Challenges in Power Distribution in Germany

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Dr.-Ing. Egon Leo Westphal,
Senior Vice President Network
E.ON Energie AG, Munich

Agenda

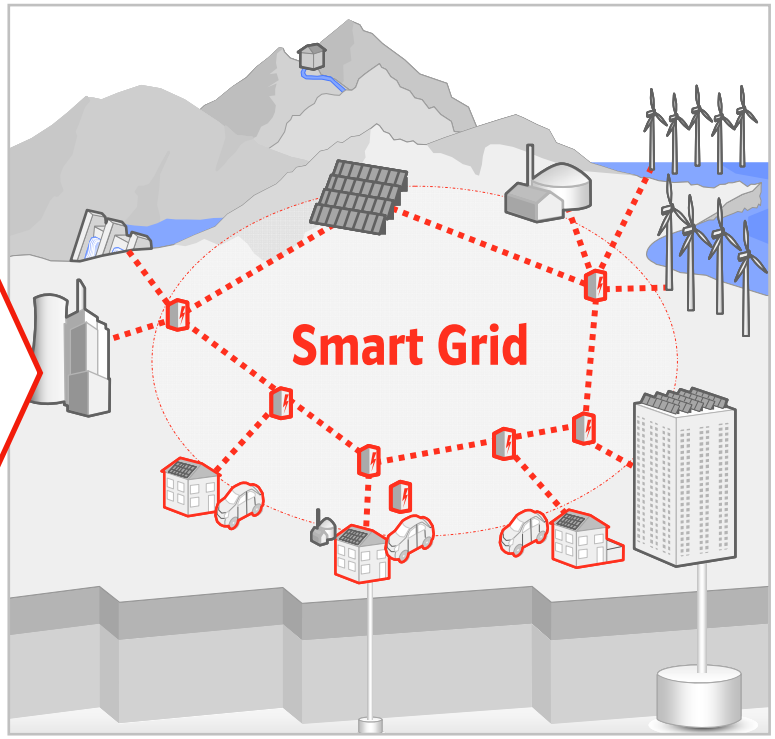
- **Background and challenges**
- **Integration of renewables in distribution grid**
- **Smart grids to address challenges**

Frankfurt – the historical place for power grids

1891: Start with 3 phase power transmission Lauffen - Frankfurt

Continuous innovation

Today: development of Smart Grid

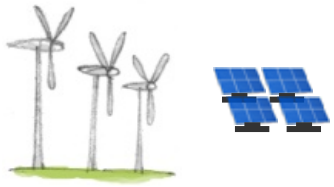


120 years of continuous innovation – now once more a major step is necessary

Grids need to change to meet key challenges

European & German climate targets call for change in the energy system

- → 20% reduction of CO_2- emissions
- → 35% share of power production from renewables (20 % Europe)
- → 20% increase in energy efficiency

