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The virtual battery: energy management in buildings and neighbourhoods

18 May, 2016

Siemens focuses on electrification, automation and digitalization – and is actively supporting Smart City/Neighbourhood development

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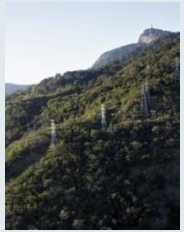
Power and Gas

Wind Power and Renewables



Energy Management

Building Technologies

TODAY

Mobility

Digital Factory

Process Industries and Drives

Healthcare

Digital transformation

Digitalization

Globalization

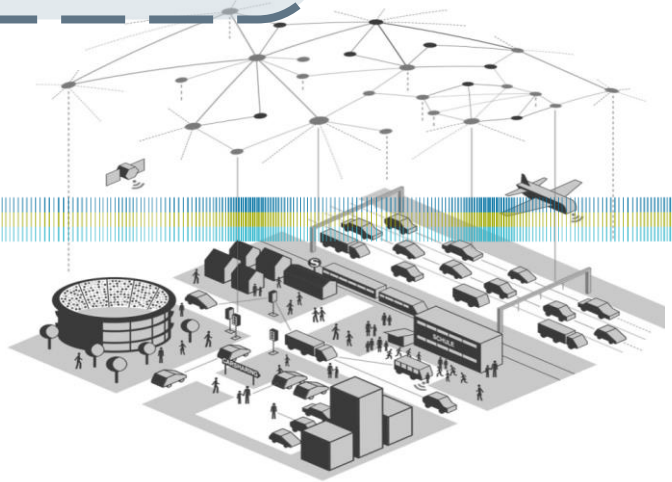
Automation

Urbanization

Demographic change

Electrification

Climate change



Enablers

- Sensors
- Computing power
- Storage capacities
- Data analytics
- Networking ability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Digital Grid
Ahead of the challenge, ahead of the change

The energy systems are changing dramatically

From monopoly power …


… to deregulated markets.


From downstream power delivery …


… to smart distribution and bidirectional power flows.


From top-down topologies …


… to autonomous local structures.


From predictable long-term value streams …


… to versatile, value-based transactions.

Germany: Energiewende 2.0 –
Future energy systems: Decoupling of generation and consumption

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Past
Production follows consumption

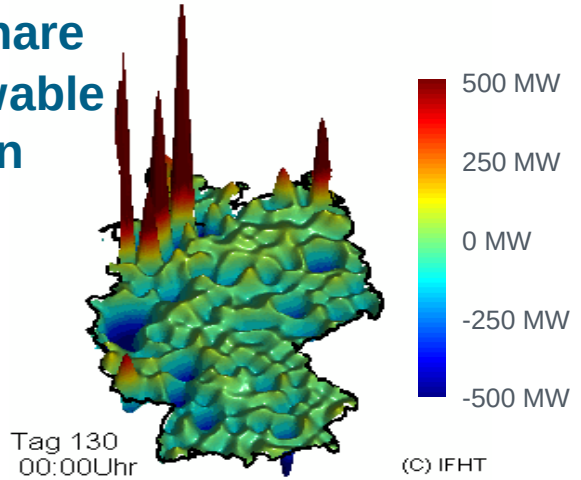
Today
Consumption vs. production

Future
Production decoupled from consumption

- **2035+: Installed capacity** of renewable energy systems: >220 GW
  - Electrical energy produced: 446 TWh
  - Electricity generation is occasionally 2.4 times higher than maximum consumption!
- **Excess energy** in northern states of Germany
  - More than 7,000 MW for over 3,000 hours per year
- **Grid stability** is the highest priority

Reducing uncertainties is a major challenge for research and development!

