Future Distribution Grids

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WESTNETZ

Westnetz is the leading Distribution System Operator in Germany

Some facts:

Turnover	5 B€
Staff	5,300
Distribution area	50,000 km²
Grid length Electricity	195,000 km
Grid length Gas	26,000 km
Connections Electricity	4,500,000
Connections Gas	600,000

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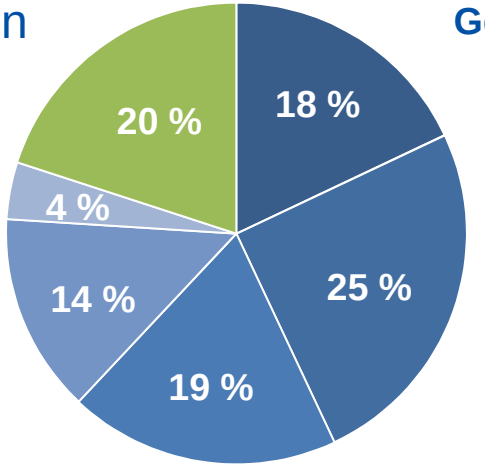
Ambitious, achievable German targets concerning renewable generation and energy efficiency

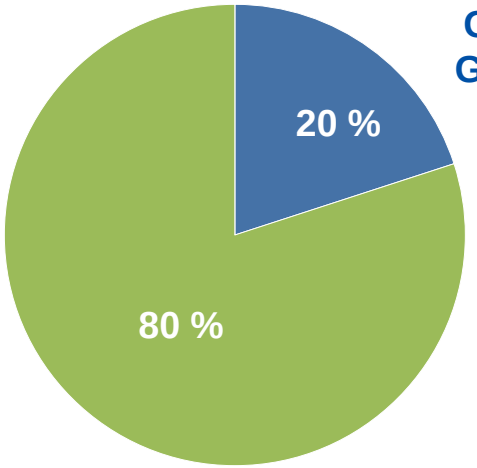
Basic points of the German energy transition

- Reduction of **greenhouse-gas emissions** by 40% in 2020 and by 80-95% in 2050 compared to 1990
- 80% **renewable generation** in 2050; 35% in 2020
- Reduction of **primary energy consumption** by 20% until 2020 and by 50% until 2050 compared to 2008
- Reduction of **emissions caused by traffic** until 2020 by 10% and until 2050 by 40%. 6 Million electrical vehicles in 2030.

Generation mix 2011 (energy)



Generation mix 2050 German policy target (energy)



Source: AGEB

Incentives for conscious energy usage and generation speed up the energy transition – supported by new technologies

Energy consumption in private households

> Almost 30 % of the overall energy consumption is caused by households

> Building restoration enables an energy reduction of up to 80 %

– Building insulation

– Efficient heat systems, e.g. heat pumps

Conscious energy usage

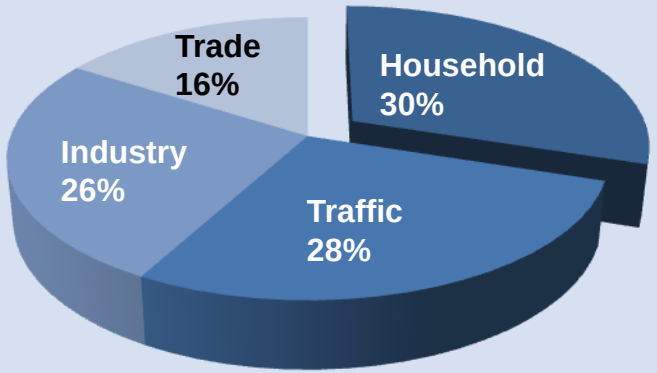
> Price incentives to lower consumption

> Technological solutions like Smart Meters and Home Energy Management Systems may support

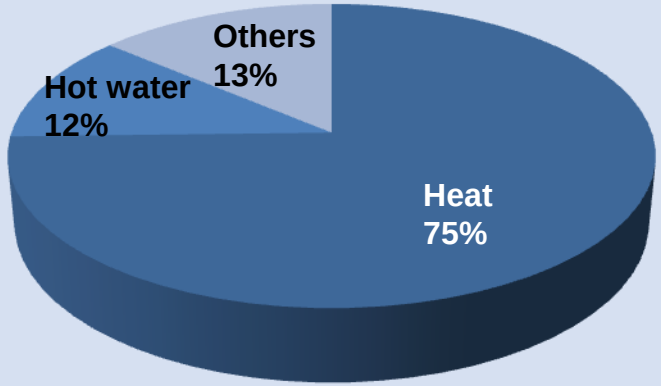
Consumers turn into producers (prosumers)

> Incentives for energy self-supply and energy feed back, e.g. photovoltaic an micro-cogeneration

