

Advantages of solar thermal power plants

Life needs power 2011, Tim Holzapfel

Who am I?

Tim Holzapfel, Heading E R STE BE



Education

Electrical Engineering, University of Karlsruhe, Karlsruhe, Germany
 University of Southampton, Southampton, UK
 ESIEE, Paris, France

Experience

- Within Siemens AG since 1998 in Mobile Networks as Technical Sales Manager in Berlin and Argentina
- Headed the Business consulting practice for new service providers within Marketing of Information and Communication Networks
- 9 years Siemens Management Consulting as Consultant, Project Manager and Partner
- Since October 2010 heading Business Excellence in Solar Thermal Business of Siemens

Spikes

- Energy Renewables, NSN / Telecommunication, Corporate programs
- M&A / PMI, restructuring, sales, portfolio mgmt. and benchmarking
- More than half of my time at Siemens abroad
- Recruiting

Personal Interests

- All kinds of sports
- Travelling, especially in Latin America

Power consumption is increasing – resource scarcity and climate change favor renewable sources

Renewable energy drivers

Demographic change



- Population growth 7.5 billion in 2020 (+1.1 billion)
- Megacities (>10 million inhabitants): 27 megacities in 2025

Increasing power consumption

Resource scarcity



- Geopolitics 70% of world oil and gas supplies in only a few countries
- Price fluctuations in fossil fuels

Increasing importance of energy efficiency

Climate change

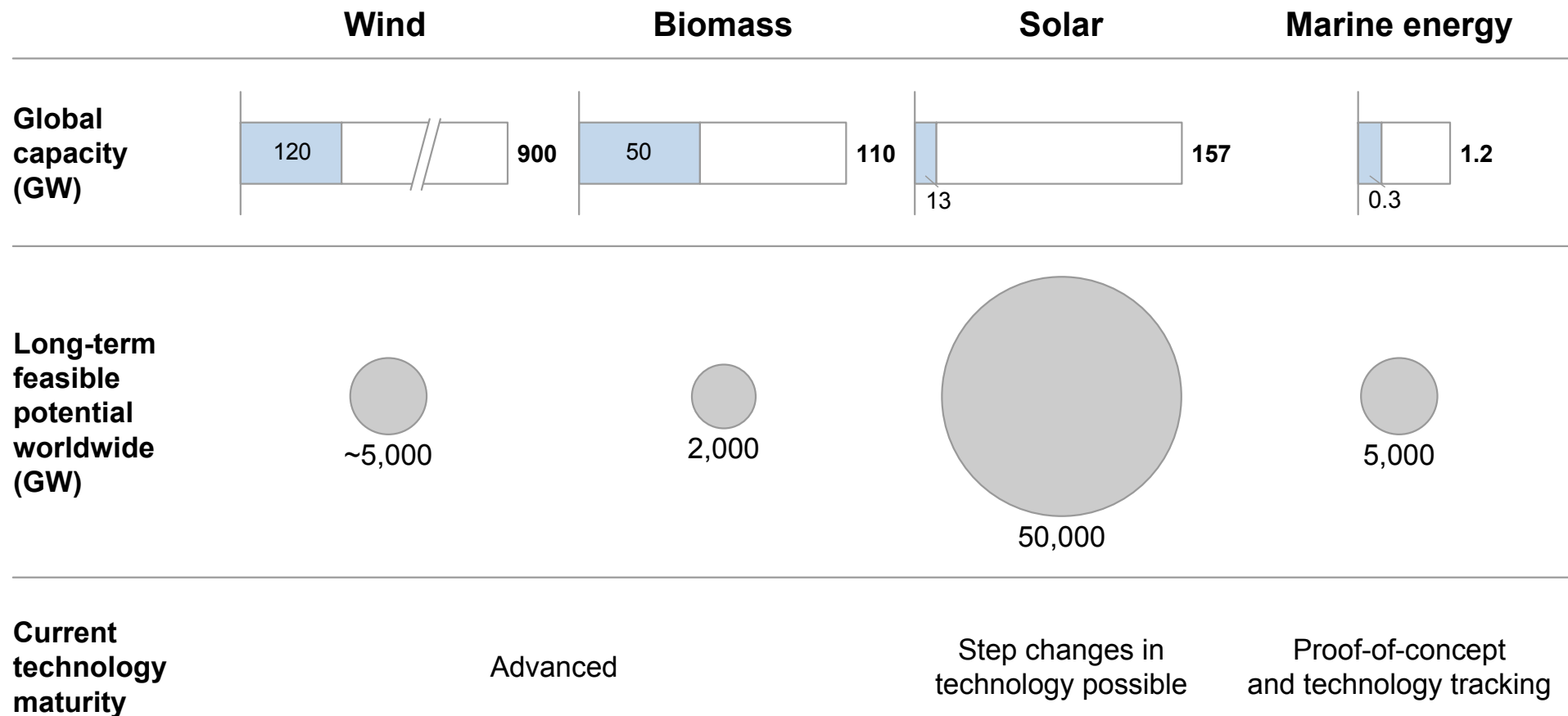


- Climate targets governmental programs for sustainable reductions in CO₂ emissions