80% share of renewable energy in 2035+



Digitalization enables you to turn challenges into opportunities

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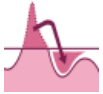
Challenges

Balancing

CO_2 and cost avoidance

Peak avoidance



Loss prevention

Resilience

Distributed optimization

Business models

Customer focus

Digitalization with Siemens delivers answers

Digital services

Vertical software

Digitally enhanced electrification and automation

Siemens Digital Grid masterplan architecture for a smooth transition to agility in energy

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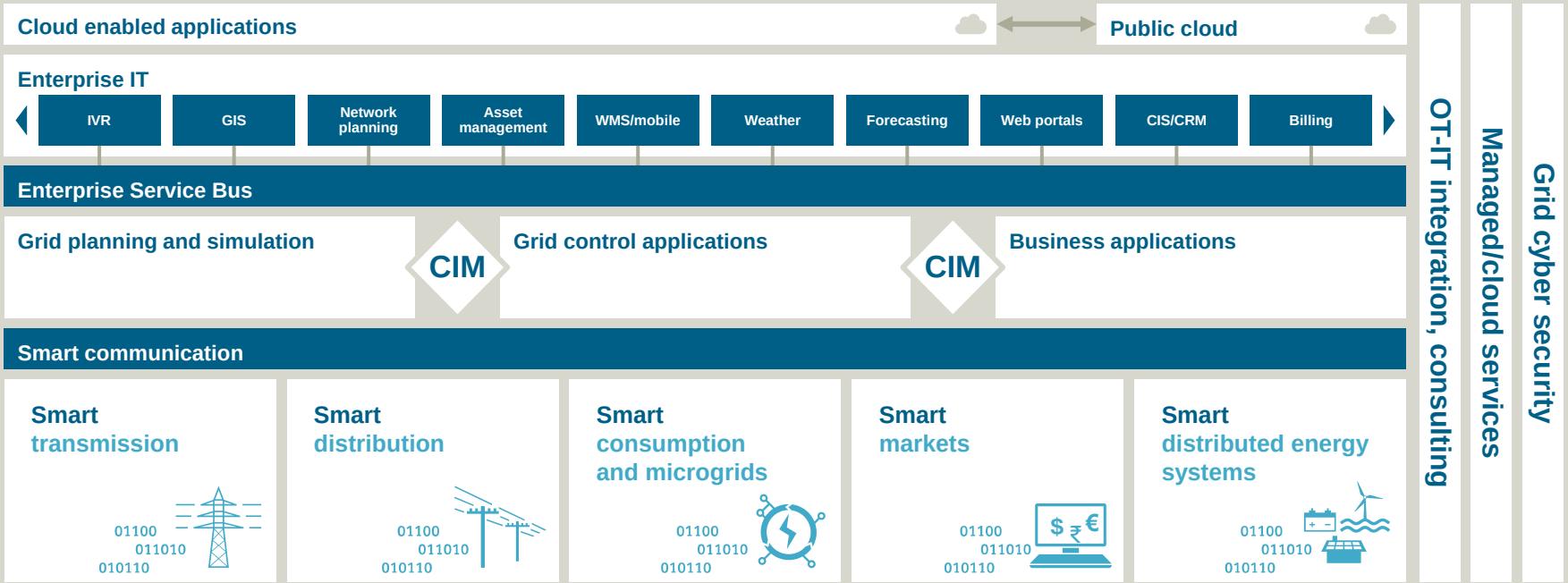

CIM – Common Information Model (IEC 61970)

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Intelligent Compact Substations for a Smarter Grid - The modular concept out of one hand

Web of Systems for distributed autonomous control – Example: The Intelligent Secondary Substation in a Smart Grid

