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Intelligente Netze und Energieversorgung

Energieforum des VDI Bayern und des VDE Bayern - 26. November 2010

Dr. Michael Weinhold
CTO Siemens Energy

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Überblick

1. Transformation des Energiesystems
2. Smart Grid

Paradigmenwechsel beim Energiesystem: Das *Neue Stromzeitalter*

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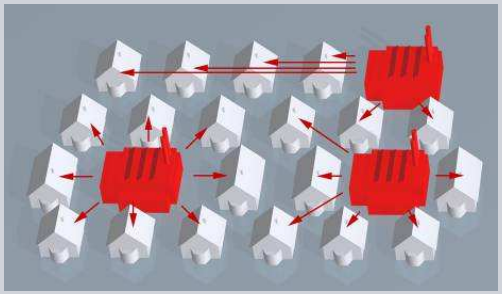
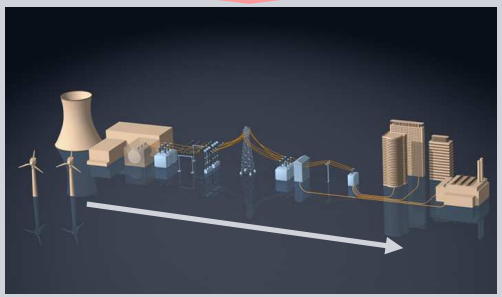
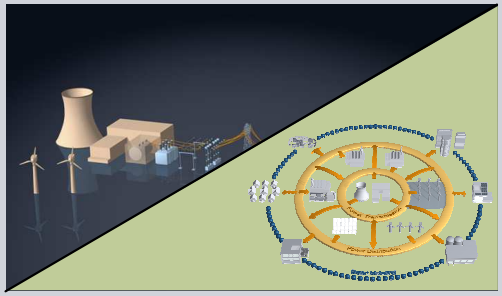
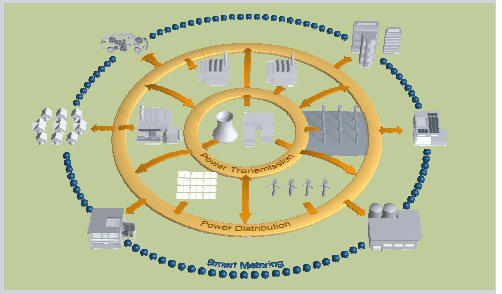
19. Jahrhundert	20. Jahrhundert	21. Jahrhundert
Energiesystem nicht nachhaltig		**Nachhaltiges Energiesystem**
Elektrifizierung der Gesellschaft **„Kohlezeitalter“**	**Elektrische Energie-erzeugung in breitem Stil** **„Zeitalter der fossilen Brennstoffe“**	**Übergang zum neuen Stromzeitalter** Herausforderungen: 1.) Demographischer Wandel 2.) Ressourcenverknappung 3.) Klimawandel	**Das *Neue* Stromzeitalter** Elektrizität wird ***der*** Energieträger mit einem Stromnetz als Rückrat **Integriertes Energiesystem**
			
„Erzeugung und Last eng aufeinander abgestimmt“	**“Erzeugung folgt Last“**	**„Energiesystem im Wandel“** „Consumer“ wird zum „Prosumer“	**„Last folgt Erzeugung“**
Kohle Wasserkraft	**Kohle, Gas, Öl, Wasserkraft, Nuklear**	**Kohle, Gas, Öl, Wasserkraft, Nuklear, Biomasse, Wind, Solar**	**Erneuerbare Energieträger, (Solar, Wind, Wasserkraft, Biomasse etc.), „saubere“ Kohle, Gas, Kernkraft**
Keine Umweltschutz-Bedenken			**Umwelt-Bewusstsein**

*) ICT = Information and Communication Technologies

Fossile Energieträger bleiben bestimmend, erneuerbare Energien gewinnen an Bedeutung

