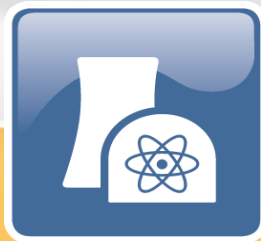




Developments in the European Energy Market and VGB's contribution

Delhi, Mumbai, Hyderabad,
August/September 2015

Dr. Oliver Then, Head of Power Plant
Technologies



Long-term co-operation with India



german
cooperation

DEUTSCHE ZUSAMMENARBEIT



- VGB has been active since 2007
- Partner of GIZ to support the “Excellence Enhancement Centre” operating as a self-sustaining organization

Some highlights:

- **Study** “Best Practices for Coal-Based Power Plants in Germany” – 300 pages about new build, operation, maintenance and servicing
- **Project** “Improvement of Electrostatic Precipitator Performance” by applying CFD-modeling at the reference, the Ramagundam power plant of NTPC



IGEF in Delhi, Feb 2015

EEC-Workshops in Delhi and Bangalore, March 2013

IGEF in Berlin, Feb 2013

EEC Inauguration, Feb 2012

VGB is active as a partner of GIZ and has set up a Memorandum of Understanding with the Central Electricity Authority.

CCS development in the EU

Even with supportive EU regulations and co-funding opportunities provided through the European Energy Programme for Recovery and NER300, carbon capture and storage has failed to develop at the rate expected.
(www.ec.europa.eu/energy)

E.ON's bold new beginning:
Demerger strategy aims to 'recapture entrepreneurial initiative' in future and classical energy worlds

(WORLD ENERGY FOCUS
March 2015)

CO₂-penalty for coal-fired power plants

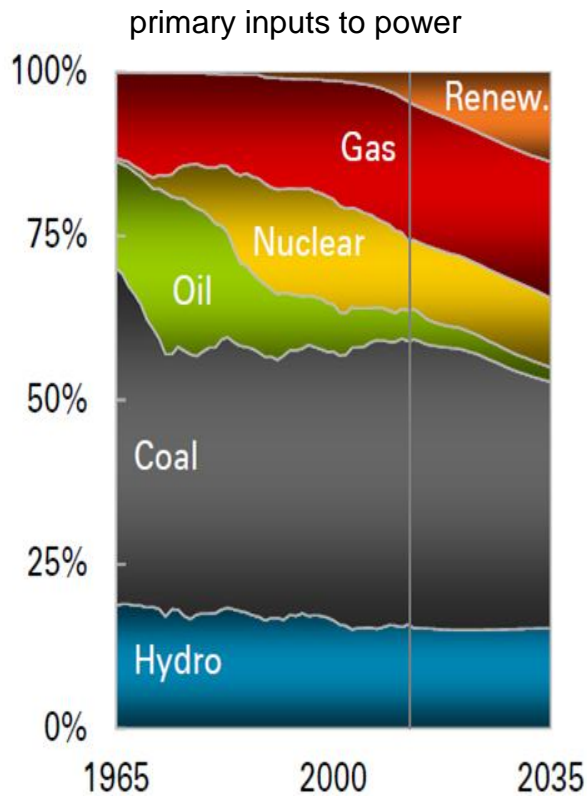
The German Federal Ministry of Economics and Energy plans to establish a CO₂-penalty for coal-fired power plants in order to meet the climate-targets

Latest coal-based new builds in Western Europe turn out being stranded investments due to heavy delays and the "missing money problem"

Major R&D projects aiming at 700°C / Advanced-Ultra-Super-Critical Technology such as ENCIO have been cancelled

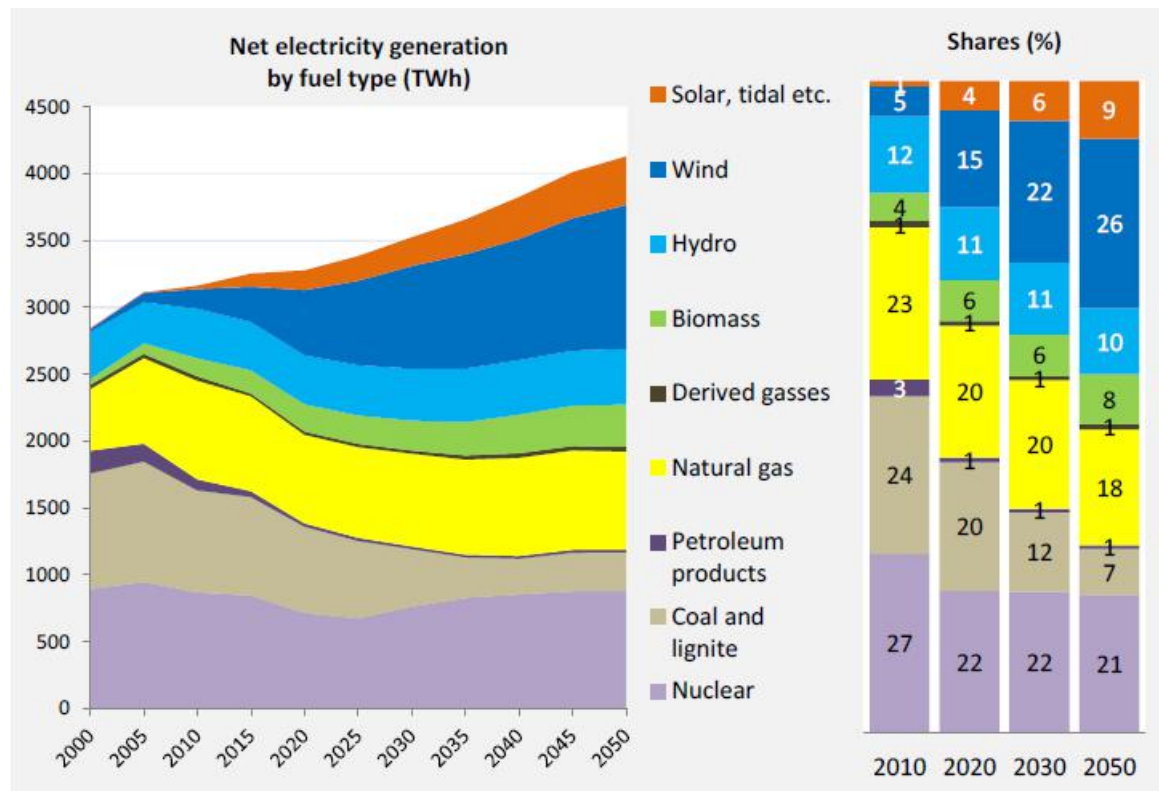
Coal-fired power plants: quo vadis?