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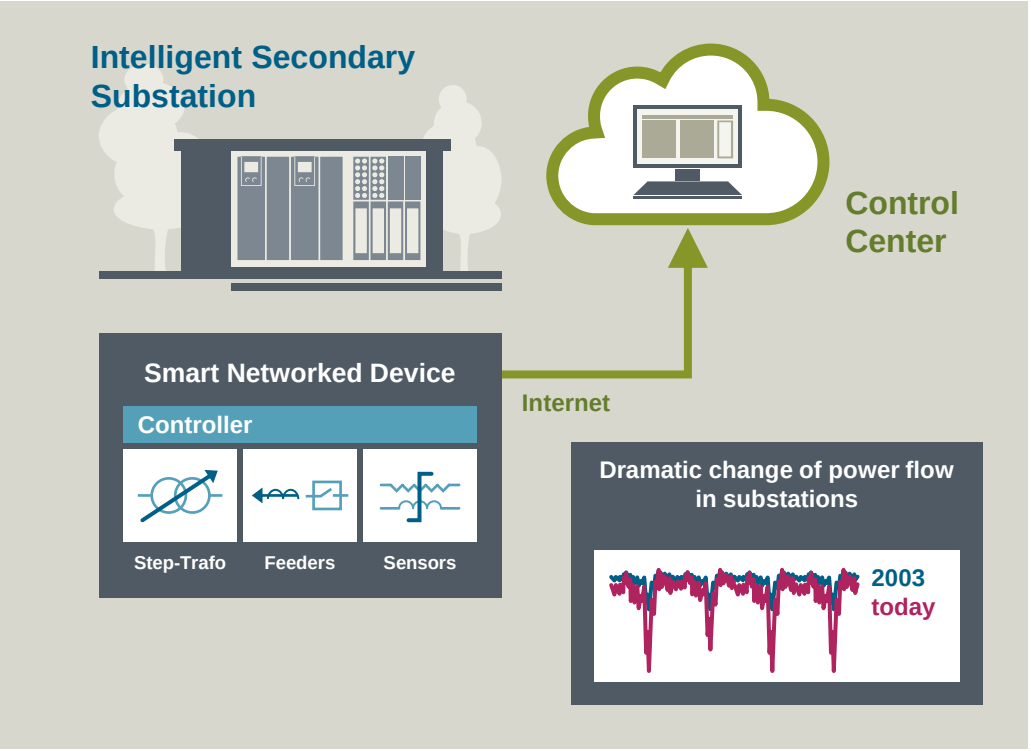

+ **Minimized engineering effort**
  Plug-and-Play capabilities, remote software update and feature enhancements, asset monitoring

+ **Reliable system operation at lower cost**
  Supervised autonomous local control enables reliable and stable smart grid operation while making use of internet connections to an operation center which are highly cost efficient but have lower quality of service

The modular energy storage system for a reliable power supply

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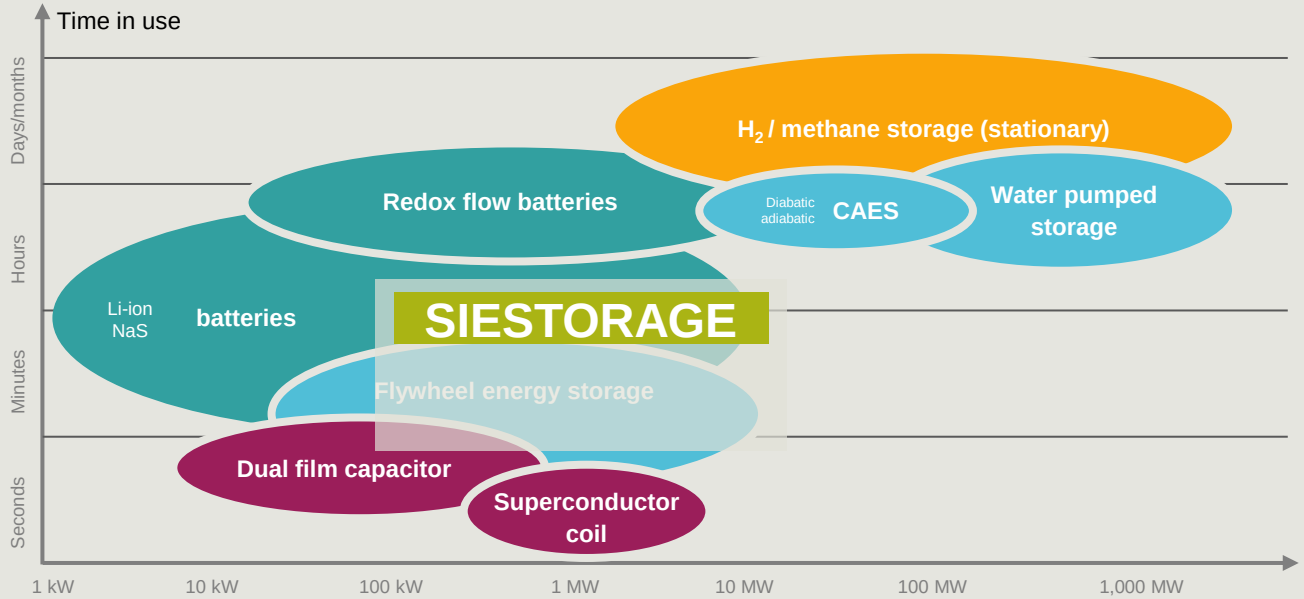
Energy storage technologies and application areas