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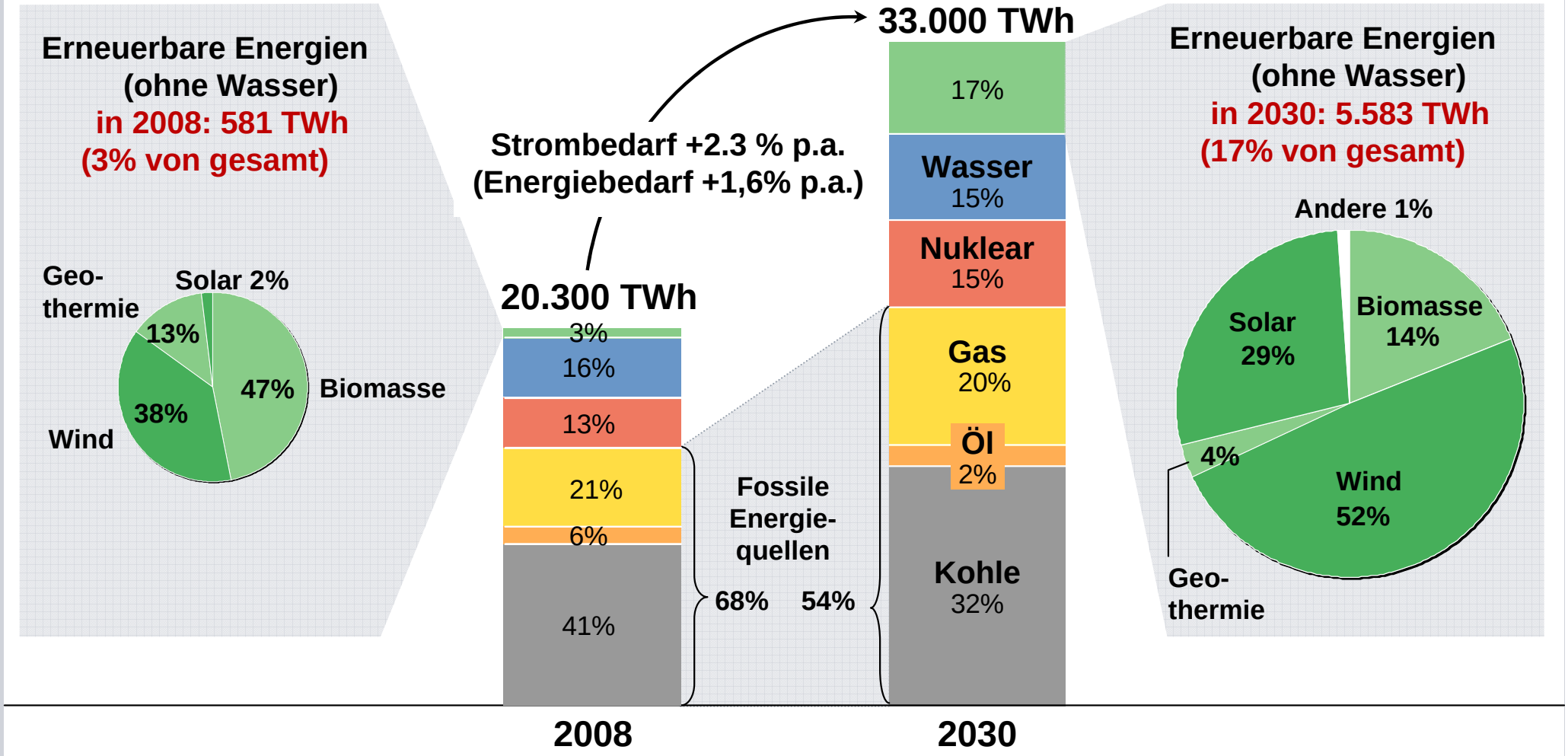
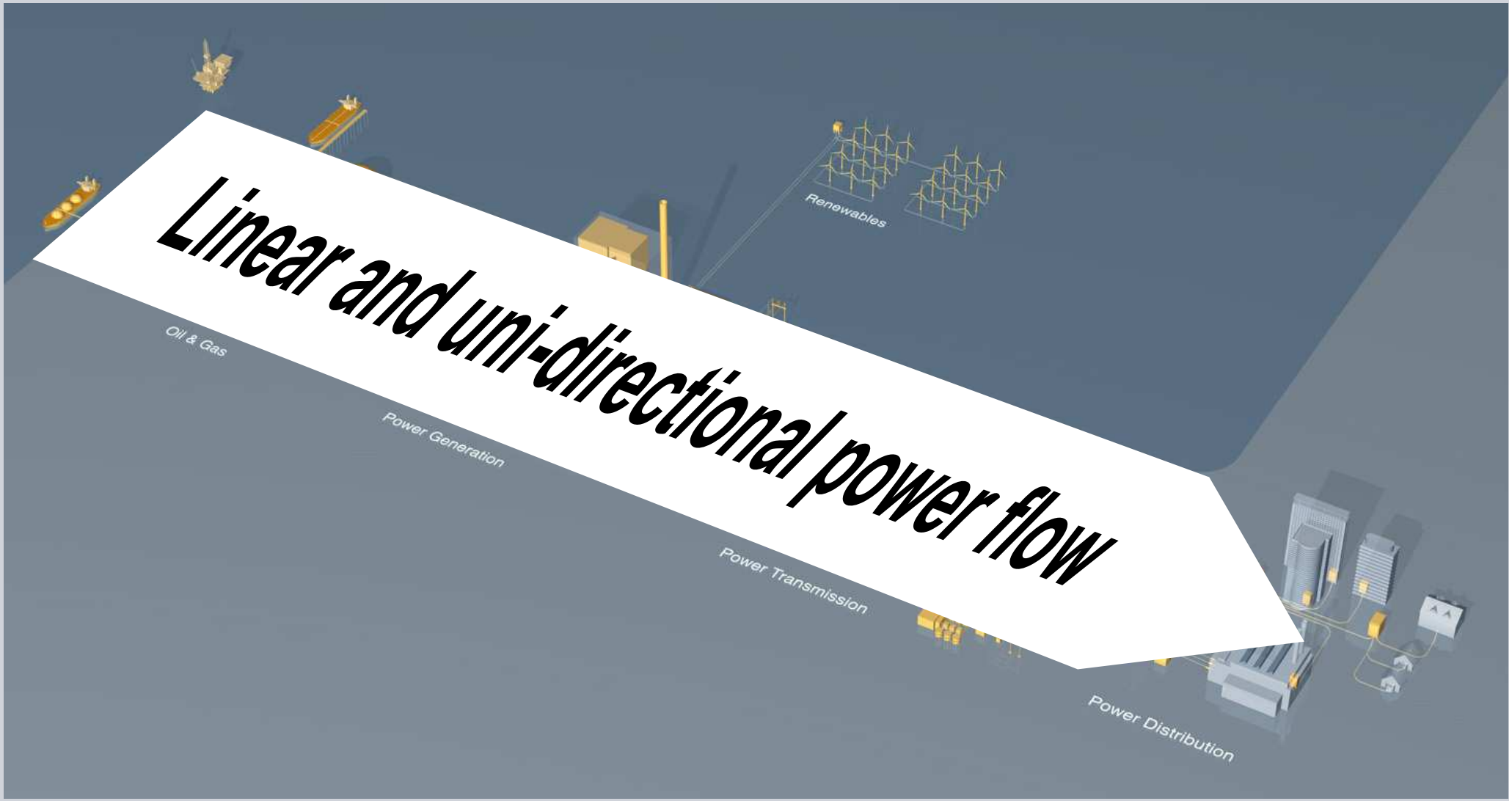
Stromerzeugung (in TWh[1])



