



SIEMENS

Intelligent Use of Energy

Münchner Kreis
Munich, November 17, 2010

Eckardt Günther
Head of Smart Grid Solutions
Energy Sector

© Siemens AG 2010

Supplying energy in the future will mean major challenges for infrastructure

Three global megatrends in the energy sector

Demographic dynamics



- **Population growth:**
7.5 bn in 2020 (+1.1 bn)
- **Power consumption:**
+5.2% p.a. in emerging regions and 1.4% in developed world
- **Megacities** (>10 million inhabitants): 27 megacities in 2025

Resource scarcity



- **Geopolitics:**
70% of world oil and gas supplies in only a few countries
- **Fuel diversity:**
Oil price increase accelerates shift to broader fuel mix

Environmental focus



- **Global emissions:**
40% increase in air pollution over past 20 years
- **Climate change:**
Global increase in temperature minimum 2 degrees Celsius until 2100

Sources: UN, IEA, Stern, IPCC

Intelligent Energy Solutions are Required in all areas of Energy Consumption



Green technology achieves high gains in efficiency and CO₂ abatement

Renewables
Wind turbines:
Efficiency up from
1 MW to 3.6 MW

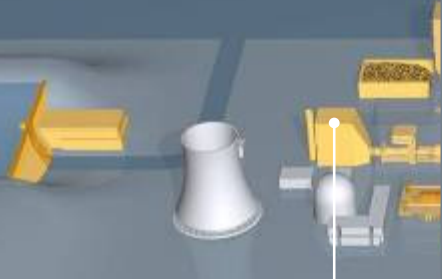
CO₂-free energy to the city
Example HVDC:
China 800 kV

Building technologies
30% less energy used
through building
energy management

Traffic management system
30% less downtime
with "Progressive traffic
em"

SIPLINK
12 tons less CO₂
emissions
per ship and day by
local grid connection

Street lighting
Potential in Europe:
3.5 million tons less
CO₂ emissions with
LED systems



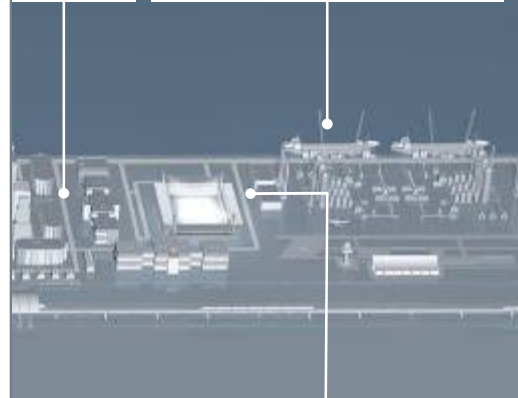
Efficient energy production
Combined Cycle: from
50% to 60%
Steam Power Plant:
from 40% to 47%

High efficiency
Efficient energy
transport by HV close
to the consumer

Energy efficiency
consumption with
variable-speed drives

Public transport
Efficiency of
public transport
(reduced waiting and
up to 20% fuel savings)

Street lighting
Potential in Europe:
3.5 million tons less
CO₂ emissions with
LED systems



