

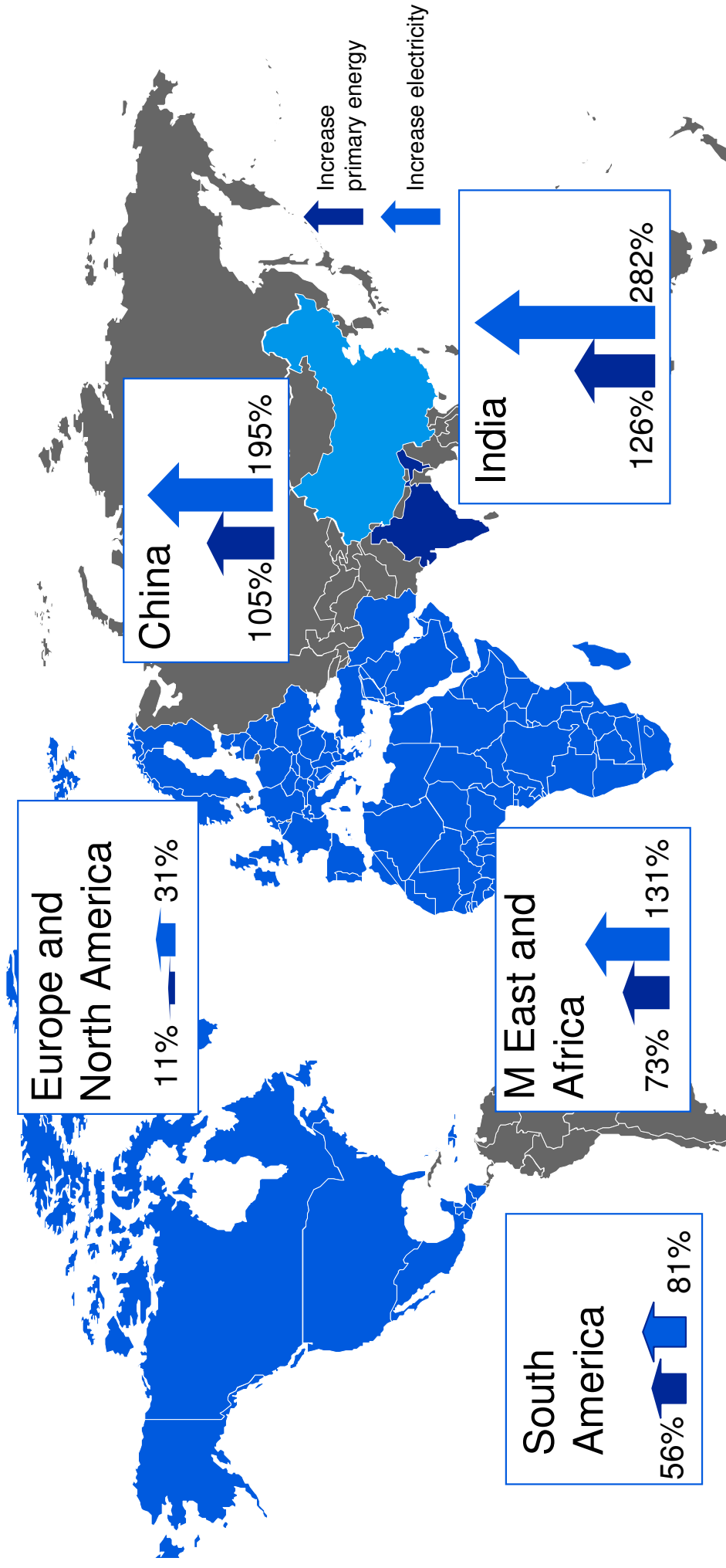


Karl Elfstadius, ABB Smart Grid

Key Drivers and Trends within Smart Grid IEA DSM Oct 6 2010

IEAs energy forecast 2006-30:

Increase of electricity twice as fast as the primary energy demand



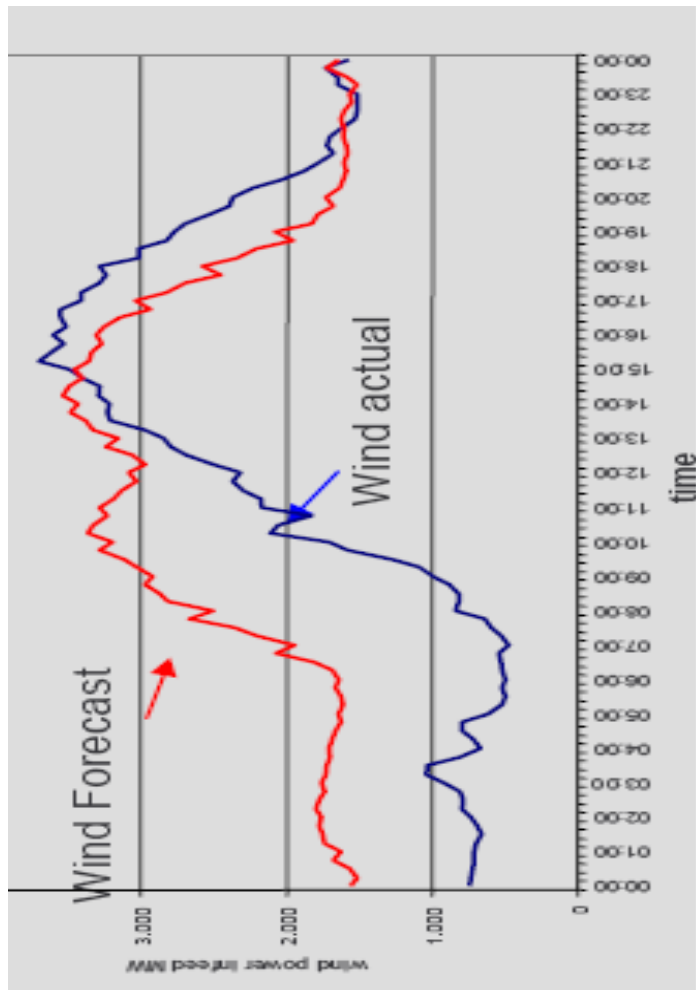
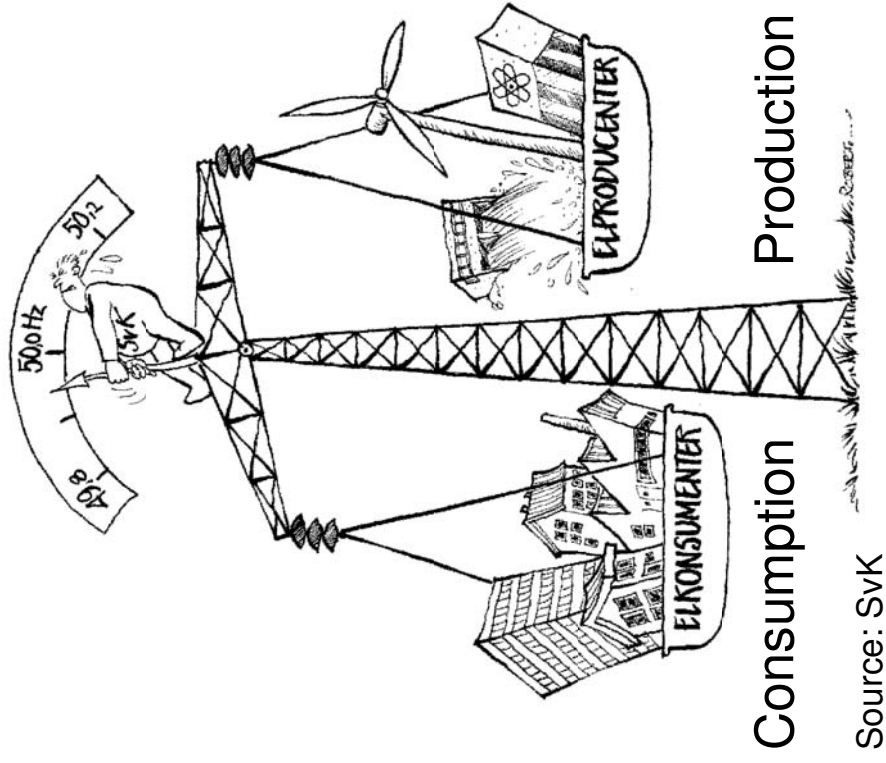
The consumers get a larger part of their energy demand supplied by the electricity network

