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SINTEG
SMART ENERGY SHOWCASES

Digitisation of the energy transition in Germany

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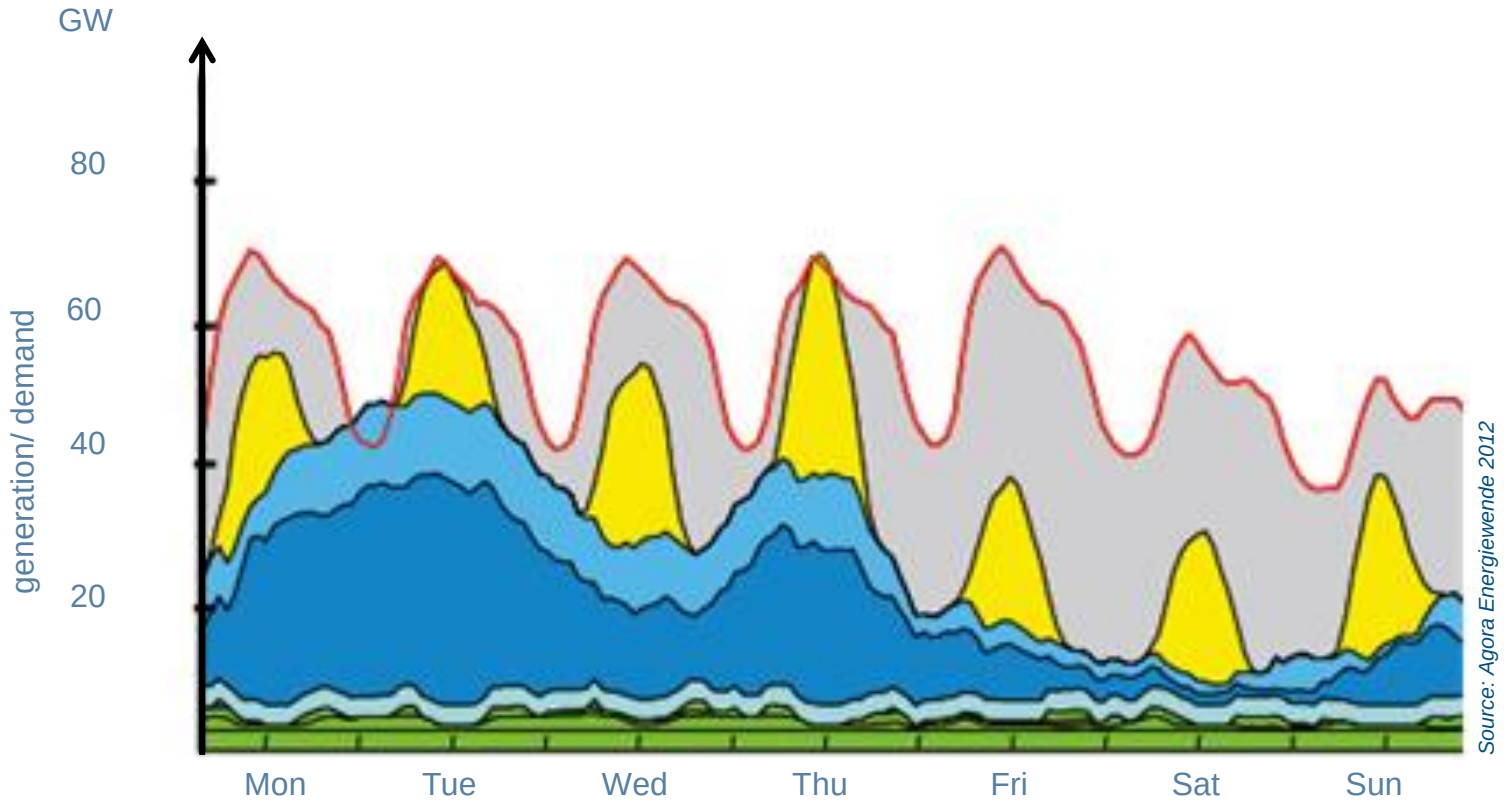
IEA workshop on Digitalisation and Energy