World-wide



Source: BP Energy Outlook 2015

Europe



Source: EU Energy, Transport and GHG Emission – Trends to 2050, EU Commission 2013

Coal based power plants will have a relevant share in power generation in the next two to three decades.



20/20/20 targets: CO₂ emission reduction, efficiency increase, share of renewables by 2020

40% CO₂-reduction target, share of renewables of 27% of energy consumption, 27% efficiency increase by **2030 framework**

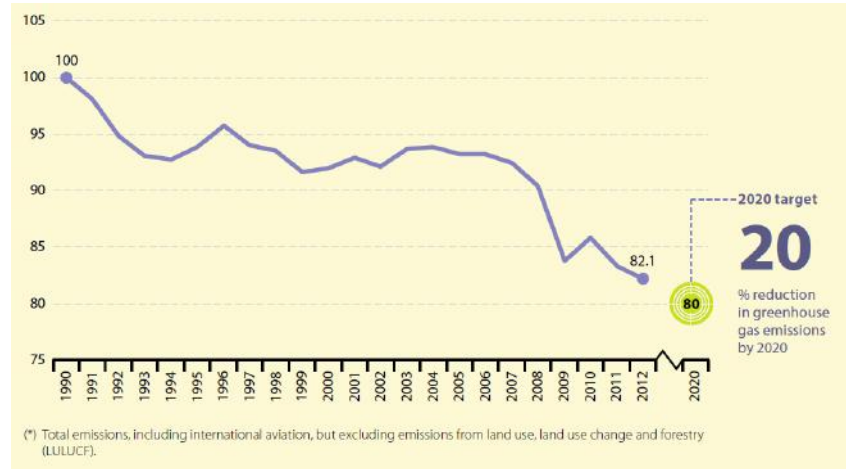


Reduction of greenhouse gases by 40% in 2020, by 80% in 2050

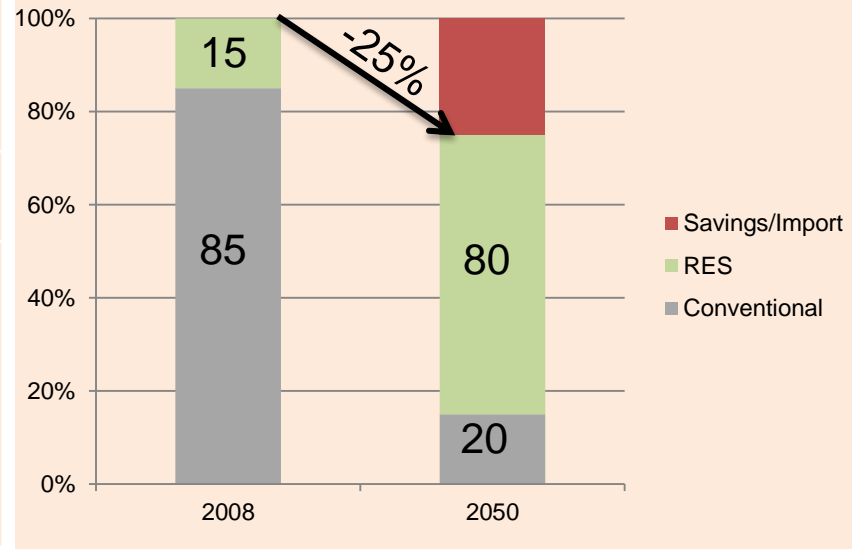
Phase-out of nuclear power by 2022

Increase of the share of renewables up to 80%, reduction of primary energy consumption by 50% and decrease of electricity consumption by 25% in 2050