A sustainable energy system - active consumers supported by a Smart Grid and a developed energy market



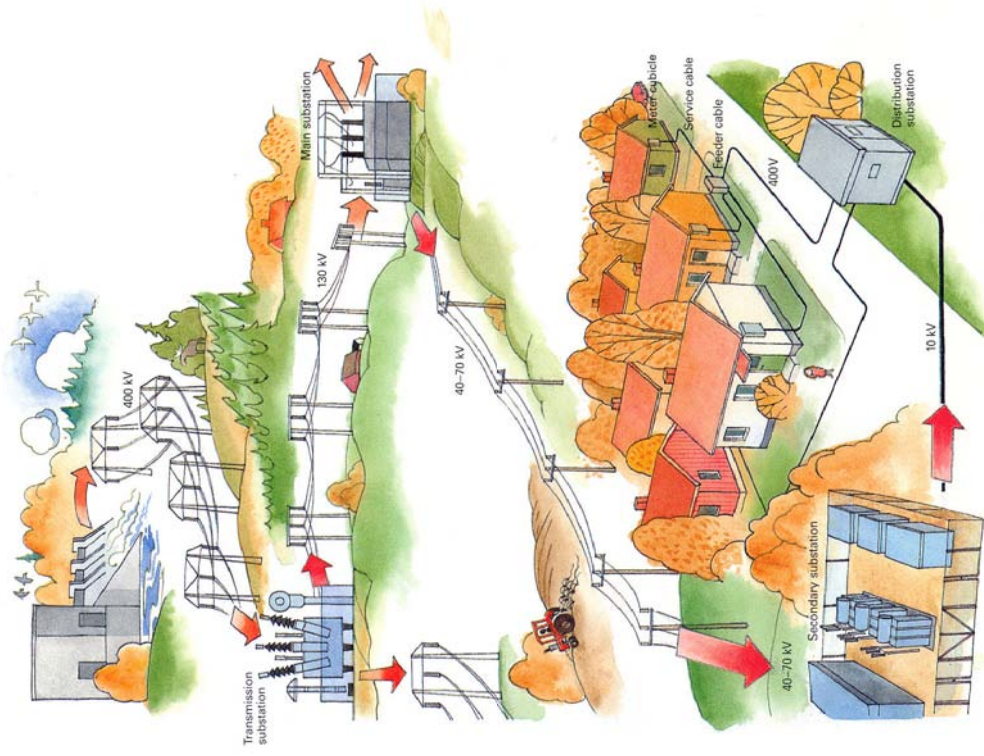
Integration of renewable energy sources

Challenge: Availability of emission free balance power



Wind and Solar requires more balance power

Smart Grid enables availability of balance power by increased transmission capacity and flexibility in demand