- Know-how in different battery technologies and chemistries
- Designed for the use of various battery suppliers
- Technical data depending on supplier
- Maximum savings through optimized plant operation

Technology

- Chemical storage
- Electrochemical storage
- Mechanical storage
- Electrical storage

Source: Study by DNK/WEC “Energie für Deutschland 2011“, Bloomberg – Energy Storage technologies Q2 2011
CAES – Compressed Air Energy Storage

Energy Storage for very different purposes

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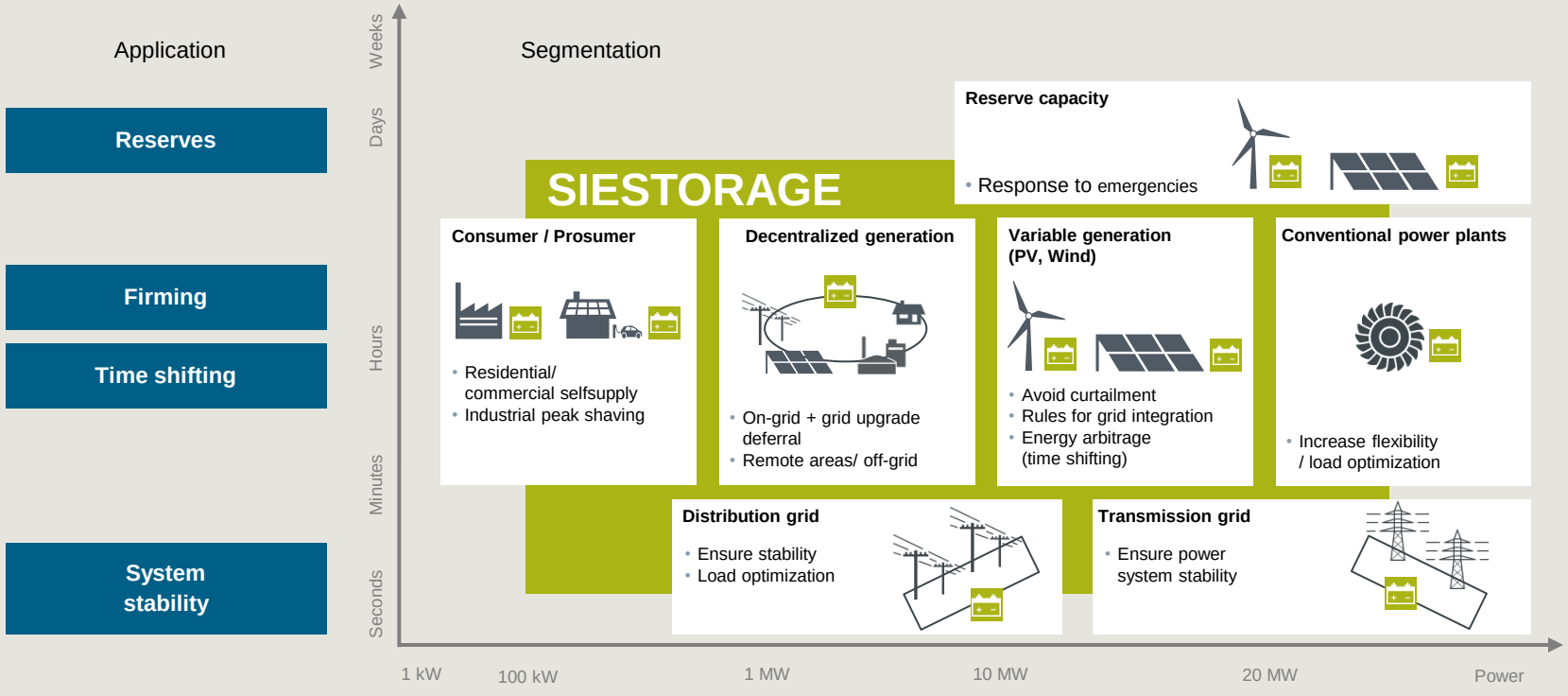

Smart buildings: the answer to the increasing complexity of tomorrow’s energy systems

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Did you know that **80%** of the total costs of building arise during operation?