Increasing demand for clean power

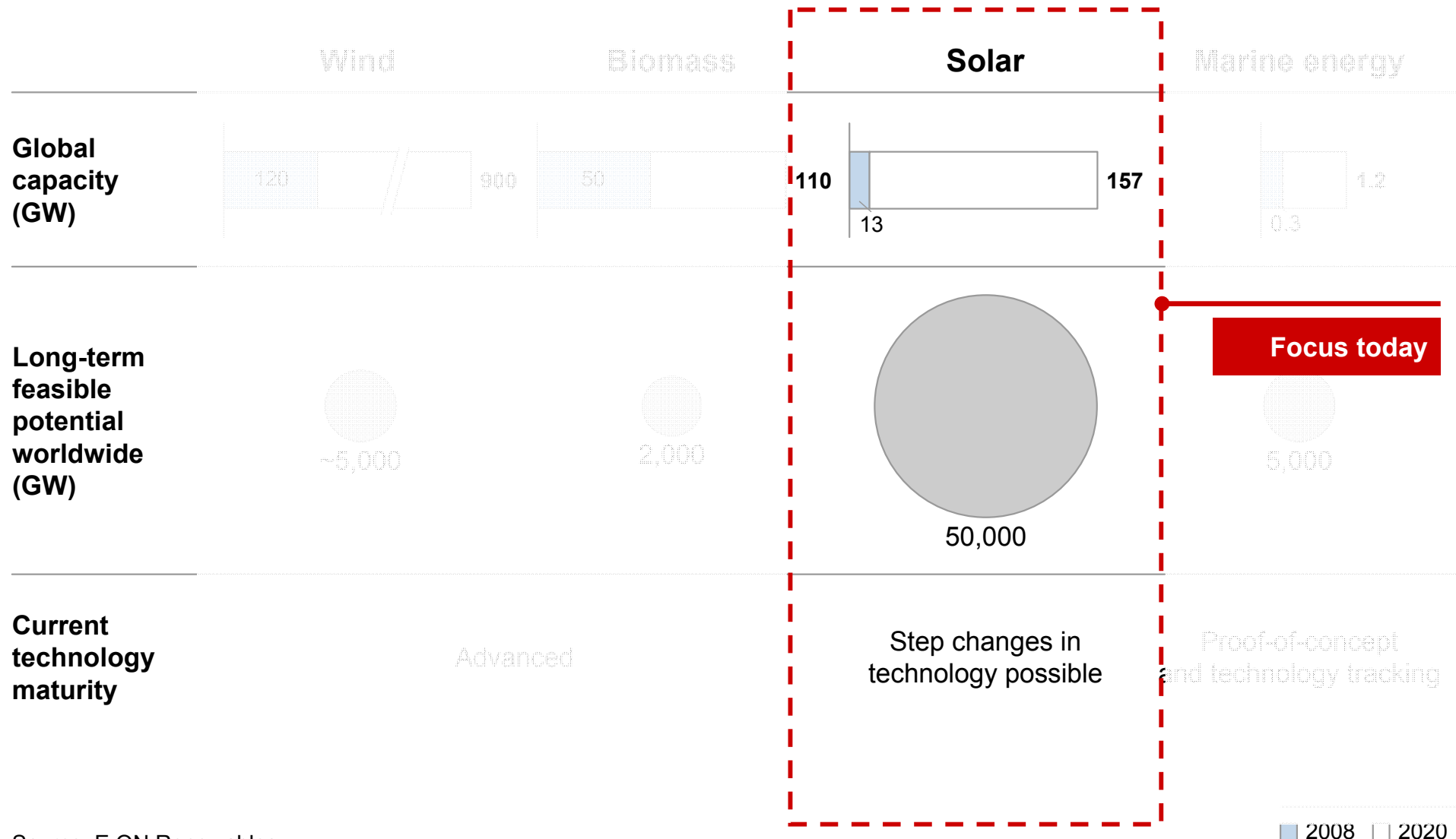
From all renewable technologies Solar Power has the largest energy potential