Planning targets for Sweden

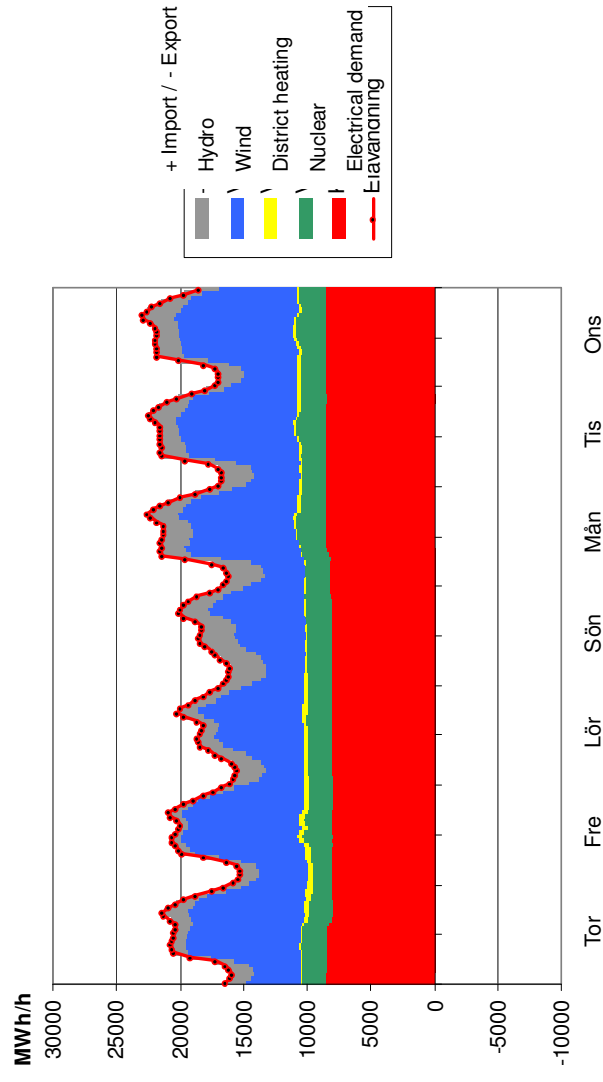
Windpower 30 TWh, 12 000 MW

Compared with today

Hydro power 16 000 MW

Nuclear power 9 000 MW

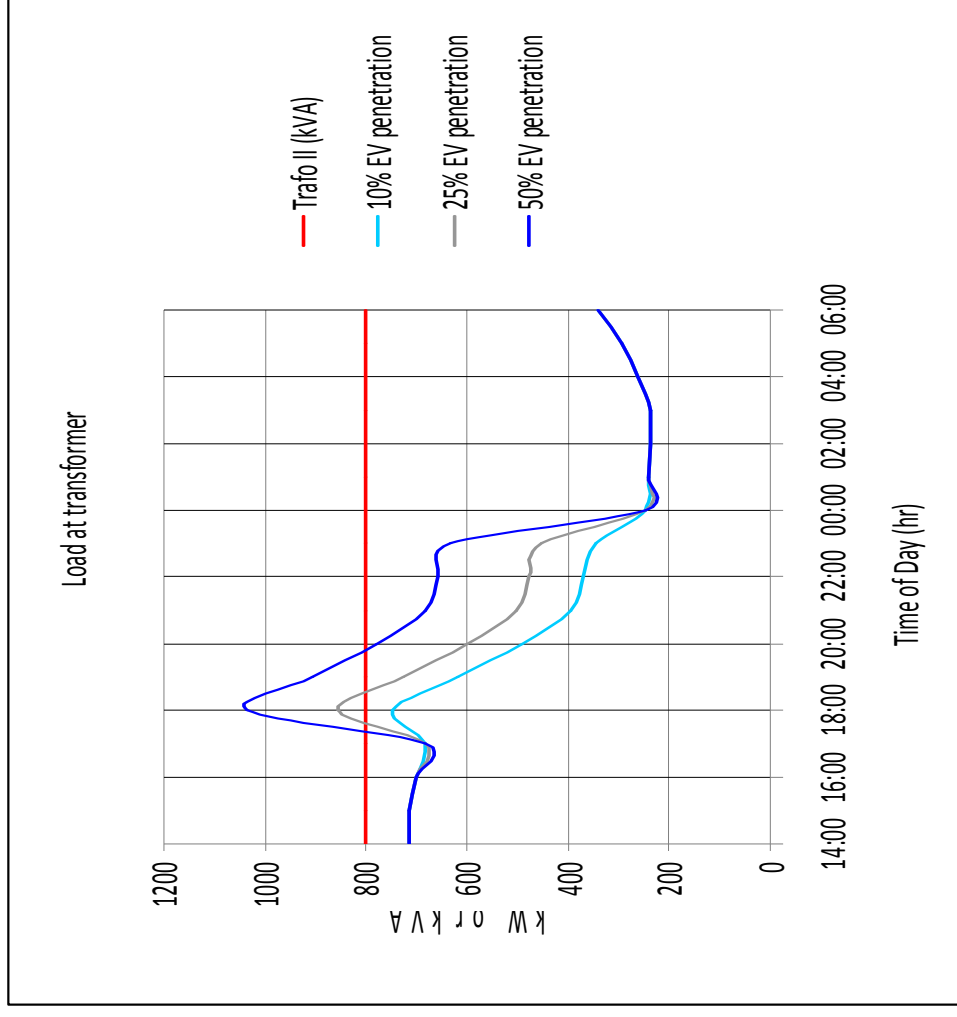
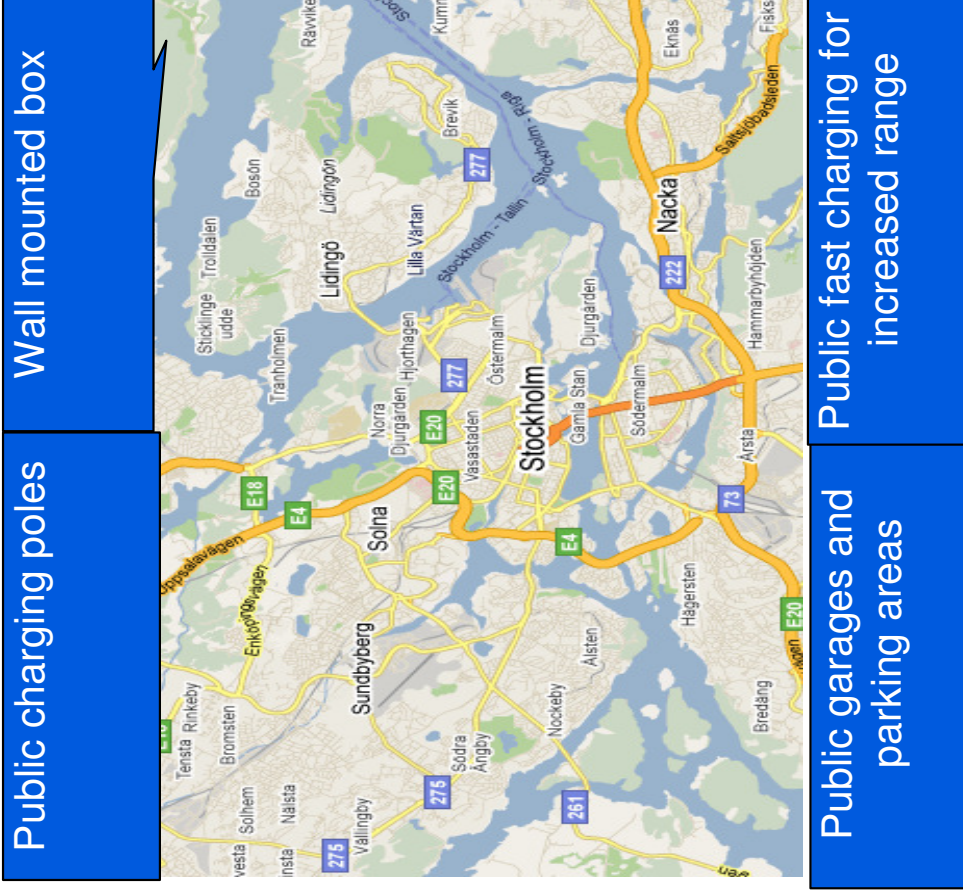
How to balance 12 000 MW intermittent wind power?



