Federal Ministry
for Economic Affairs
and Energy

The *Energiewende*

Transformation of the German energy system

International Symposium on Renewable Energy

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Tokyo

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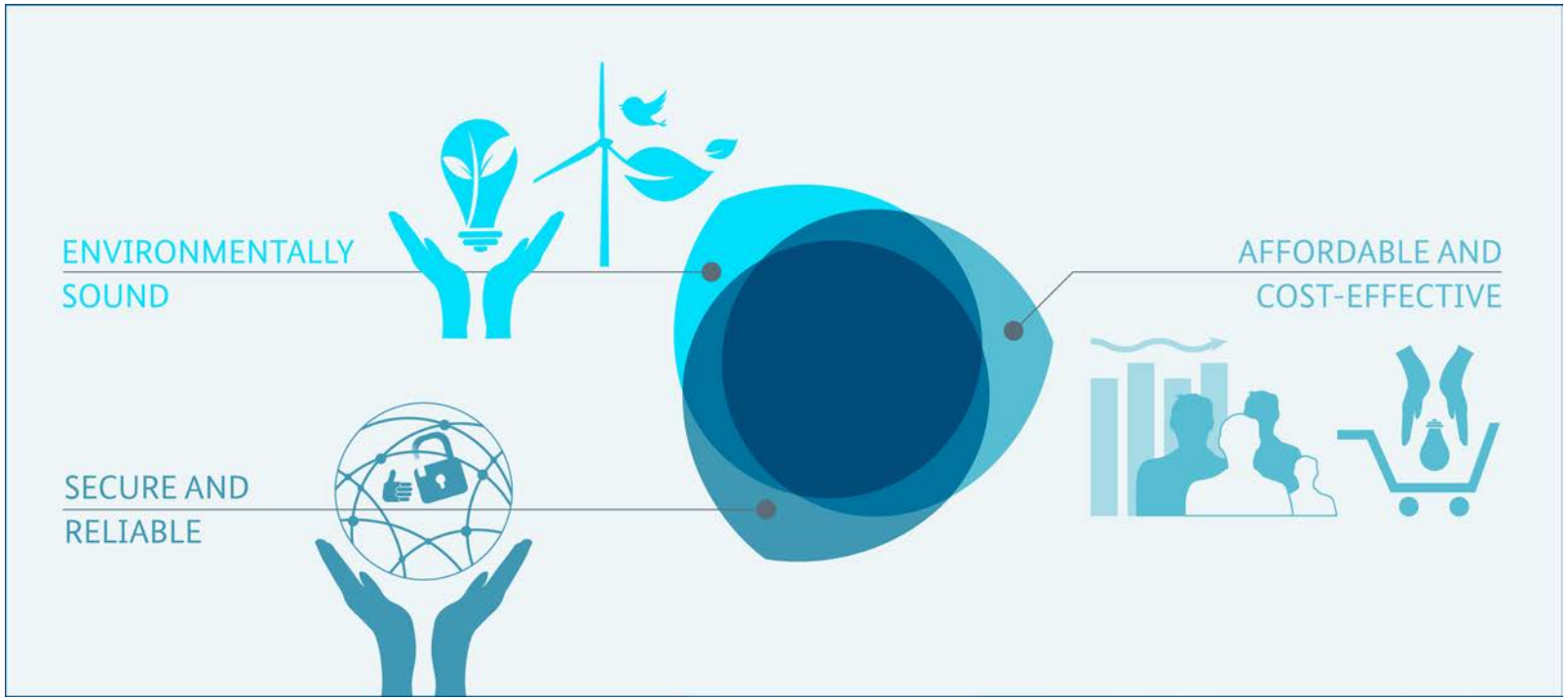
Three target areas of the *Energiewende*



Affordability, reliability and environmental protection are interlinked.