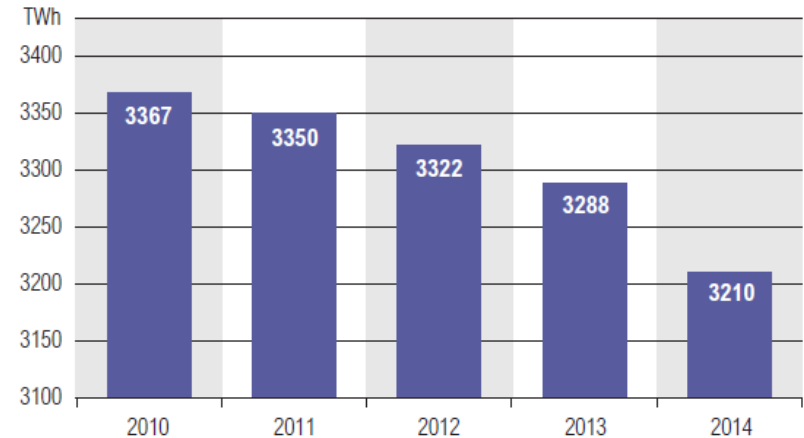
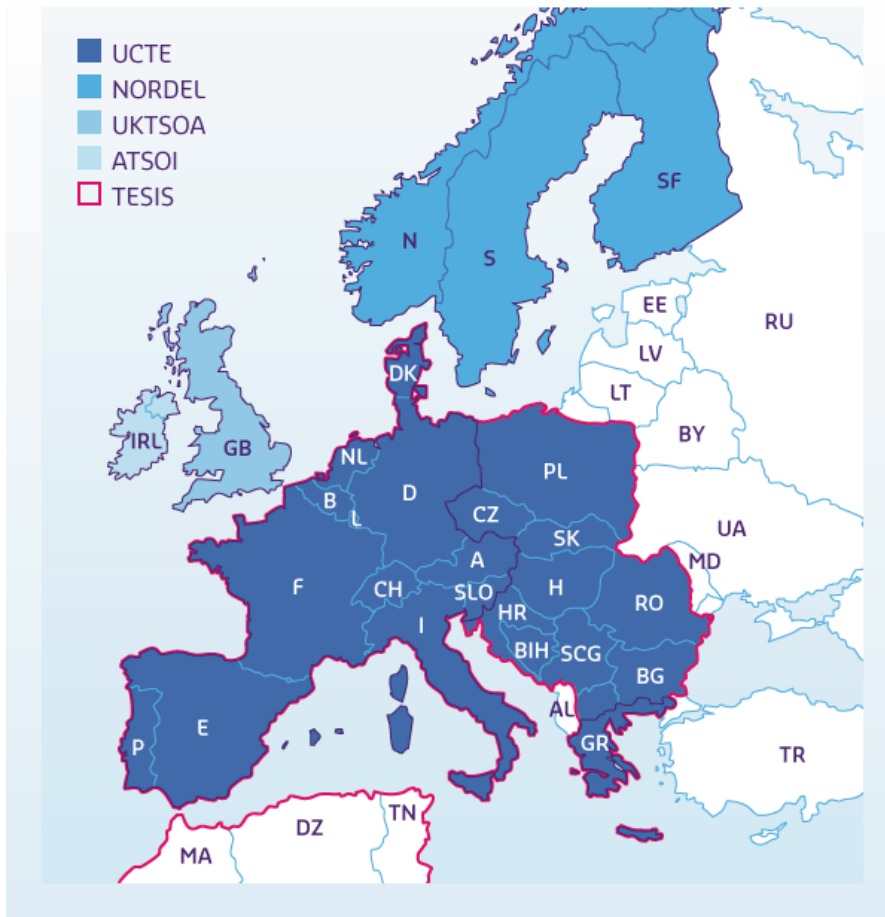
Reference year for CO₂-reduction:1990



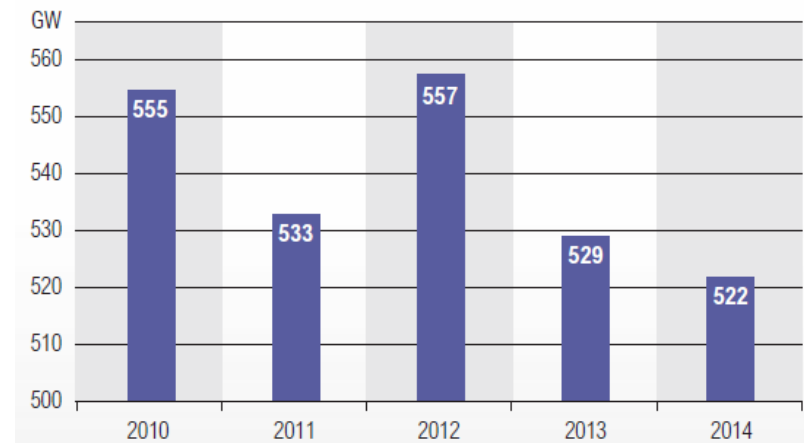
Source: Eurostat



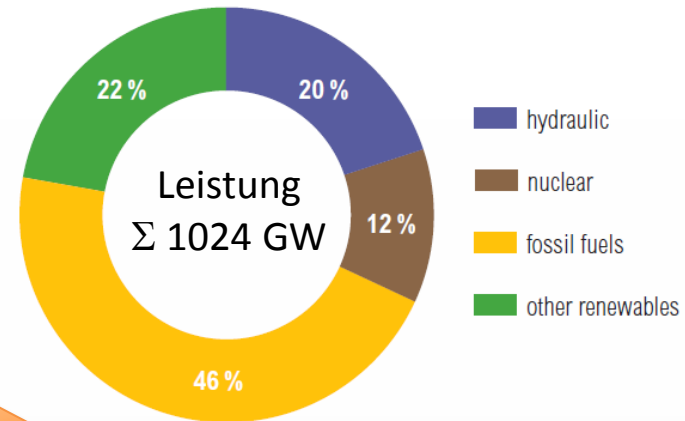
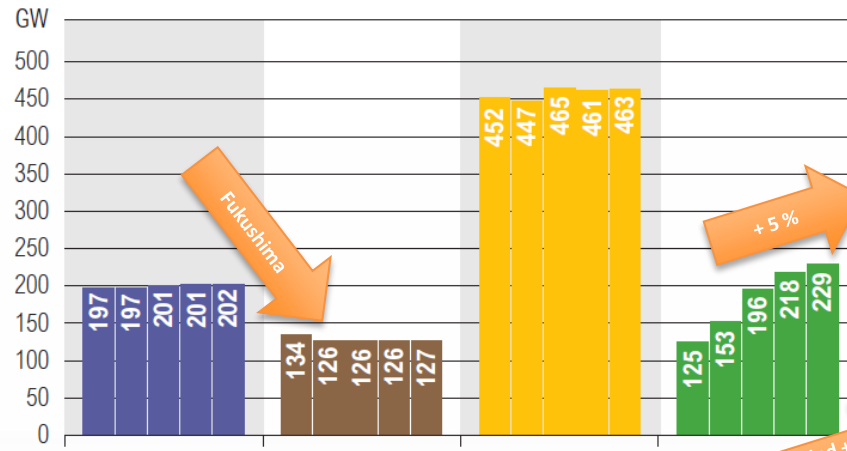
Integrated Network