Källa: Swedpower/SvK

Charging infrastructure for e-mobility

Challenge: Peakload



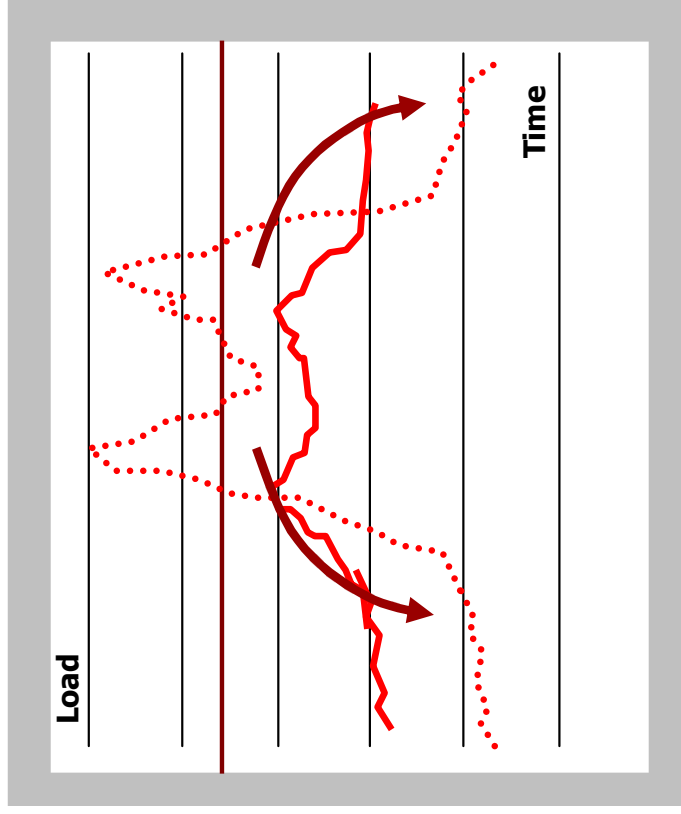
Smart Grid enables peak load shaving by active consumers

Benefits for network operator and energy supplier

- Use more efficient production units
- Use less costly production units
- Use units with less emission
- Improved utilization of the grid capacity
- More available balance power

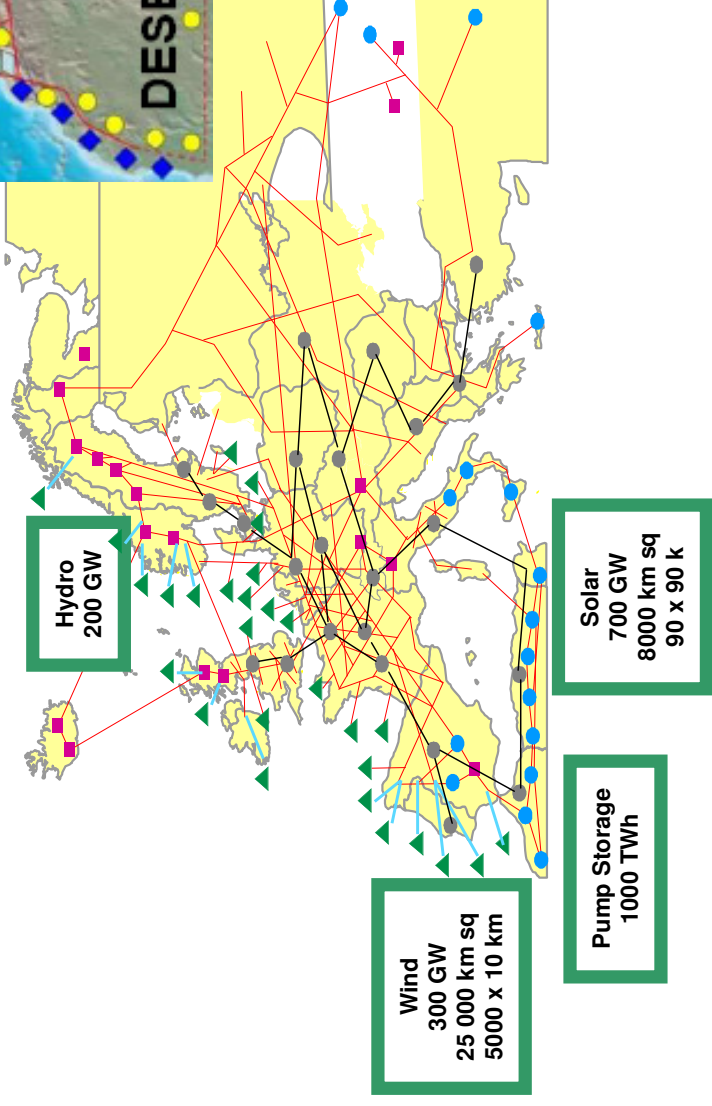
Develop business models that transfers part of the profit to the consumers

