Securing European Energy Supplies: Making the Right Choices

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CEPS 29.09.09
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Energy and Climate Policy

Increasing power consumption even with slow global economic growth

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Demographic dynamics

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

Source: UNO

Increasing power consumption

Resource scarcity

- **Geopolitics:** 70% of world oil and gas supplies only in a few countries
- **Oil price fluctuations**

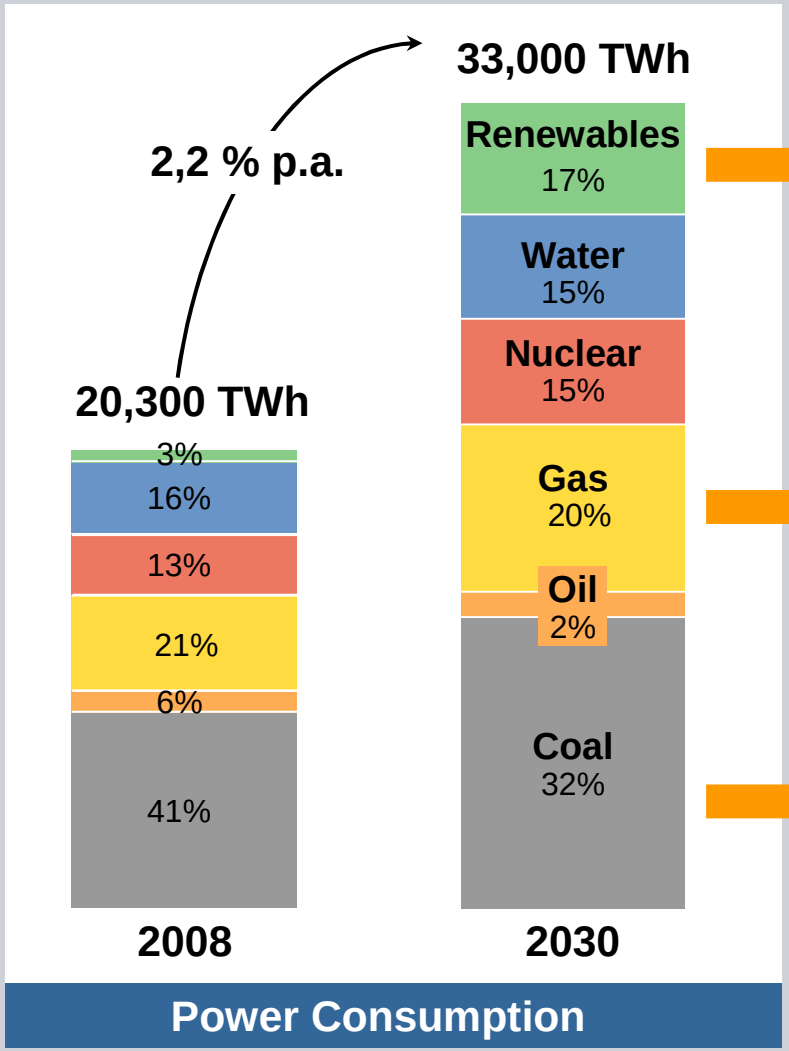
Need for efficiency: Increasing electrification of society

Climate change

- **Climate targets:** Political programs for long-term reduction of CO_2 emissions

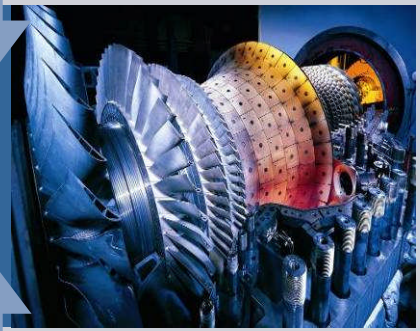
Growing demand for "clean" power

1) Optimization of energy mix

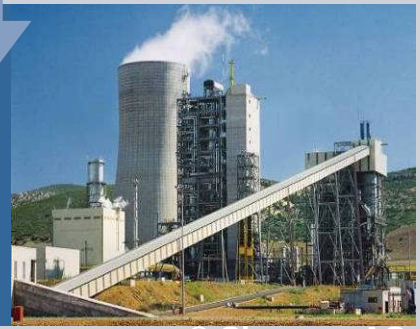


Privileged feed-in of renewables
- Wind power
- Solar thermal power
- Photovoltaic