80%
operating costs

Of this

40% energy

30% maintenance

10% other costs

20%
building costs

Building Technologies - The future of building management

Convergence and integration of autonomous systems in one communication platform

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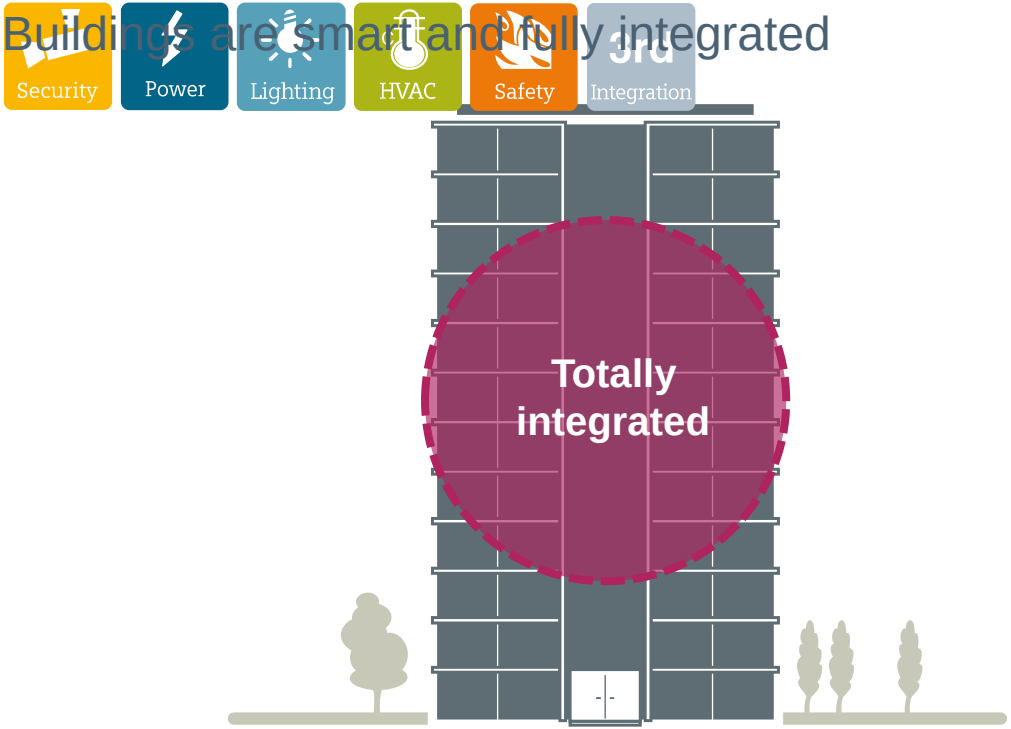
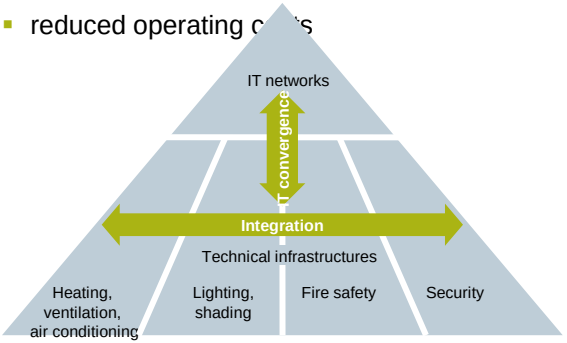
Buildings are smart and fully integrated