Quelle: Siemens Energy Sector

[1] Terawattstunden

Die traditionelle Energieumwandlungskette



Siemens wird den ersten Offshore-Windpark der Gigawatt-Klasse errichten

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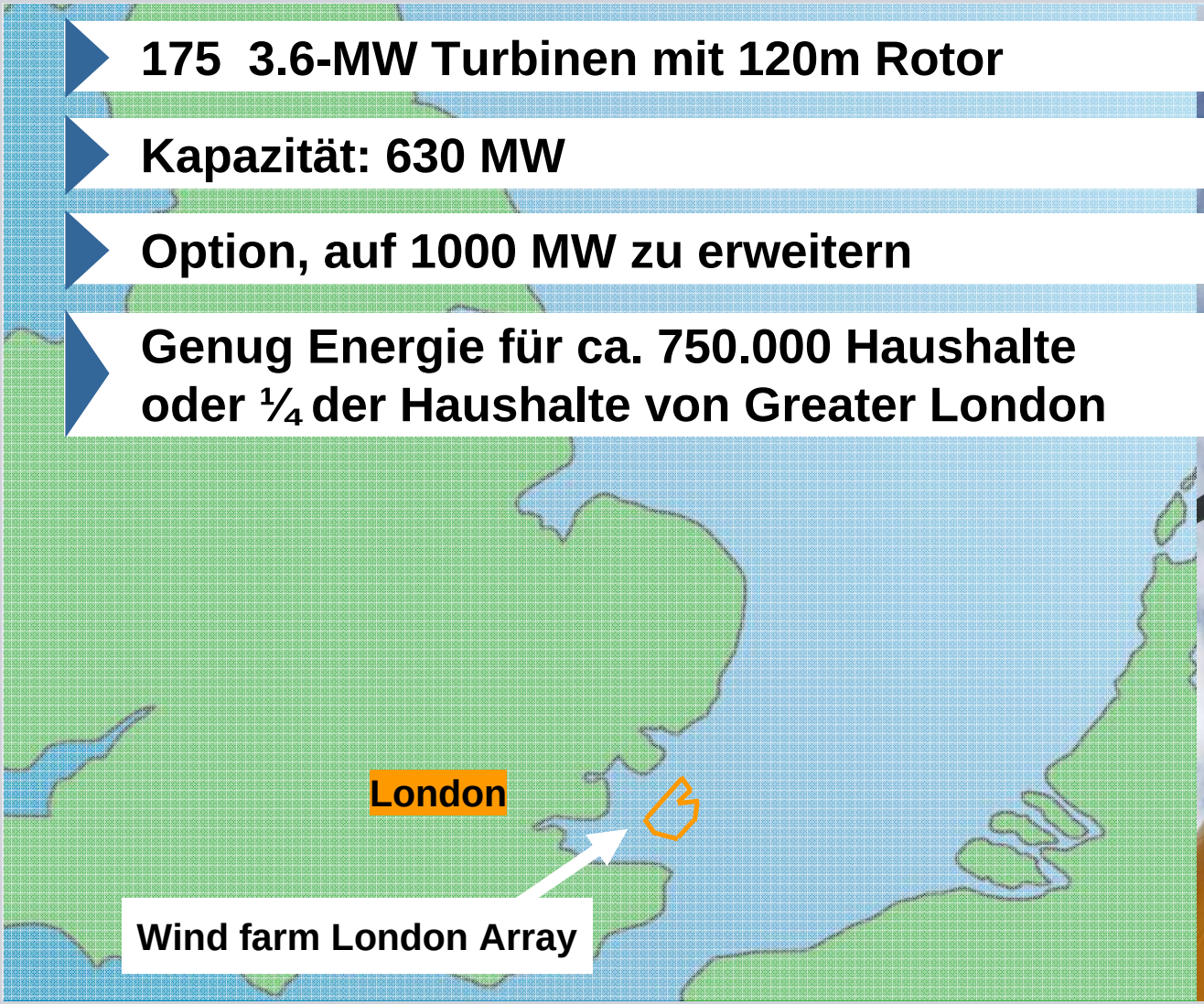
- 175 3.6-MW Turbinen mit 120m Rotor
- Kapazität: 630 MW
- Option, auf 1000 MW zu erweitern
- Genug Energie für ca. 750.000 Haushalte oder ¼ der Haushalte von Greater London



Das *Neue* Stromzeitalter in Europa: das europäische Offshore Super Grid

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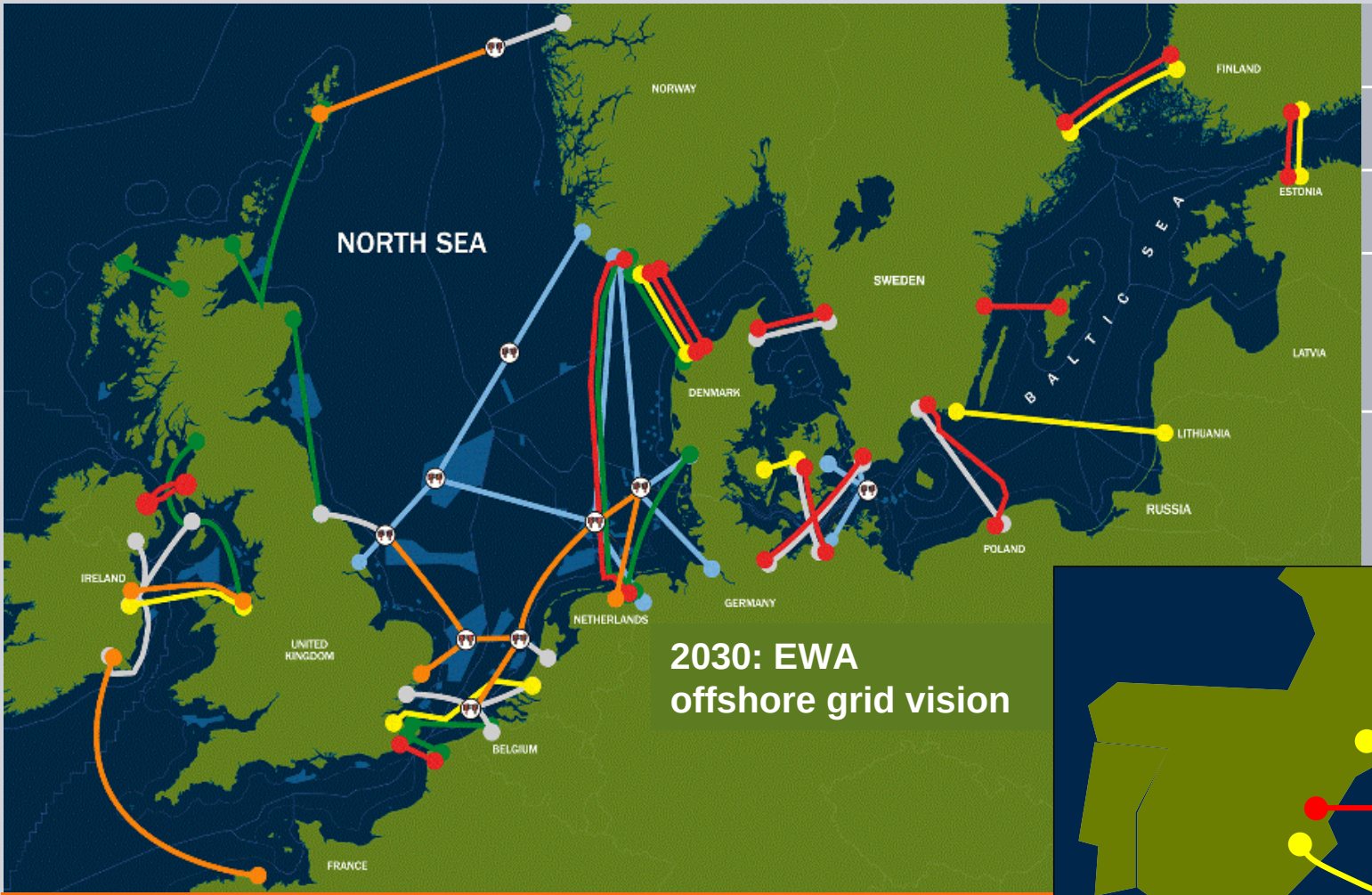

- Operational 7,350MW
- Planned 4,950MW
- Under Study 10,400MW
- Under Study (with EWEA Recommendation) 9,600MW
- EWEA Recommendation 7,100MW (2020)–11,100MW (2030)