5 April 2017, Paris, France

Germany's electricity system in 2022: exemplary summer week



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Energy system of the future:

flexible demand-orientated generation + flexible generation-orientated demand, ancillary services also by distribution networks

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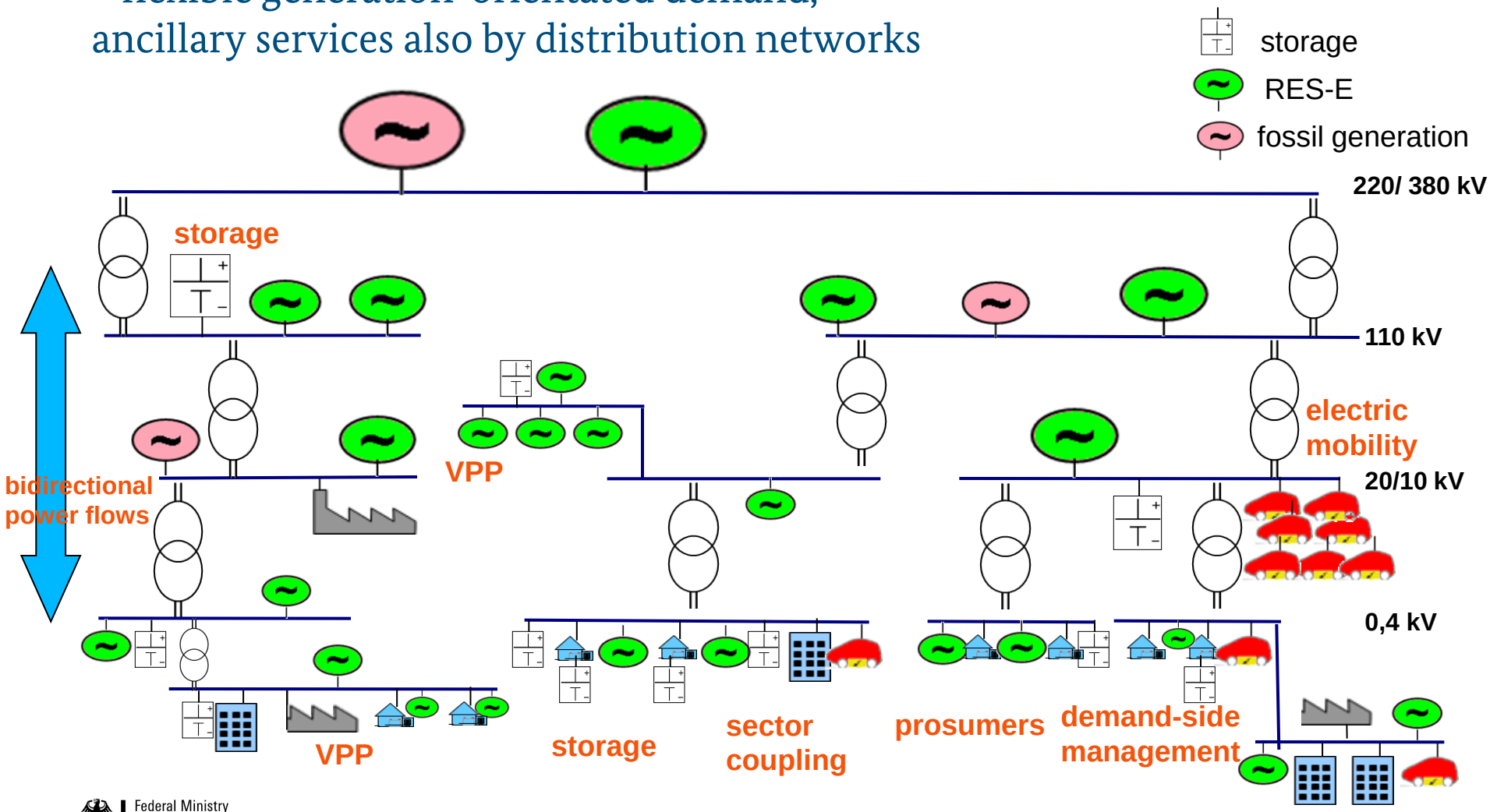

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Act on the Digitisation of the Energy Transition