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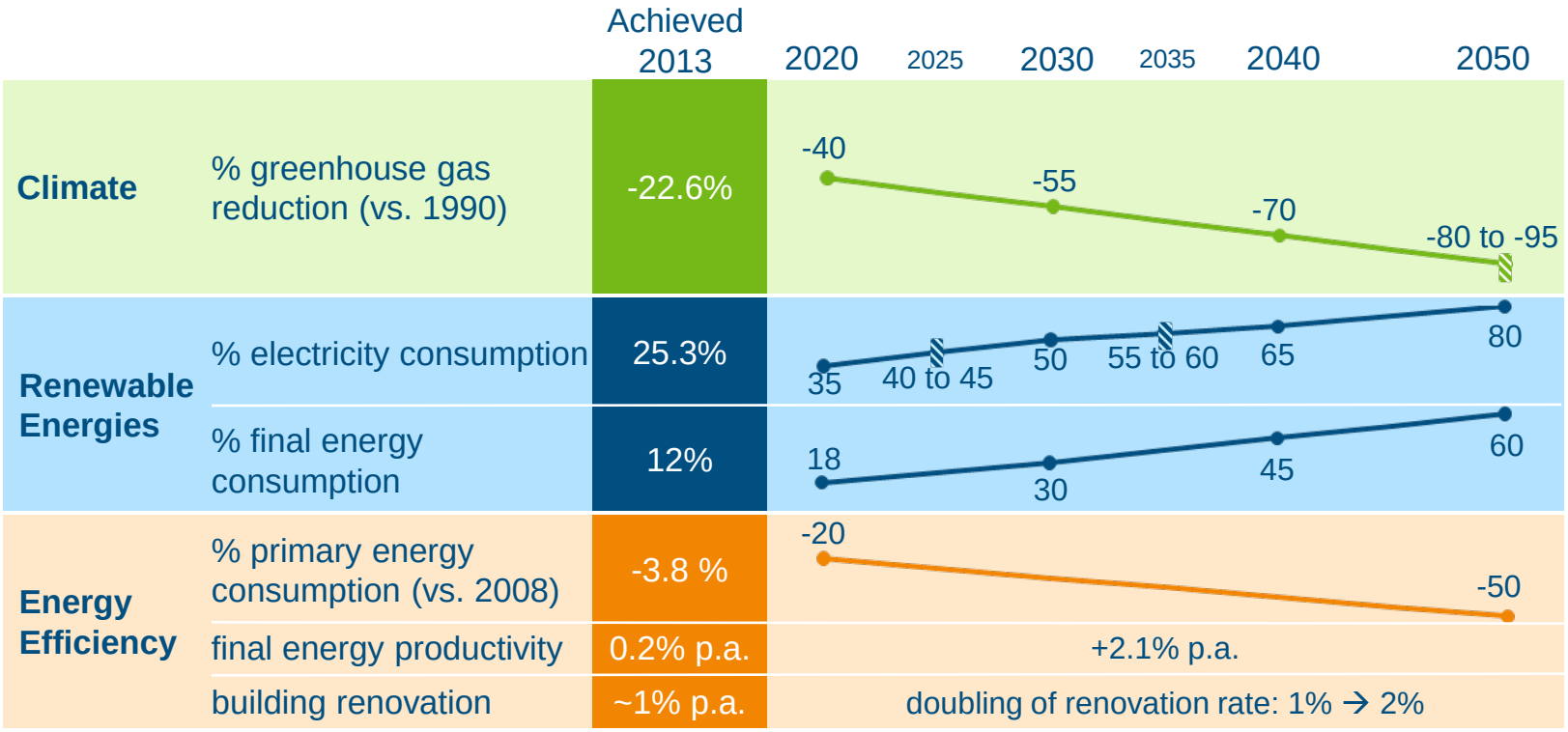
Energiewende targets until 2050



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

Germany is on track to reach the ambitious targets it has set.