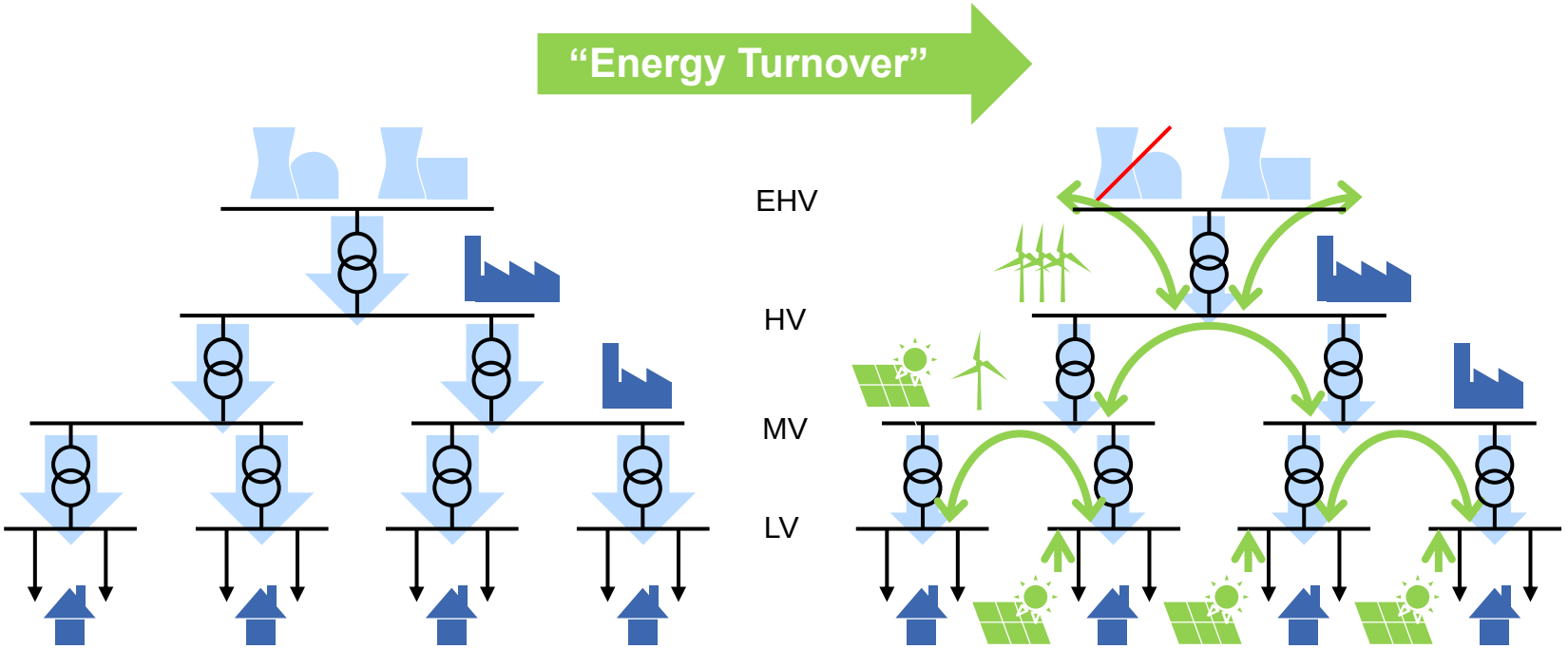
Energy consumption in Germany
Source: dena, Energiedaten BMWi



Energy consumption in private households
Source: AGEB



Huge power plants will be increasingly completed and replaced by decentralized renewable generation units

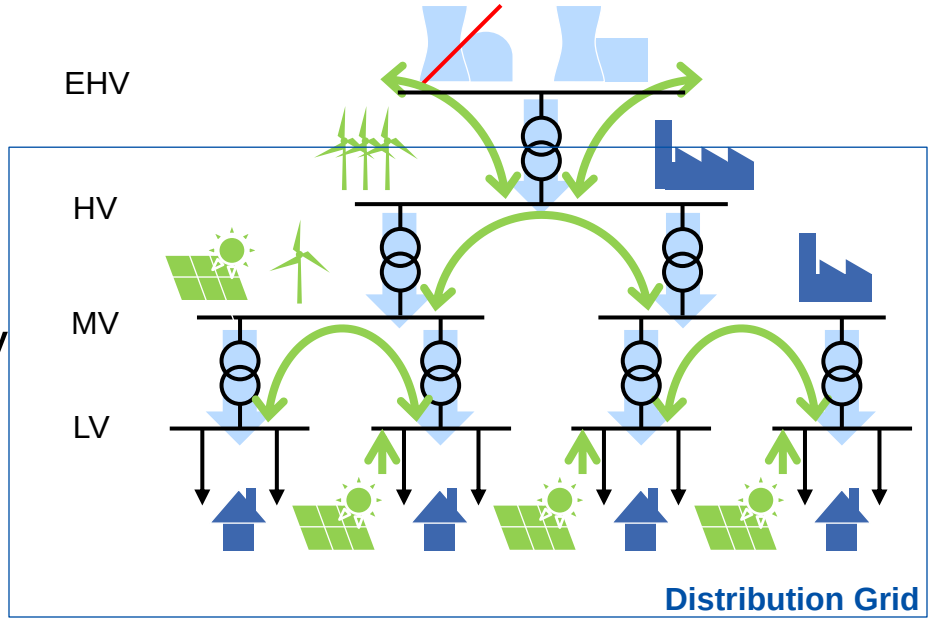


The “Energy Turnover” takes place in the distribution grid!