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- gradual phase in of smart meters in DE:
  - large-scale consumers and generating installations (start 2017)
  - smaller consumers later (start 2020)
- Smart meter: **intelligent metering systems** = digital meter + communications unit (smart meter gateway - SMG)
- Aim: development of a digital infrastructure
  → provide a secure **communication platform = data hub**
  - → Connect all players of the energy system:
    - consumers, generators, smart home, ...
    - system operators, utility, aggregators,...
- heavy focus on data protection and data security (e.g. “privacy by design”)
- Act is **start** → now development of specific use cases and products necessary

The SINTEG programme: "Smart Energy Showcases – Digital Agenda for the Energy Transition"

- Overall aim: develop solutions for a secure and efficient energy system relying on **temporarily up to 100% of RES**
- focus: **connect generation, demand side, storage, grids and market using ICT → smart grids/ market**
- Solutions are to be implemented in **five large pilot regions** (**showcases**)
  → scalability/ preparing mass market
  → pilot solutions for our future energy system (e.g. market platforms, sector coupling, ancillary services, TSO-DSO cooperation,...)
- **more than 300 firms + other players** involved; Start: 12/2016 + 01/2017
- Volume of funding: more than € 200 million; firms provide more than € 300 million → **some € 500 millions to be spent on smart grids**
- Solutions are to serve as a **blueprint for wider use**
- **"regulatory sand box": gain experience → information on necessary adjustments to the regulatory framework** → upcoming amendments
- part of the German government's "**digital agenda**"

Thank you for your attention!

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back up

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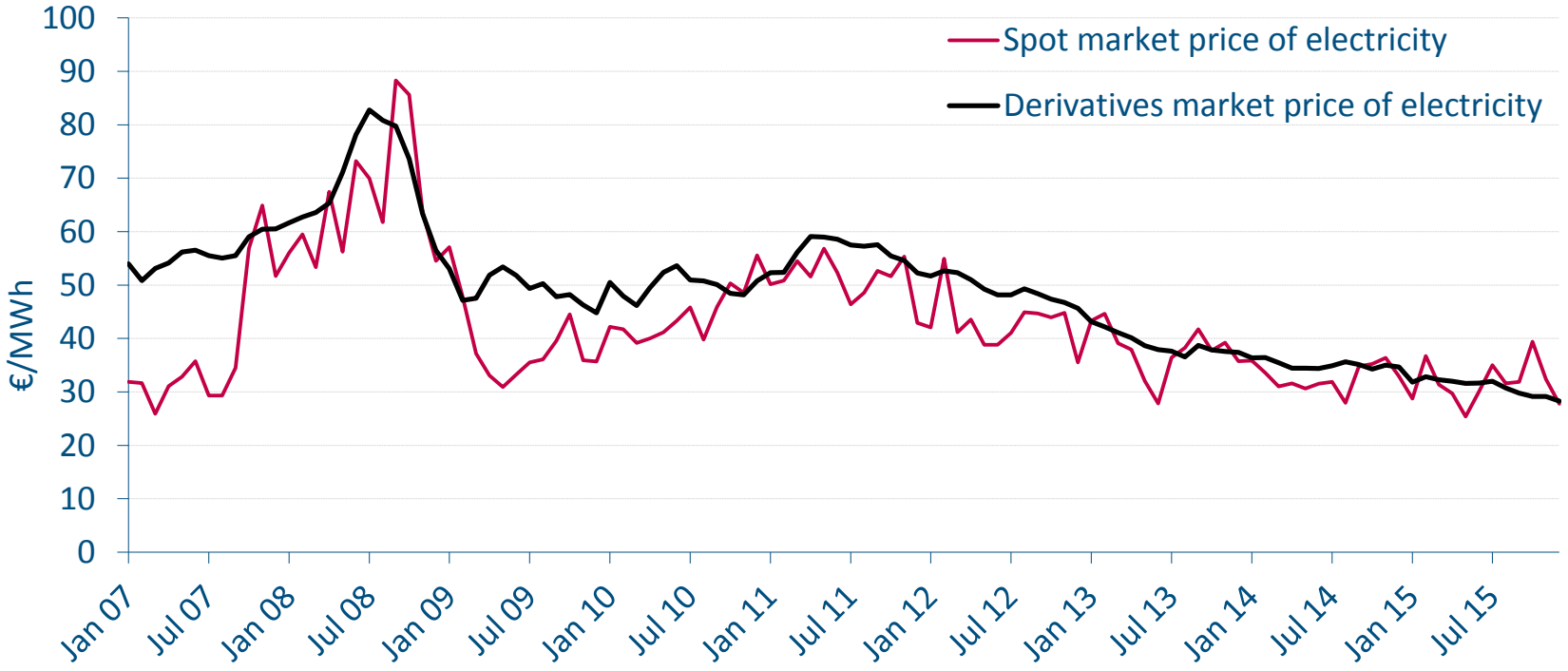
Electricity price in Germany (stock exchange)