€13bn+ of investment

China: over 217 GW * of additional HVDC Transmission Capacity are expected between 2010 and 2020

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1. Yunnan – Guangdong
   800 kV, 5000 MW, 2009/10
2. Xiangjiaba – Shanghai
   800 kV, 6400 MW, 2010
3. Qinghai – Tibet
   500 kV, 1200 MW, 2011
4. Mongolia – Tianjin
   660 kV, 4000 MW, 2012
5. Russia – Liaoning
   660 kV, 4000 MW, 2012
6. Nuozhadu – Guangdong
   800 kV, 5000 MW, 2012
7. Jingping – Sunan
   800 kV, 7200 MW, 2012
8. Xiluodu – Guangdong
   500 kV, 2 x 3200 MW, 2013
9. Humeng – Tangshan
   660 kV, 4000 MW, 2013
10. Ningdong – Zhejiang
    800 kV, 7200 MW, 2013
11. Xiluodu – Zhejiang
    800 kV, 7200 MW, 2013
12. Sichuan – Hunan
    660 kV, 4000 MW, 2014
13. Xiluodu – Hunan
    660 kV, 4000 MW, 2014
14. Humeng – Shandong
    800 kV, 7200 MW, 2014
15. Hami – Henan
    800 kV, 7200 MW, 2014
16. Mengxi – Jiangxi
    800 kV, 7200 MW, 2015
17. Mongolia – Shandong
    800 kV, 7200 MW, 2015
18. Shaanxi – Jiangsu
    660 kV, 4000 MW, 2016
19. Jiuquan – Jiangsu
    800 kV, 7200 MW, 2016
20. Zhundong – Henan
    800 kV, 7200 MW, 2016
21. Baoqing – Liaoning
    660 kV, 4000 MW, 2017
22. Hami – Shandong
    800 kV, 7200 MW, 2017
23. Tibet – Chongqing
    800 kV, 7200 MW, 2017
24. Jinghong – Thailand
    500 kV, 3000 MW, 2018
25. Ximeng – Wuxi
    800 kV, 7200 MW, 2018
26. Baihetan – Hubei
    800 kV, 7200 MW, 2018
27. Wudongde – Fujian
    1000 kV, 9000 MW, 2018
28. Northwest – North
    B2B, 1500 MW, 2018
29. Mongolia – Jing-Jin-Tang
    800 kV, 7200 MW, 2019
30. Russia – Liaoning
    800 kV, 7200 MW, 2019
31. Zhundong – Jiangxi
    1000 kV, 9000 MW, 2019
32. Tibet – Zhejiang
    1000 kV, 9000 MW, 2019
33. Baihetan – Hunan
    800 kV, 7200 MW, 2020
34. Yili – Sichuan
    1000 kV, 9000 MW, 2020
35. Kazakhstan – Chengdu
    1000 kV, 9000 MW, 2020

1 x B2B
3 x 500 kV
7 x 660 kV
19 x 800 kV
5 x 1000 kV

* Options for further Projects > 7 GW

Sending Station Chuxiong

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Einsdrucksvolle Dimensionen!

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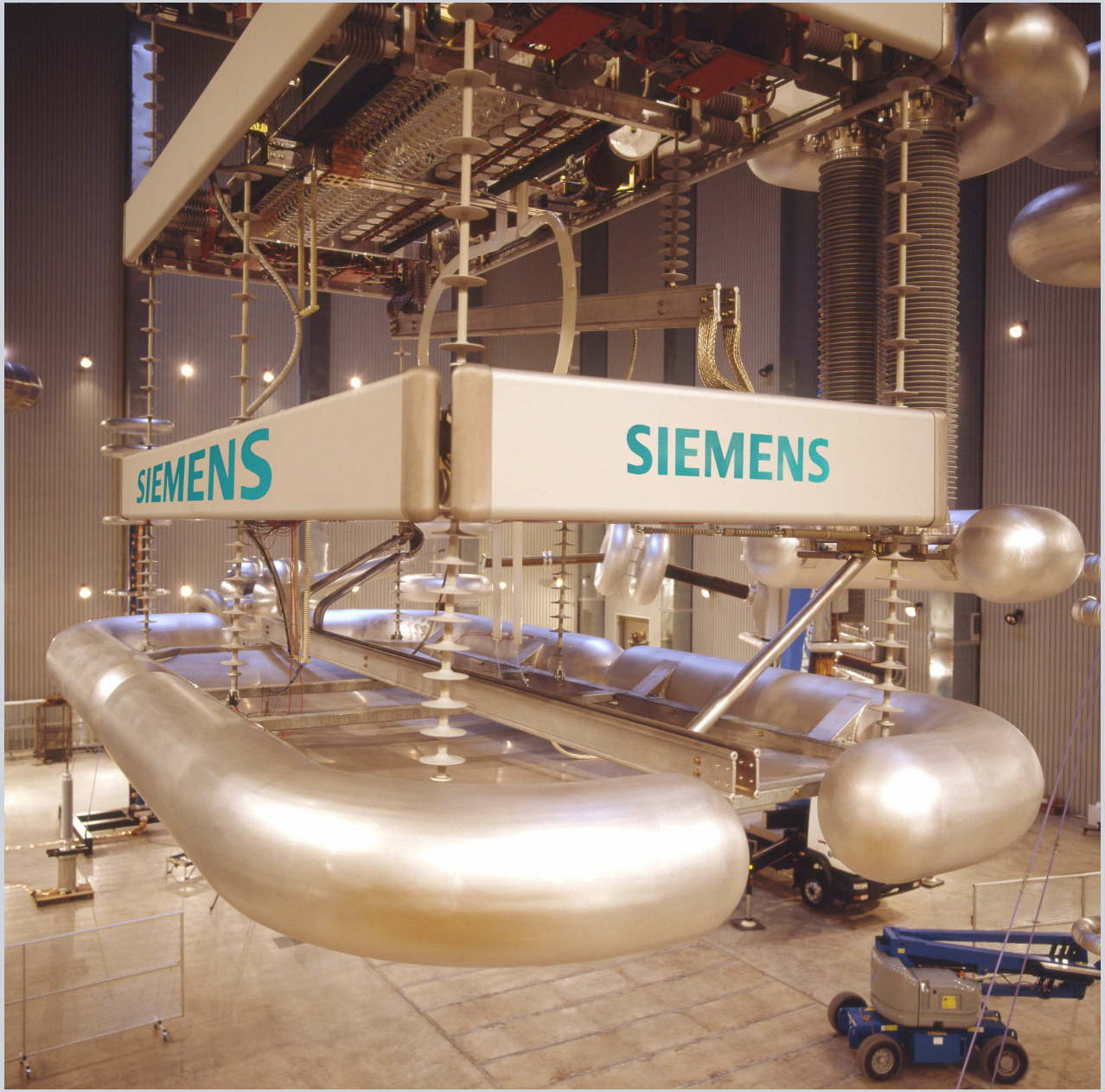