The Distribution Grid in Germany

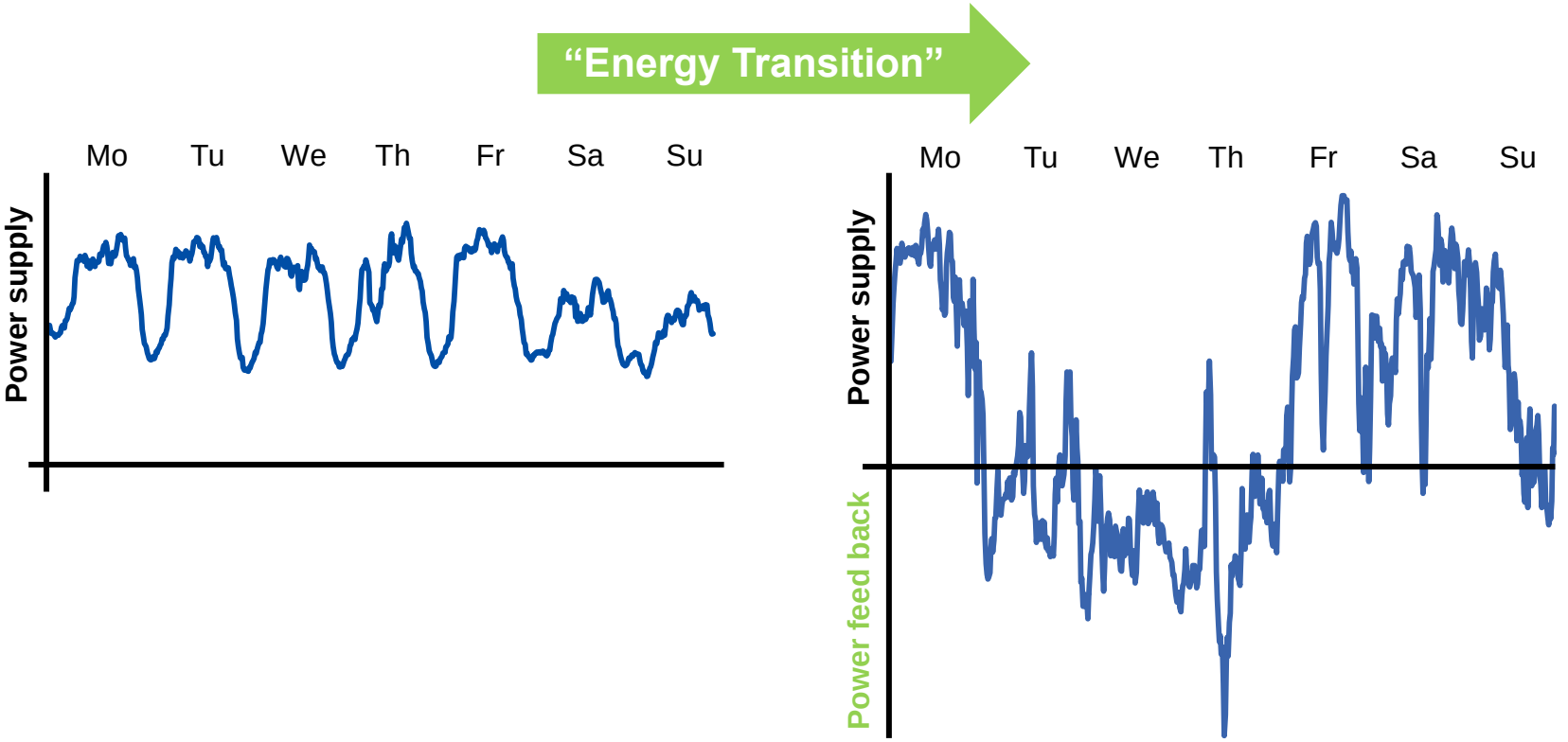
- 98% of about 1.7 Mio. km power lines...
- 99,9% of about 45 Mio. Metering points ...
- 98% of all renewable energy generation untis ...

... are part/connected to the distribution grid*



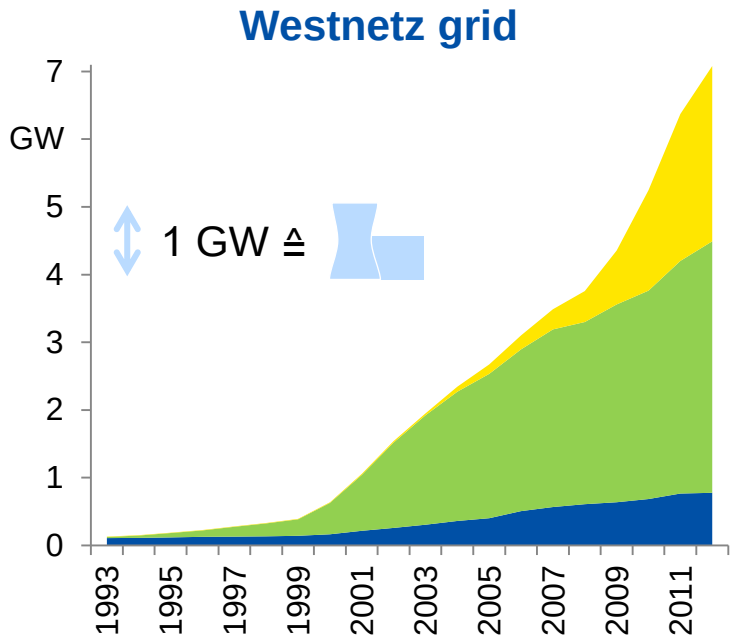
* VDN-Report, Energiehorizonte 2020 – Stromversorgung der Zukunft

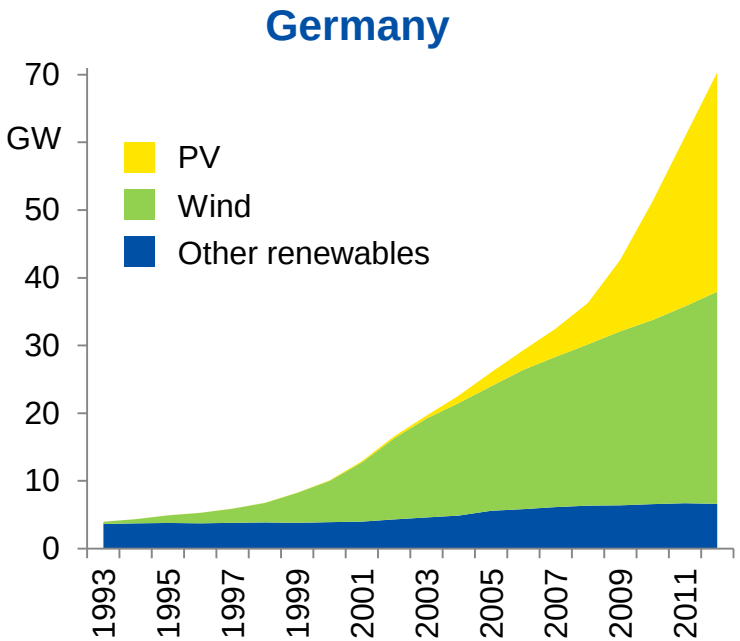
Customer-related power flow is overlaid by supply-related renewable generation



A fluctuating power flow as the challenge for distribution grids!