Source: Ecofys 2015, EEX 2015

Electricity prices have declined and volatility sank over the past years.

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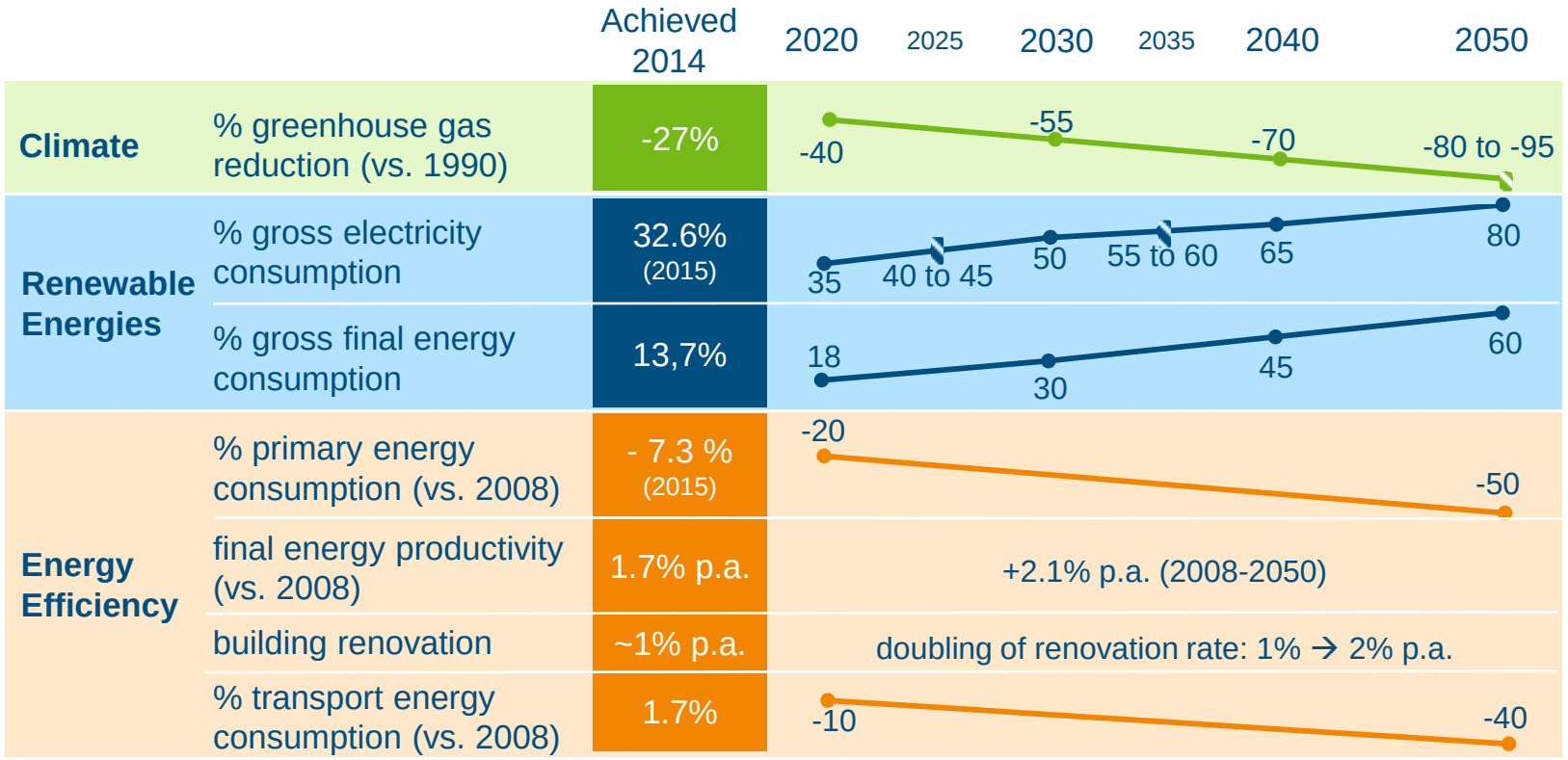
Germany's "Energiewende" targets until 2050