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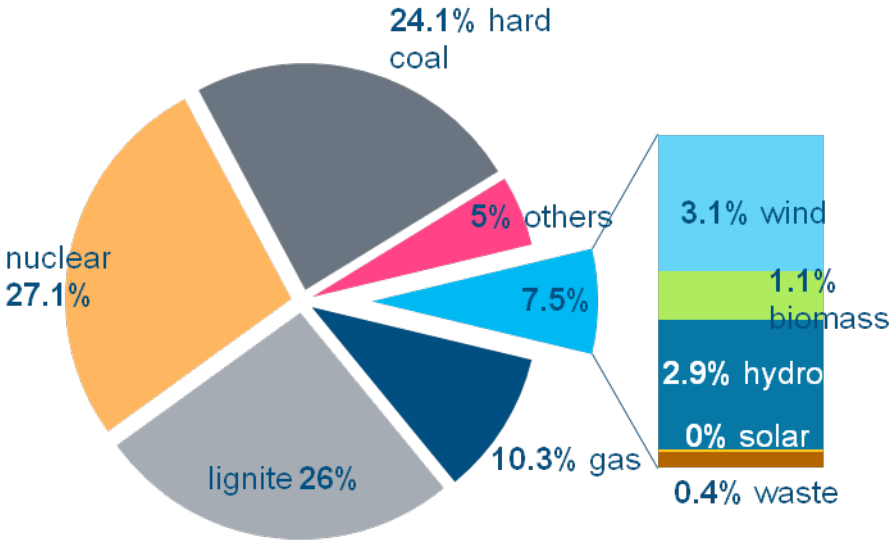
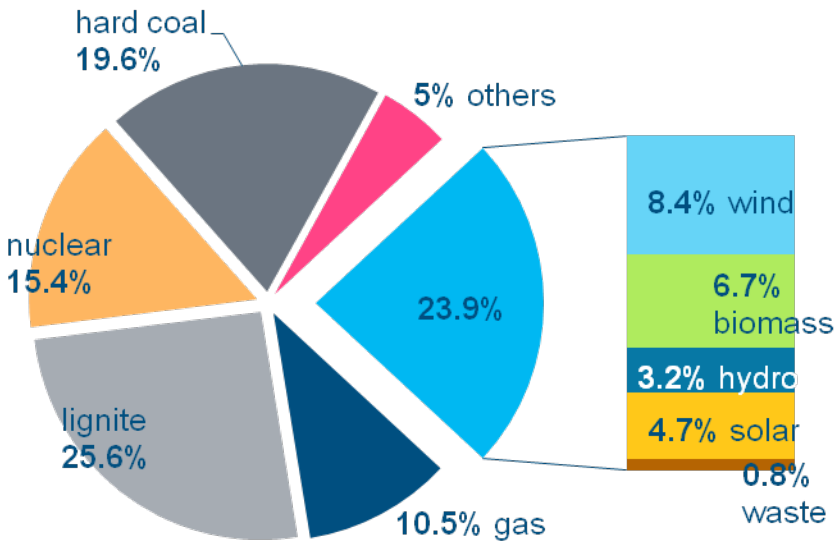
German gross electricity production

2003 total: 608.8 TWh
renewables share: 45.6 TWh



2013 total: 634 TWh
renewables share: 147.2 TWh



Source: Statistisches Bundesamt, BDEW /AGEB 2014

Renewables have become a major electricity source in just ten years.

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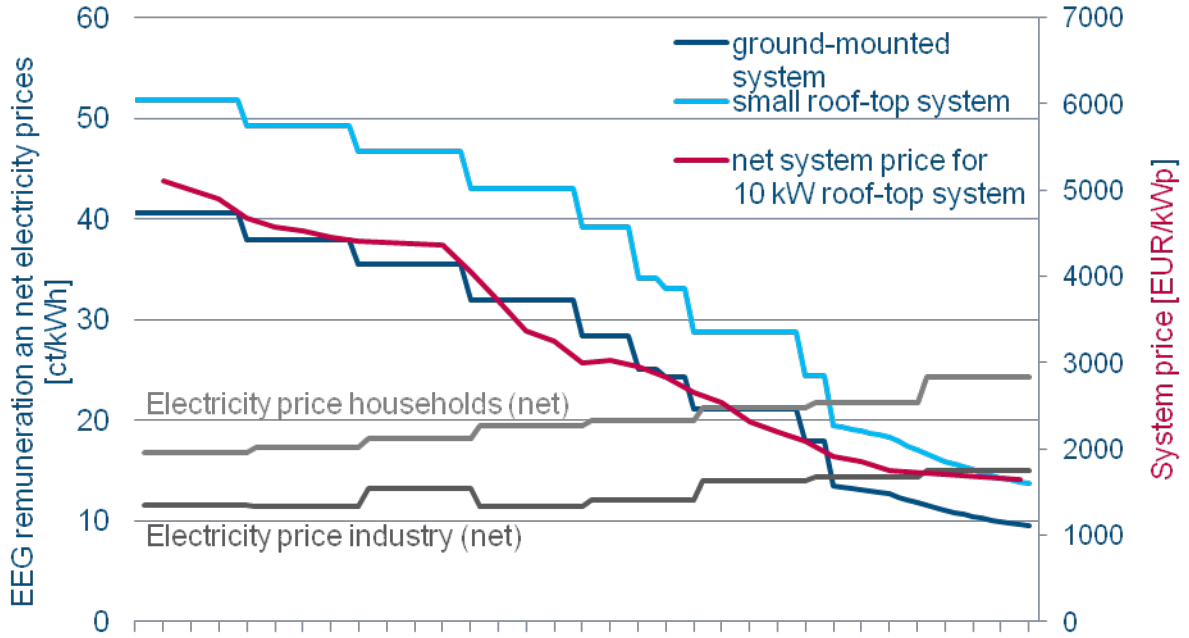
Feed-in Tariffs for PV: support costs decline constantly