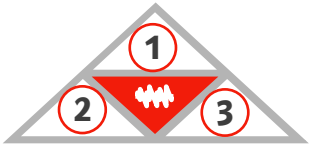


Changes in electricity consumption initiated by new smart applications

- → Smart Meter
- → E-mobility / vehicle-to-grid
- → Customer participation

Necessity to maintain balance in magic triangle in energy policy

1. Security of supply
2. Economic efficiency
3. Sustainability



Answers to challenges are core elements of CIRED activities and this conference

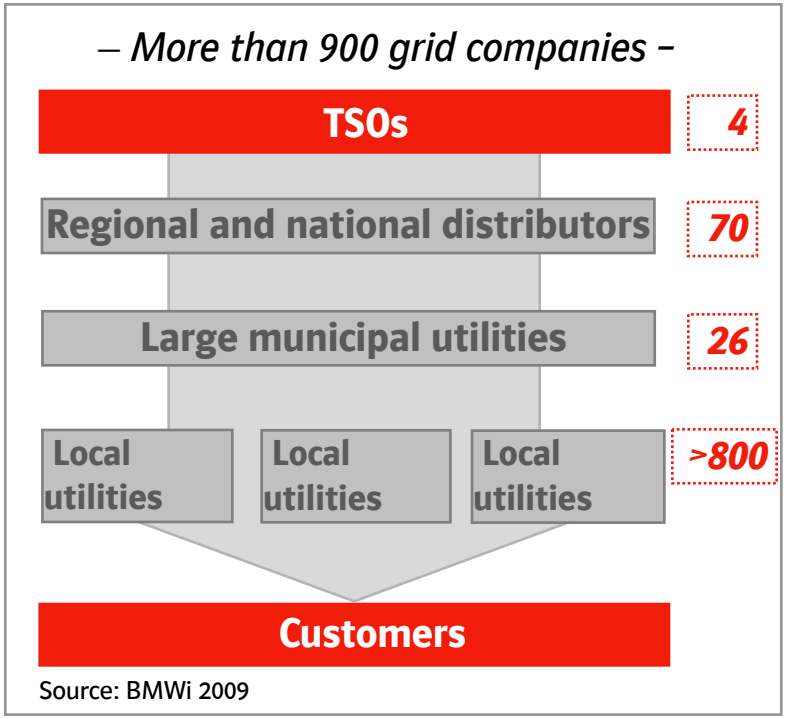
The German power industry – structure and key figures

Highly diversified structure [1)]

- Ca. 1050 market players in sales and 300 in generation (> 1 MW)
- Private, public or mixed ownership
- Competitive market structure for generation and sales
- Grid is un-bundled and regulated due to natural-monopoly status

Key figures 2009 [2)]

- Consumption fin. customers: 580 TWh
- Power production: 600 TWh
  of which renewables (EEG[3)]): 70 TWh



Source: BMWi 2009

1) Source: BDEW; 2)* Source. BMWI; 3) EEG: Renewable Energy Act

Ambitious goals for renewables – challenges for transmission and distribution grids

Massive growth of renewables – Challenges for Transmission

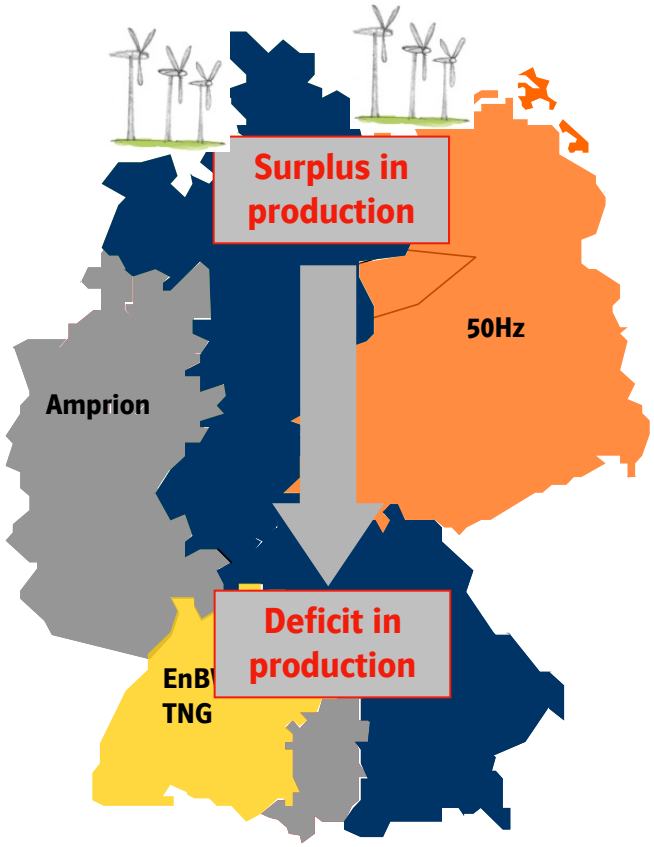
Political goals for renewables in Germany