Source: Federal Government 2010, BMU/BMWi 2014, BMWi 2015, AGEE-Stat 2014, AGEB 2015, BMWi 2016

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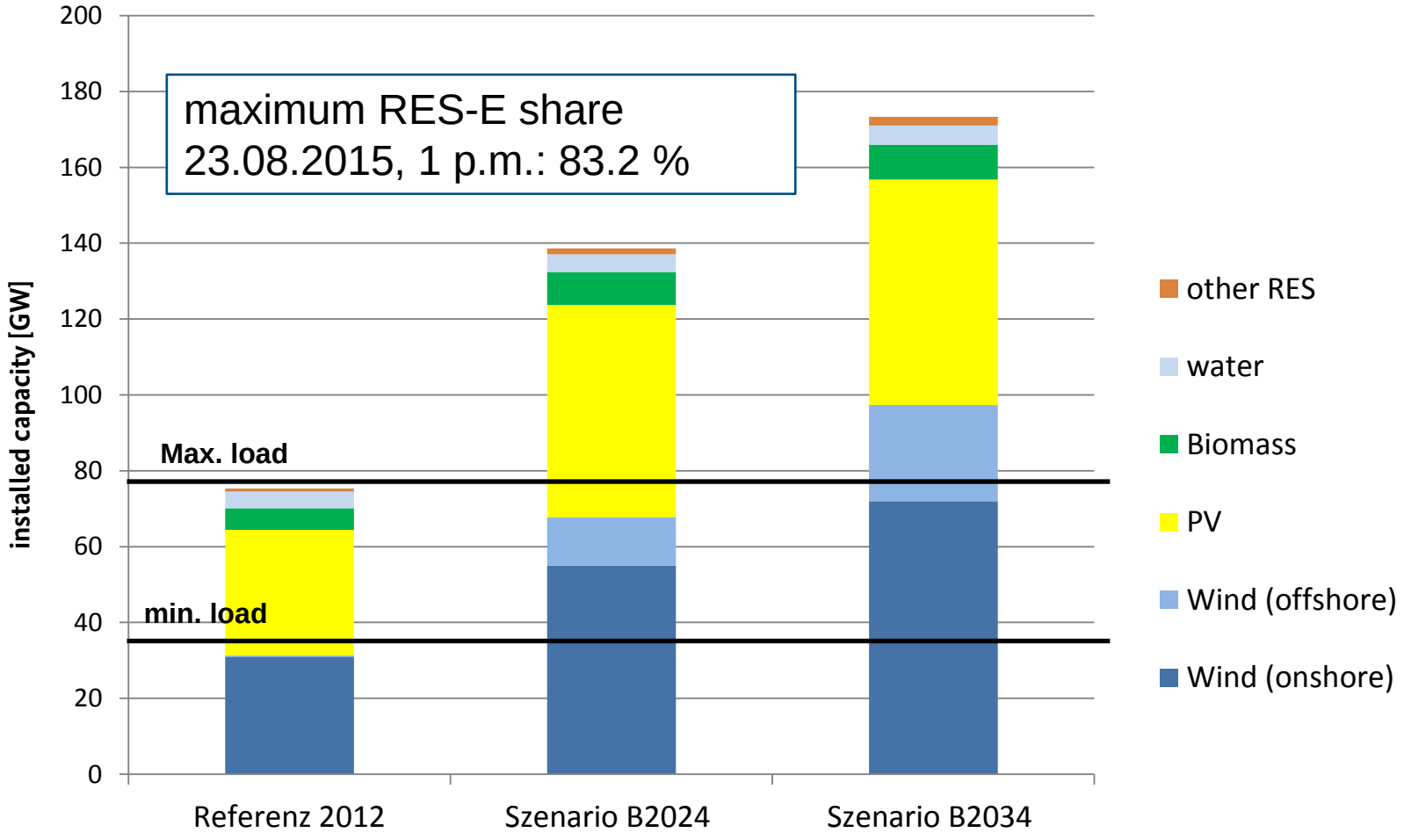
Development of installed capacity of RES-E in Germany