**Electrical energy will keep
gaining in importance...**



Improvement of grid capacity

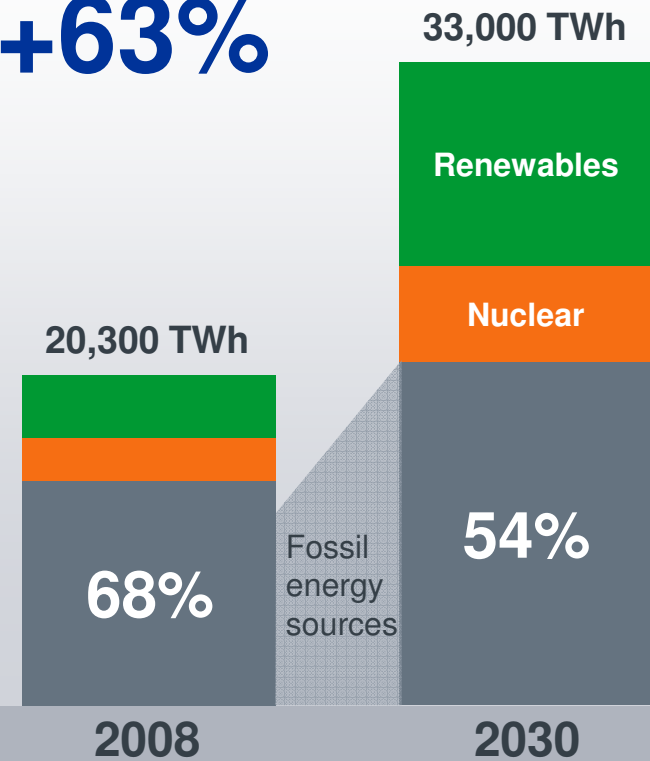
Growth of population and energy demand

Grid capacity must be extended by

- Grid expansion
- Intelligent usage of the grid

EI. Power Consumption (worldwide)

+63%



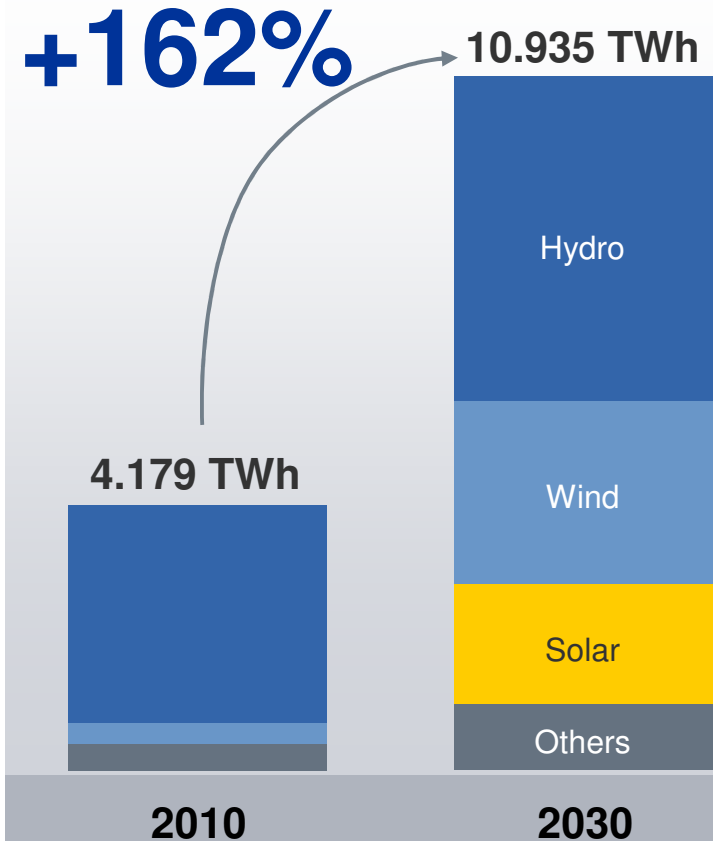
Increase of sustainable energy recourses