Renewable energy technologies potential



From all renewable technologies Solar Power has the largest energy potential

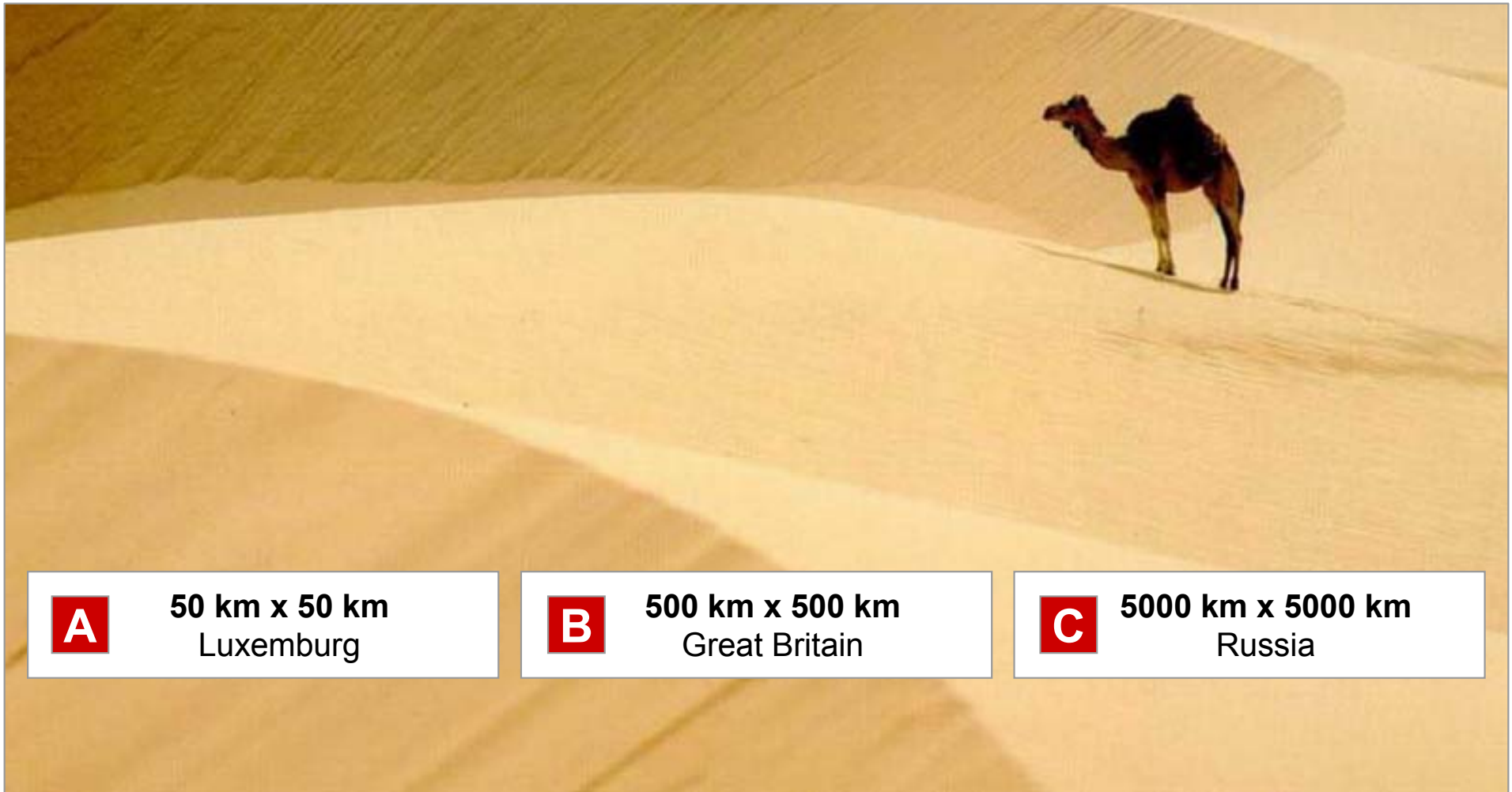
Renewable energy technologies potential



Source: E.ON Renewables

What area of CSP plants in the Sahara desert would cover the world's energy demand?

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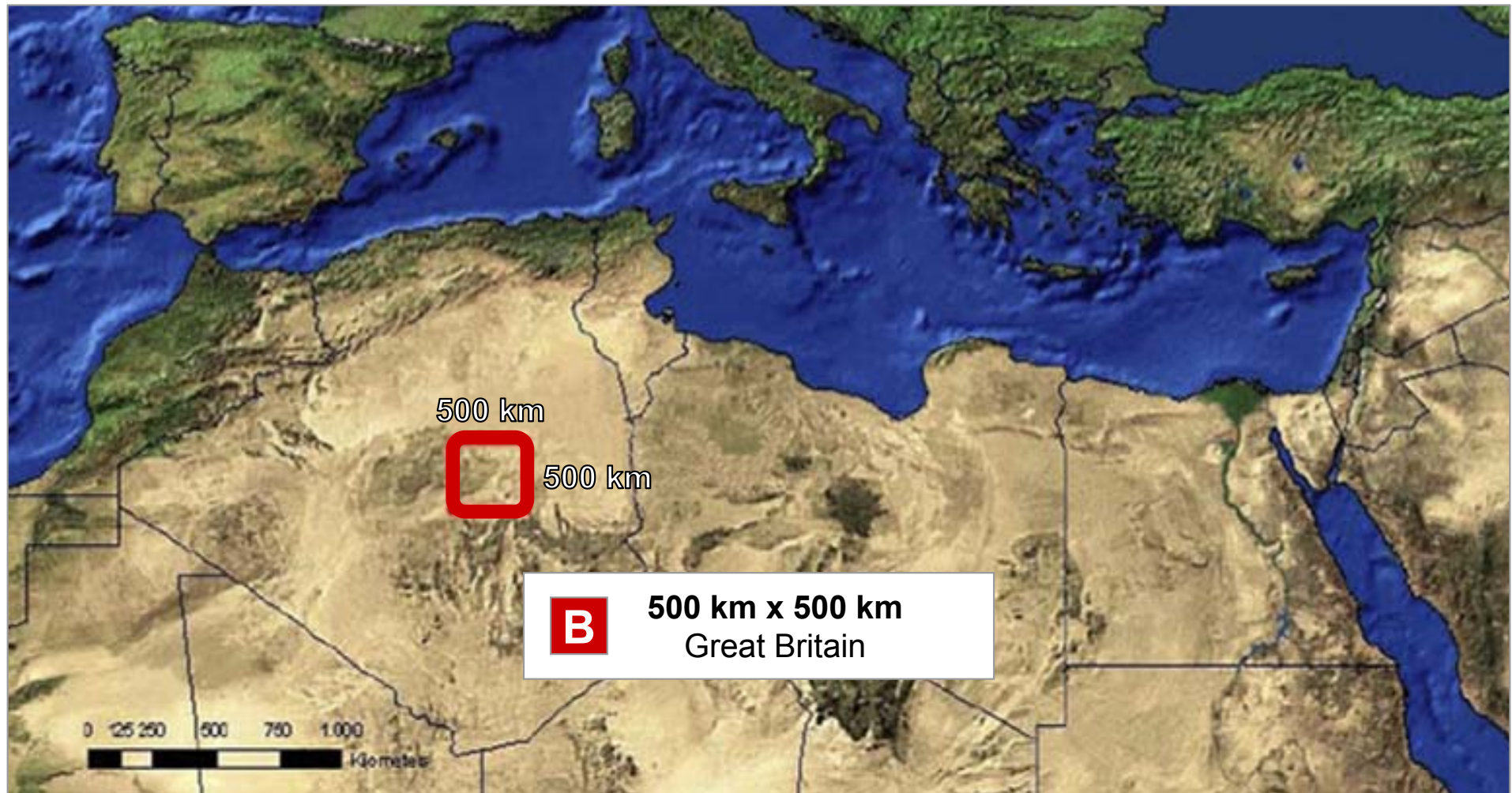
CSP: Concentrated Solar Power