Intermediate-load/ peak-load for load leveling
-With high efficient, high flexible combined cycle PP



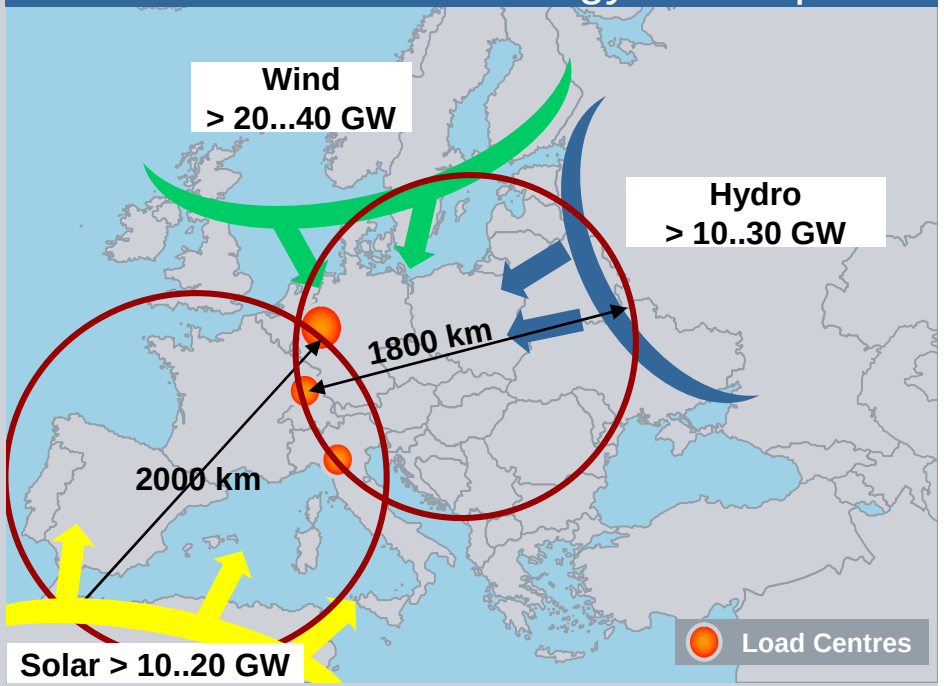
Low-emissions base load
- CCS
- Nuclear
- Hydro



Integration of Renewable Energies

Use of hydro power in China

Use of renewable energy in Europe



- Powerful wind energy plant
- Wind off-shore plant
- High-efficient turbines solarthermal power generation

- Integration of renewable energies via HVDC PLUS
- Energy lines with UHVAC and UHVDC
- Gas-insulated lines (GIL)