Climate change - the need for CO₂ reduction

Integration of more renewables
these are

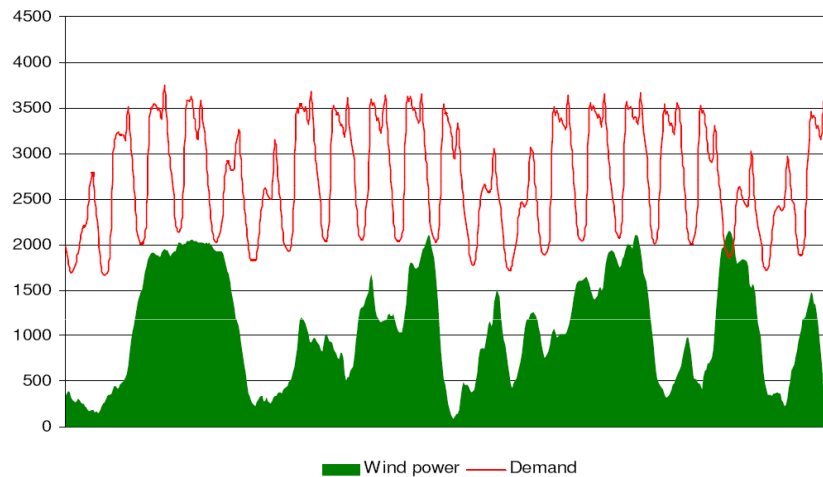
- Decentralized
- Stochastic

**Renewable Power Consumption
(worldwide)**

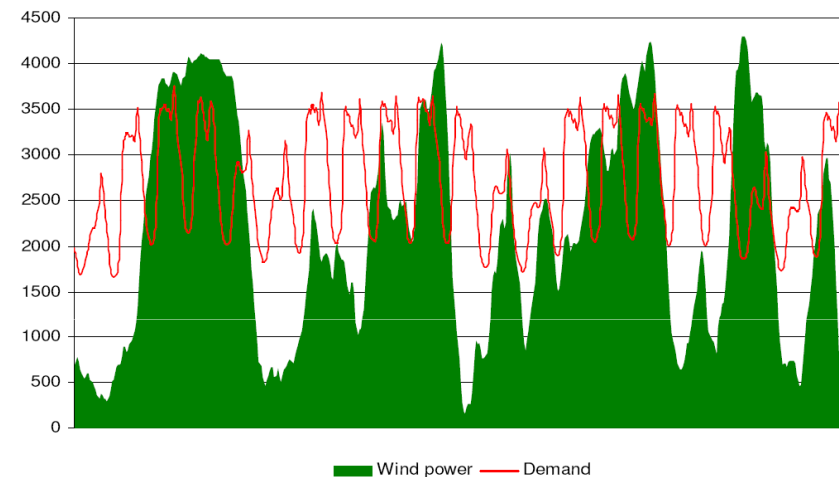


The 'Danish' Experience is illustrative for the European Challenge

DK Vest, January 2008, Demand and Wind power



January 2008 + 3,000 MW



Today (2008)

- 20 % of electricity demand is covered by wind power (West DK)
- 3,180 MW wind power installed
- Wind power already covers the entire Danish demand for electricity in 200 hours
- Cost of regulation and ancillary services: 1.045 Billion DKK ~ 140 m€

Tomorrow (2025)

- 50 % of electricity demand is covered by wind power
- Doubling wind power capacity (=6,000 MW)
- In the future wind power will exceed demand in more than 1,000 hours
- The need and cost for balancing resources and system services will increase significantly

High degree of wind power penetration already has led to negative energy pricing in 2009 and 2010