Source: Siemens

Page 6

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An area of ~ 500 x 500 km would be required to cover world's energy demand of ~ 13.5 TW per year



Every technology has its strengths and weaknesses





Comparison CSP technologies

Parabolic trough	Linear Fresnel	Solar power tower	Dish / Stirling
<ul style="list-style-type: none"> + Only mature & field proven concentrating solar technology with more than 25 years track record + Bankable technology - High CAPEX required to maximize owner's revenues 	<ul style="list-style-type: none"> + Low complexity + Flat mirrors cheaper than parabolic trough + Lower footprint than parabolic trough (less space btw. rows) - Lower efficiency than parabolic trough due to lower operating temperatures 	<ul style="list-style-type: none"> + More efficient than parabolic trough due to higher operating temperatures - Limited experience with this technology - Limited size per tower (MW) 	<ul style="list-style-type: none"> + Highest solar-to-electric conversion efficiency of all options + Modular system - High complexity - Maintenance intensive - Low field experience



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Focus today

Solar thermal is a proven technology operational since 25 years

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Advantages

- Proven technology

SEGS plants US – 6 x 30 MW



Source: FVEE

The CSP market is moving while plant sizes are increasing significantly

Construction of initial **SEGS plants I – IX in California, USA.** Choice of technology for all is **parabolic trough.** Performance classes
 1 x 17 MW, 6 x 30MW,
 2 x 80MW

1980s

Second wave of operating parabolic trough plants:
 64 MW Nevada Solar One,
 50 MW Andasol 1/2,
 50 MW Puertollano

2008–2009

First additional countries with project around 100–125MW, such as Israel and UAE

First commercial solar towers connected to the grid in Spain:
 PS10 and PS20

2009



~2006

Re-awakening of CSP.
Spain becomes the dominant market with standard 50MW parabolic trough solutions.
 More than 100 parabolic trough plants with standard capacity 50 MW in project pipeline. Very few plants are smaller or use different technologies



2010 onwards

Larger power plants are kicking off worldwide. With ~30 projects, the US will become the largest market. Dominant project size is >100 MW for parabolic troughs.