Feed-In Tariff Solar energy (Cent/kWh)	January 2006	August 2014
Roof-top installations		
< 10 kW	51,80	13,15
< 30 kW**	51,80	12,8
< 100 kW	49,28	11,49
< 1000 kW	48,74	11,49
< 10 MW	48,74	9,23
Ground-mounted	40,60	tender



Source: EEG 2014 (Draft, 26.06.2014), BSW 2013, 2014, BMWi 2013

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Renewable Energy Sources Act Amendment 2014

More coordination
(1) Binding target corridors for RES deployment
(2) Introducing quantity control mechanisms

More efficiency
(3) Focus on cost-efficient technologies

More market integration
(4) Increase market integration through premium system
(5) Tendering scheme for ground-mounted PV

More diversified distribution of costs
(6) EEG levy on self-supply
(7) Adjusted exemptions for the industry

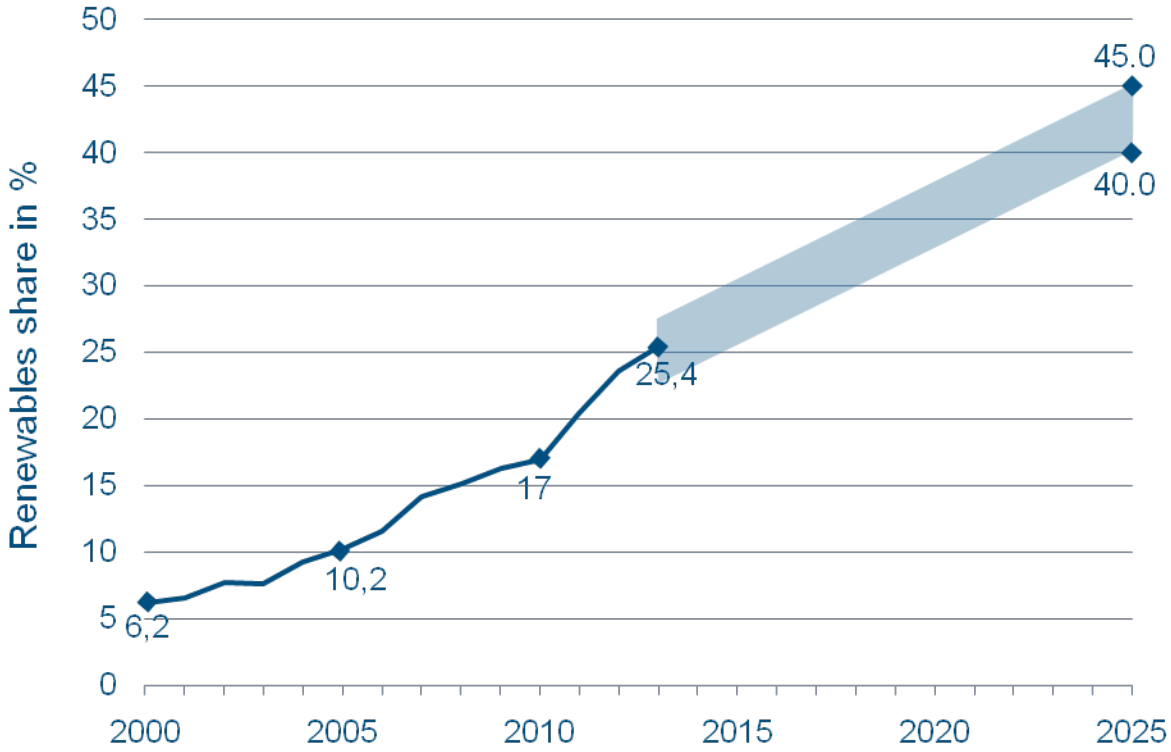
More Europe
(8) Open auctioning scheme for European neighbours