(data source: NEP 2014, Szenariorahmen)

SINTEG Showcase regions

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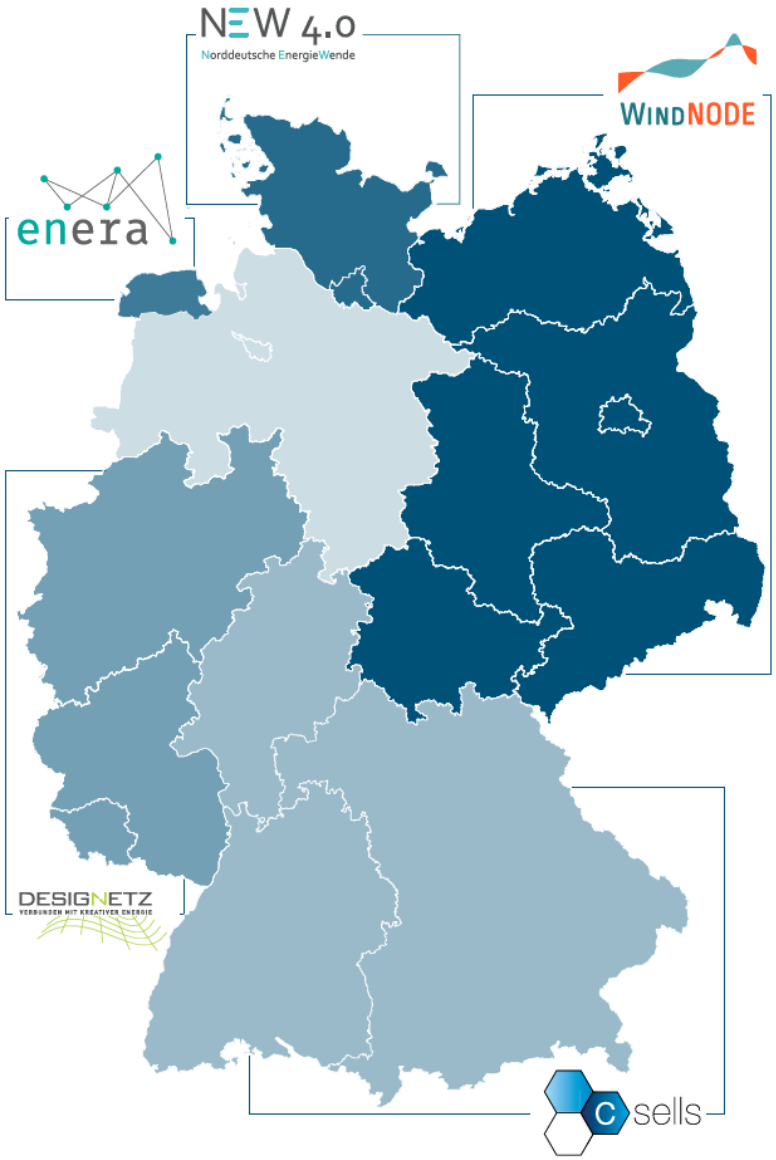

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Showcase regions

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- In common: show cases cover the entire smart energy system of the future
  - Efficient and **secure grid operation** with high shares of renewables
  - tapping **efficiency and flexibility potentials** (in terms of markets and grids)
  - Ensuring efficient and secure **cooperation of all players** in the **smart energy system → data explosion**
  - **New business models** in the energy sector
- Each of the project has different points of focus