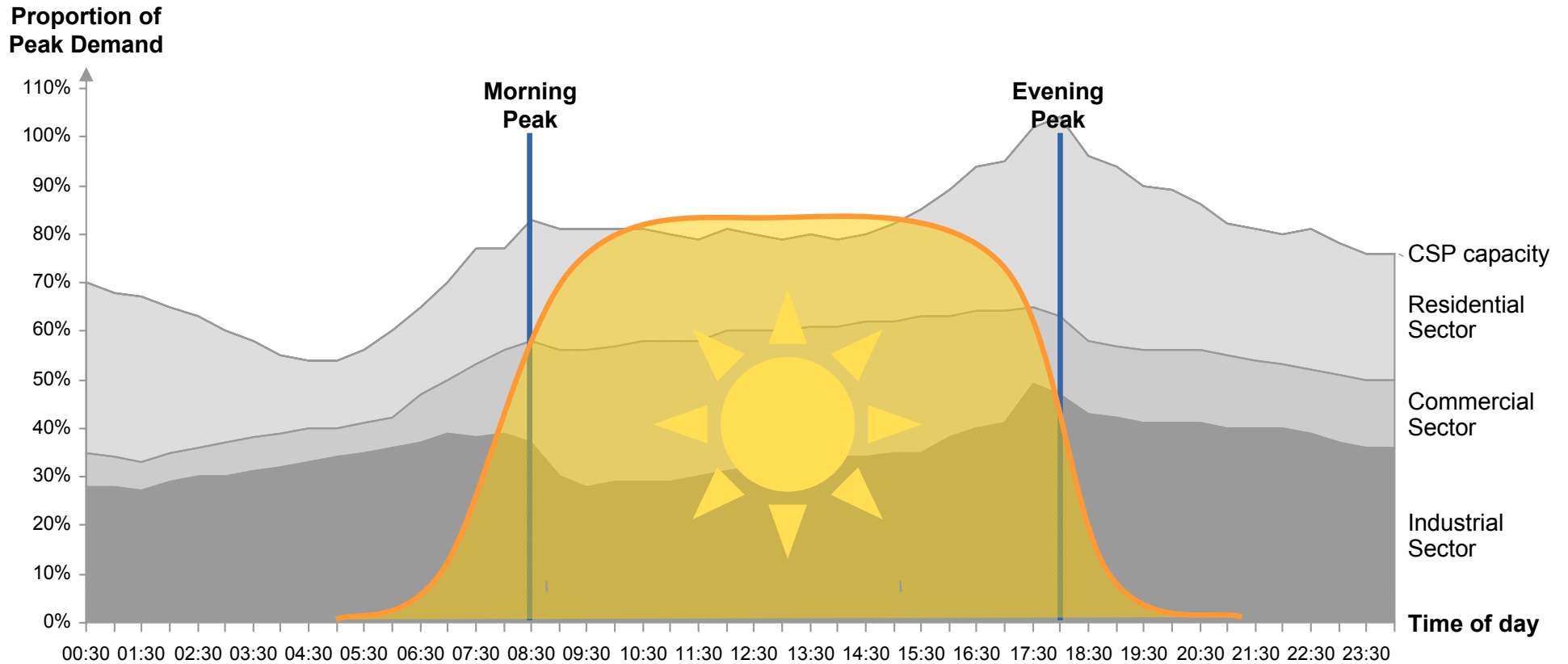
Solar thermal can be used in hybrid plants

Advantages

- Proven technology
- Hybrid possible

Concentrated Solar Power is available at major energy consumption time ...