Affordability

Environmentally friendly energy supply

Security of supply

Renewables share in gross electricity consumption



Overall **target corridor**

- In 2025: between 40% and 45% RES-E
- In 2035: between 55% and 60% RES-E

Capacity additions

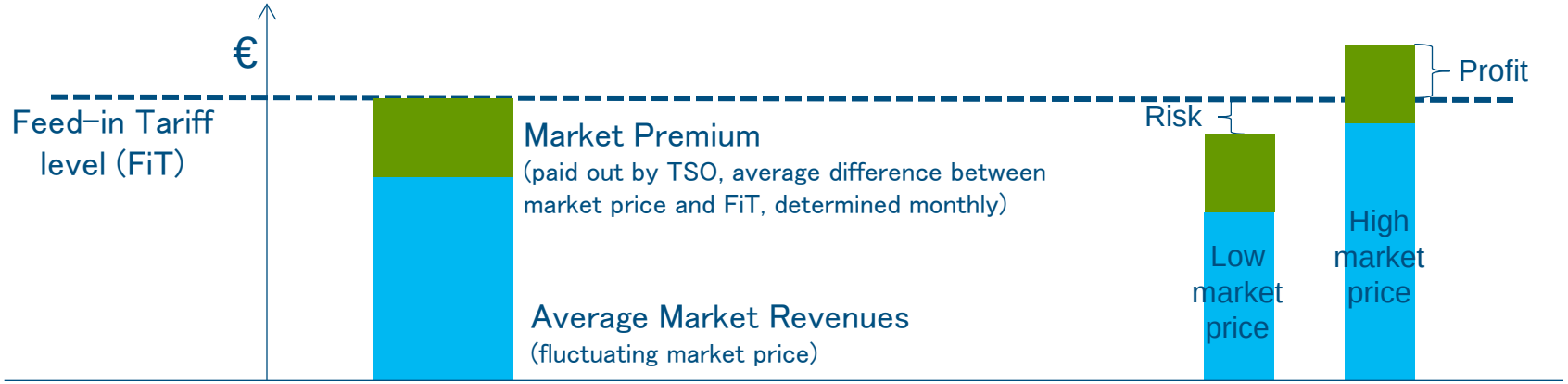
- **Onshore wind and PV** 2 500 MW (2.5 GW) per year each
- **Bioenergy** 100 MW per year
- **Offshore wind** 6.5 GW by 2020, 15 GW by 2030

Focus on Wind and PV as most cost-effective solutions

Source: BMWi 2014

Increase market integration through premium system

- Market price signal reaches RES-E generators, who thus react to market needs
  - RES-E generators can create additional profit by adjustment to market prices
  - Efficient market integration, incentives improved prognosis and balancing



The market premium bears new opportunities and incentivises flexibility.

Tendering scheme

- General intention: introducing tender procedures for all renewable technologies as of 2017
- First, necessary experience needs to be gained
- The first pilot phase from 2015 will cover ca. 400-600 MW ground-mounted PV per year
- Several challenges need to be solved before rolling out tendering, e.g.
  - underbidding,
  - non-realisation,
  - higher risks for investors,
  - strategic bidding

Auctions can help to achieve further support cost reductions.

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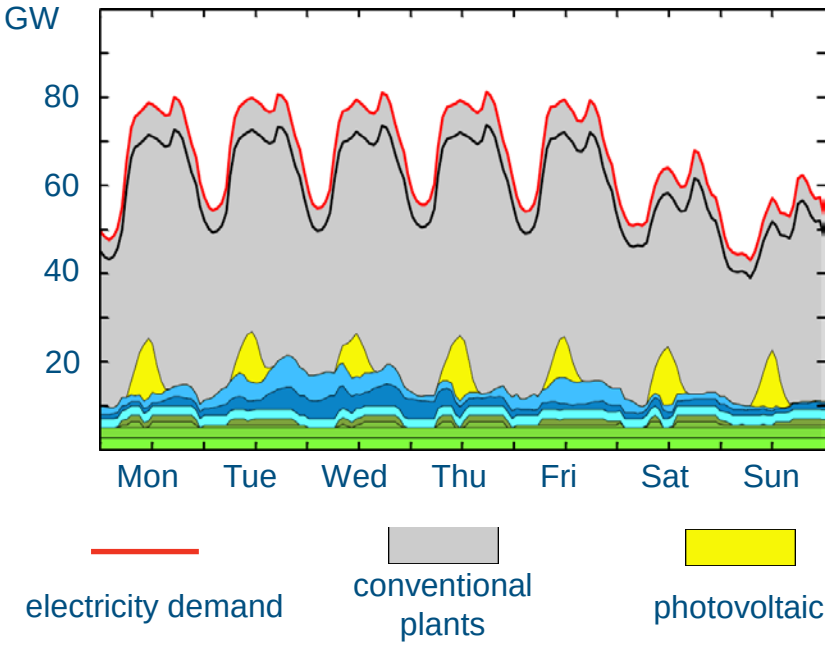
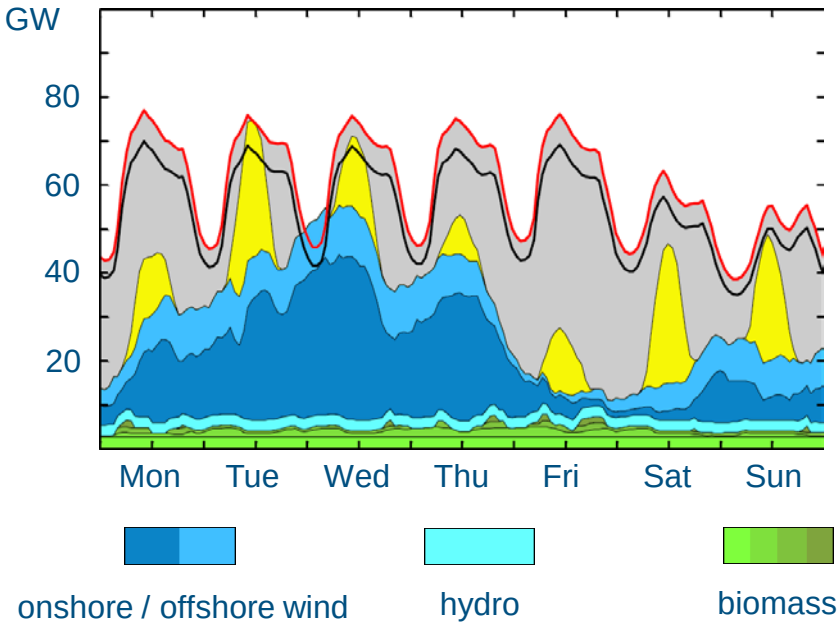
German electricity-system volatility in 2022