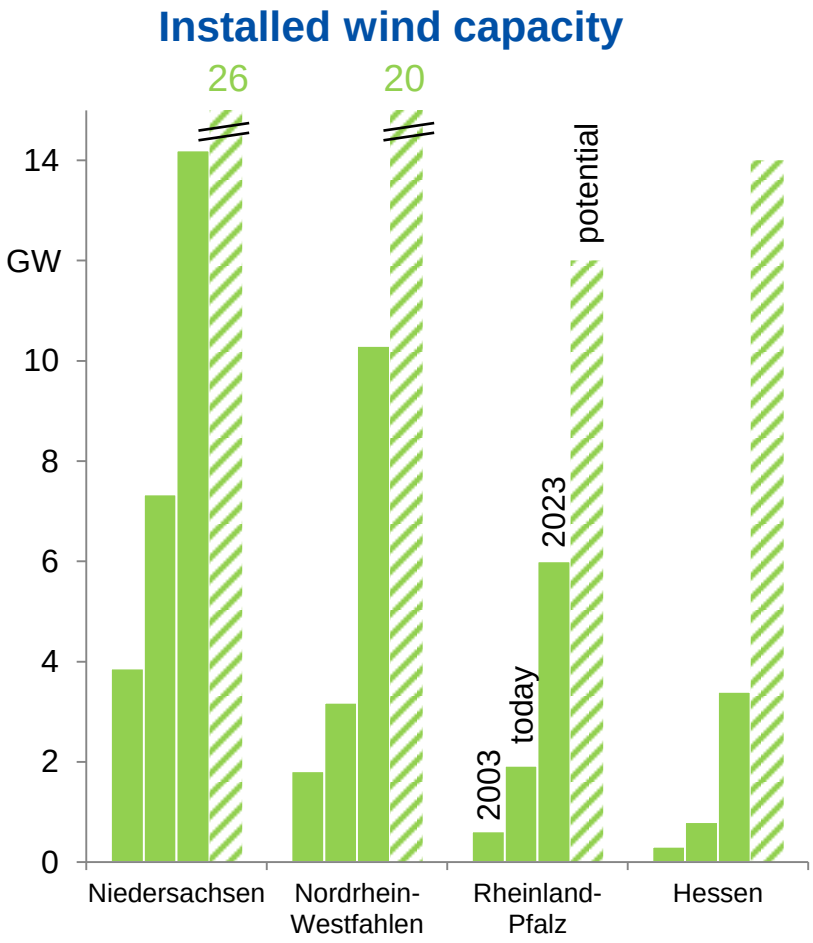
10% of renewable generation in Germany are connected to the Westnetz distribution grid

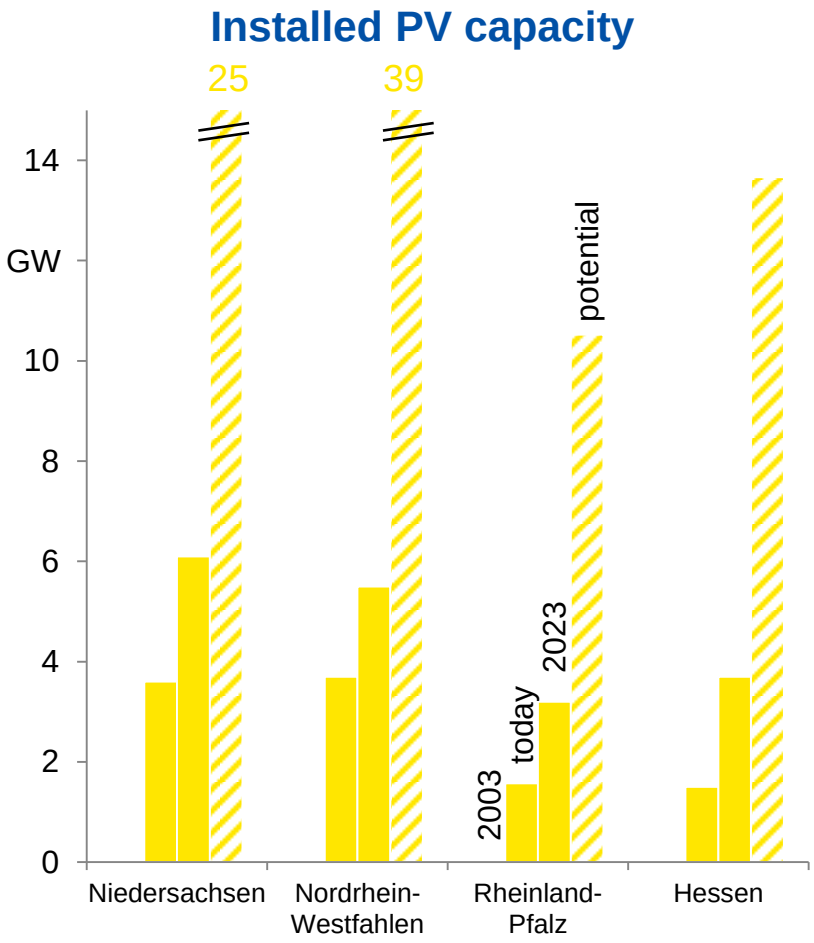




12% of Germanys wind-energy and 8% of Germanys PV-energy are connected to the distribution grid of Westnetz.