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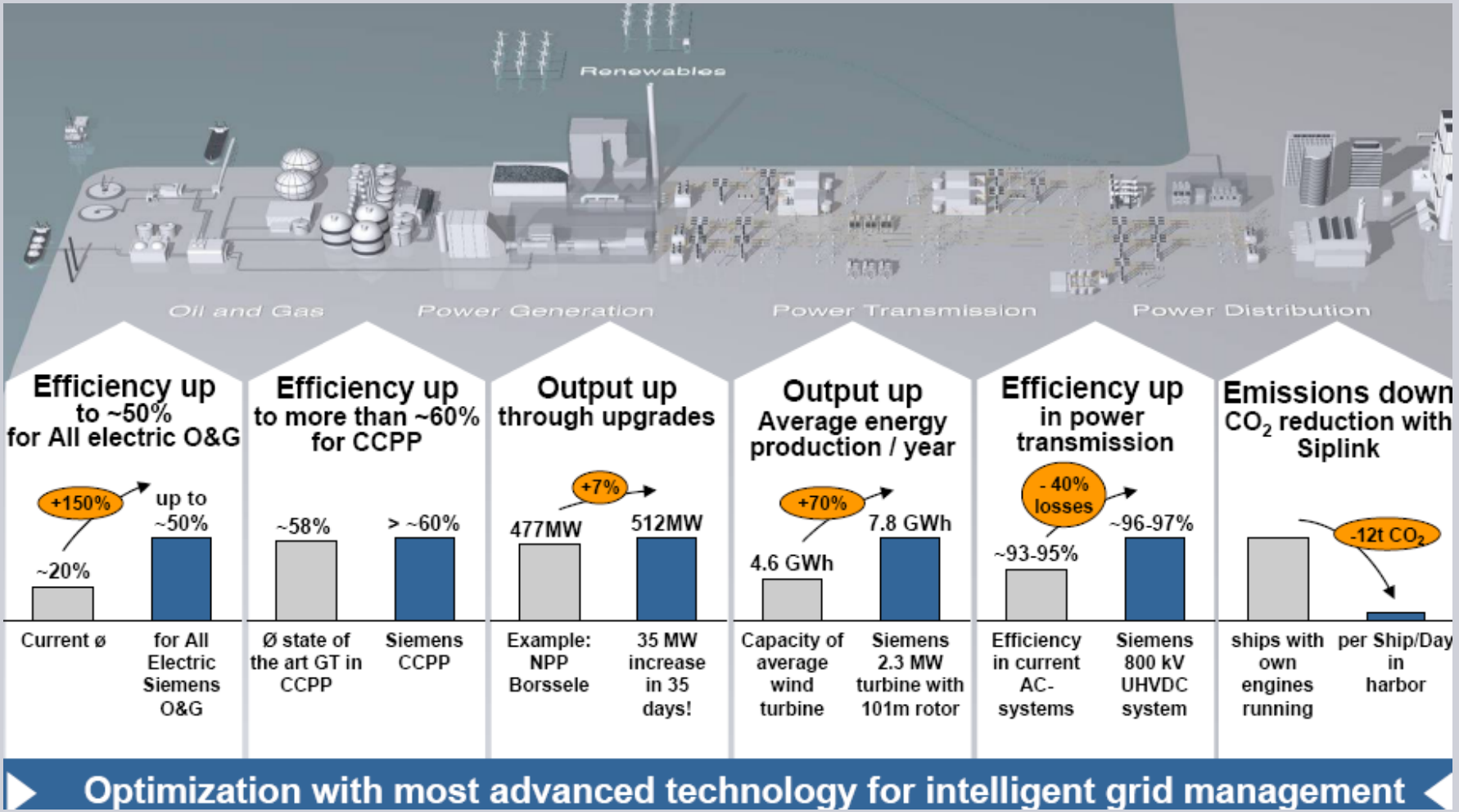
2) Efficiency along the energy conversion chain



Irsching - The worlds most efficient gas turbine with more than 60% efficiency CCPP

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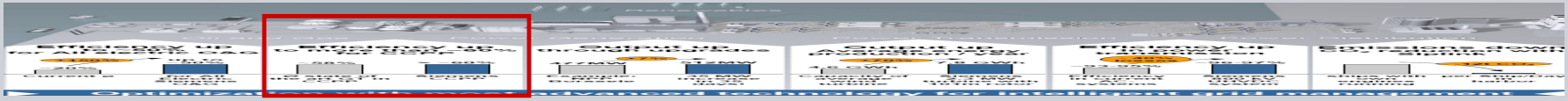