Showcase regions

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- Examples
  - Feeding regional information into the electricity market/stock exchange →'**regional order books**'
  - **several hundred MW of demand-side management across different sectors** (PtH, PtC, PtG), e.g. to use excess electricity within the region
  - Use/roll-out of **> 300,000 iMSys**
  - **ICT platforms** for networking/coordination
  - **800 supermarkets to act as flexible consumers**
  - **Energy transition AppStore** for players involved (across different sectors, e.g. to help **increase the energy performance of buildings**)

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Selected showcase regions

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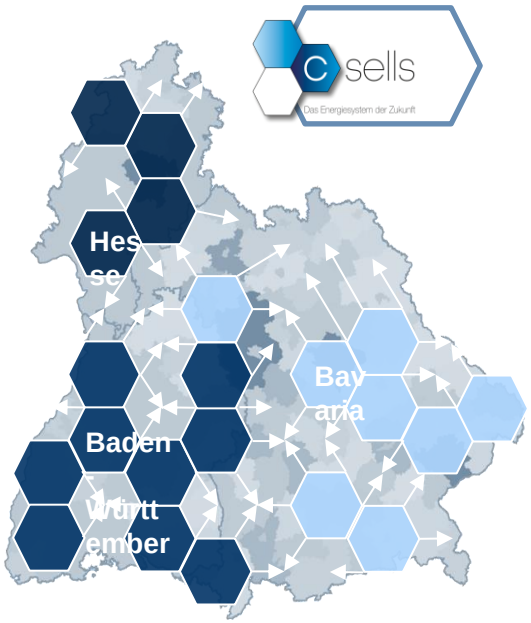
No.	Title	Partners involved in project (associated partners/contractors)
1	**C/sells**: large-scale showcase in the 'solar arch' region in southern Germany	53 (15)
2	**Designetz**: a modular concept – from isolated solutions to an efficient energy system	35 (14)
3	**enera**: The next big step in the energy transition	32 (19)
4	**NEW 4.0:** The energy transition in northern Germany	37 (11)
5	**WindNODE**: showcase for smart energy from the north-east of Germany	49 (16)

C/sells – the solar arch in the south

- 1,200 MW of load, 1m consumers, 15,000 distributed PV installations (500 MW); 200 electric vehicles, 1,000 controllable electric heating systems, 600 controllable loads



- Looks at flexibility across different sectors using an **energy system organised in cellular form** (subsidiary within and across cells)
- Autonomous regional cells that interact at supra-regional level
- **Cloud-based infrastructure information system** (IIS) serving as an ICT platform
- Expanding regional markets for ancillary services
- Flexibility between electric power, heat and transport

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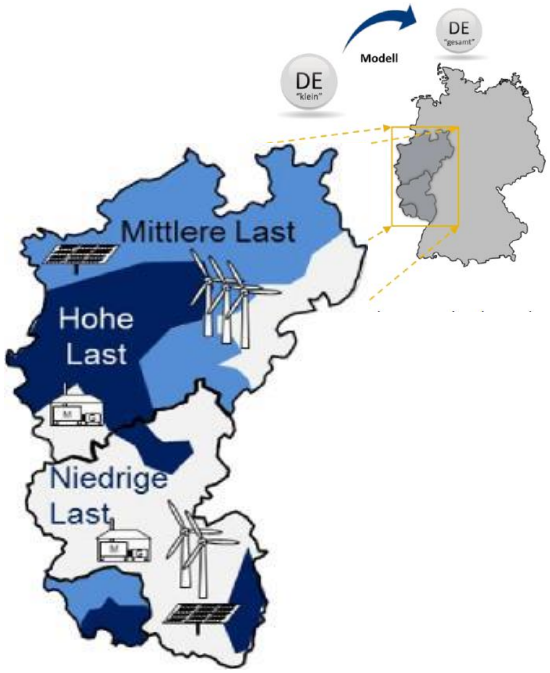
Designetz – a modular concept

- Rural renewables vs. industrial centres of demand → typical situation in DE
- Distributed energy (mix of solar and wind) to be used to supply industrial centres of demand



- **Responsibility for the system across grid levels**
- **Cascading, bidirectional procedure:**
  - Requests for greater flexibility to be made by higher grid levels to lower grid levels
  - Lower grid levels provide projections of grid condition and of scope for flexibility
- Use of iMSys, sensors and actuators to assess the state of distribution networks and to control (including data from some 100,000 metering systems)
- includes gas and heat (PtG, PtH etc.)