Further development potential of renewable energies in the area of Westnetz





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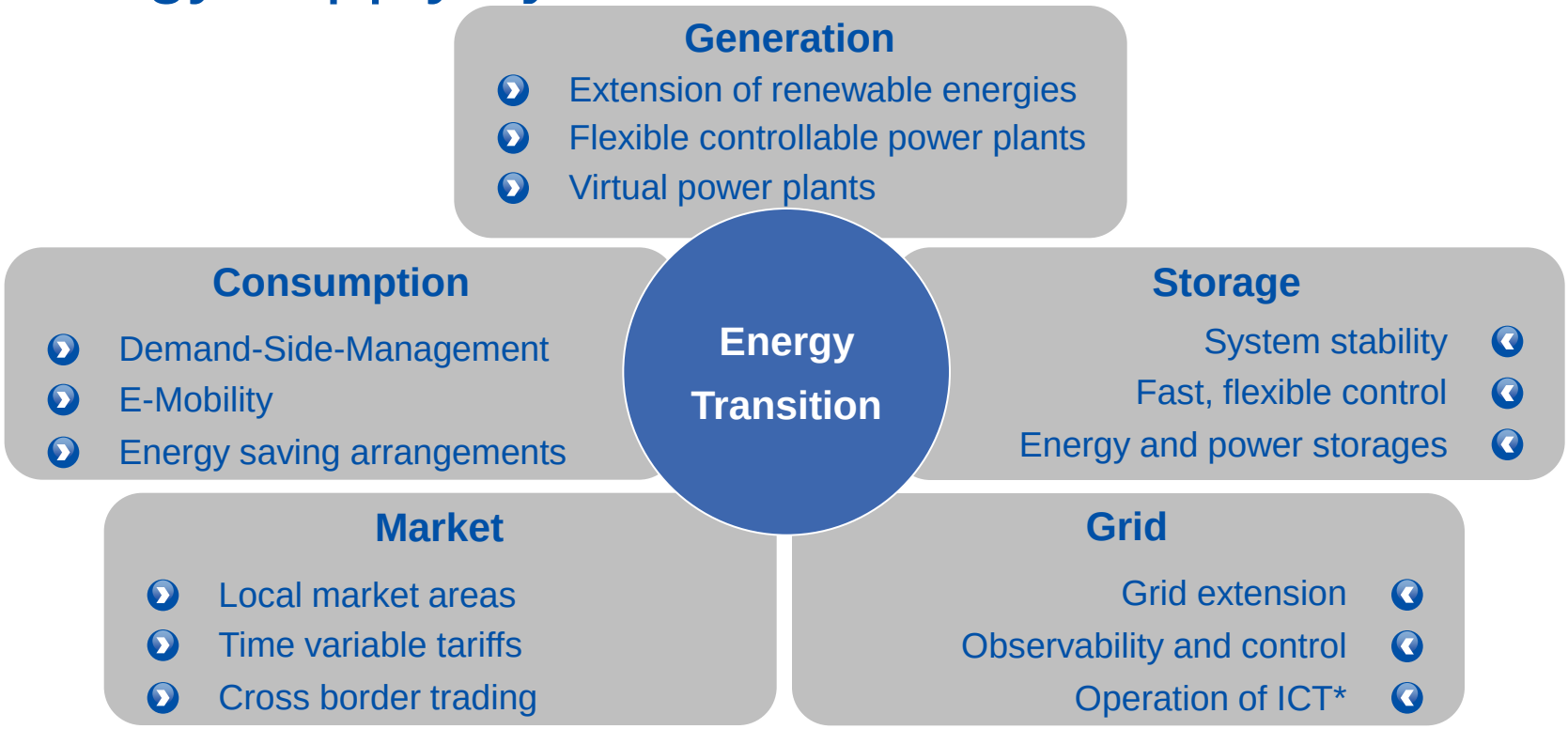
The energy turnover affects all sectors of the energy supply system



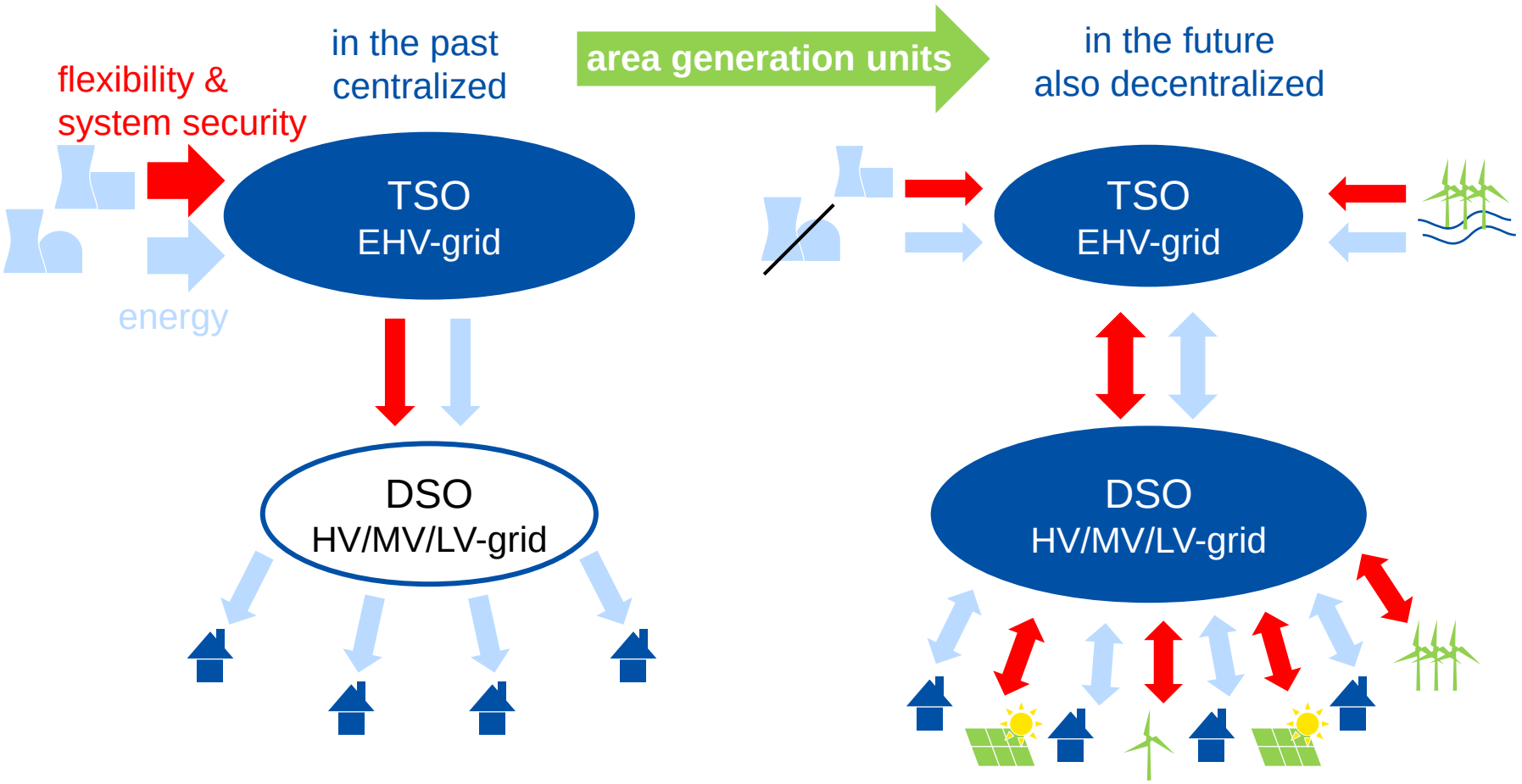
Cooperation of all market participants necessary