Winter 2022 - week no. 46 (November)



Summer 2022 - week no. 33 (September)

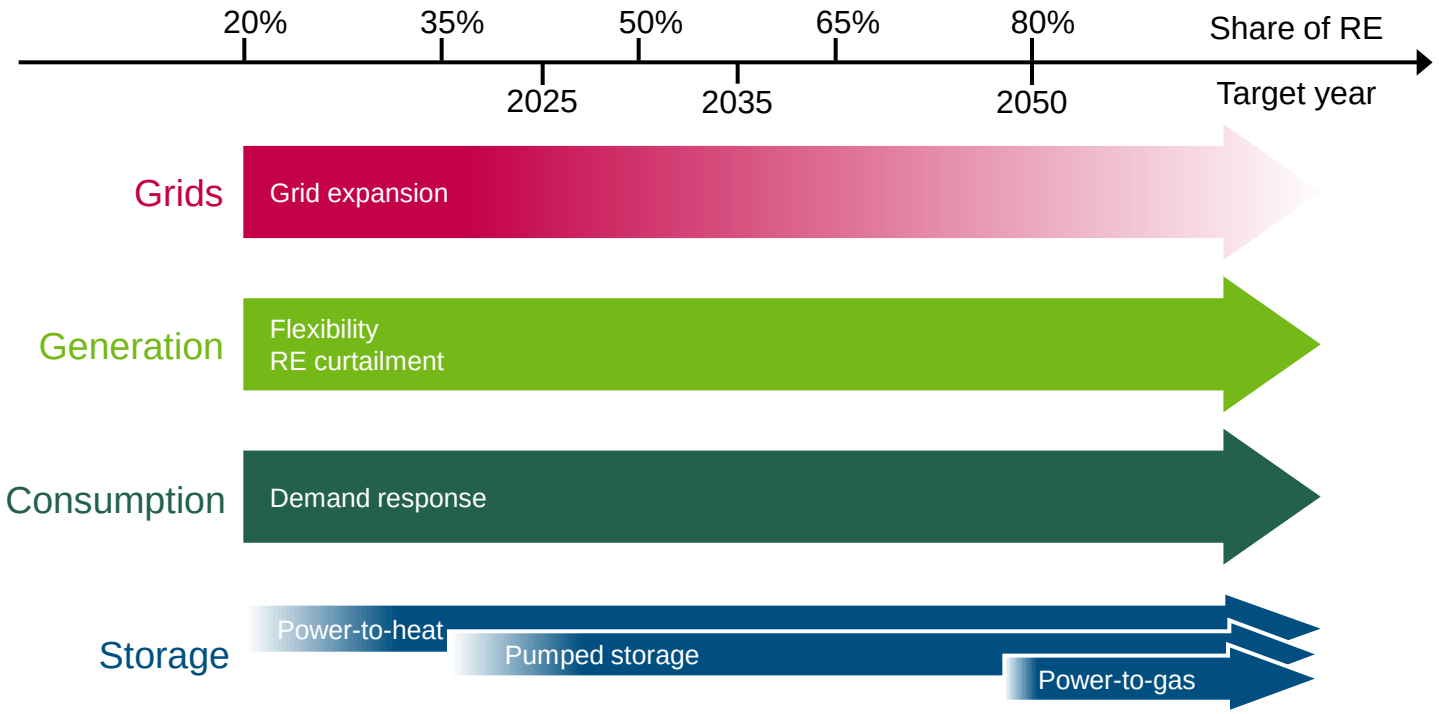


electricity demand | conventional plants | photovoltaic | onshore / offshore wind | hydro | biomass