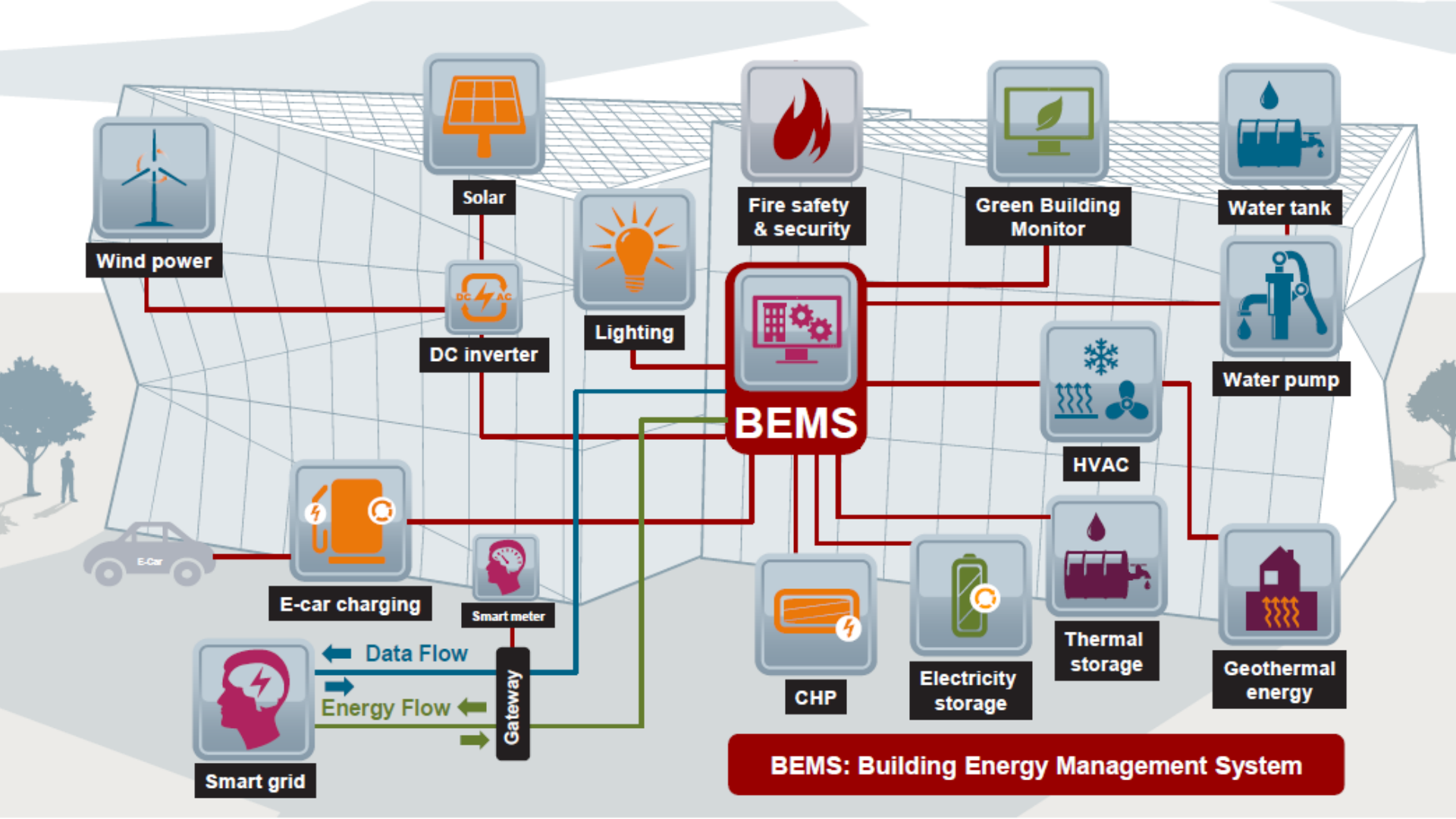


Convergence and integration

Thanks to interfaces, the technical infrastructure solutions converge with superior business systems, thus increasing the benefits of the complete infrastructure for:

- more transparency
- more flexibility
- reduced operating c[illegible]s




Solar
Wind power
DC inverter
Lighting
Fire safety & security
Green Building Monitor
Water tank
Water pump
BEMS
HVAC
E-car charging
Smart meter
Data Flow
Energy Flow
Gateway
Smart grid
CHP
Electricity storage
Thermal storage
Geothermal energy
BEMS: Building Energy Management System

Smart Buildings manage optimally local consumption, generation and storage, by providing detailed monitoring

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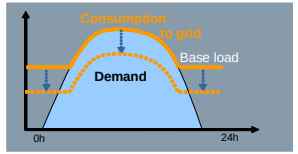
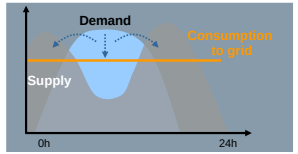
Building Energy Management System (BEMS)

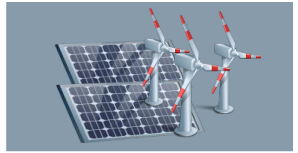
Shaping
Reduce consumption



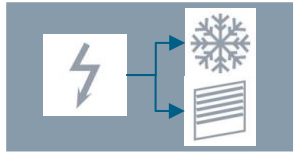
Shifting/Balancing
Shift consumption to low tariff to reduce peak load



Co-Generation
Use CHP, PV or other Power Supply for Co-generation



Energy Portfolio Management
Replace one energy source by a more cost-competitive alternative



Smart Neighbourhood

Grid and Building have entered the development phase of becoming "smart"

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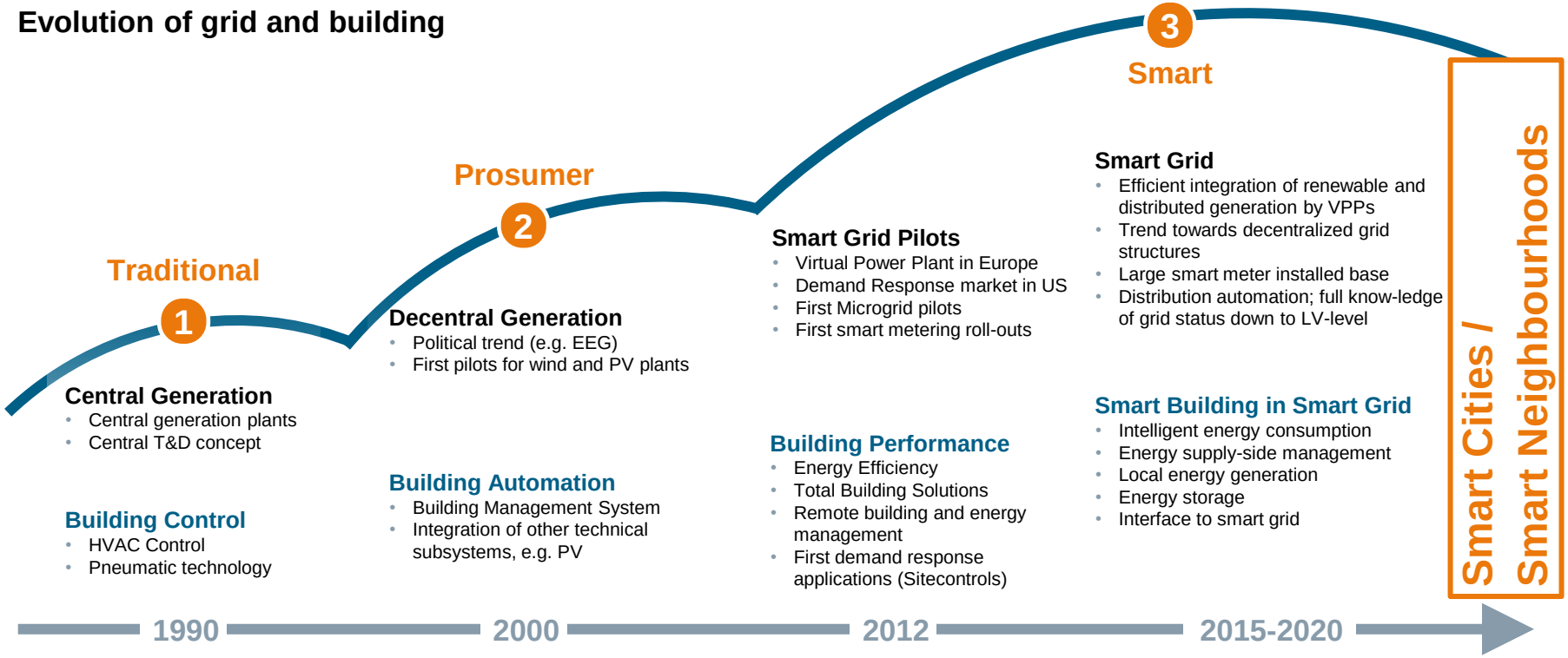
Evolution of grid and building