> The future energy supply system integrates demand and feed in characteristics of **all market participants**

> The future energy supply system must be **economical efficient, enduring** and **reliable**

*ICT = Information and Communication Technologies

Developing distribution grids towards „area generation units“



New technologies to improve the integration of renewable energies into the distribution grid

Improving the transport of effective power	Improving the voltage stability
> Demand-orientated control or shut-down of renewable energies	> Cos(φ)-control of renewable generation units
> Integration of decentralized storages	> Demand-orientated control or shut-down of renewable energies
> Demand Side Management	> Controllable transformers
> Superconductive power lines	> Power electronically voltage controller

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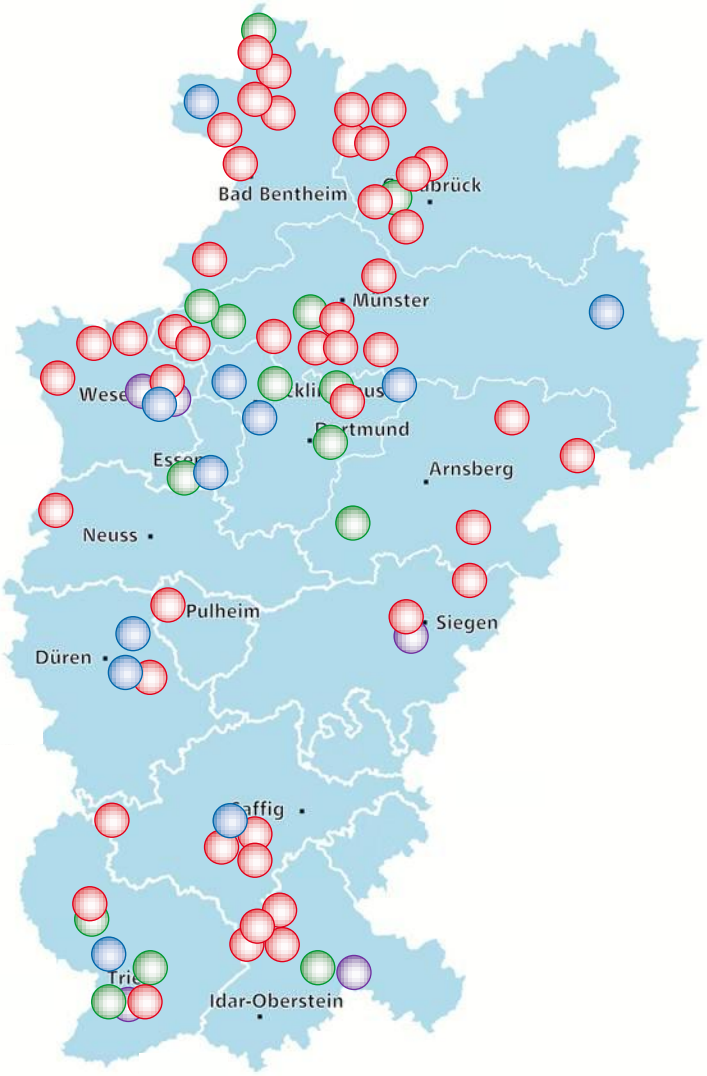
Innovation projects of Westnetz