- Ambitious goals in power generation: 2020 → 35%; 2030 → 50%; 2050 → 80%
- Wind in the North to play a key role

➔Additional transmission North-South

Challenges for TSOs:

- Need for new build of 3600 km of EHV-lines identified (DENA II- study, 2010)
- But: out of necessary 850 km identified in 2005 (DENA I) only 100 km built so far
- Meanwhile: necessity to interfere in power production to maintain system stability (e.g. redispatch)



New forms of co-operation between DSOs and TSOs necessary

E.ON distribution activity in Germany

Area E.ON Netz (110 kV)	140,000 km²
Area 7 Regional DSOs (≤ 110 kV)	143,000 km²
Length of lines	455,000 km
Renewable production – Installed capacity – No. of installations	 13,000 MW 155,000
No. of employees in grid business	ca. 10,000

HV-grid (E.ON Netz)
HV grid (other E.ON DSOs)
Distribution area of E.ON-DSOs

Also E.ON distribution business in Nordic countries and Central Europe East

Quality of supply will be introduced in grid fee regulation in Germany in 2012

Background

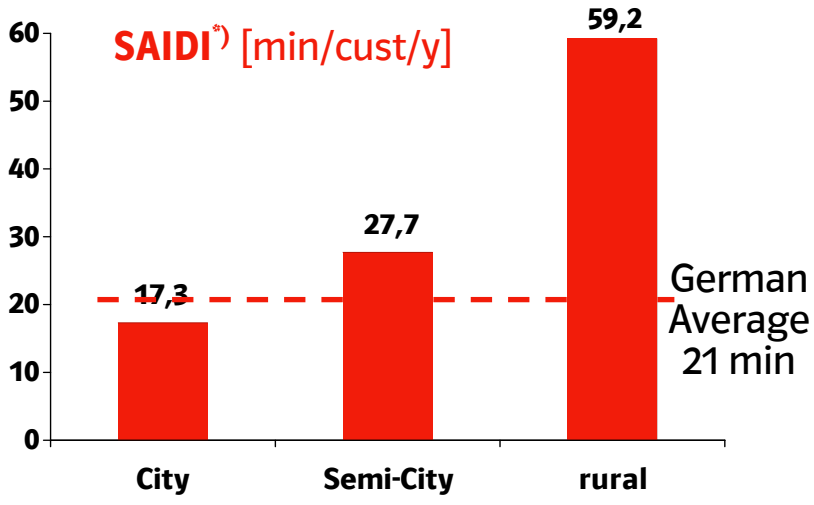
- Legal framework requires introduction of quality of supply in grid fee regulation
- Implementation of a quality element for grid reliability now planned from 2012 on

Status

- Interruption Duration Index will be used to reflect quality of supply in LV and MV
- Bonus malus system on regulated income
- New methodology must adequately reflect the customer/ load density of a distribution area

*)SAIDI (System Average Interruption Duration Index)

Durations of interruptions correlate with structure of the distribution area



(Source: VDN and FGH, German Statistical Bureau, 2007)

(rural:≤100 Inhabitants/km²; Semi-city ≤500 Inh./km²; City: >500 Inh./km²)

Germany has a good position in quality of supply also when compared to European neighbours. New methodology should be adequate to keep quality standard.