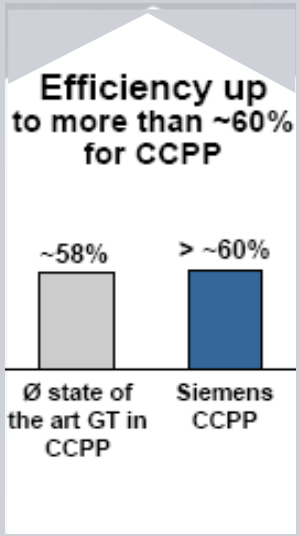

Sustainability Triangle		Impact	EU in the World
Security of Supply	↑	>Increased electricity output >High flexibility and availability	>Decreasing dependence on energy imports
Economics	↑	>Lower generation costs (fuel etc.) >Less EU-ETS allowances	>EU leading green technology for global implementation
Climate Change	↑	>Only 345g CO2-emissions per kwh, power generation worldwide: 578g aver.	>Contributes to meet EU'S international emission reduction targets

The usage of Power Electronics increases efficiency

Example: E-Car

In an electric car, electricity from batteries is converted to kinetic energy with 95-percent efficiency.

Example: All Electric Oil&Gas

Traditional Concepts:

Gas turbine direct drive of compressors and pumps

Efficiency: 20-25%

All-Electric Solutions:

Central power generation and all drivers E-motors

Efficiency: 34-50%

3) Systemic optimization: Smart Grid
The future‘s intelligent grid

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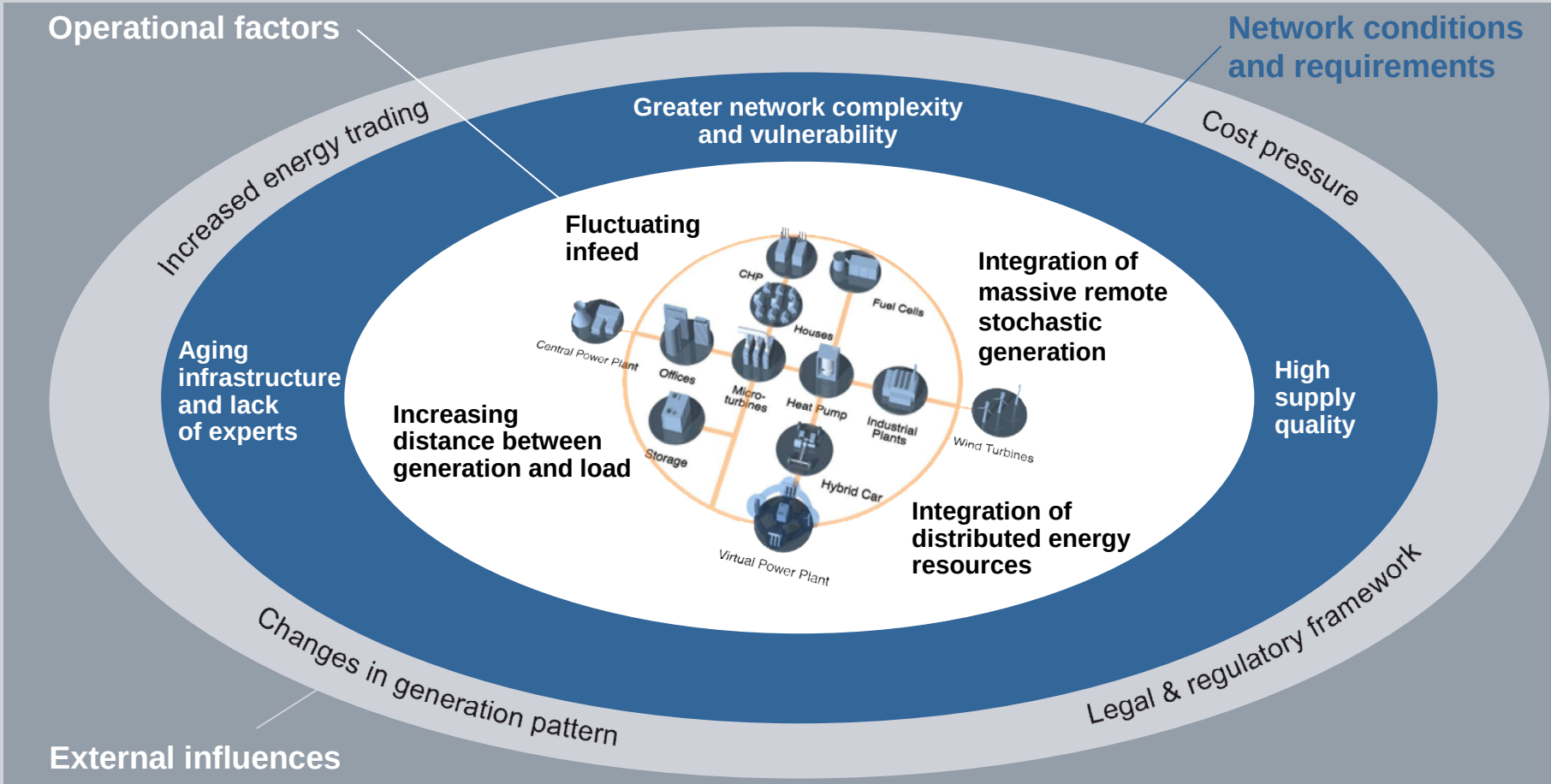