- New rules for the electricity market
- Modified network regulation

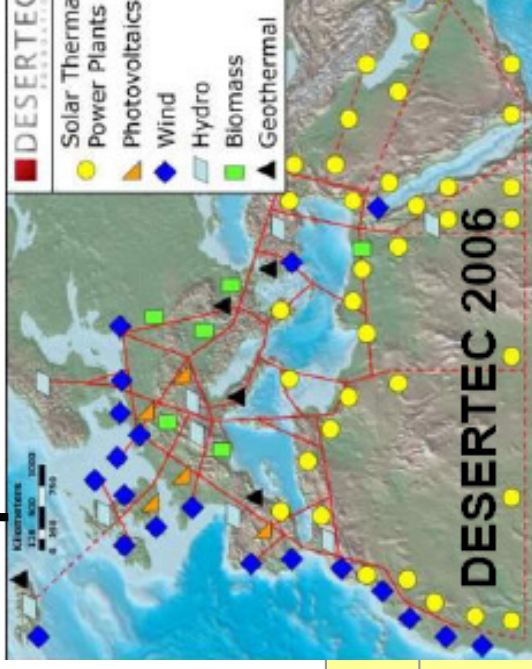


Smart Grid Components: Super Grid vision with HVDC connections

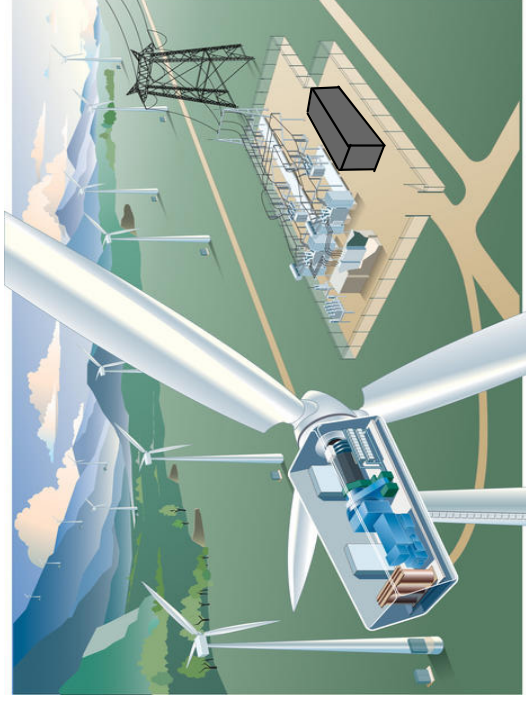
ABB vision 1992



European vision 2050



Smart Grid components: Grid support to ensure stability and quality

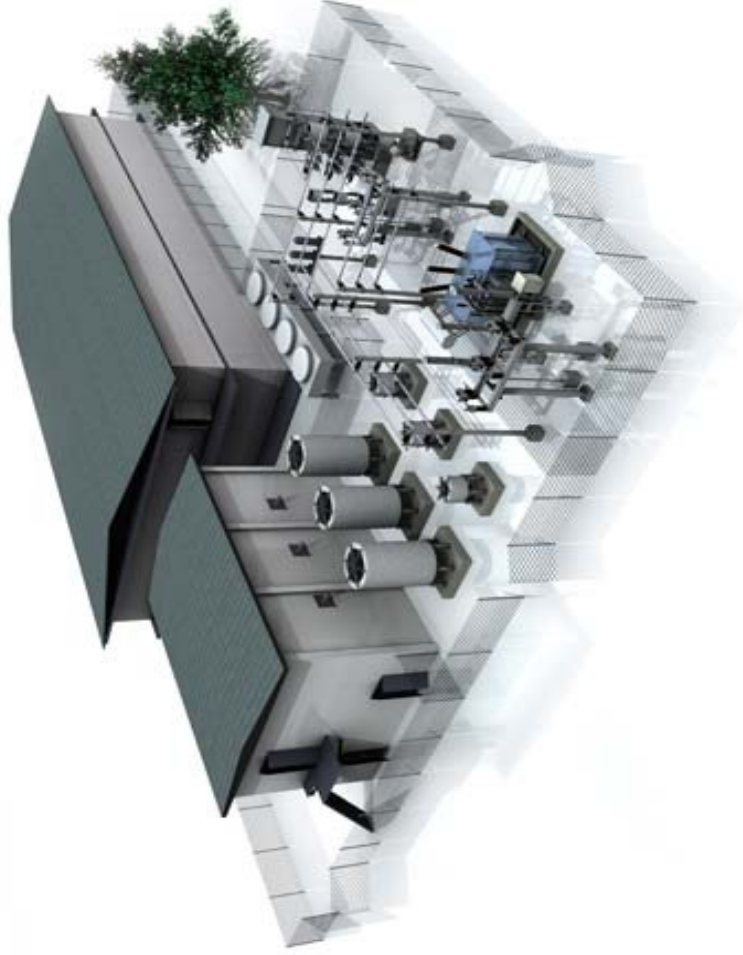


Energy storage to compensate intermittent production



Flexible AC Transmission Systems (FACTS) including **SVC** and **STATCOM** for increased grid capacity, voltage control and comply with grid code