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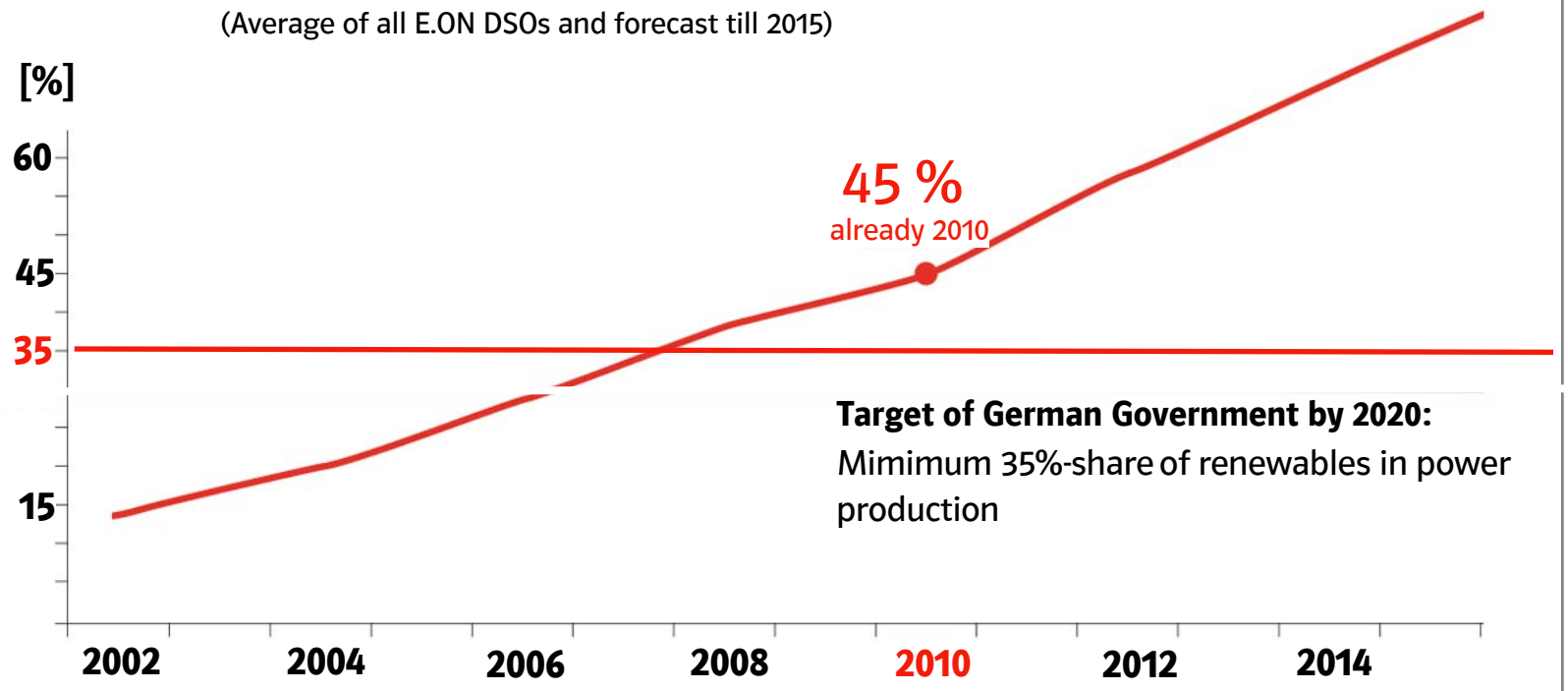
Integration of renewables is a key challenge for DSOs

Share of renewable production in E.ON distribution grids

(Average of all E.ON DSOs and forecast till 2015)



Distribution grids are the enabler for achievement of climate targets – particular challenge for E.ON DSOs in rural areas