Smart Buildings as a “prosumer” - a new active element within Smart Grids

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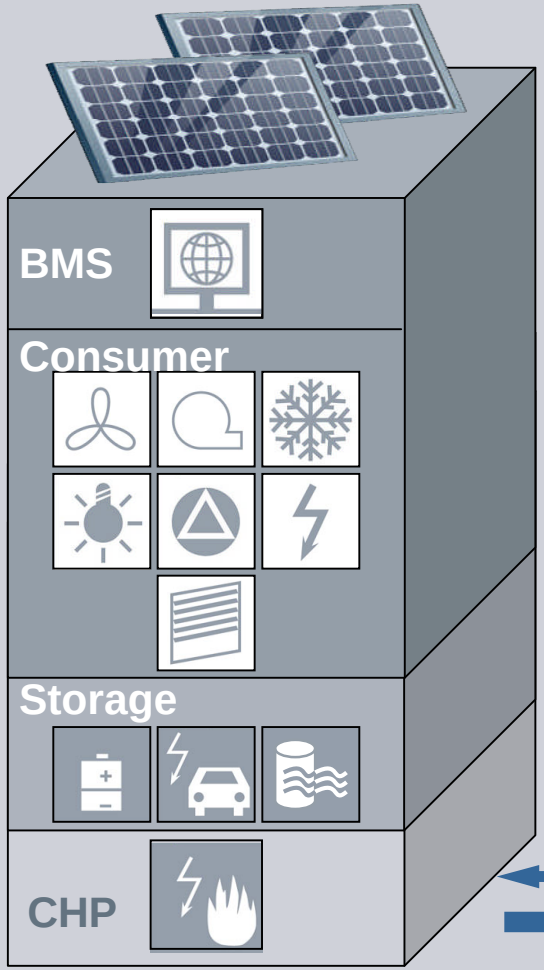
Low energy tariffs

- Intelligent filling of storage capacities, e.g.:
  - Load e-car
  - Load thermal storage (boiler, ice, building structure, indoor air)
- Minimal use of CHP
- Use comfort band to build reserves

Building is energy consumer to grid



High energy tariffs

- Use energy from storage, e.g.:
  - Use reserves in e-car
  - Empty thermal storages
- Maximum use of CHP
- Minimize el. consumption within comfort band
- Use or sell self produced energy (PV, wind, CHP…)
- Switch to oil or gas