Smart Grid components: Bulk energy storage

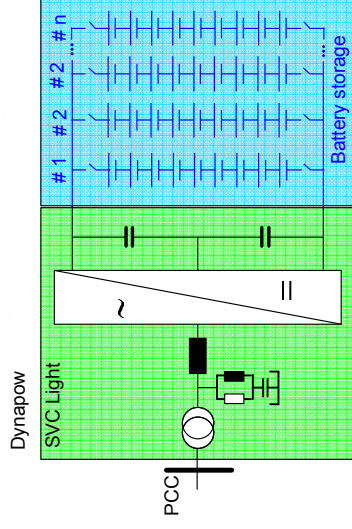


Energy storage

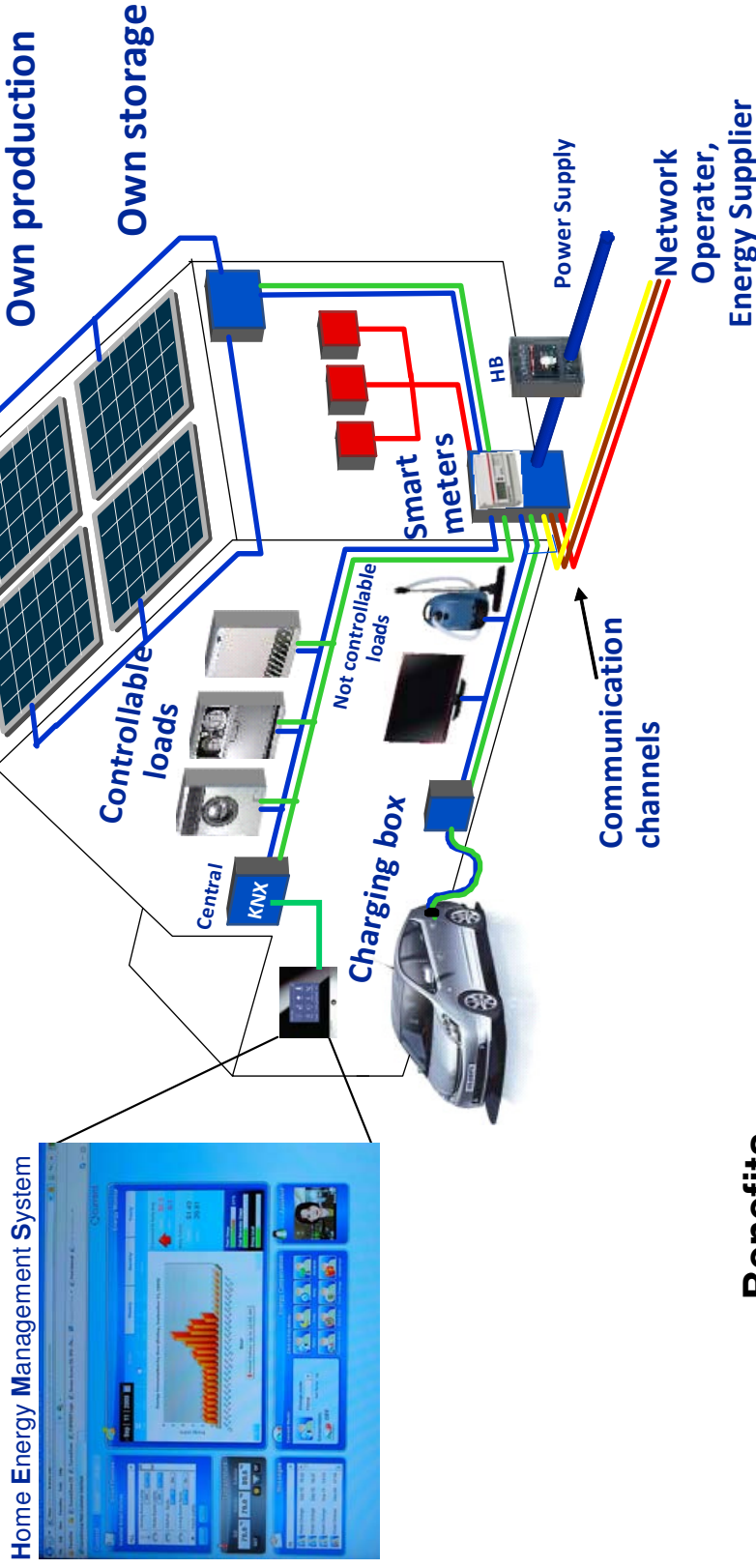
- Voltage control
- Increased stability
- Used during peak load situations and as emergency reserve during power outages.

Product concept

- Li-on battery cells
- 5-50 MW, 5 min to 60 min
- Modular concept



Smart Grid components: Integrated Active House and Electric Vehicle



Benefits

- Active 'prosumer' benefits from most favorable spot price
- Peak load shaving by local production, storage and time shift of consumption
- Overall reduction of energy consumption by increased consumer awareness

Smart Grid components: Charging infrastructure Electric Vehicles

Billing system

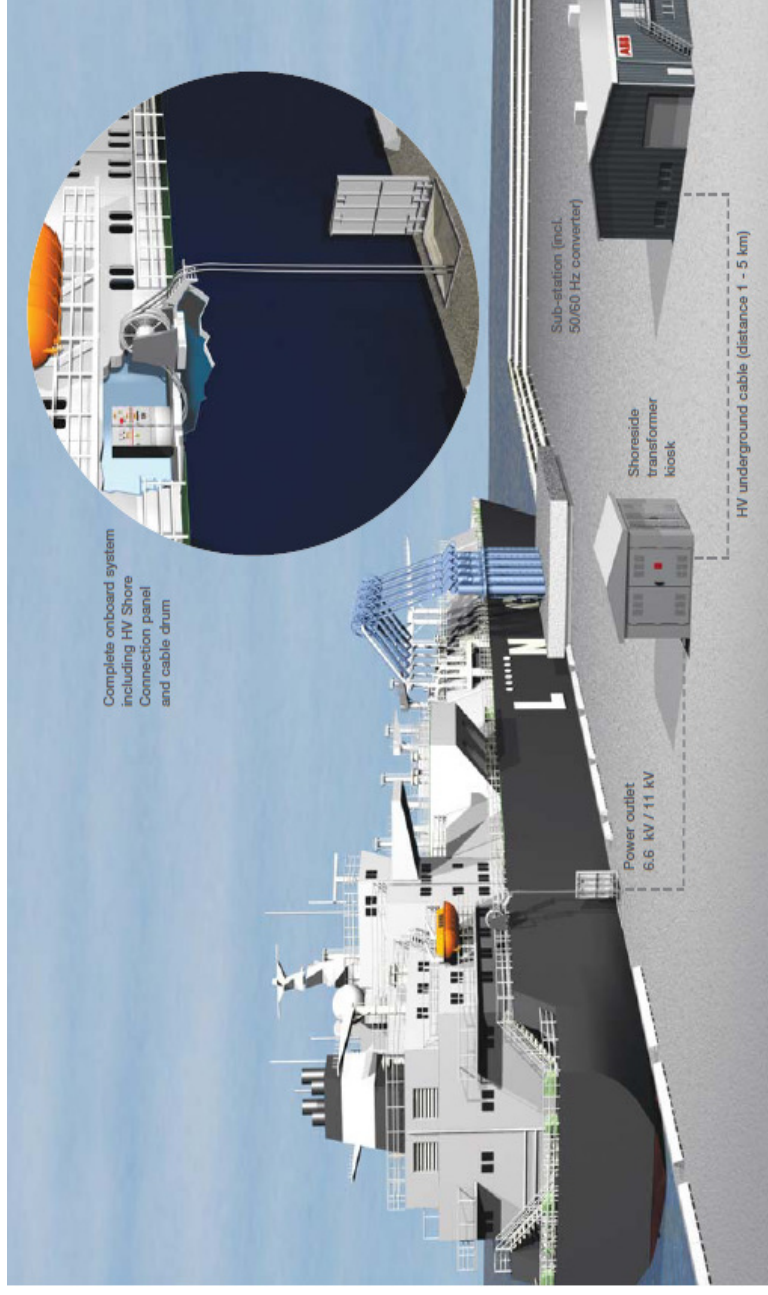


Benefits

- CO2 reduction
- Allows for the possibility to dispose energy when excess production is available.
- Peak load shaving

Charging method	Description	Installation
Slow charging	<ul style="list-style-type: none"> ▪ Individual poles at home or parking lots ▪ Charging time ~6 hours 	<ul style="list-style-type: none"> ▪ ~2kW, AC converters
Fast charging	<ul style="list-style-type: none"> ▪ Special charging stations or with equipment at home ▪ Charging time ~1 hour 	<ul style="list-style-type: none"> ▪ ~20kW, AC converters
Ultra-fast charging	<ul style="list-style-type: none"> ▪ Concept for special charging stations ▪ Charging time ~6 min 	<ul style="list-style-type: none"> ▪ >300kW, DC converters