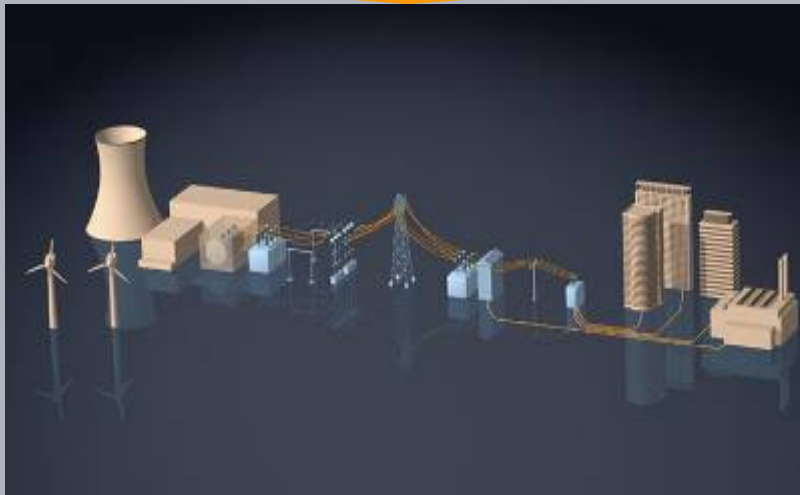
Source: Energinet.DK

Paradigm shift in power grids: The new age of electricity

SIEMENS

20th Century

Unsustainable energy system



'Generation follows load'

Fossil energy sources

End of 21st Century

Sustainable energy system

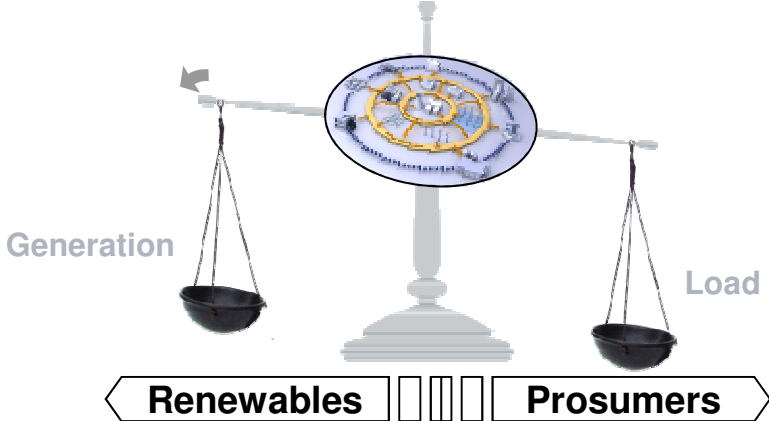


'Load follows generation'