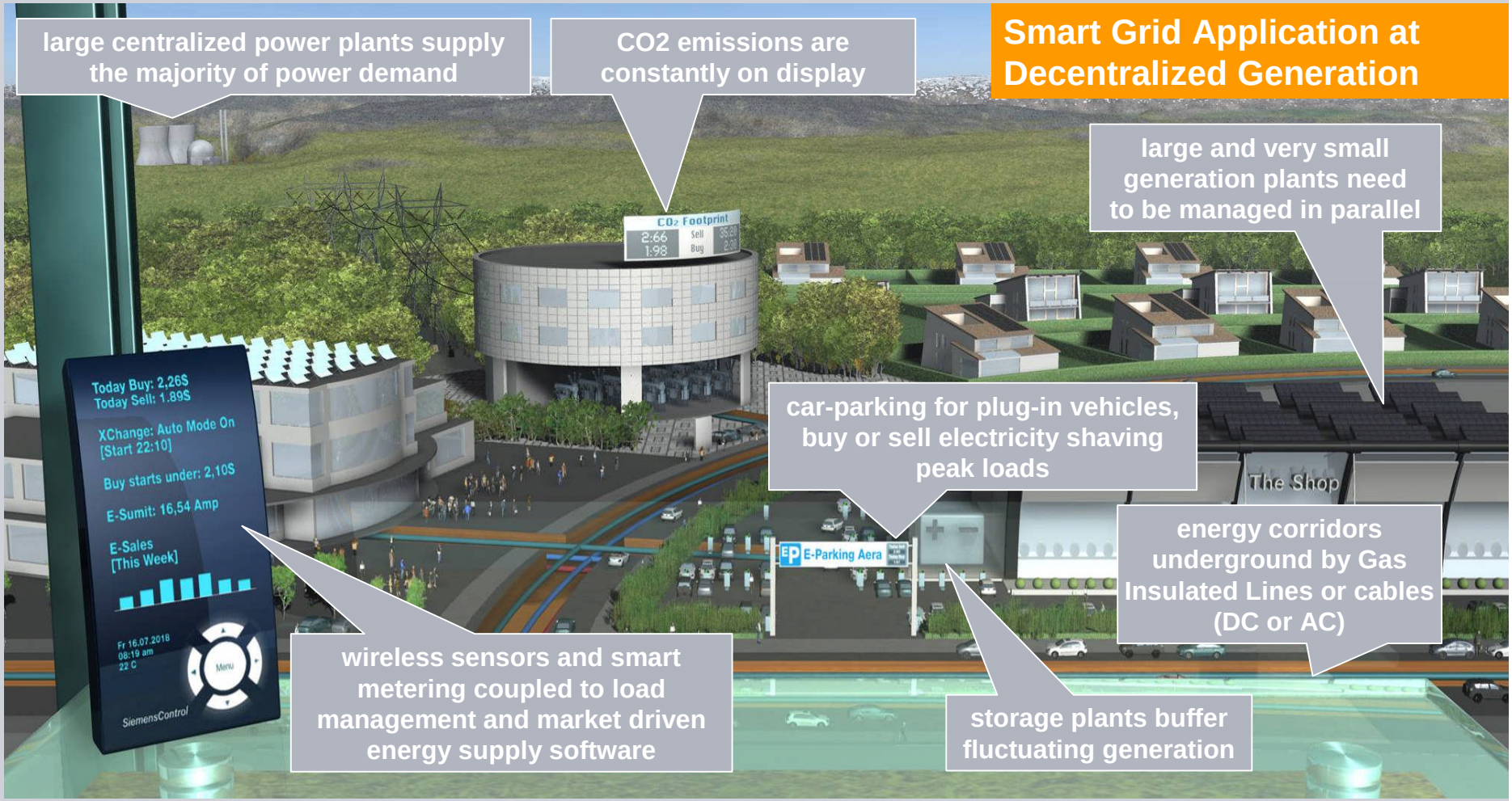
Building may even deliver energy to grid

CHP : Combined Heat & Power

BMS : Building Management System

PV : Photo Voltaic

Distribution Grid enabling load side in-feed



Transmission Grid enabling bulk renewable in-feed