Example 1: Integration of large scale on-shore wind in Northern Germany

Feed-in from Wind, PV and Biomass is increasingly exceeding local demand

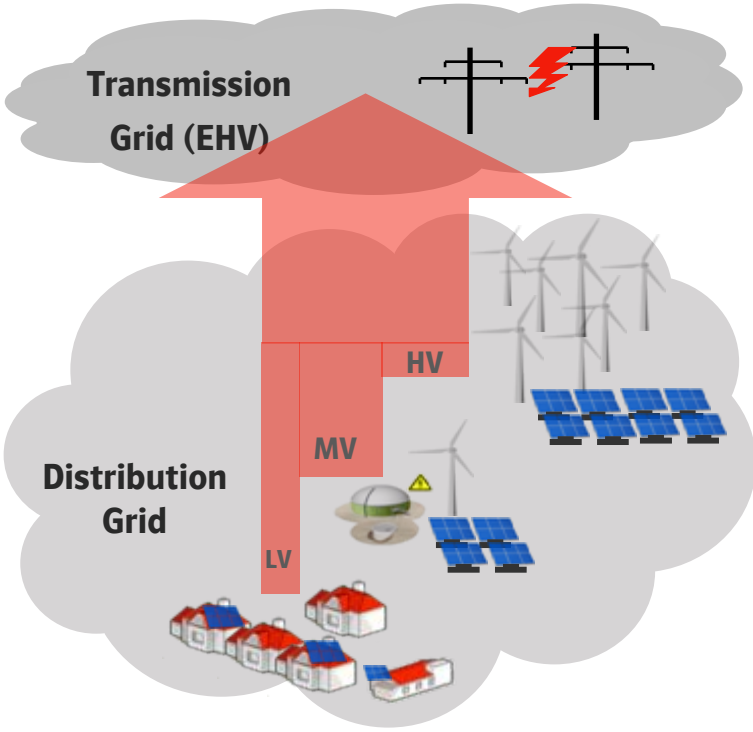
Change of flows in distribution grids

- Past: one directional flow (distribution grids for supply task only)
- Today and future: bi-directional flows

New task sharing between TSOs and DSOs

- DSO has to balance generation and demand at regional level
- TSO must absorb excess of generation and ensure transmission to centers of demand

➔Necessity to build new sub-stations and transmission lines



Key figures E.ON Edis

- Load: ca 2,400 MW
- Inst. capacity RES: 3,950 MW

DSOs and TSOs are developing new forms of collaboration in operation and planning

Example 2: Integration of decentralized PV in Bavaria

Bavaria: 40% of German PV-Capacity

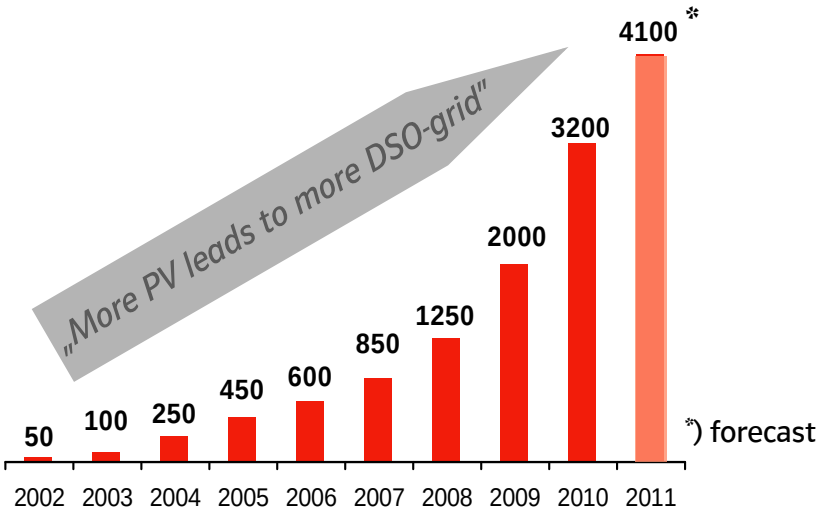
With high installed capacity in limited area PV is becoming increasingly relevant for system stability

➔Necessity to improve compatibility of PV installations with the grid:

- Complement regulatory framework and technical rules
- Implement participation of PV in
  - Voltage regulation
  - Reactive power management
  - Capping of peaks in feed-in
  - Optimized management of decentral storage

with technical solutions

E.ON Bayern (EBY) - massive increase in installed PV capacity

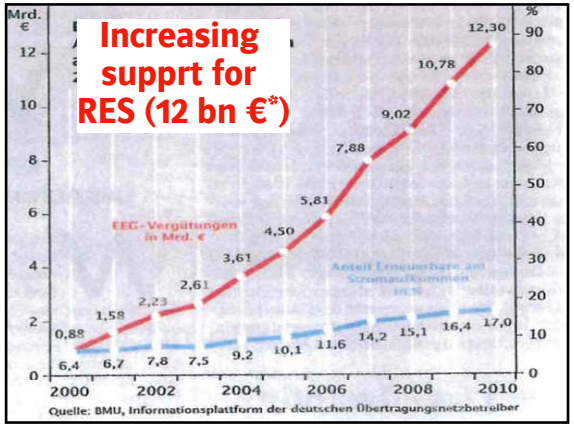


Key figures

- Installed PV capacity : > 3,200 MW (direct)
- Annual peak consumption: ca. 6,000 MW
- Number of PV installations: 160 tsd.

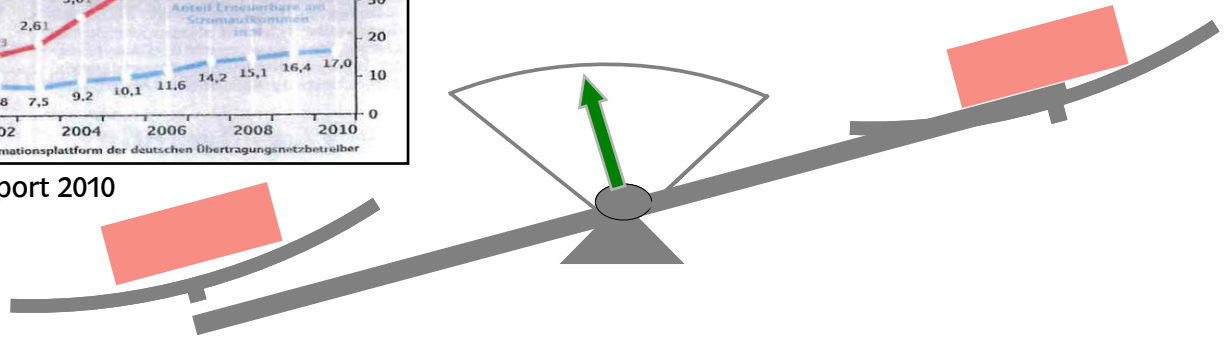
High installed PV capacity is a challenge for distribution → Smart Grid solutions

Balance between support for renewables and regulation of return on investments for DSOs necessary



*) EEG support 2010

Focus of regulation on cost reduction



<u>Urgent need to improve the regulatory framework*):</u>

- ➔ Secure adequate remuneration for new investments
- ➔ Incentivise innovation in grids (positive examples in some countries)
- ➔ Implement clear roles and rules for smart meter/ smart grid deployment

*): see also Eurelectric Study "Regulation for Smart Grids, February 2011 »

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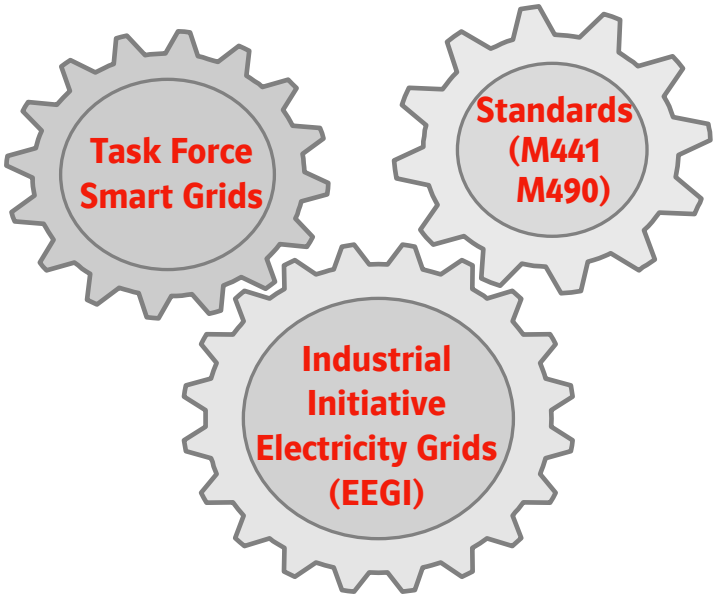
EU communication for deployment of Smart Grids is a good starting point to address challenges