Yearly energy consumption in TWh

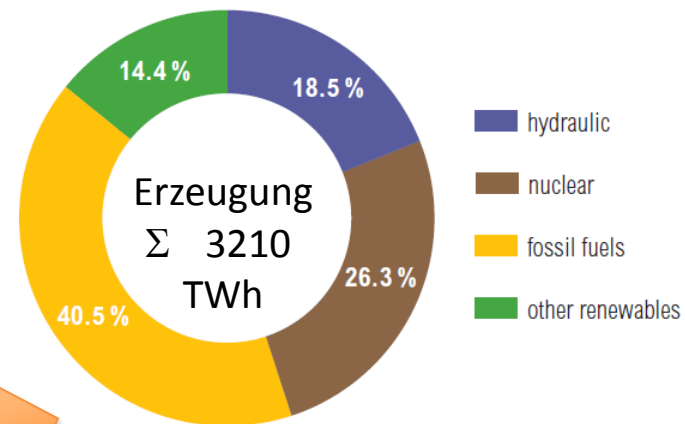
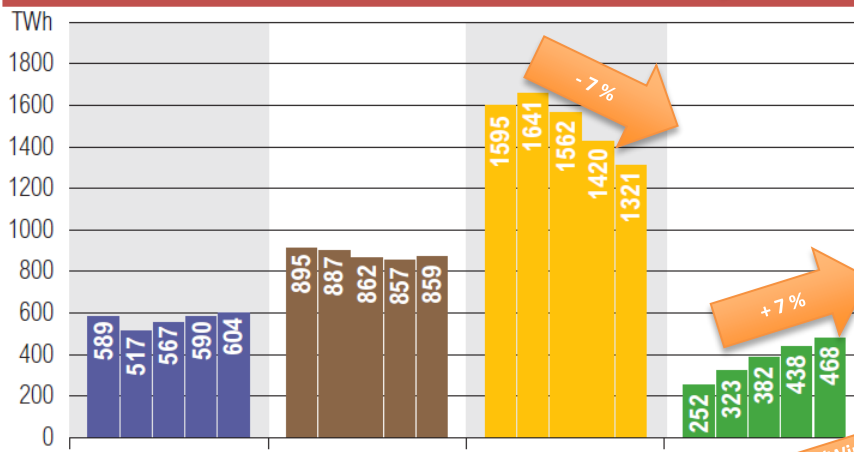