Source: Agora Energiewende 2012

Renewables can cover the total demand by 2022 but conventional back-up capacity for the winter will still be needed.

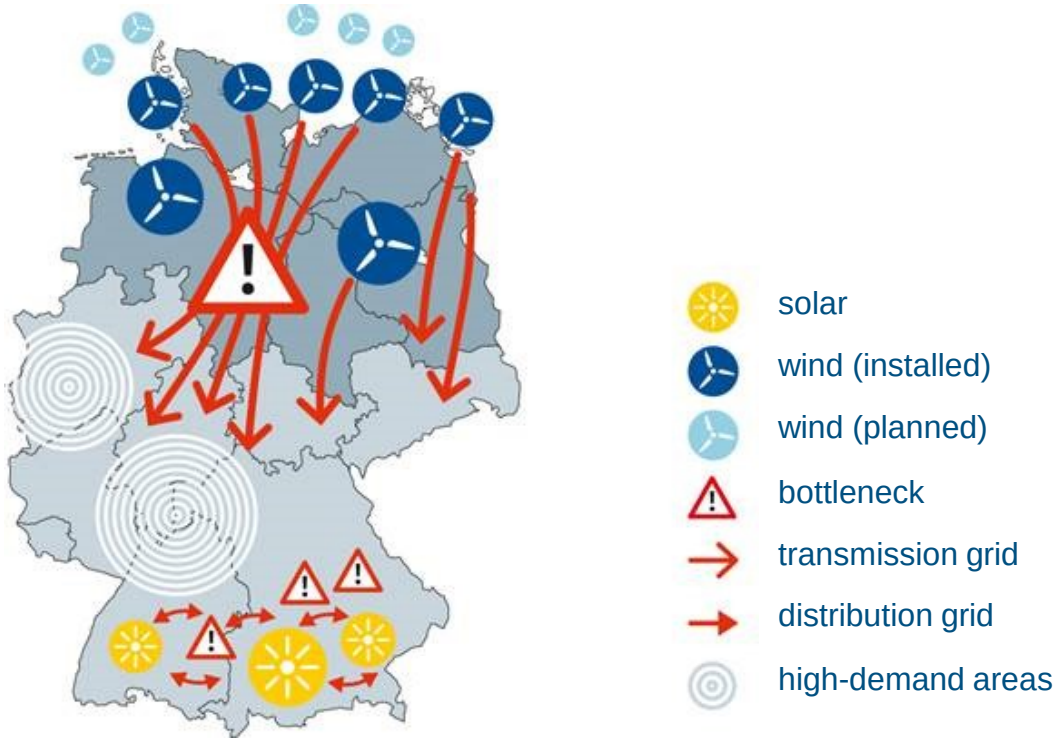
Four areas to increase flexibility



Source: BMU 2012

Different flexibility measures are suitable for varying shares of volatile renewables.

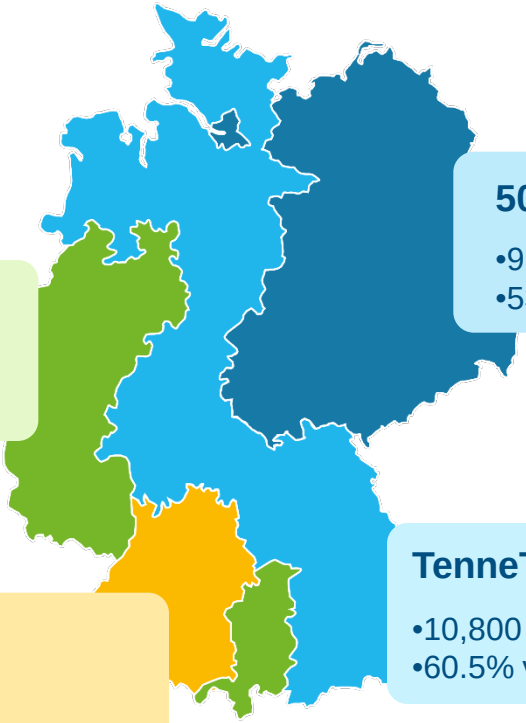
The challenge: connecting supply and demand



Source: DUH 2011

New power lines need to transport excess supply in northern Germany to southern Germany in order to prevent shortages.