Distributed Energy Systems
Aspern (Vienna), Austria

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Smart data to business example: Smart City Research Aspern, Vienna

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City infrastructure
- Market drivers
- Customer needs
- Power networks
- Building technology

Smart Grid / Smart building
- Electrical engineering
- Power storage
- Smart meters

Smart City Cockpit
- Integration of smart grid, smart buildings, water and mobility
- Analytics dashboard

Objective

"My clear goal now is to become the greenest city in the world."

Michael Häupl, Mayor of Vienna

Domain know-how + Device know-how + Analytics know-how = Smart Data

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One of the biggest Smart City Projects in Europe

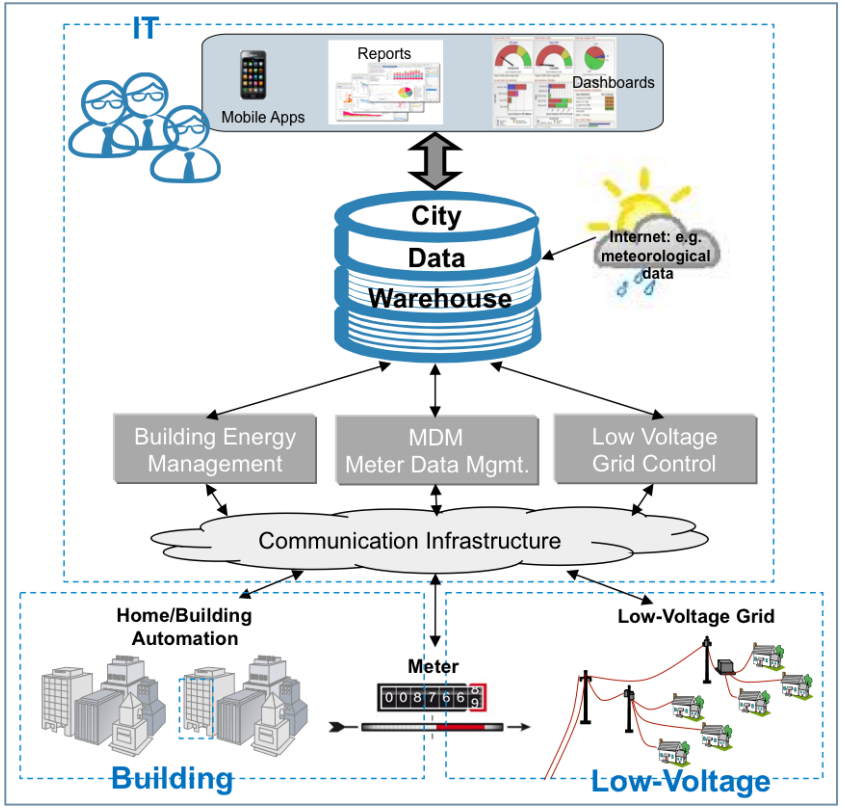
Apartments for
20.000 inhabitants and
20.000 work places until 2030
Size: 240 Hectare

Manifold utilization generates economic impulse and provides quality of life, ideal "living lab"

New, multifunctional city district including apartments, offices, business and research quarters and a school campus.

Seestadt Wien Aspern addresses the Megatrends urbanization and climate change

Future oriented concept including technologies, products and solution for an energy efficient city district



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Digitalization changes everything