Smart Grid components: Shore to ship



- Lower emission CO₂, NO_x, SO_x, PM
- Reduction of noise

Smart Grid components Network Management with improved Situational Awareness and Grid Automation



- Improved visualisation
 - Preventive information
 - Intelligent alarm handling
- Control center applications for integration renewables and demand response
- Improved outage management based on meter data instead of trouble calls
 - remote fault location, isolation, restoration and crew management
 - Improved customer information
- Improved automation of MV/LV grid
 - Distribution automation
 - Volt/Var regulation
 - Zone concept
- Cyber security

Need of Smart Grid R&D Arenas Development of technology, business models & regulatory framework

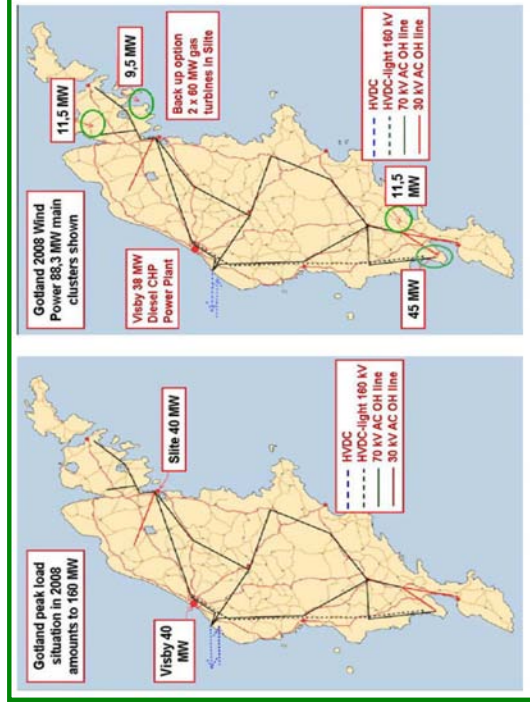


Stockholm Royal Seaport

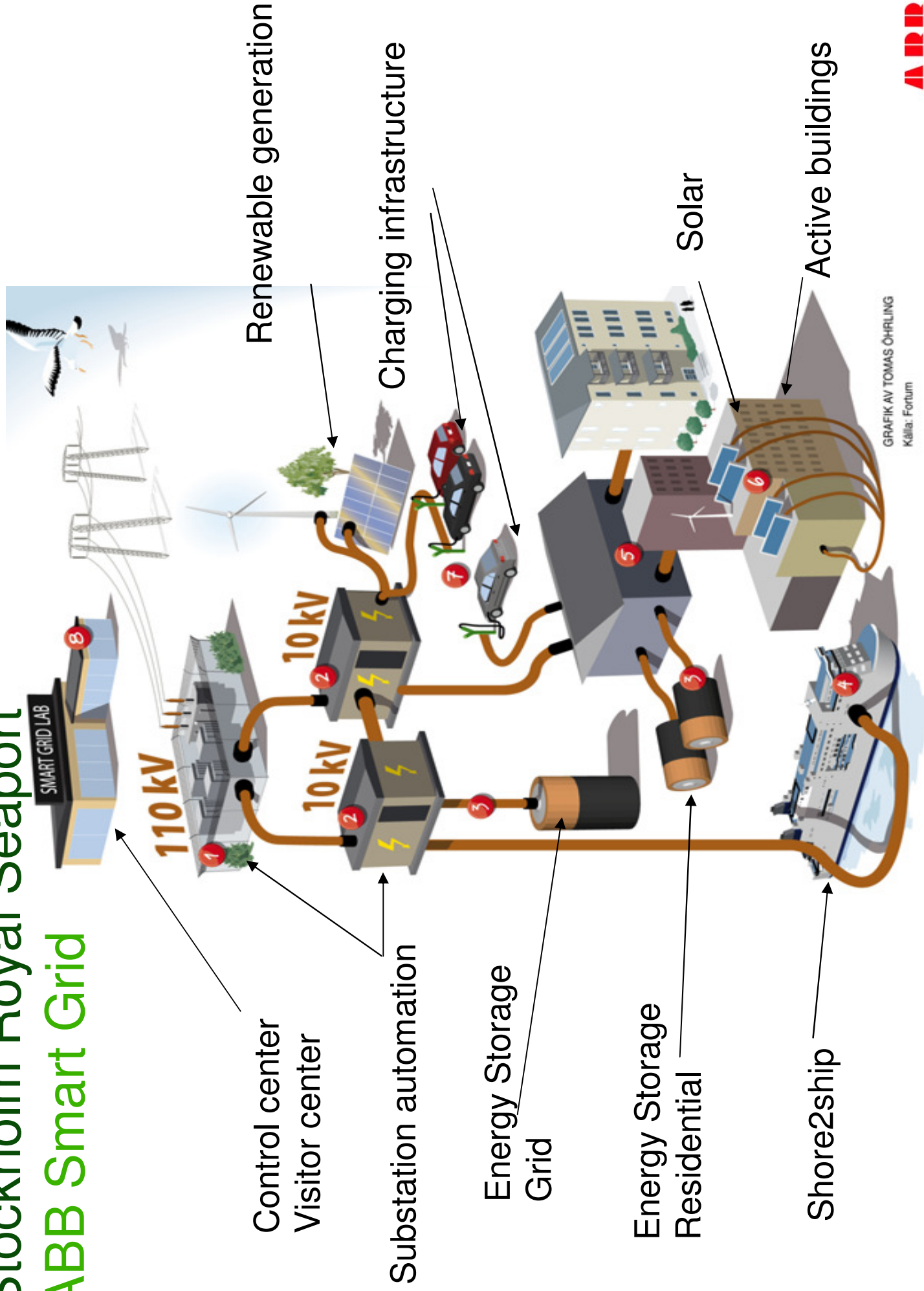
- A full scope Urban Smart Grid for a sustainable city and harbor environment
- Focus on active consumers (residential and harbor) and peak load reduction
- Main partners - Fortum and ABB

Smart Grid Gotland

- A full scope Rural Smart Grid
- Focus on wind integration and related stability and reliability issues
- With 30% intermittent renewable production Gotland represents the challenge many regions and countries will face in the future.
- Main partners – Vattenfall and ABB



Stockholm Royal Seaport ABB Smart Grid



GRAFIK AV TOMAS ÖHRLING
Källa: Fortum

Stockholm Royal Seaport – Open R&D&D Arena



New solution..