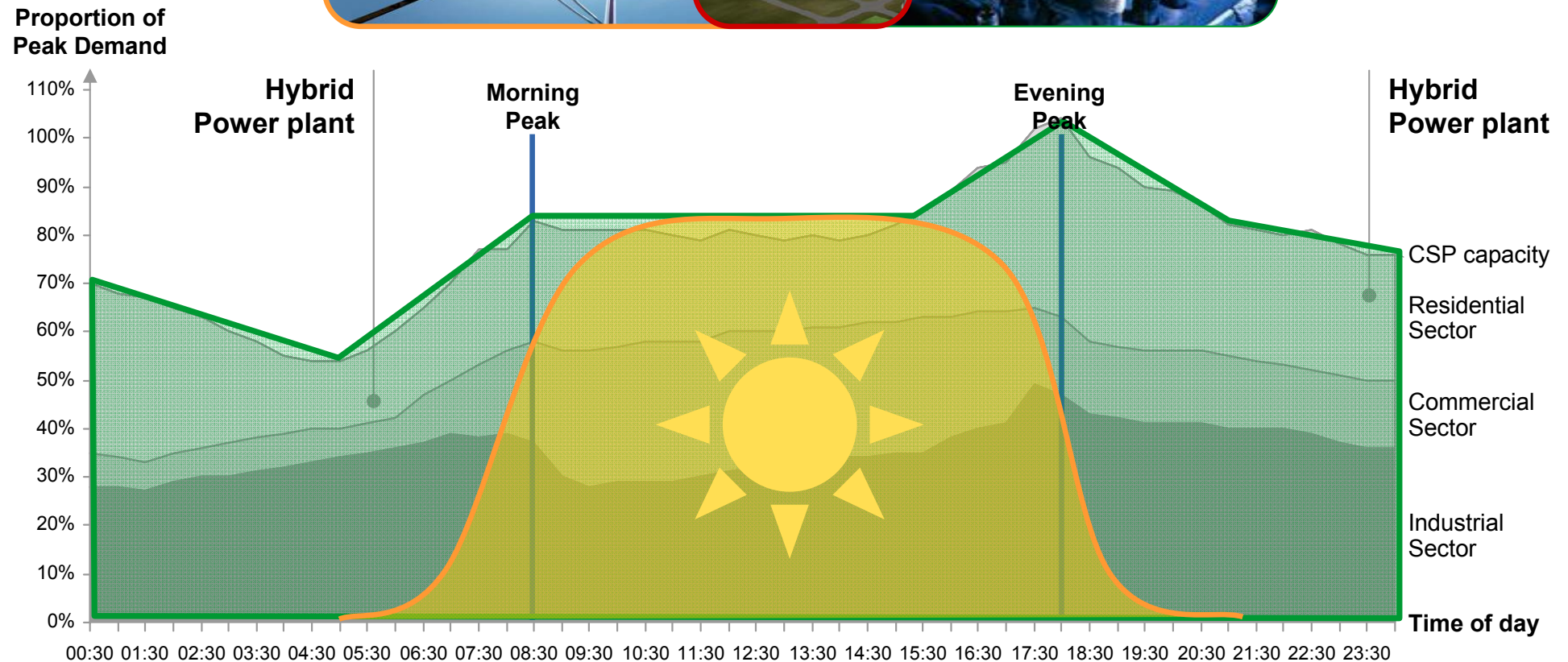
CSP availability



Source: Siemens

... peaks can be compensated by hybrid setup together with gas power plant

Hybrid



In solar thermal there are still quantum leaps possible

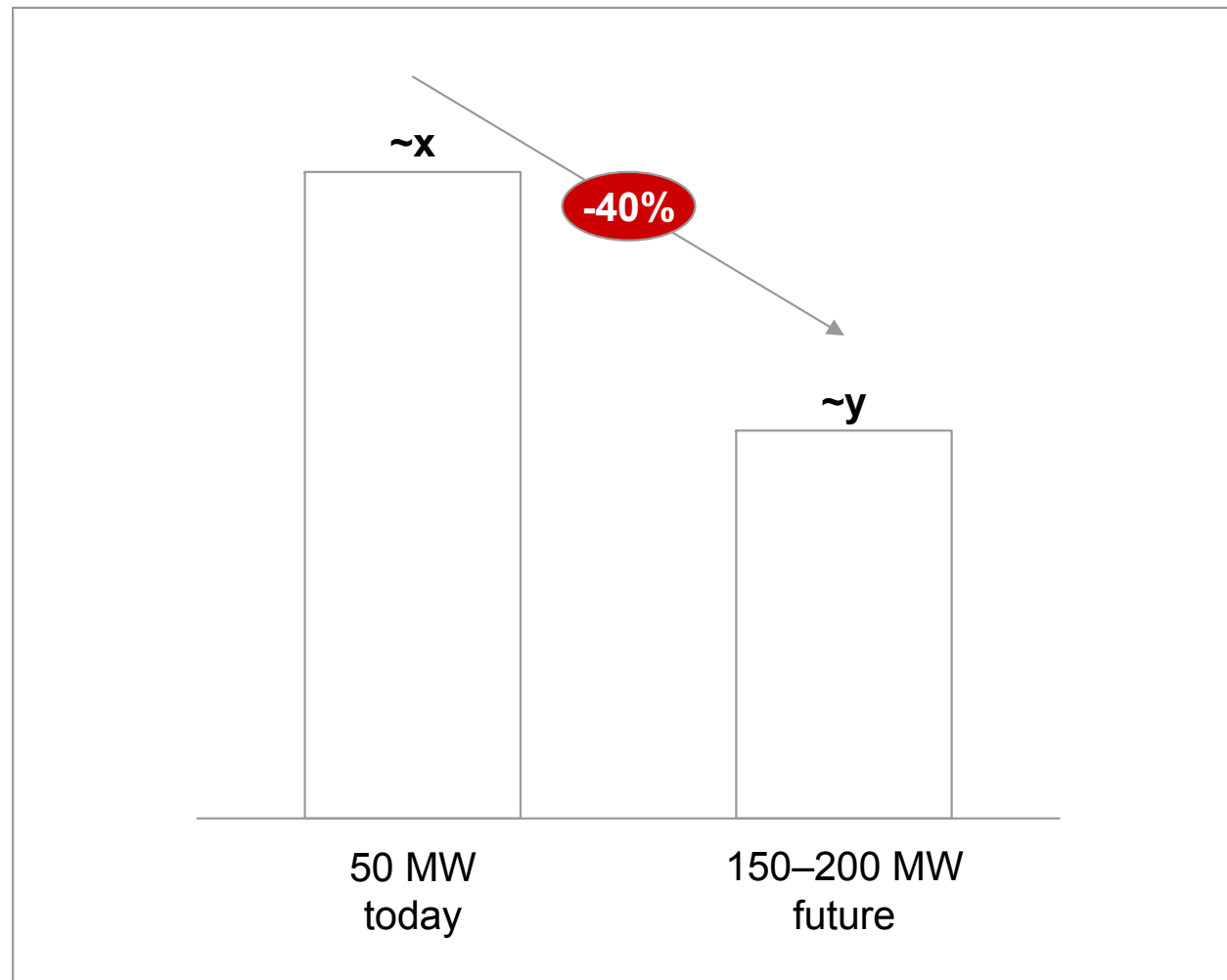
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Advantages