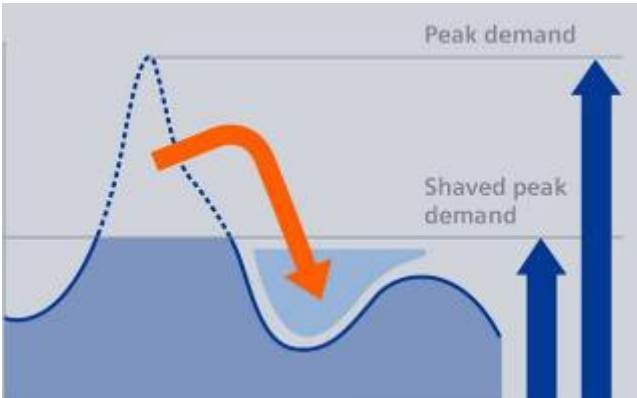
Renewable energy sources

Drivers for a Smart Grid

Balancing



Load shifting



Outage prevention and restoration

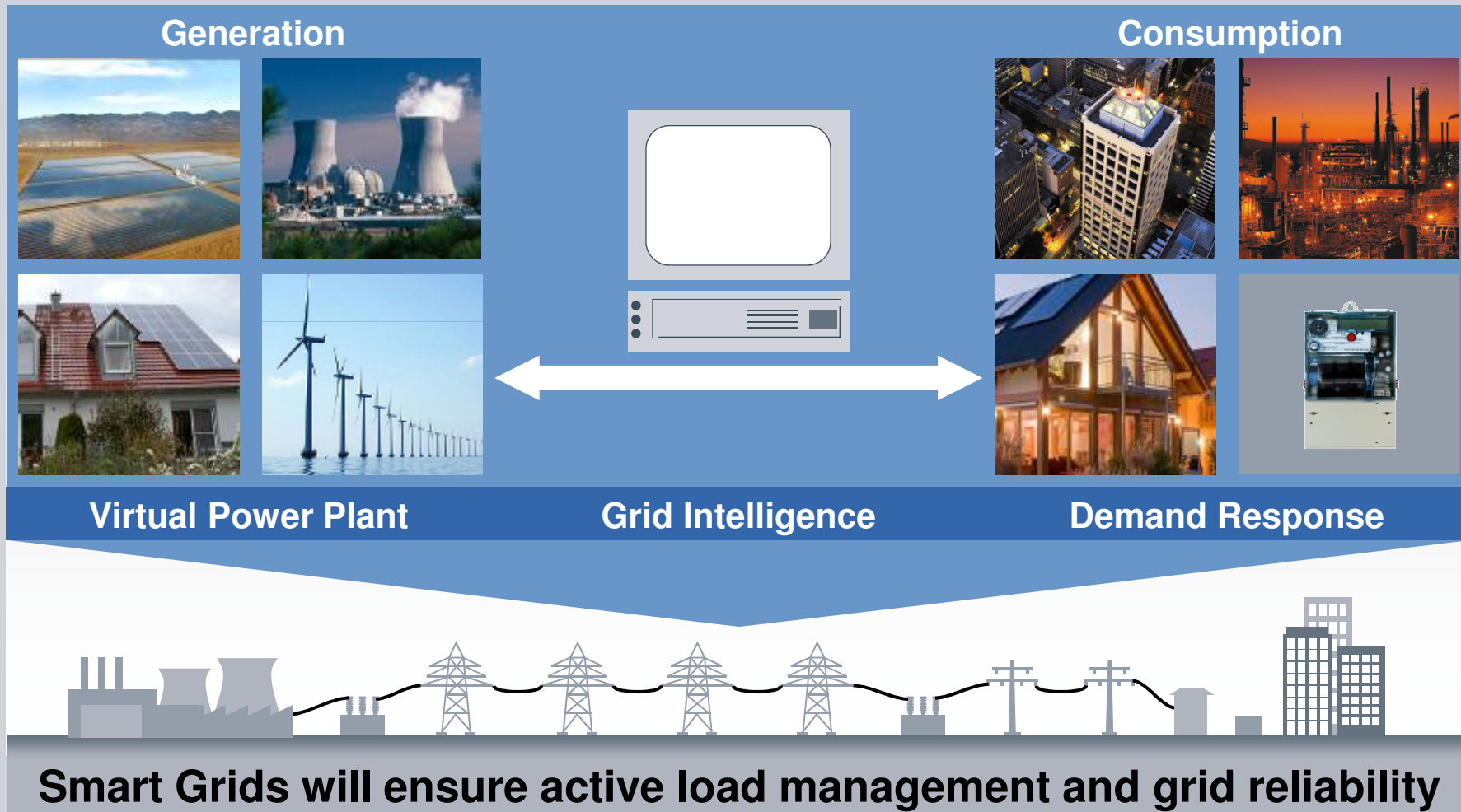


Efficiency



The smart grid ensure balance between generation and consumption

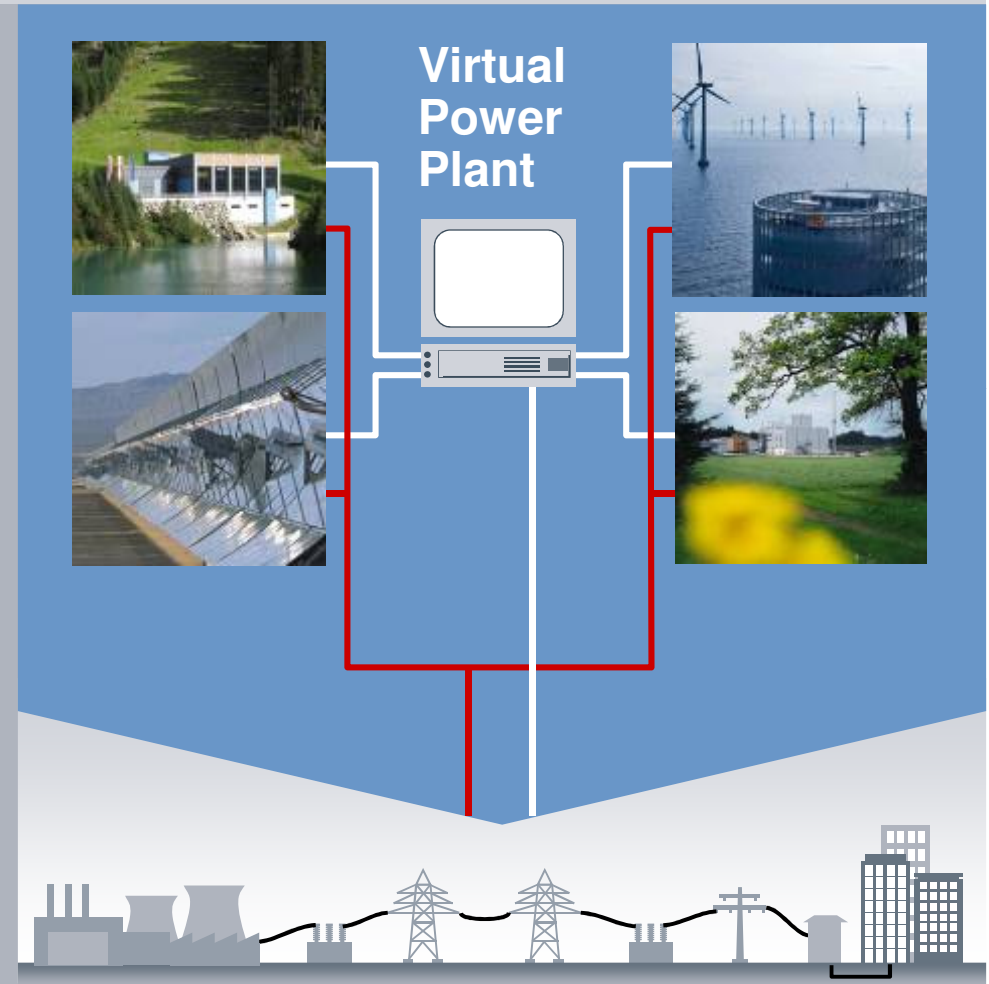