Die DESERTEC-Vision wird Realität mit Produkten und Lösungen von Siemens

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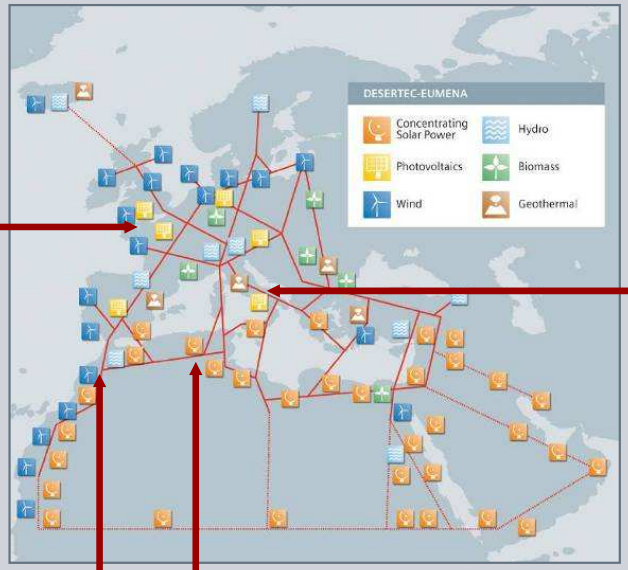
Offshore wind farms



HVDC electricity highways

Onshore wind energy

Solar thermal power plants

Solar fields

Receiver

Power block

Steam turbines

Siemens will play a key role in Desertec Industrial Initiative !


Zollfrank


Photovoltaik - 31.8.2010:
14.7 GW in Deutschland
installiert!

Stromproduktion einer 314 kWp PV-Installation nahe Erlangen, Deutschland

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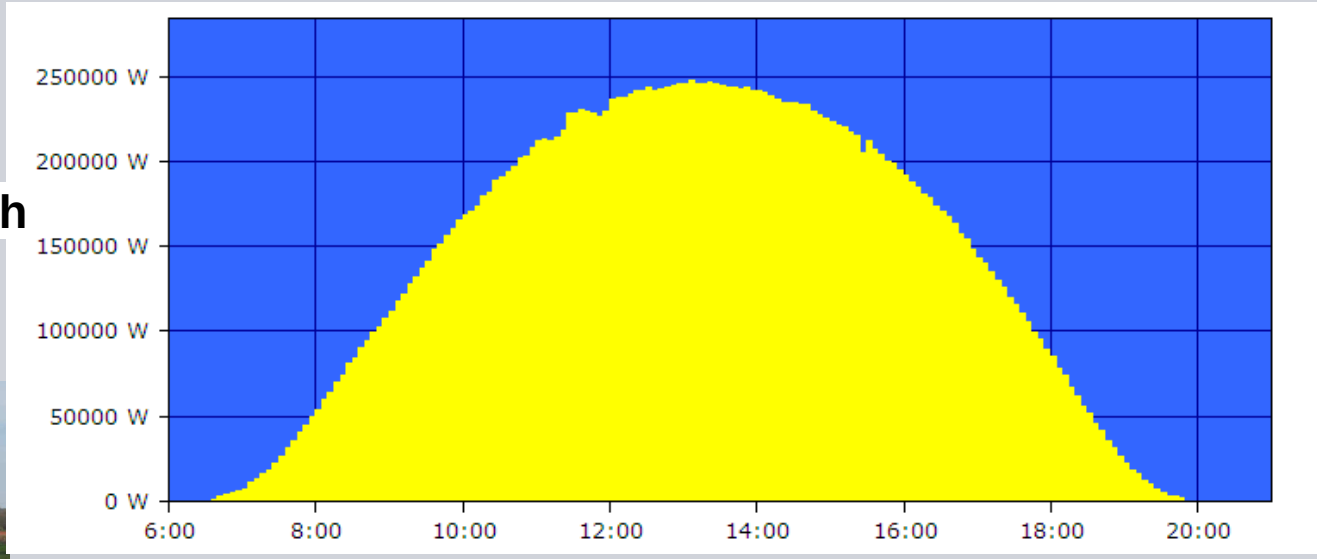
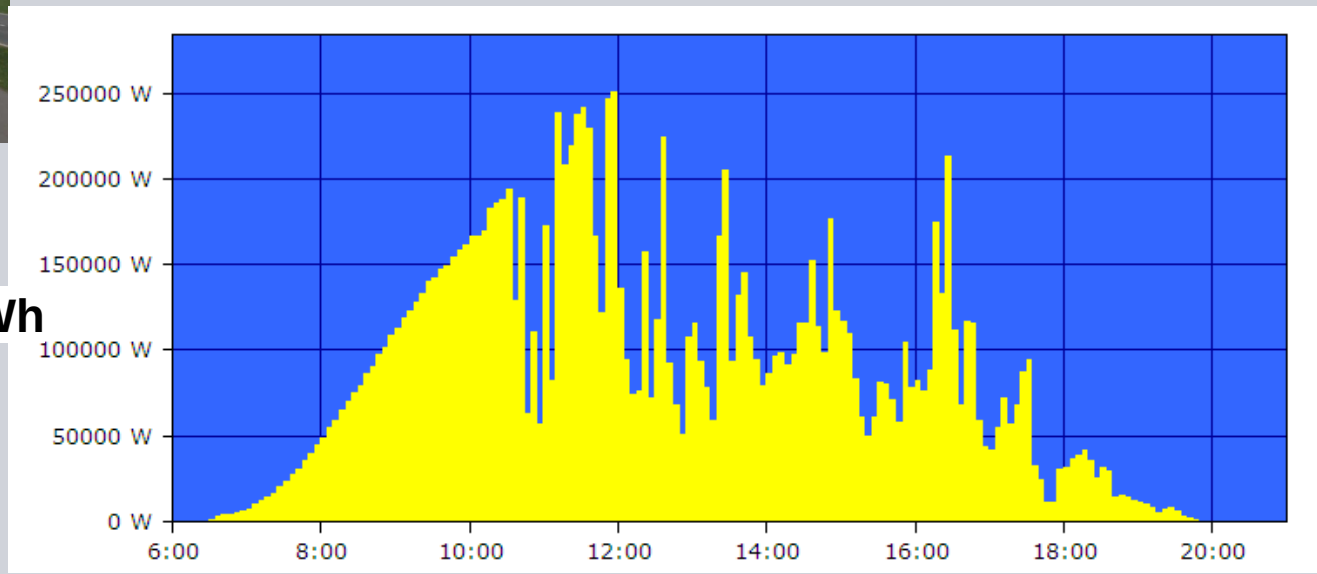
Sonniger Tag im April: 1,9 MWh



