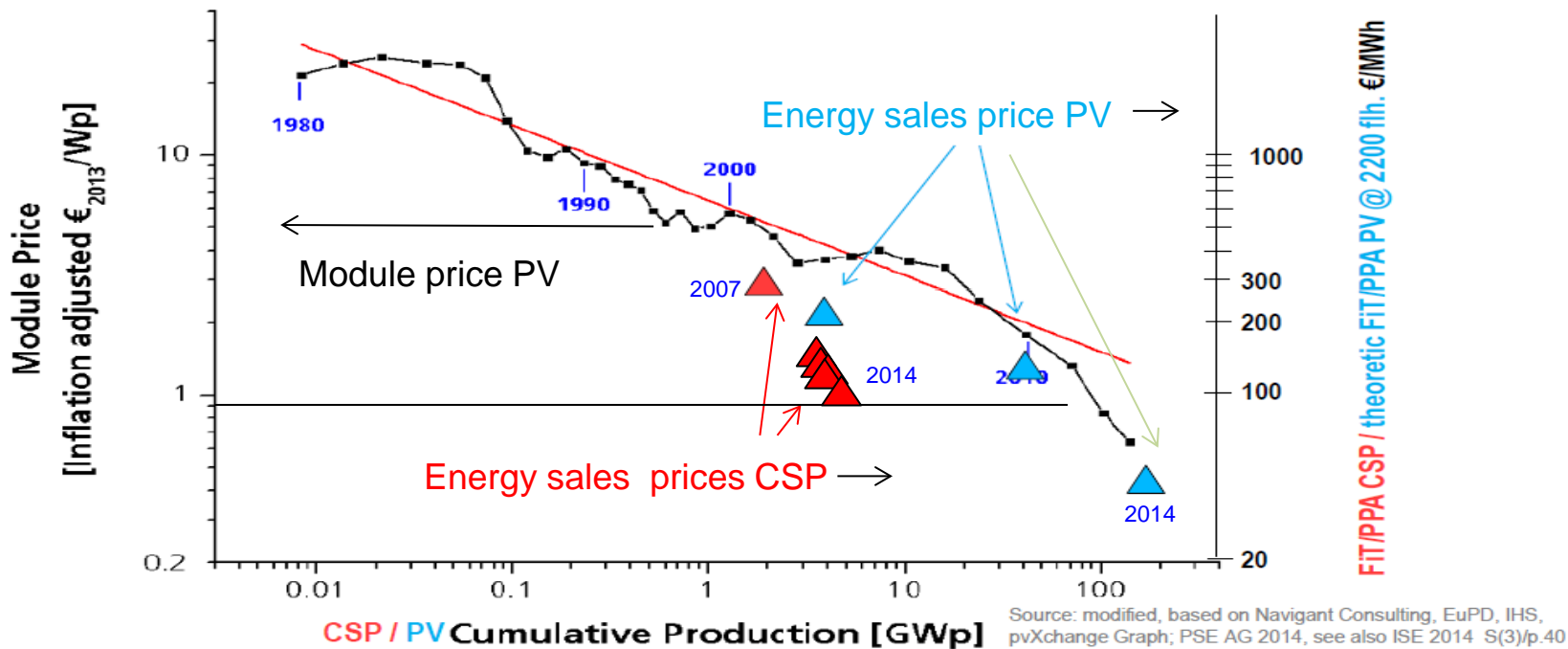
- 2020 Tower
- 2020 Trough



- 2025 Tower
- 2025 Trough

Cost for CSP and PV have dropped strongly with their deployment

- CSP deployment is smaller than PV today, thus it still has higher costs



CSP Market Perspectives until 2025

- Estimated installed capacity until 2025: 10 - 20 GW (plus 5-15 GW)
- Accumulated investment in CSP until 2025
25 – 75 Billion EUR
- Annual Volume on O&M Contracts in 2025:
1 – 2 Billion EUR per Jahr
- Additional Capacity in the field of process heat