SIEMENS



Virtual power plant – the control of distributed energy resources

Integration of distributed and renewable energy sources

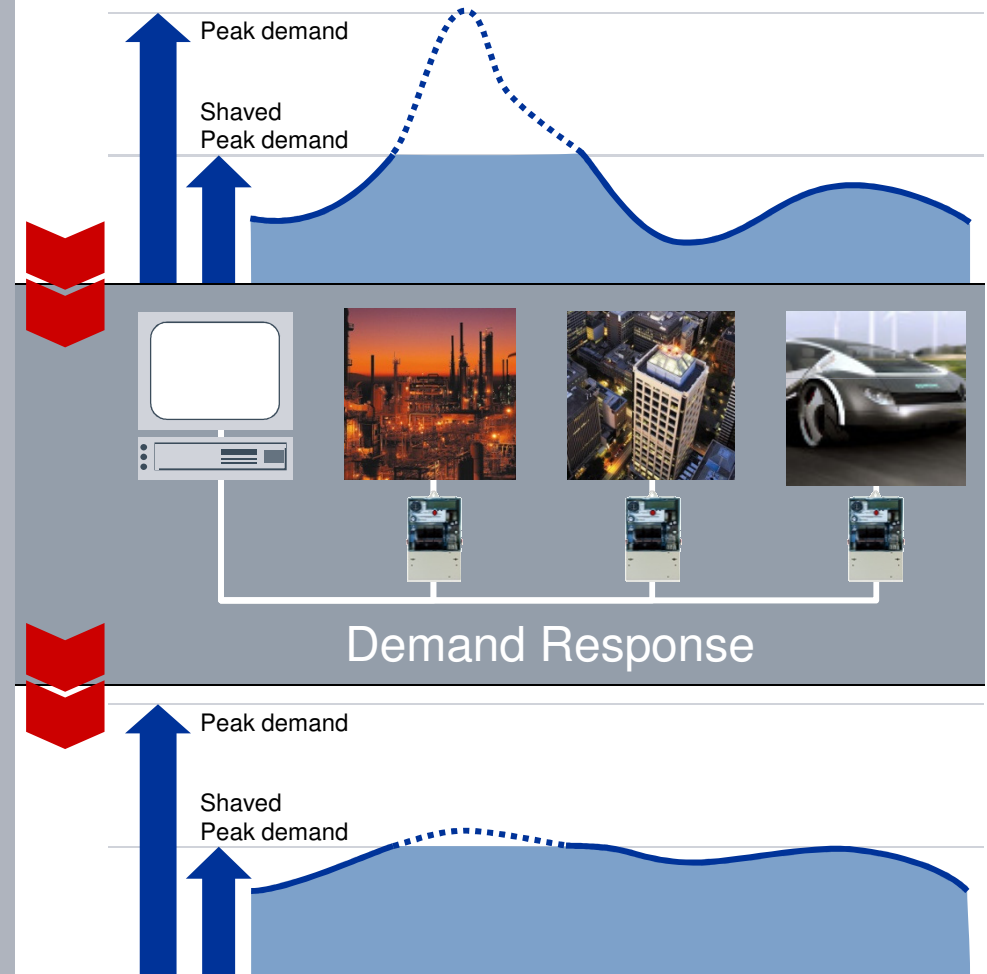
- More reliable forecasting and planning
- Decentralized power generation managed like a single power plant