Bewölkter Tag im April: 1,2 MWh



Source: Michael Weinhold & friends

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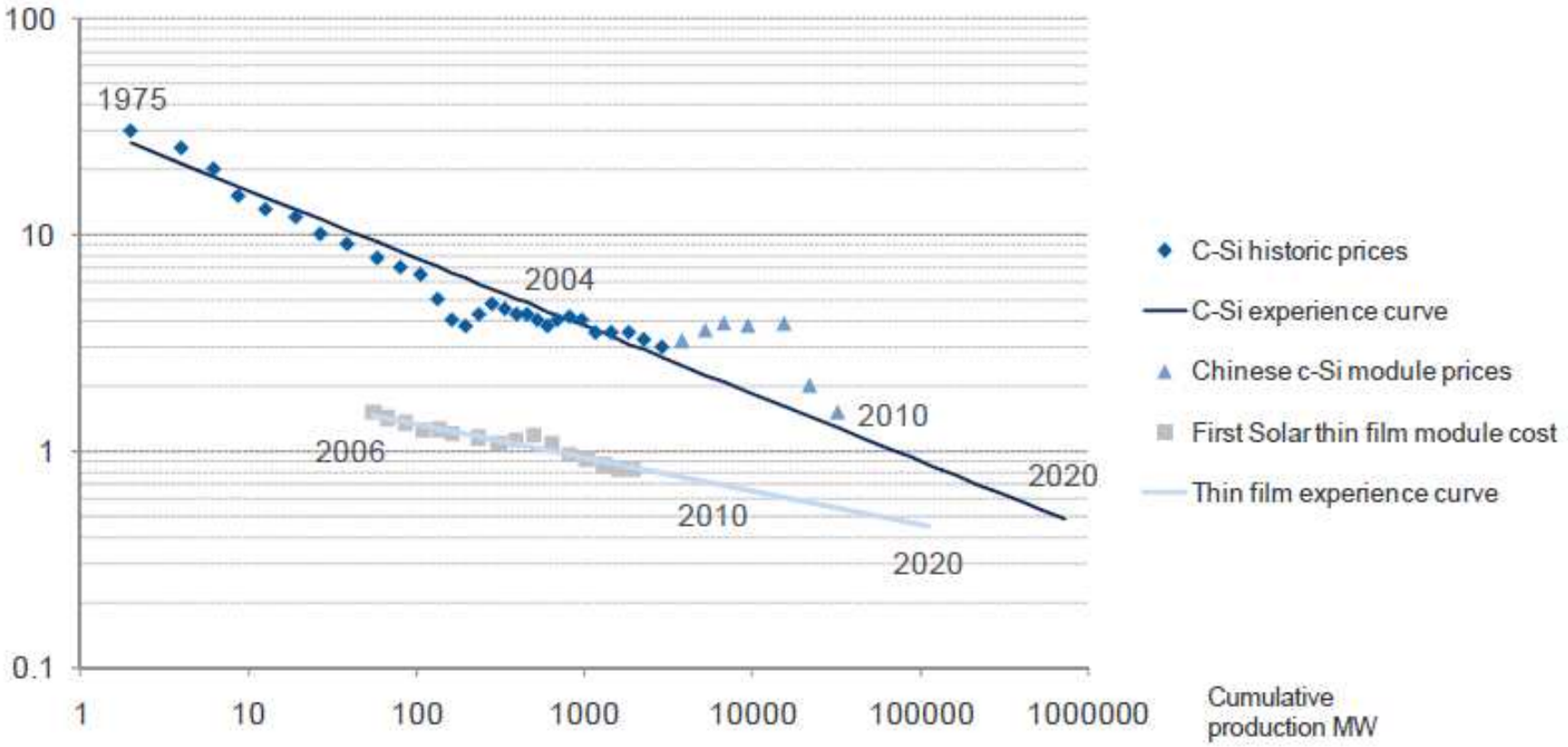
Preisentwicklung von PV Modulen

Solar PV module prices 1975 - 2010 ($/Wp)



Source: Bloomberg New Energy Finance
Note: 1975 – 2003, Paul Maycock; 2004 – 2010, Chinese c-Si module prices

Optimization of the energy mix for power generation – use of different technologies necessary

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Green energy but mostly intermittent supply

- Renewable energies such as…
  - Wind energy
  - Solar thermal
  - Photovoltaic
- *Wholesale parity for all technologies to be reached within next 5-10 years*

Low-emissions base load

- High-efficiency coal-fired power plants
- Coal/gas power plants with CO_2 separation and storage
- Nuclear power plants
- Water power plants
- *Low-cost power gener.*

Compensating Mid/peak load

- Gas-fired combined-cycle power plants:
  - High efficiency
  - Low emissions
  - Short start-up times
- Future storage solutions, e.g. Batteries, H_2
- *Decreasing costs due to higher efficiency*