New partnerships...

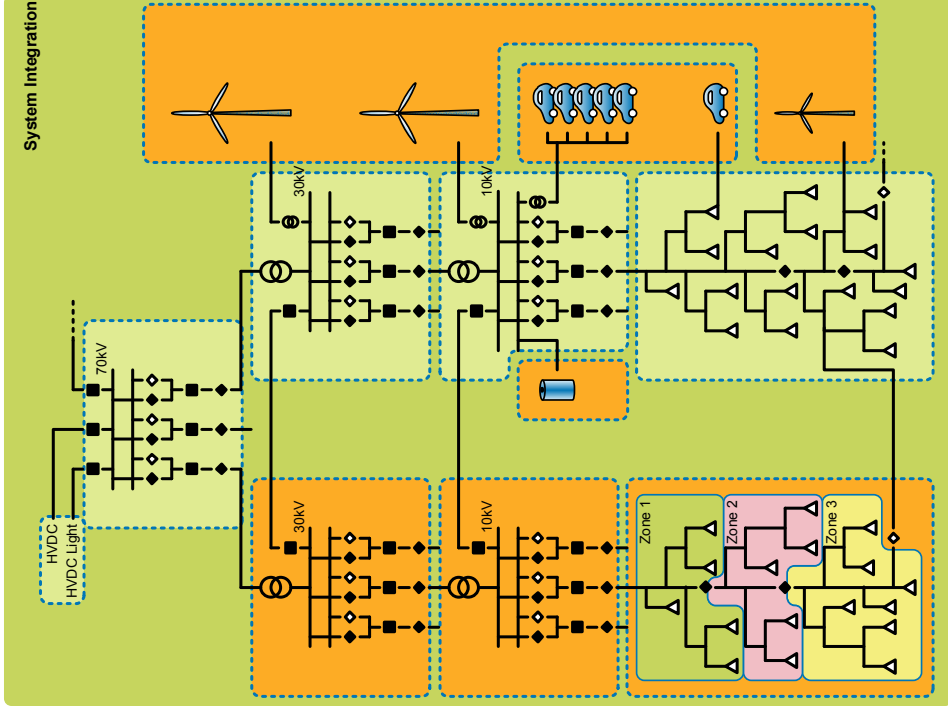


Different competencies meet to solve a common problem

Smart Grid Gotland ABB Smart Grid

Scope

- Integration of Distributed Intermittent Generation (Wind)
- Energy Storage for Network Support
- Distribution Automation
- Smart Primary Substations
- Demand Side Participation with commercial and industrial users
- Integration and Use of PHEVs/EVs
- Smart Grid Control Center
- System for Innovation Center



European Institute of Innovation and Technology InnoEnergy Smart Grid Leadcenter



CC BENELUX

- **Intelligent energy-efficient buildings and cities**
- *Setting up an intelligent house with minimum energy needs*

CC IBERIA

- **Renewables (wind, CSP, photo voltaics, wave and tidal energy)**
- *Demonstration project solar CSP*

CC ALPS VALLEYS

- **Sustainable nuclear & renewable energy convergence**
- *Nano-materials for high energy / high power batteries*

CC SWEDEN

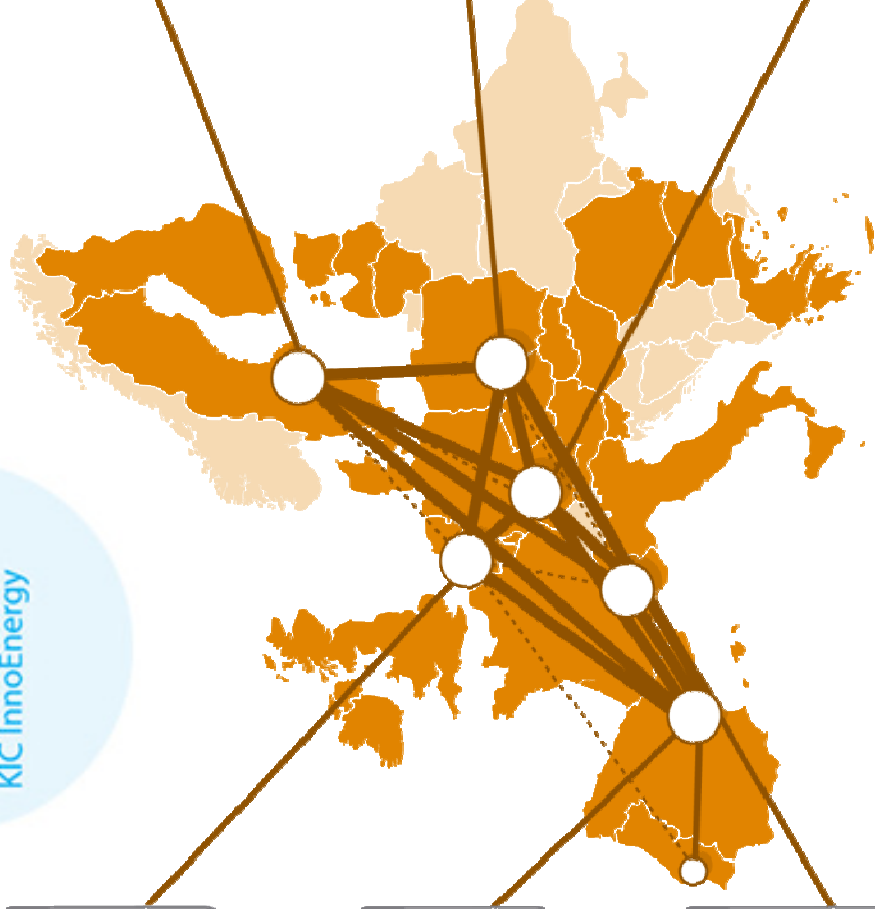
- **European Smart Electric Grid and Electric Storage**
- *System and markets for the smart super grid of the future*

CC POLAND PLUS

- **Clean Coal Technologies**
- *Gasification of coal with CO2 internal reduction*

CC GERMANY

- **Energy from chemical fuels**
- *Demonstration unit hybrid power plant based on micro gas turbine*



Smart Grid - What are the benefits? Smart Grid is the enabler for...

- transformation to a sustainable energy society
- development of a consumer driven electricity market
- increased grid capacity with a favourable impact on electricity prices
- a less vulnerable energy system
- attraction of young talents to the power industry

**Power and productivity
for a better world™**