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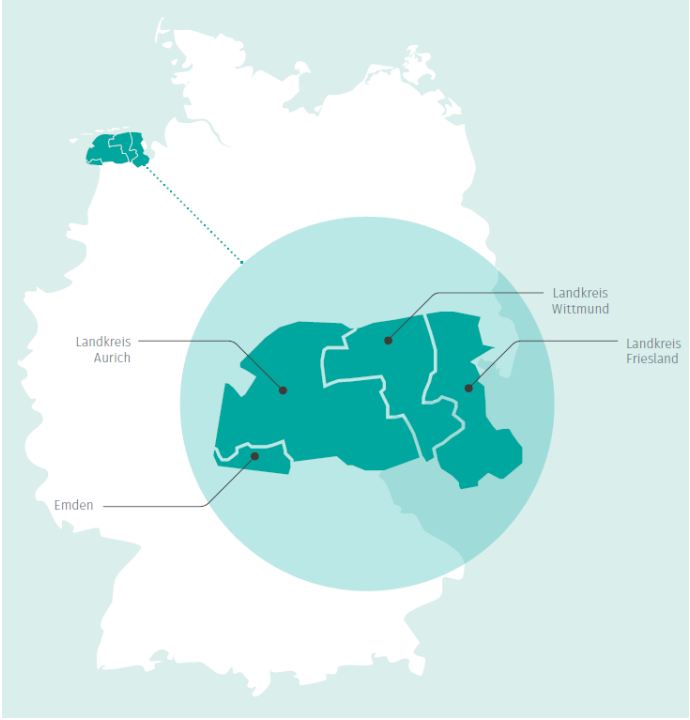
Enera – the next big step

- Share of renewables > **170%** (wind, PV, biogas)
- 390,000 inhabitants, approx. 200,000 households, 1.75 GW RES-E (onshore wind: 1.5 GW, offshore wind: 175 MW; another 1,000 MW envisaged)



- Transition to a dynamic, distributed energy system
- Increasing flexibility of distributed generators, loads, storage
- **Regional ancillary services** to be treated as tradable, regional goods (e.g. voltage stability)
- Feeding in regional information into the **electricity exchange** to support **distribution networks**
- Rollout and management of 40,000 iMsys
- 'Smart Data and Services' platform
- 30-60 start-ups to develop new business models for a smart energy system for the future
- 'Energy transition AppStore'

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NEW 4.0 – energy transition in the north

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- large centre of energy demand (Hamburg) with rural region as centre of supply of wind energy (Schleswig-Holstein)
- Project is to demonstrate that 70%-share of renewables in region's supply providing full energy security will be possible by 2025

- Main objective: **finding efficient ways of dealing with local surplus electricity**
  Two-way strategy:
  - better export to other regions;
  - greater flexibility to use energy locally
- Greater flexibility mainly by means of **demand-side (load management, storage, sector coupling** (100s of MW)
- Minimising 'must-run capacity' of conventional power plants with the help of innovative ancillary services, DSM and flexible CHP

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WindNODE –smart energy from the noth-east of Germany

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- Balancing zone of 50 Hertz (excluding Hamburg)
- Thousands of controllable loads, > 150 MW
- Installed renewables capacity (in 2014): 25 GW (59% wind, 33% PV),
- 42%-share of renewables in electricity consumption

- **Optimisation of overall system:** electricity, heat, mobility
- ICT platform connects generators, loads, grids, markets and provides for flexibility (e.g. flexible industrial loads, PtX, electric mobility, distributed small-scale generators)
- **More than 800 supermarkets involved, which will act as flexible loads**
- **New system operation TSO-DSO**
- “Regional power plants”/ VPP
- Urban-rural energy cooperation (Berlin and Brandenburg)
- Greater **system responsibility** assigned to balance responsible parties (BRP) and aggregators

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