Überblick

1. Transformation des Energiesystems
2. Smart Grid

Smart Generation, Grid und Consumption ermöglichen das *Neue Stromzeitalter*

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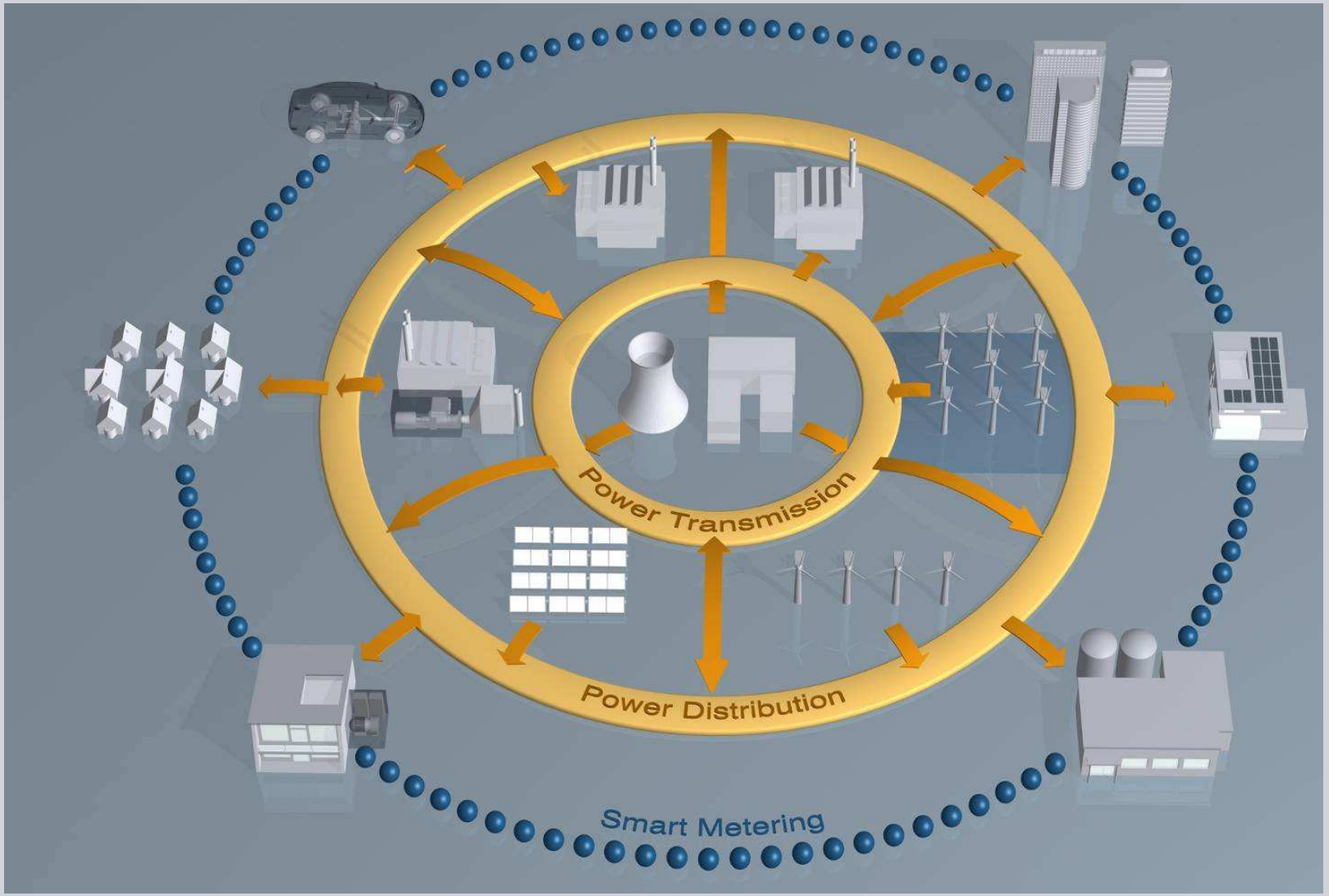
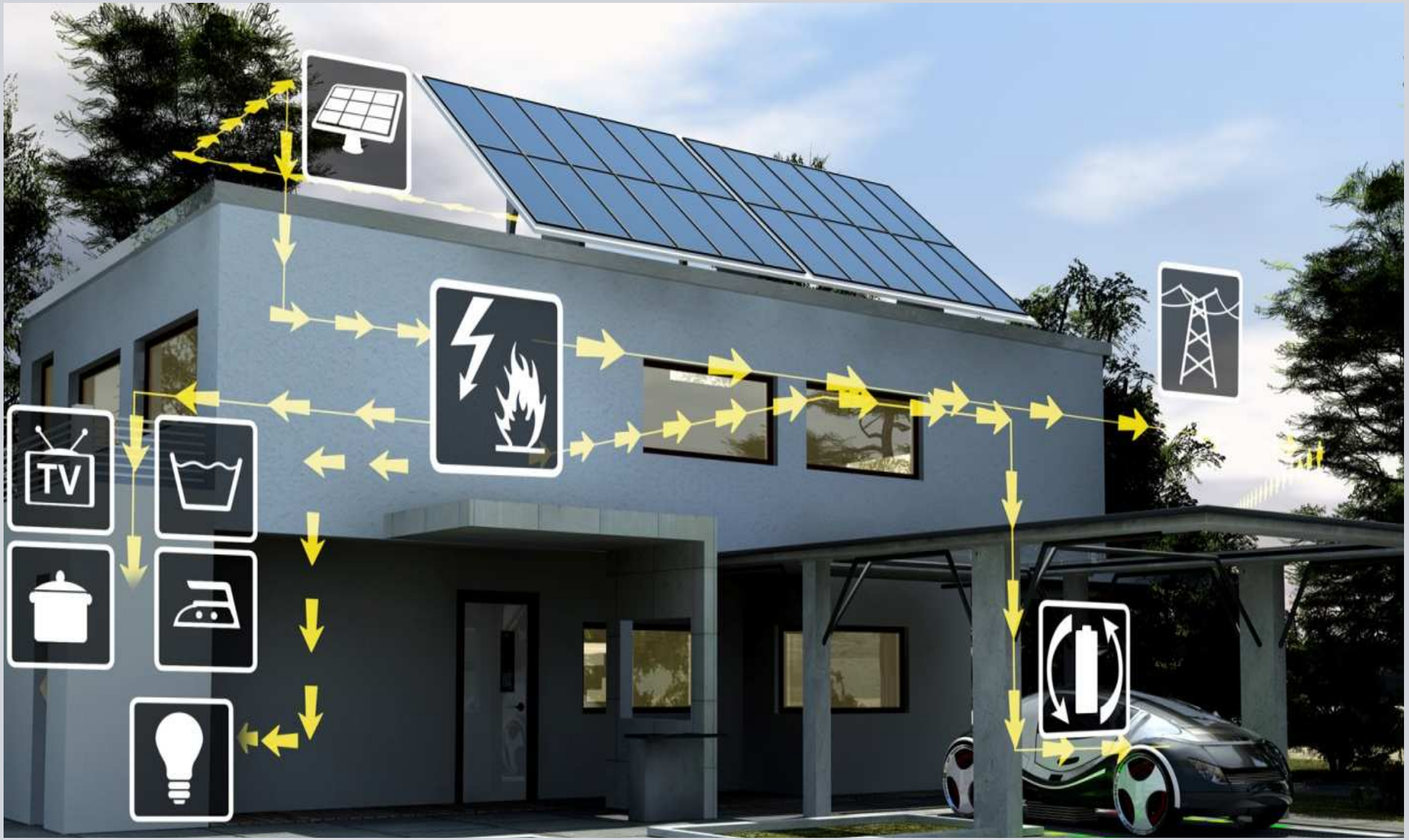