Maximum peak load in GW



Net generating capacity from 2010 to 2014 in GW

Net generating capacity in 2014

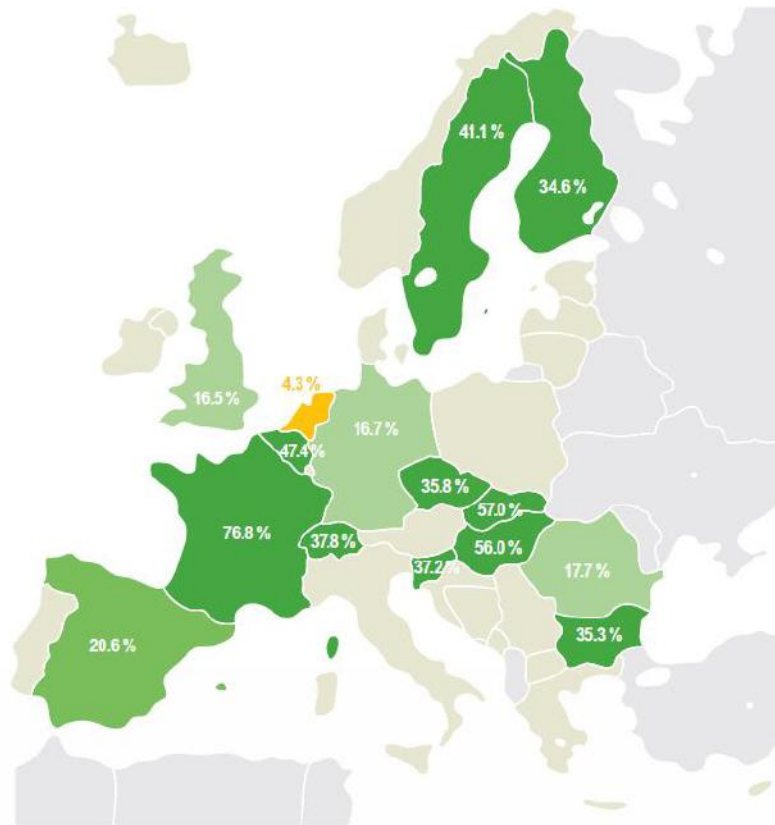


Energy net generation from 2010 to 2014 in TWh

Energy net generation in 2014

Quelle: Entso-E, Electricity in Europe 2014

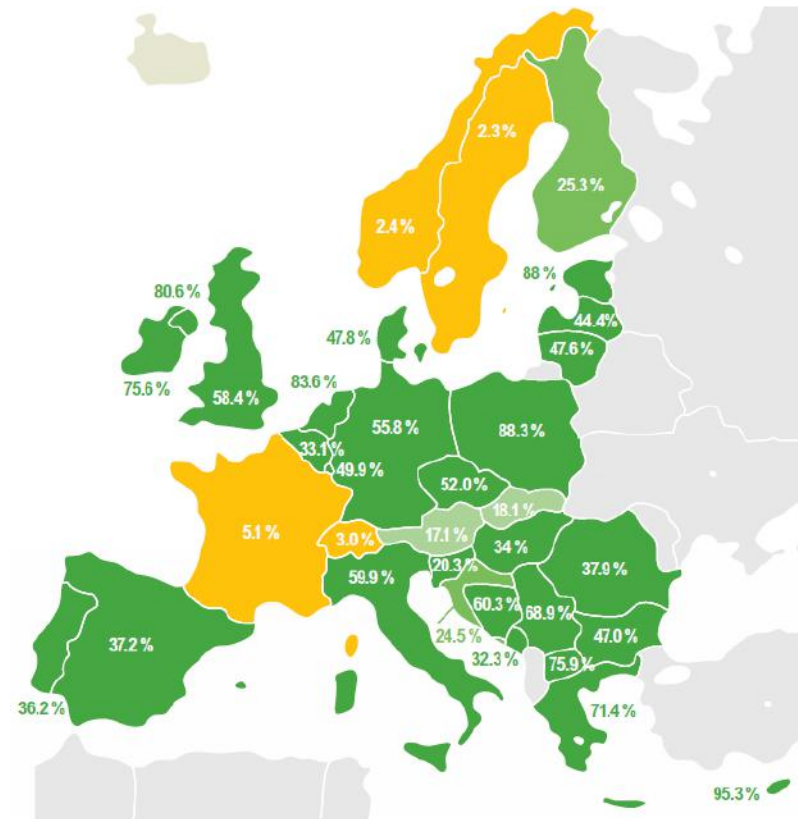
SHARE OF NUCLEAR ENERGY NET GENERATION IN 2014



Share of the national generation:

- ≥ 30%
- ≥ 20% and < 30%
- ≥ 10% and < 20%
- < 10%
- no plant

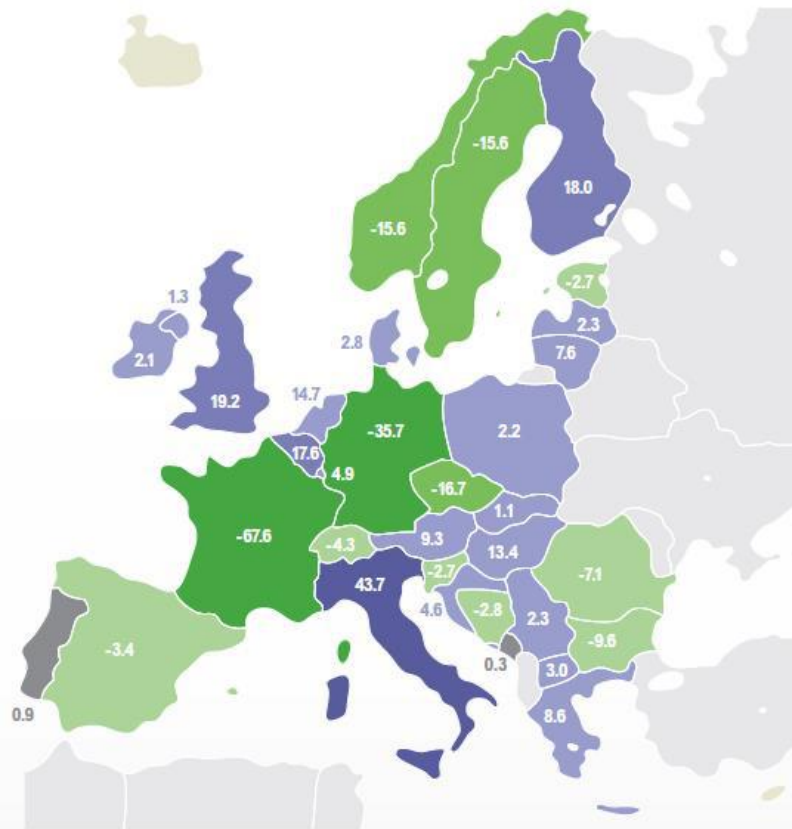
SHARE OF FOSSIL FUELS ENERGY NET GENERATION IN 2014



Share of the national generation:

- ≥ 30%
- ≥ 20% and < 30%
- ≥ 10% and < 20%
- < 10%
- no plant

EXCHANGE BALANCES IN 2014



Exporting balance:

- ≤ -30 TWh
- ≤ -15 TWh and > -30 TWh
- ≤ -1 TWh and > -15 TWh

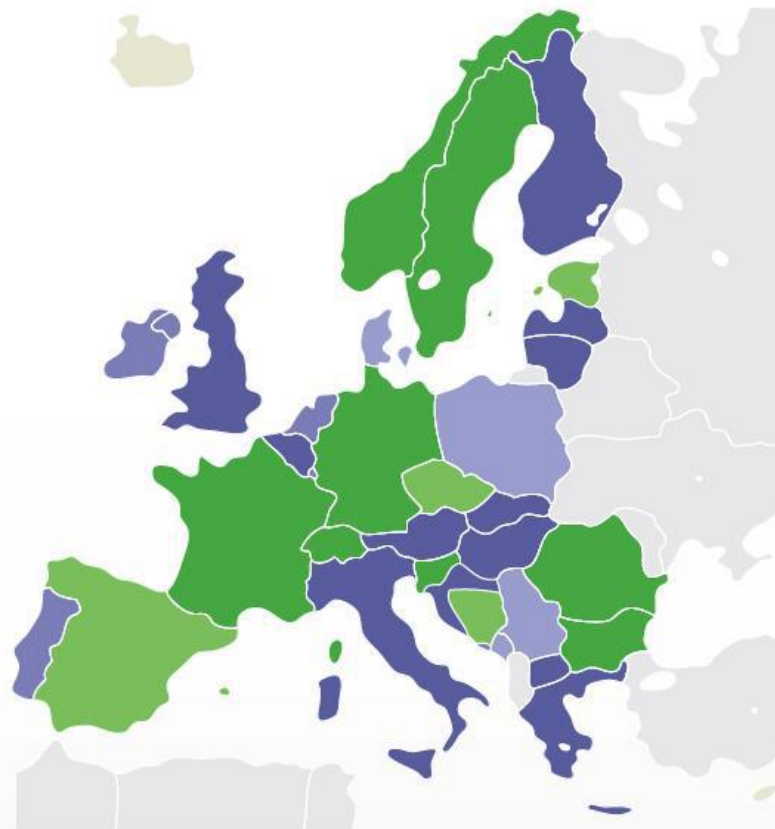
■ balanced

■ isolated

Importing balance:

- ≥ 1 TWh and < 15 TWh
- ≥ 15 TWh and < 30 TWh
- ≥ 30 TWh

EVOLUTION OF EXCHANGE BALANCES BETWEEN 2013 AND 2014



Balance:

- more exporting
- less exporting
- becomes exporting

■ stable

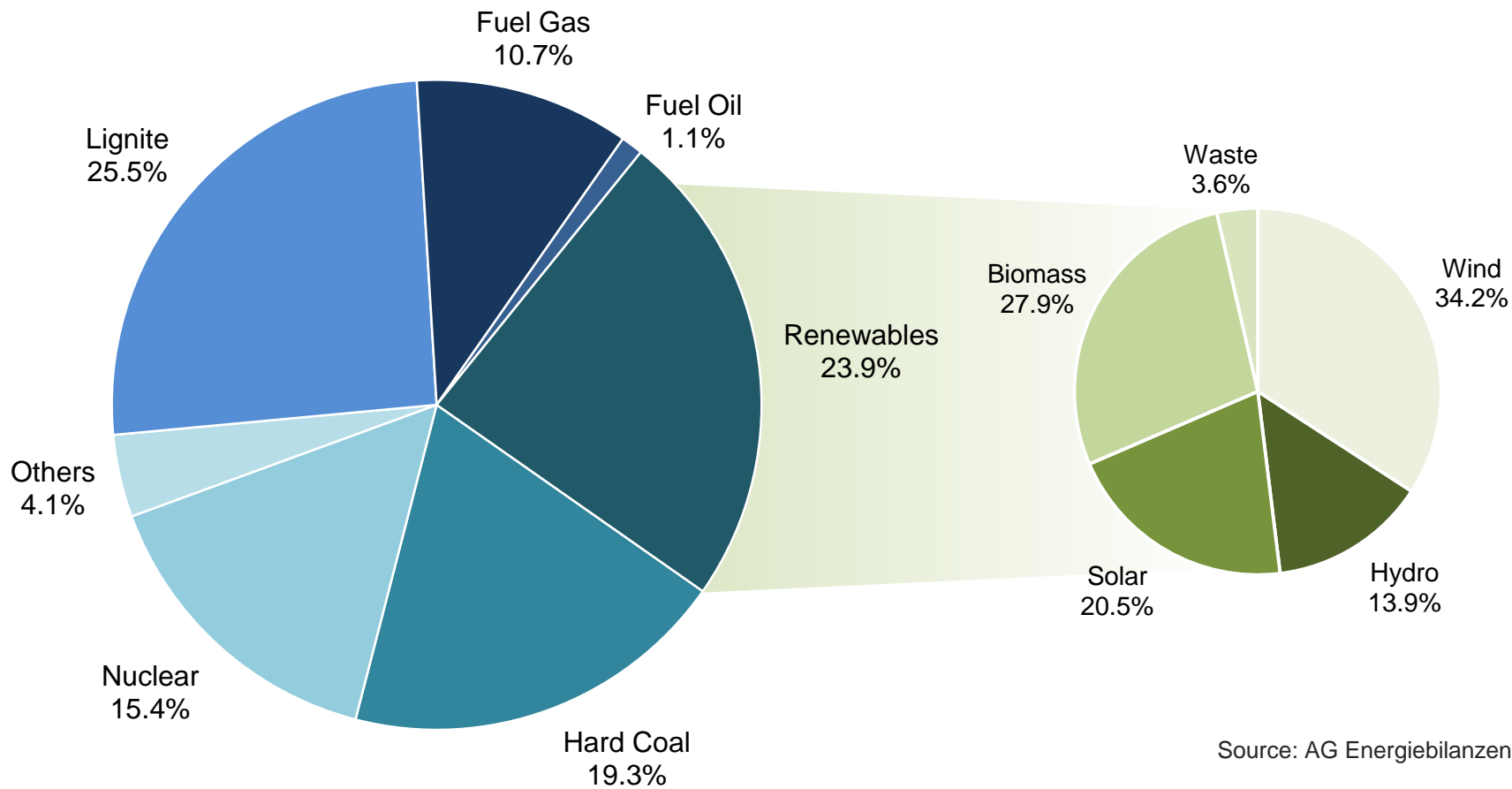
■ isolated

Balance:

- becomes importing
- less importing
- more importing

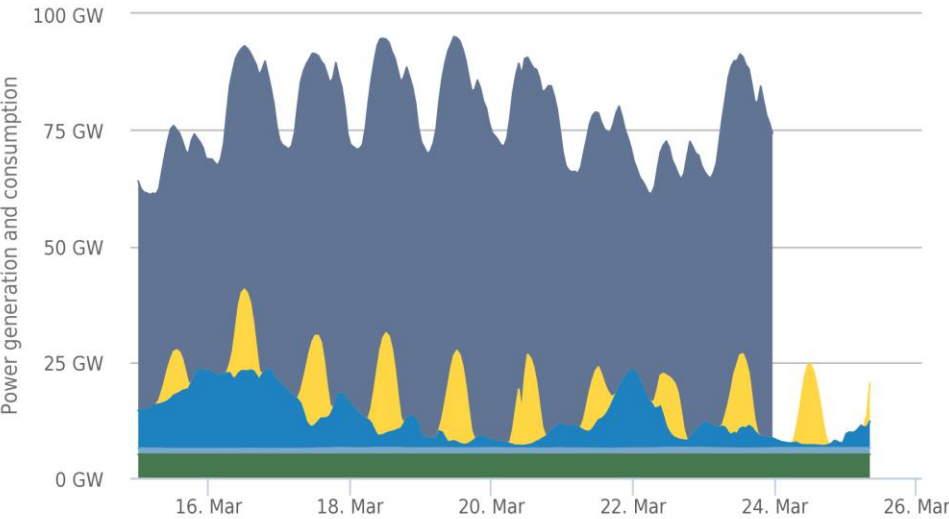
Power generation in Germany in 2013

- Installed capacity: 189 GW
- Gross power production: 632 TWh

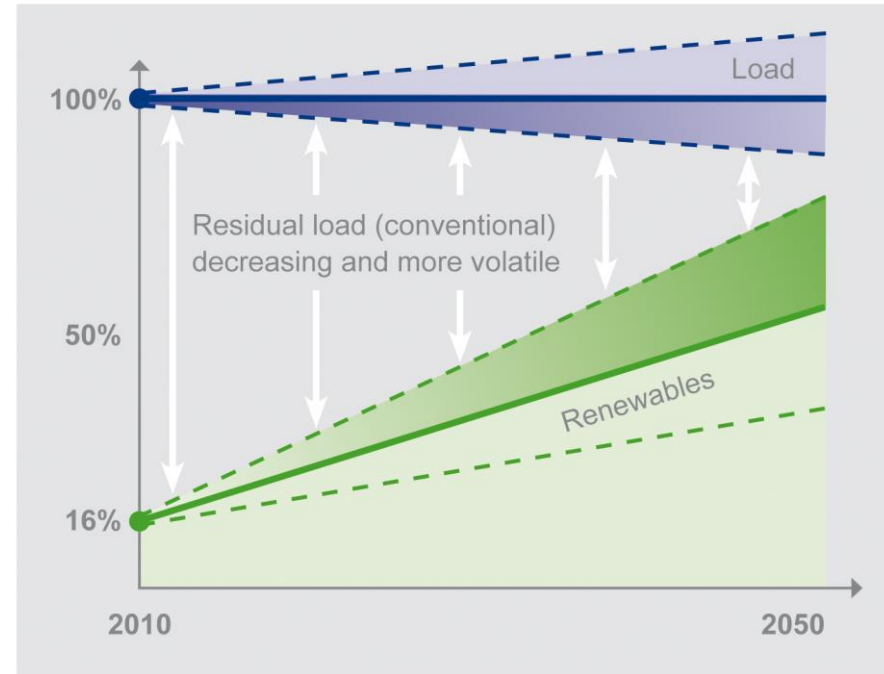


Source: AG Energiebilanzen

Fluctuation of power generation in Germany

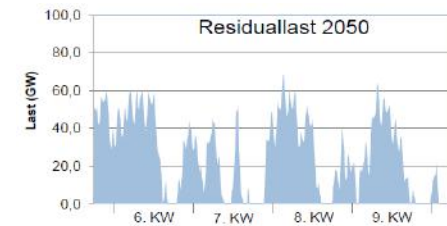
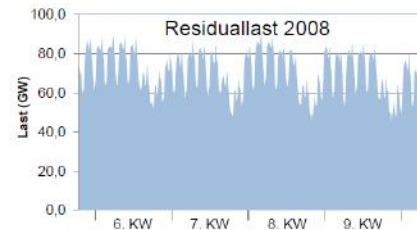


- Conventional power plants ■ Solar ■ Wind ■ Water ■ Biomass
- Electricity Consumption ■ Hard coal ■ Lignite ■ Nuclear
- Pumped hydro storage and storage water ■ Natural gas ■ Other



Agora Energiewende; Current to: 25.03.2015, 12:15

Source: KWE

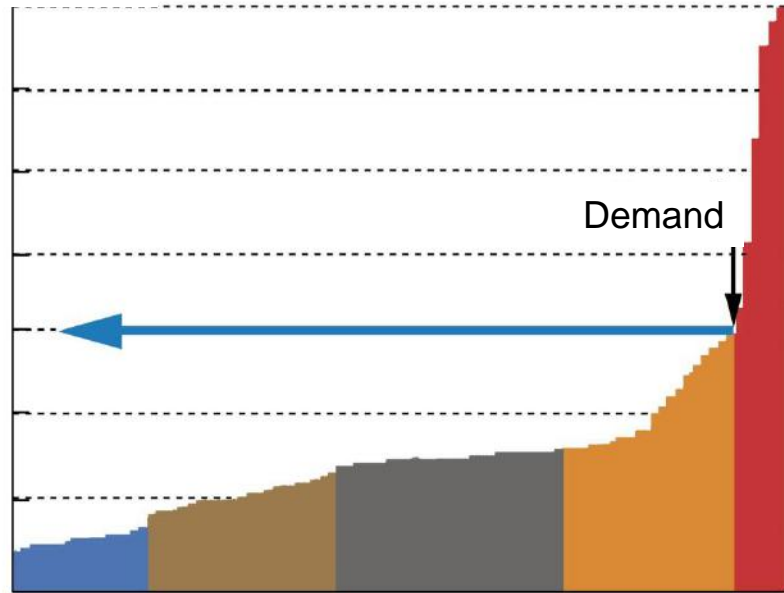


Even in Germany there will be a significant fossil-based capacity of 45 to 65 GW by 2030 to 2050. Big challenges are a decreasing residual load and increased fluctuations.