- Proven technology
- Hybrid possible
- **Quantum leaps possible**

**Single biggest lever to reduce costs
is scaling up plant size**

Investment costs, USD / installed kW



Solar thermal energy is dispatchable

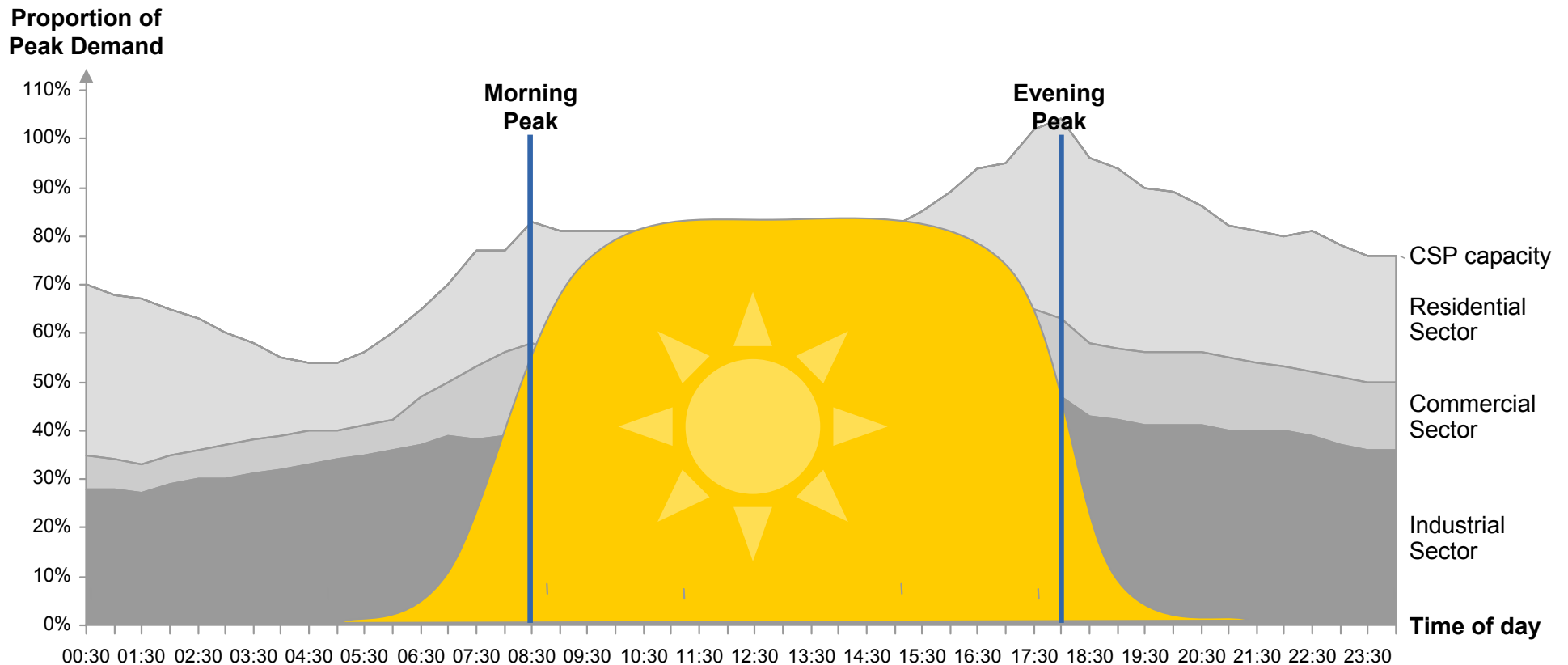
Advantages

- Proven technology
- Hybrid possible
- Quantum leaps possible
- **Dispatchability**

Usability of Solar Power can be prolonged after sun set to cover evening peak aswell