Smart Grids: Integration von Produzenten, Konsumenten und Elektromobilität



Haus / Wohnanlage von morgen: Geringe CO_2-Emmissionen

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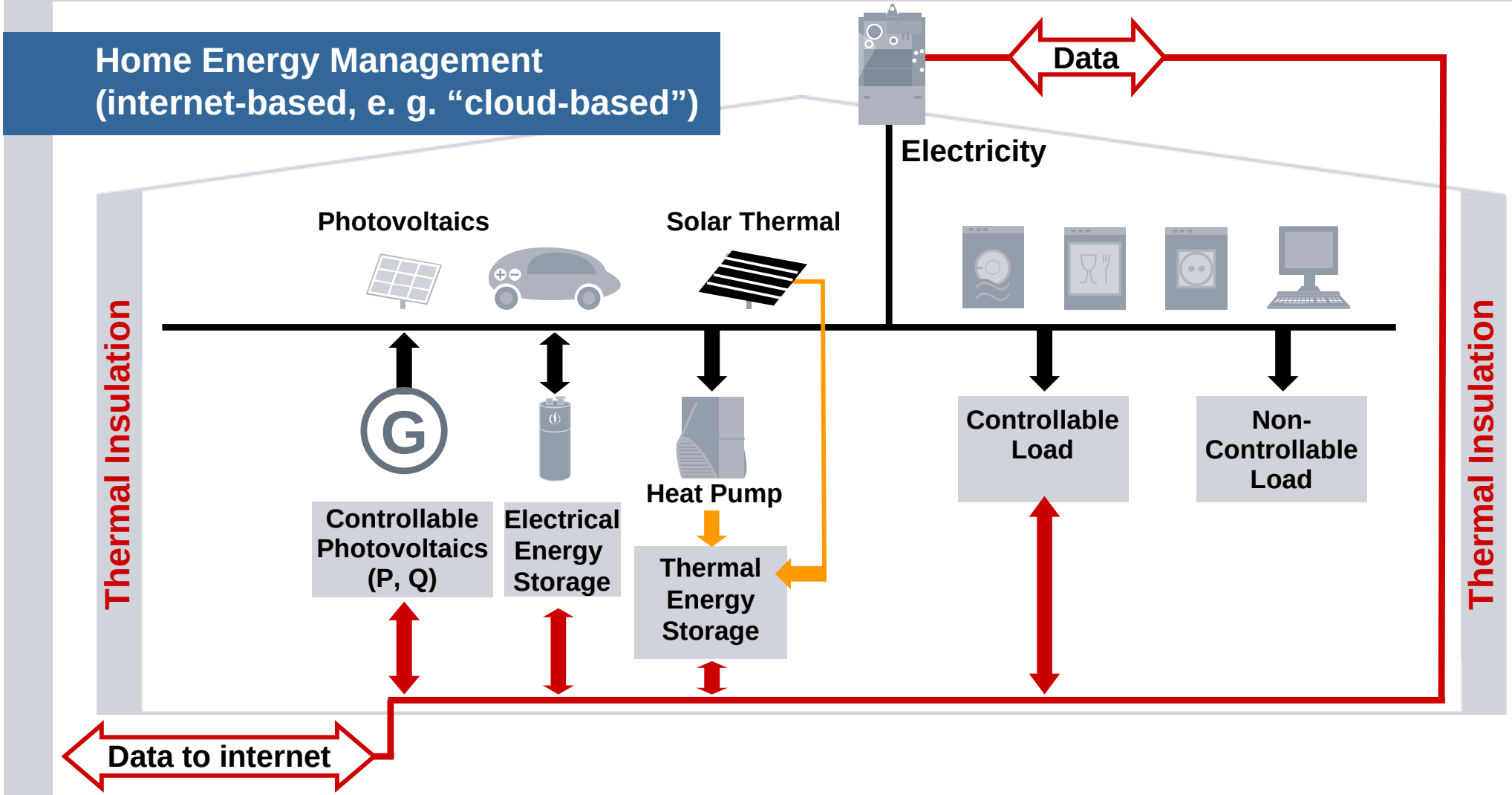

Relevanz von Energiespeichern

Erneuerbare Energien: Ausbalancieren des Missverhältnisses von Erzeugung und Verbrauch

Energie-Speicher

Industrie / Gebäude: Steigerung der Energieeffizienz

Mobilität: Steigerung von Effizienz und Elektromobilität

Source: Team Energy Storage

Die drei Schritte hin zu einem nachhaltigen integrierten Energiesystem

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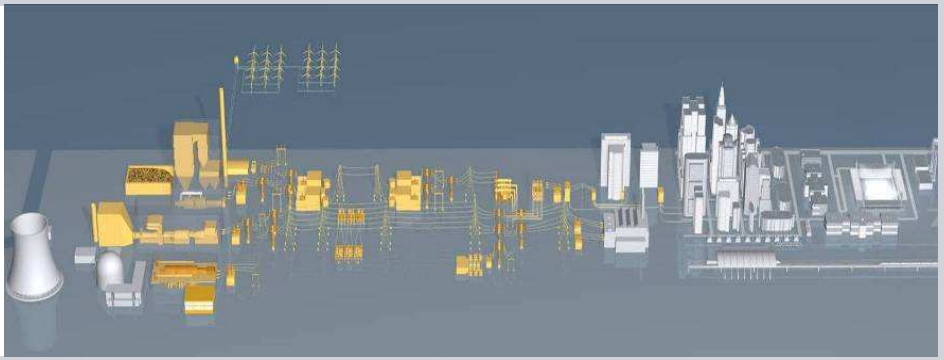
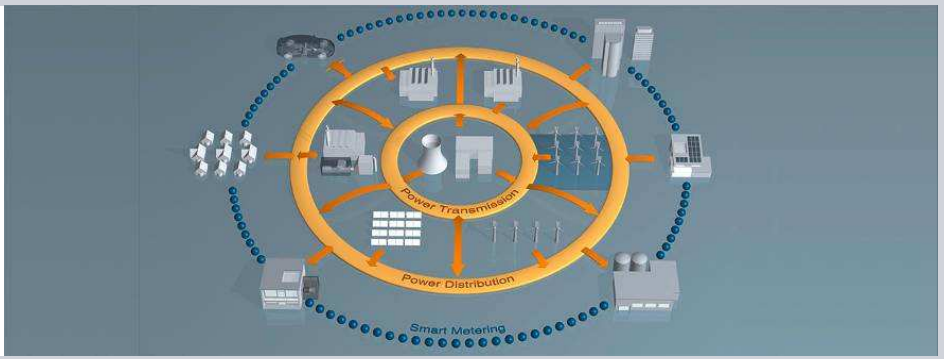
1 **Optimierung des Energiemix**

2 **Effizienzerhöhung entlang der gesamten Energiekette**



3 **Systemische Optimierung/ Smart Grid**



Das *Neue* Stromzeitalter: Smart Grid und intelligenter, effizienter Energiemix verschmelzen…

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Disclaimer

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