"Smart Grids: From innovation to deployment"
Communication of EU Commission April 2011

Proposed Actions to address key issues

1. Developing Smart Grid **standards**
2. Addressing **data privacy & security** issues
3. Developing **regulatory incentives** for Smart Grids
4. Guaranteeing competitive Smart Grids **services to customers**
5. Continuing **support for innovation** and its rapid application

Activities of the European Commission



Recommendation: Implement Market Design with appropriate role for DSOs and create a modern regulatory regime (incentives for investment in distribution grid)

Smart Grids - addressing the challenges in distribution

Challenges

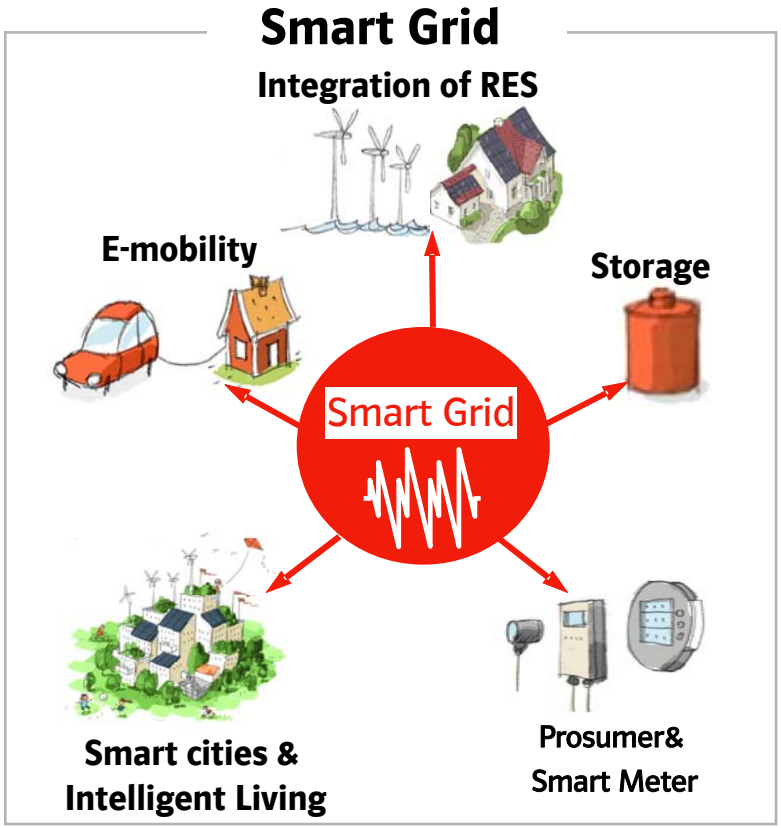
- Efficient integration of RES, decentral generation and storage, e-mobility
- Offering the platform for new applications for customers/ prosumers

whilst

- Maintaining grid stability, quality and security of supply

Tasks

- Link of flows of energy and information
- Implementation of communication technology and data interfaces
- Development and standardisation of new equipment
- Deployment of data management and security



E.ON pilot projects for Smart Grids – Intelligent Grid Control

Customer Behavior

PV – Integration (LV)

Intelligent Substation

Wind power Integration (MV)

Pilot projects by DSOs create the basic knowledge for smart technology innovation