- Energy trading



Demand Response – load follows generation

Management of demand

- Optimize generation cost
- Maximum use of CO₂ free energy
- Optimal use of valuable grid assets



Smart Buildings



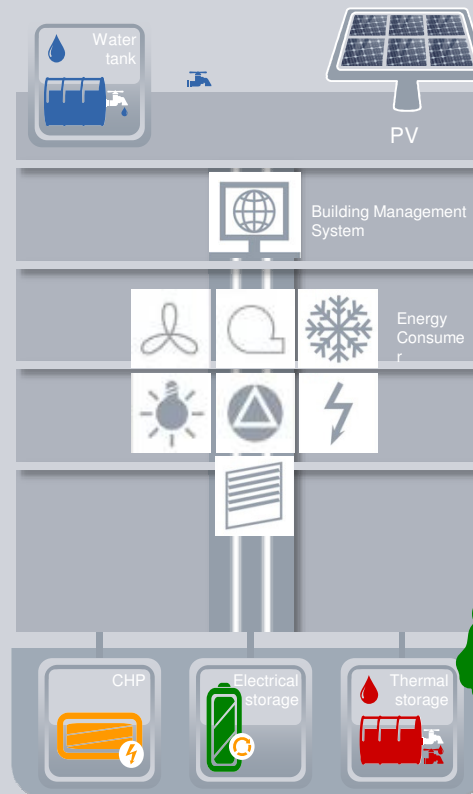
Interact with the grid and other drivers to maximize efficiency