Developing innovative grid systems

> Smart Grids
> Storage technologies

Optimizing existing capacities

> Voltage control

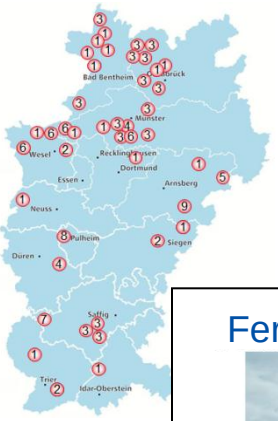
Optimizing asset usage

> Innovative assets

Optimizing maintenance

> Innovative procedures

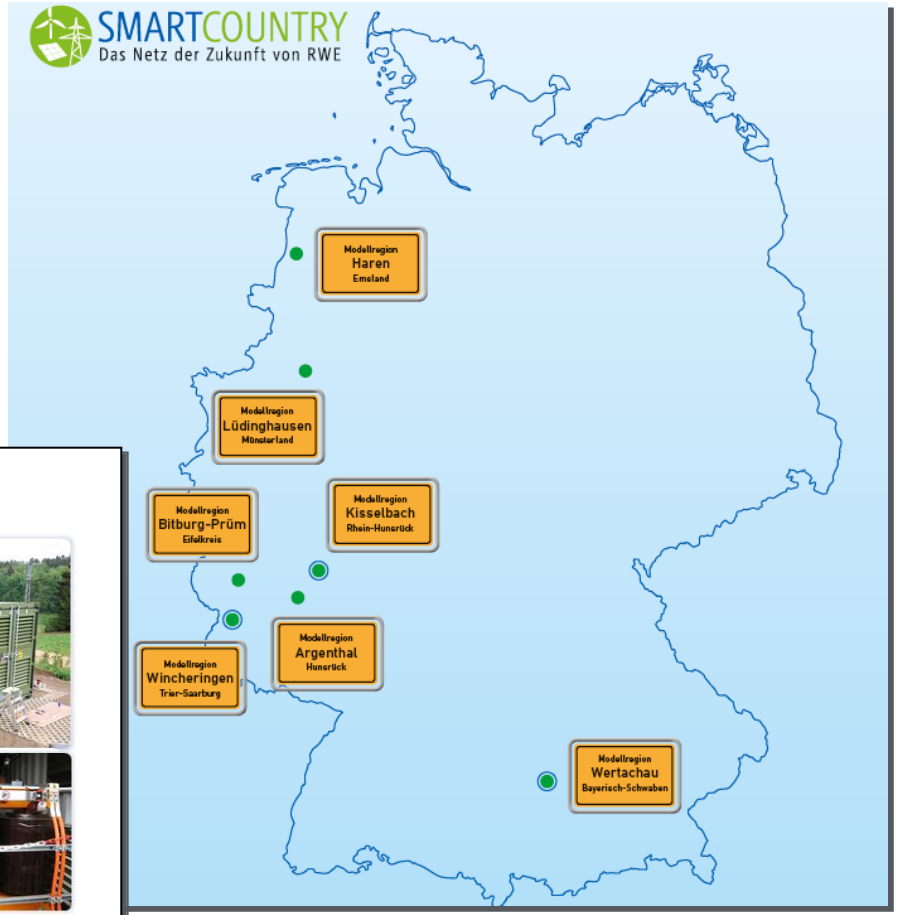
Optimizing existing capacities



Smart Country –
Smart Grid Solutions passed field test in rural region

Fermenter, Storage, CHPU

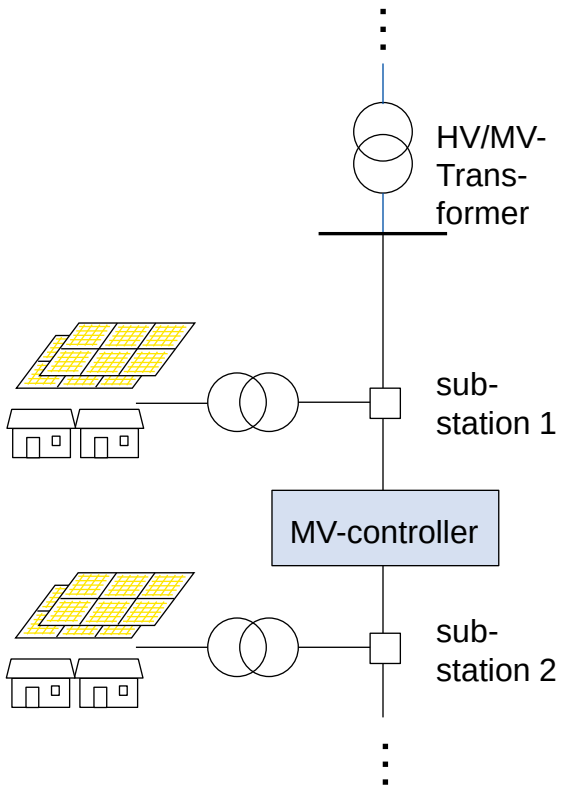
Voltage Controller – 20 kV



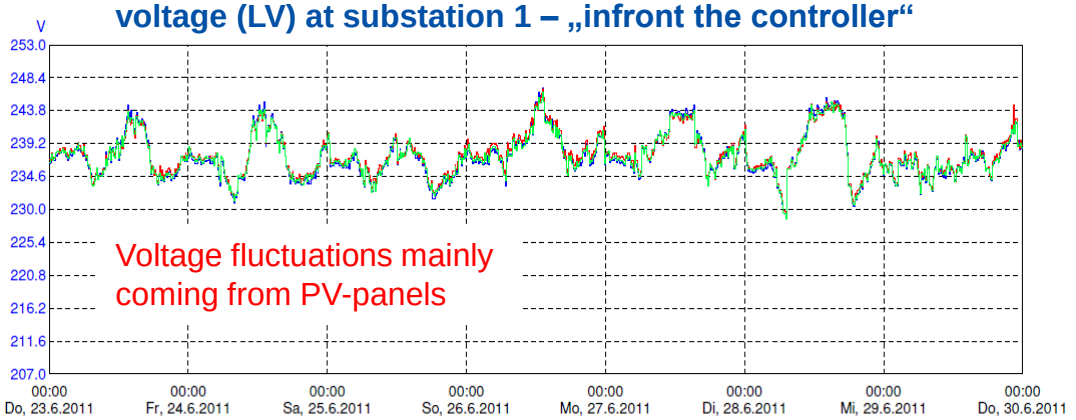
Voltage controllers to balance fluctuations

Smart Country –
Smart Grid Solutions passed field test in rural region

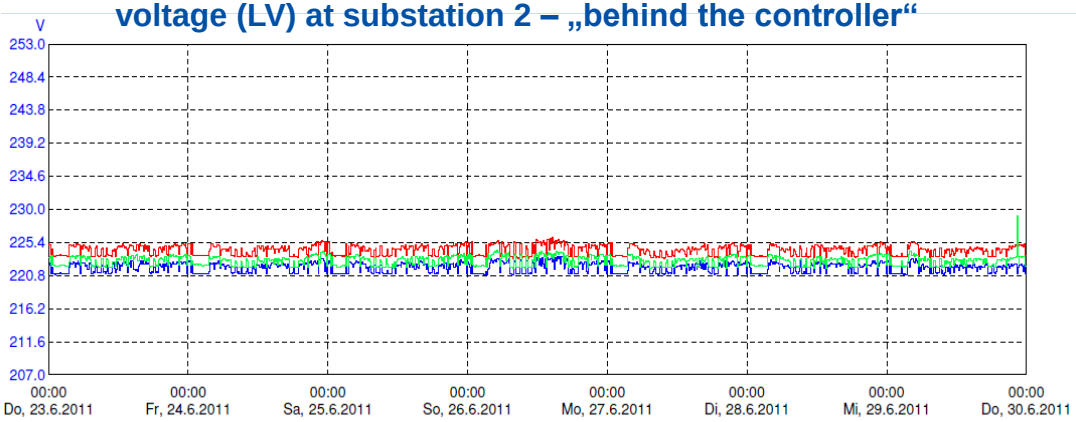
Schema



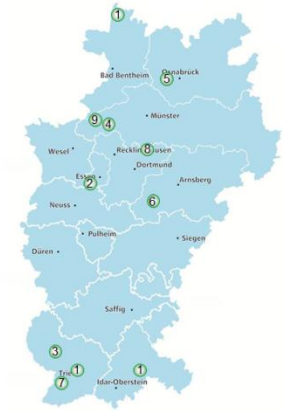
voltage (LV) at substation 1 – „infront the controller“