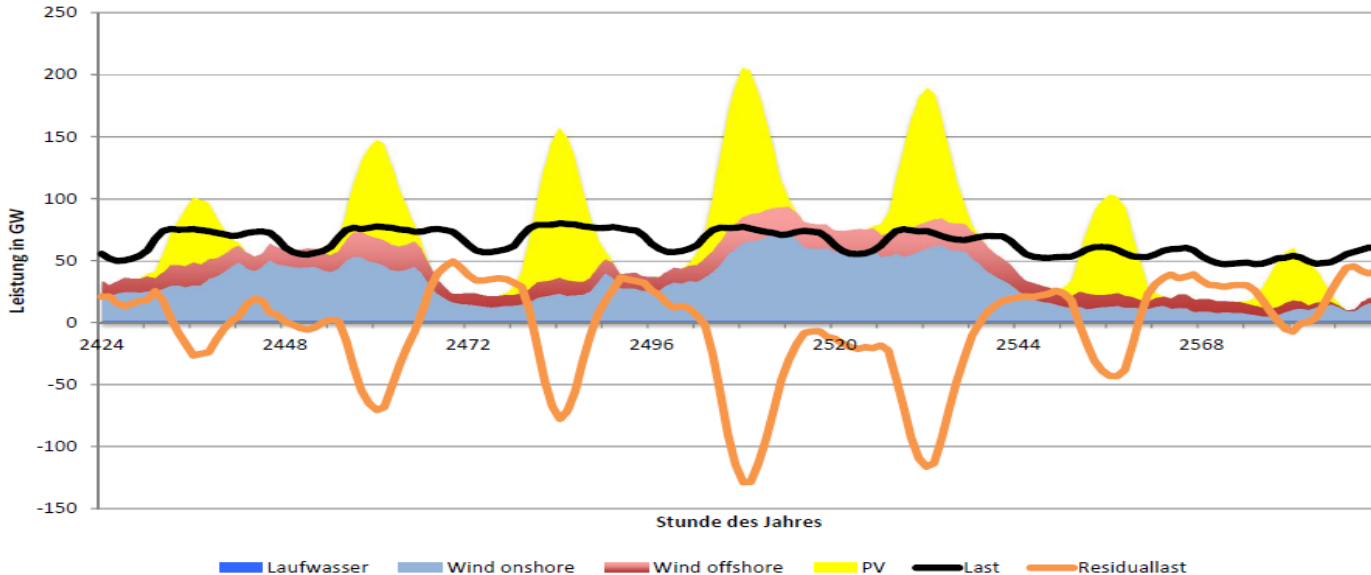


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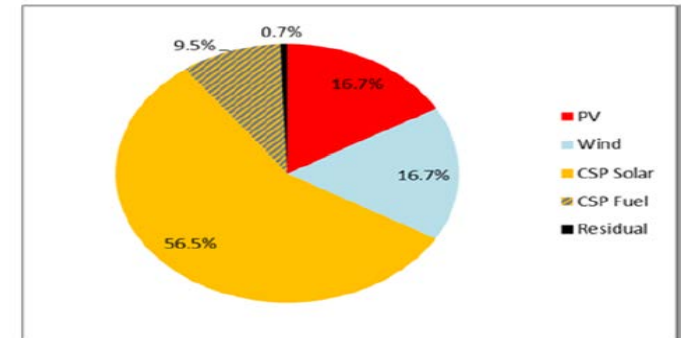
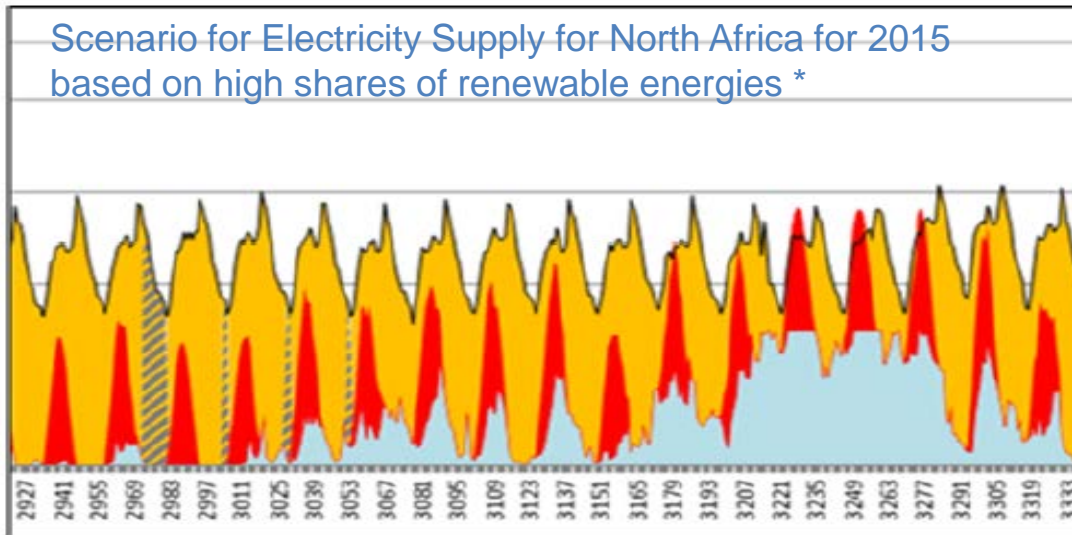


High shares of cheap Wind and PV capacity lead to a strongly fluctuating residual load that need to be covered by other technologies



PV and CSP

- Two technologies that complement each other perfectly in many regions of the world, in particular if large shares fossil fuel can not be used



*Results from the EU Better Study (www.better-project.net)



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Conclusions

- PV and CSP with storage and hybridization are complementary technologies:
 - PV: provides power,
 - CSP: Energy + secured power
- PV market is booming since today often the most cost-effective option
- CSP is at the beginning of the learning curve:
further cost reduction is expected





Thank you for your attention

contact: bernhard.hoffschmidt@dlr.de