Low energy tariffs

- Fill storage / Load E-car
- Load thermal elements (boiler, ice)
- Turn-off CHP

All consumption normal and build reserves within comfort band

Building is energy consumer to power grid



High energy tariffs

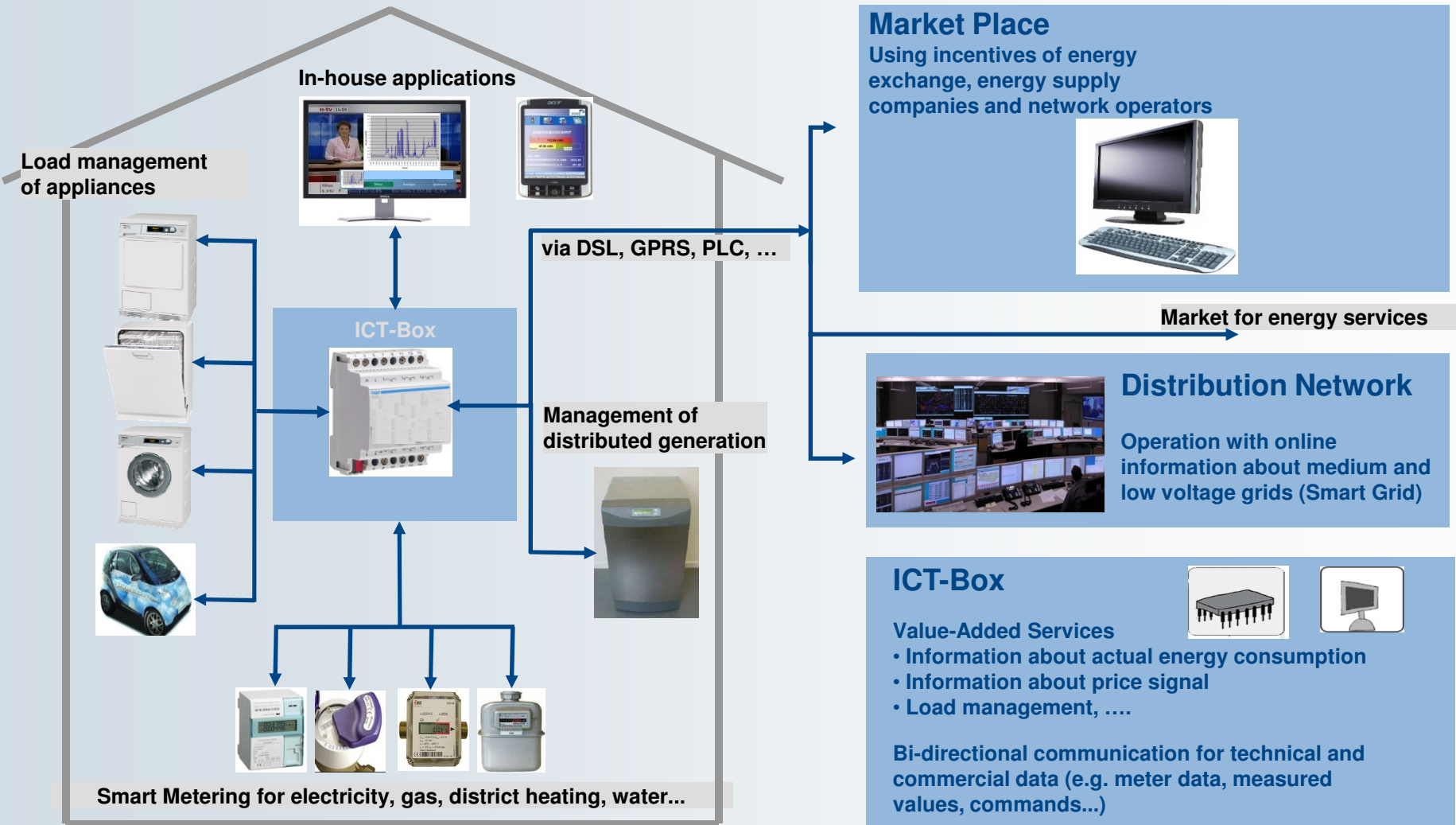
- Energy storage
- Use reserves E-car
- Empty thermal storage (boiler, ice)

All consumption to minimum level within comfort band

Building may even deliver energy to grid

Centered around an intelligent building energy management system that controls consumers, storage and on-site generation. Goal is to shift loads for energy cost reductions

E-DeMa Smart Prosumer Market Integration



A vision to become reality!