Frankfurt 2011 – a step forward

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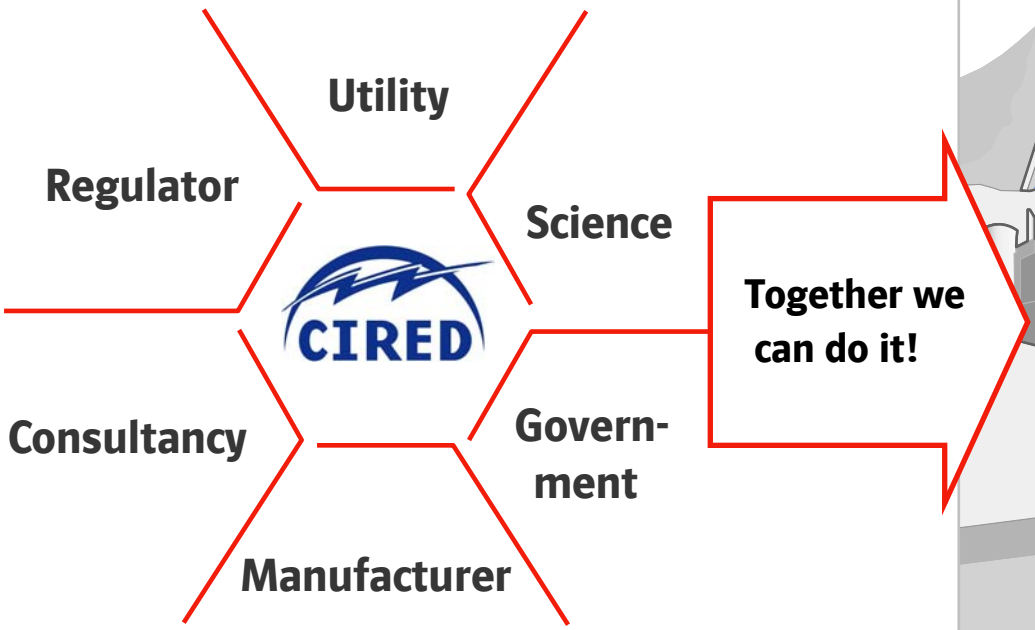
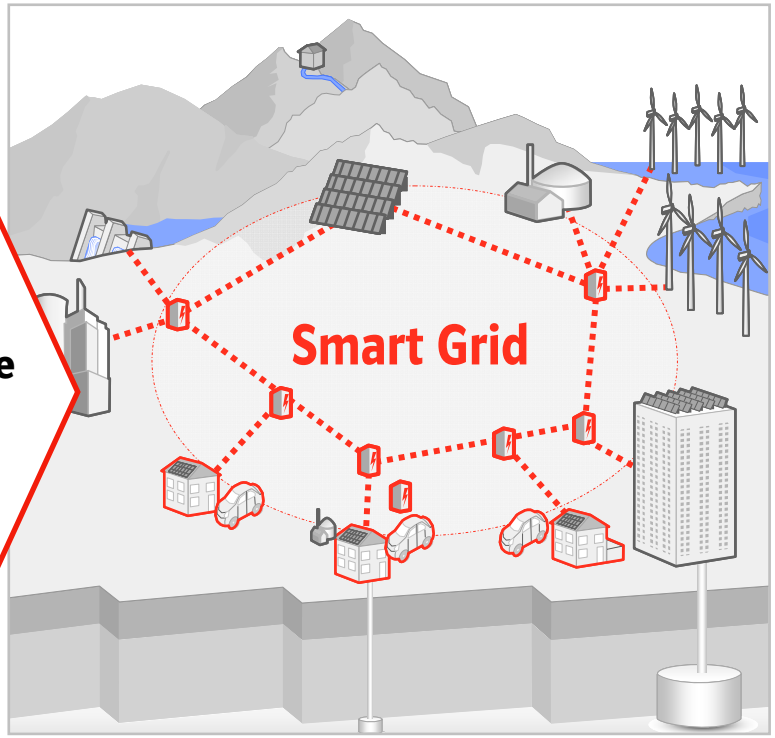


Development of Smart Grid



CIRED: All competencies are joined together to pave the way ahead

Thank you for your attention

and my best wishes for

a successful conference!