voltage (LV) at substation 2 – „behind the controller“

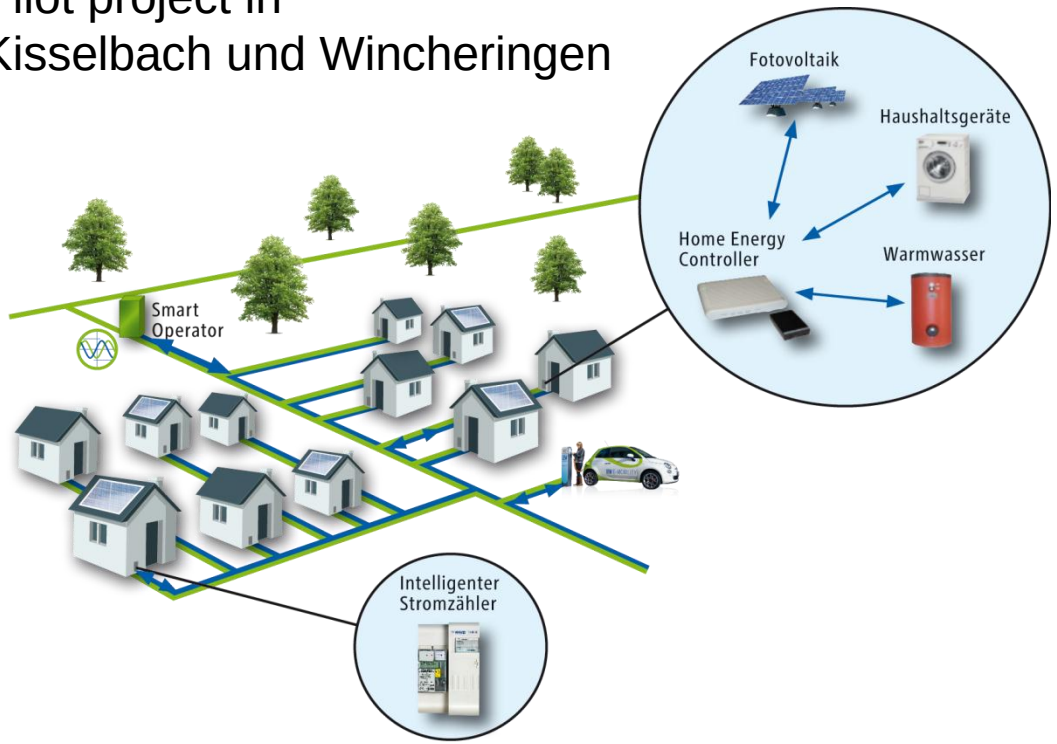


Developing innovative grid systems



Smart Operator –
decentralized intelligence in the low-voltage grid

Pilot project in
Kisselbach und Wincheringen

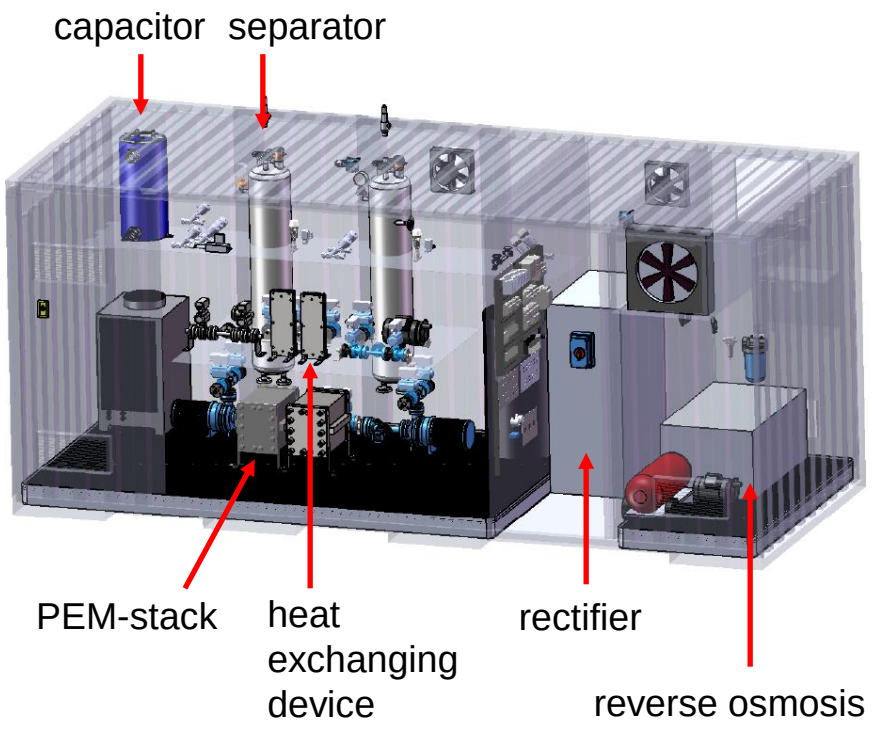


Converting electricity into hydrogen and feed into the natural gas grid

Power-to-Gas –
pilot project with a new storage technology

> Pilotproject in Ibbenbüren:
  - Degree of efficiency: 70 %
  - Production of hydrogen: 20 Nm³/h
  - Feed in pressure: 12 bar
  - Initial operation: Sept. 2013
  - Daruation of project: 2.5 years

> Examination focus:
Effects of alternating stress; stability of the system



Conclusions

Elementary changes of the energy supply system

> Past: **Huge** generation facilities **close** to customers with high operation hours

> Future: **Smaller decentralized** generation fed into various grid levels

Challenges for generation, grid and consumption

> Increasing amount of decentralized and partly **volatile** generation

> Flexible power plants and storages will simplify the **system management**

> **Changing** supply tasks result in increasing complexity of distribution grids

Possible Solutions

> Integration of load and generation within future energy networks

> Smart Grids serving as a platform for innovative solutions within the energy sector

> Westnetz is an active player in “Energy Turnvover”

Thank you very much for your attention!

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Westnetz as a designer of the future distribution grid

BACKUP