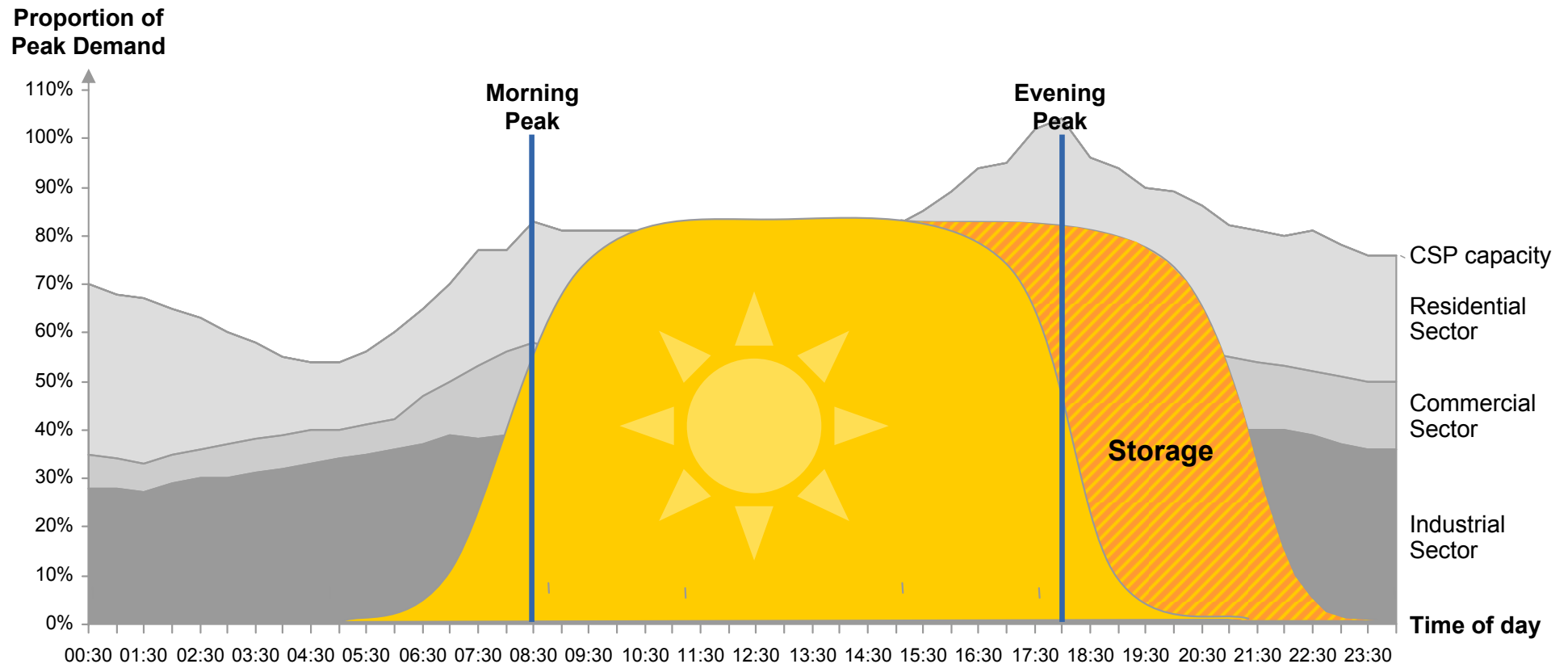
Storage



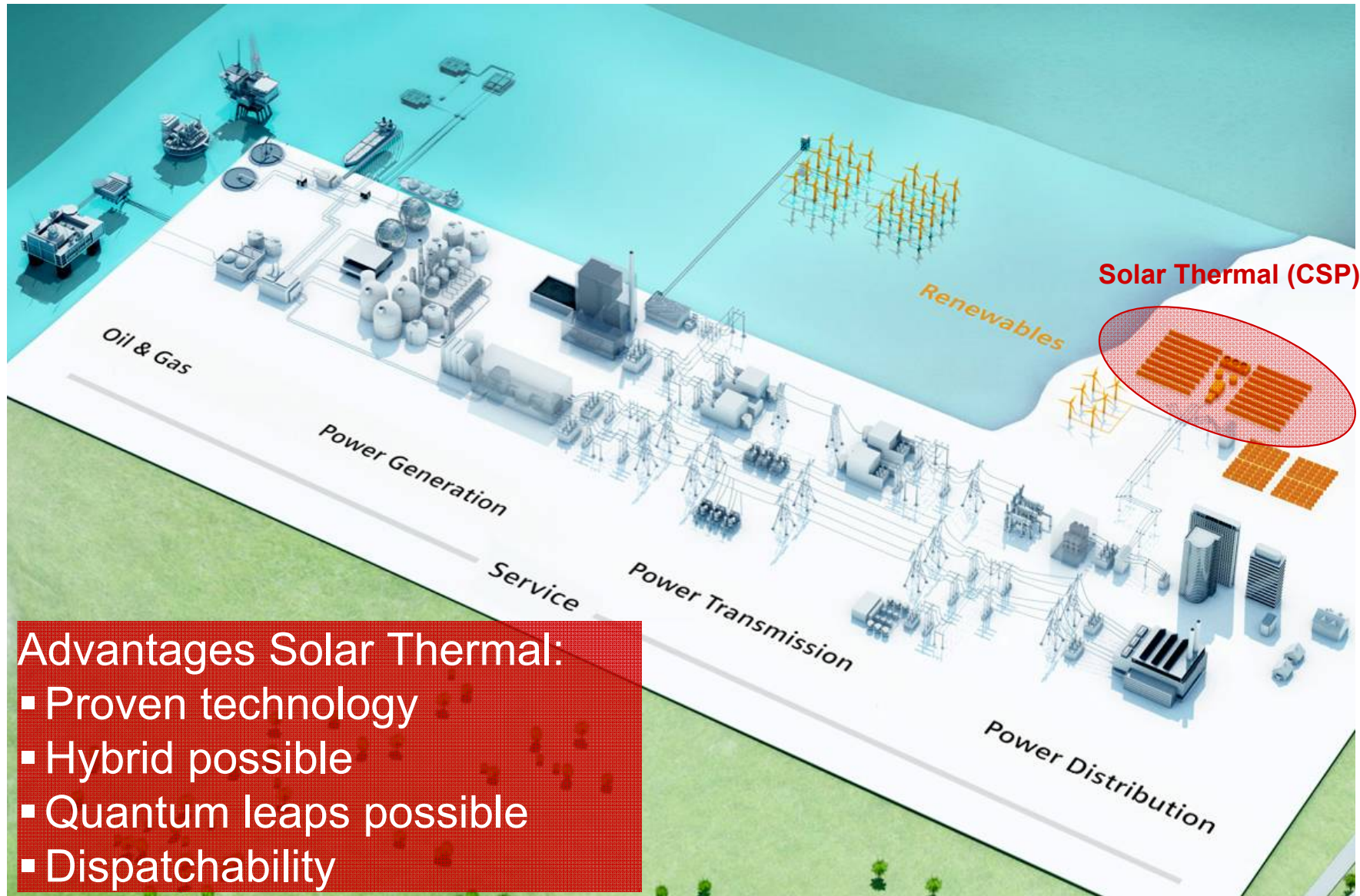
Source: Siemens

Usability of Solar Power can be prolonged after sun set to cover evening peak aswell

Storage



Solar Thermal will play its important role in the renewable energy market



Advantages Solar Thermal:

- Proven technology
- Hybrid possible
- Quantum leaps possible
- Dispatchability