Transmission system operators in Germany and share of fluctuating renewables production



50Hertz

- 9,995 km
- 53.4% volatile capacity

Amprion

- 11,000 km
- 29.1% volatile capacity

TenneT

- 10,800 km
- 60.5% volatile capacity

TransnetBW

- 3,330 km
- 42.7% volatile capacity

Source: Transmission system operators, 2013

German transmission-grid planning

Source: Federal Network Agency 2013

The process ensures a continuous "one-stop shop" authority and broad stakeholder participation.

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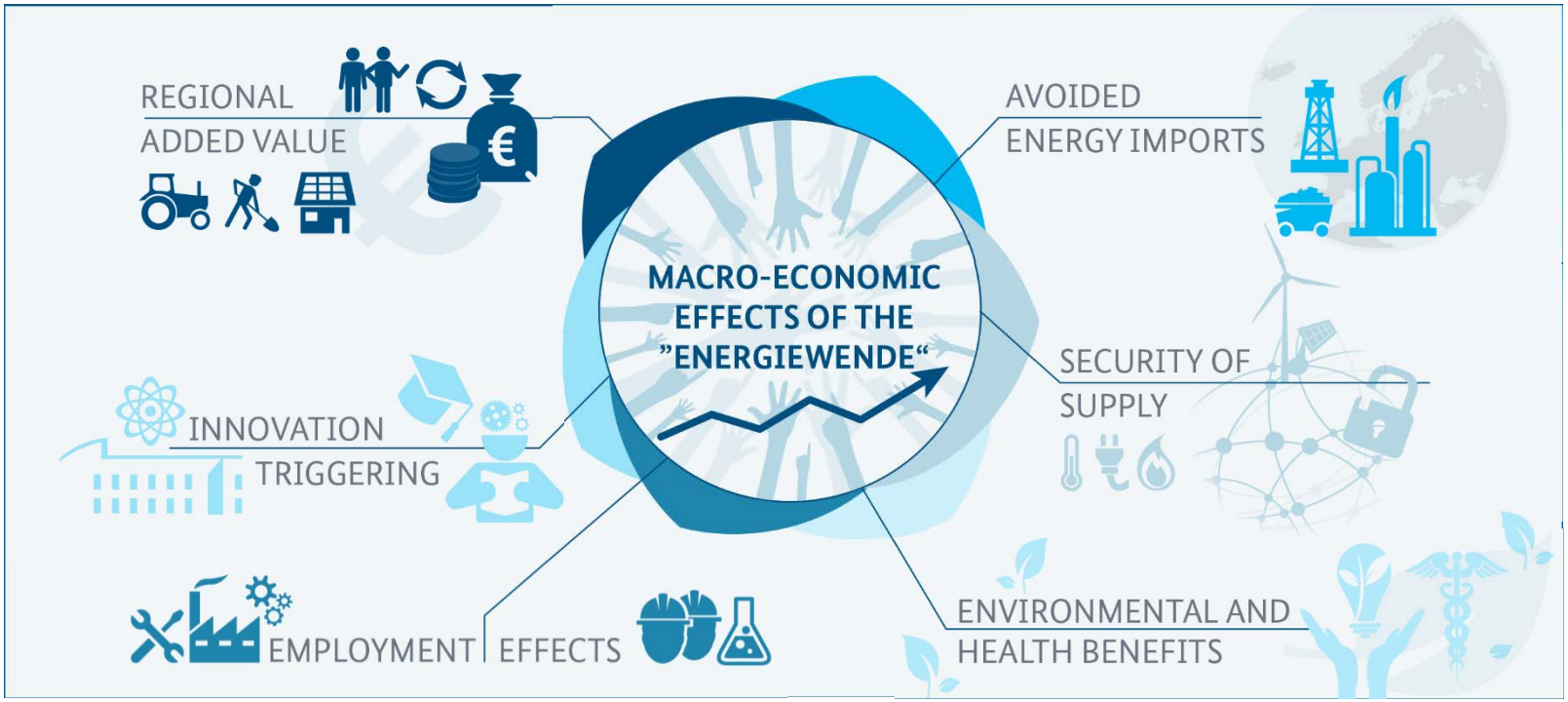
Benefits of fostering energy efficiency and renewables



The energy transition has positive effects on various levels.