Example for the market development

Classic Market

€/ct/kWh



■ Nuclear

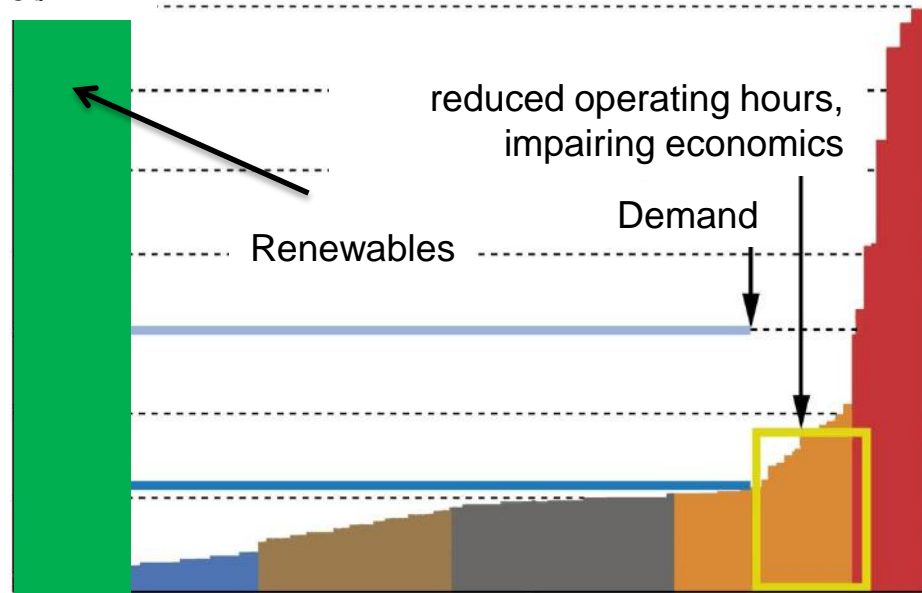
■ Lignite

GW

■ Hard Coal

Market with priority feed-in of renewables

€/ct/kWh



Renewables

reduced operating hours,
impairing economics

Demand

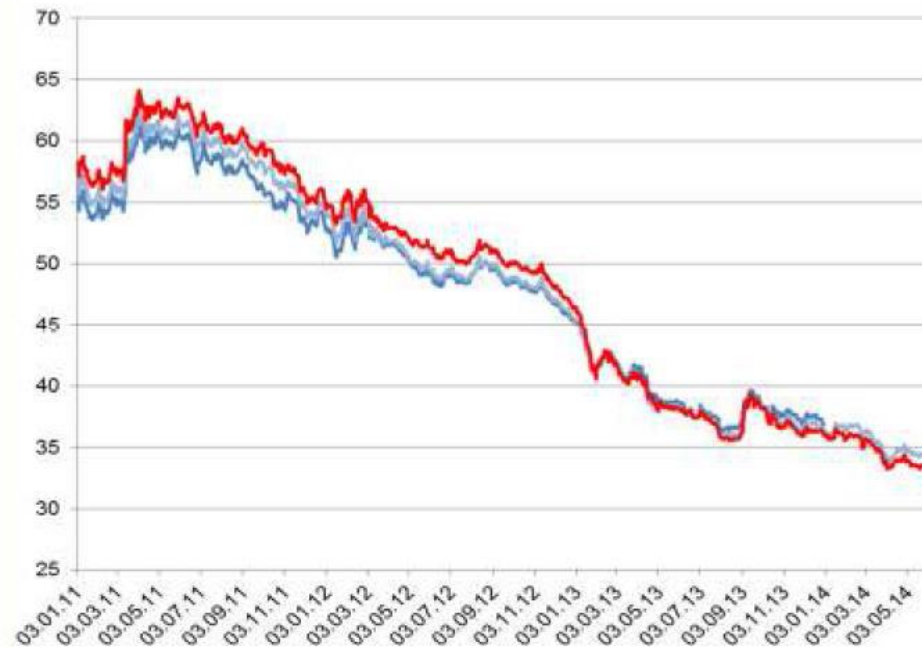
■ Gas

■ Oil

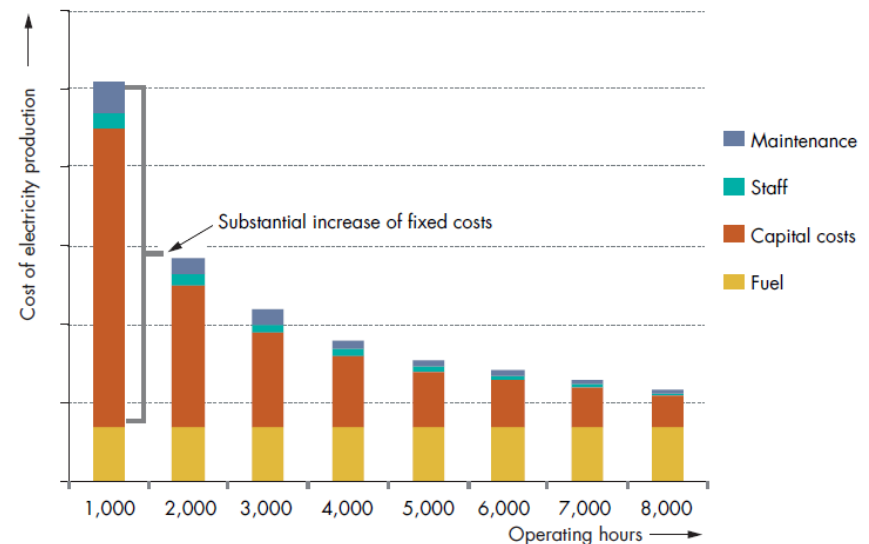
GW

Consequences of the merit order distortion are lower wholesale prices and less operating hours.

Price of electricity at EEX (€/MWh)



Cost of electricity (CoE) production



Lower prices and less operating hours have deteriorated the profitability of conventional power plants, even on marginal costs.