

Connecting the dots on Germany's *Energiewende*

Rebecca Bertram
Heinrich Böll Foundation North America



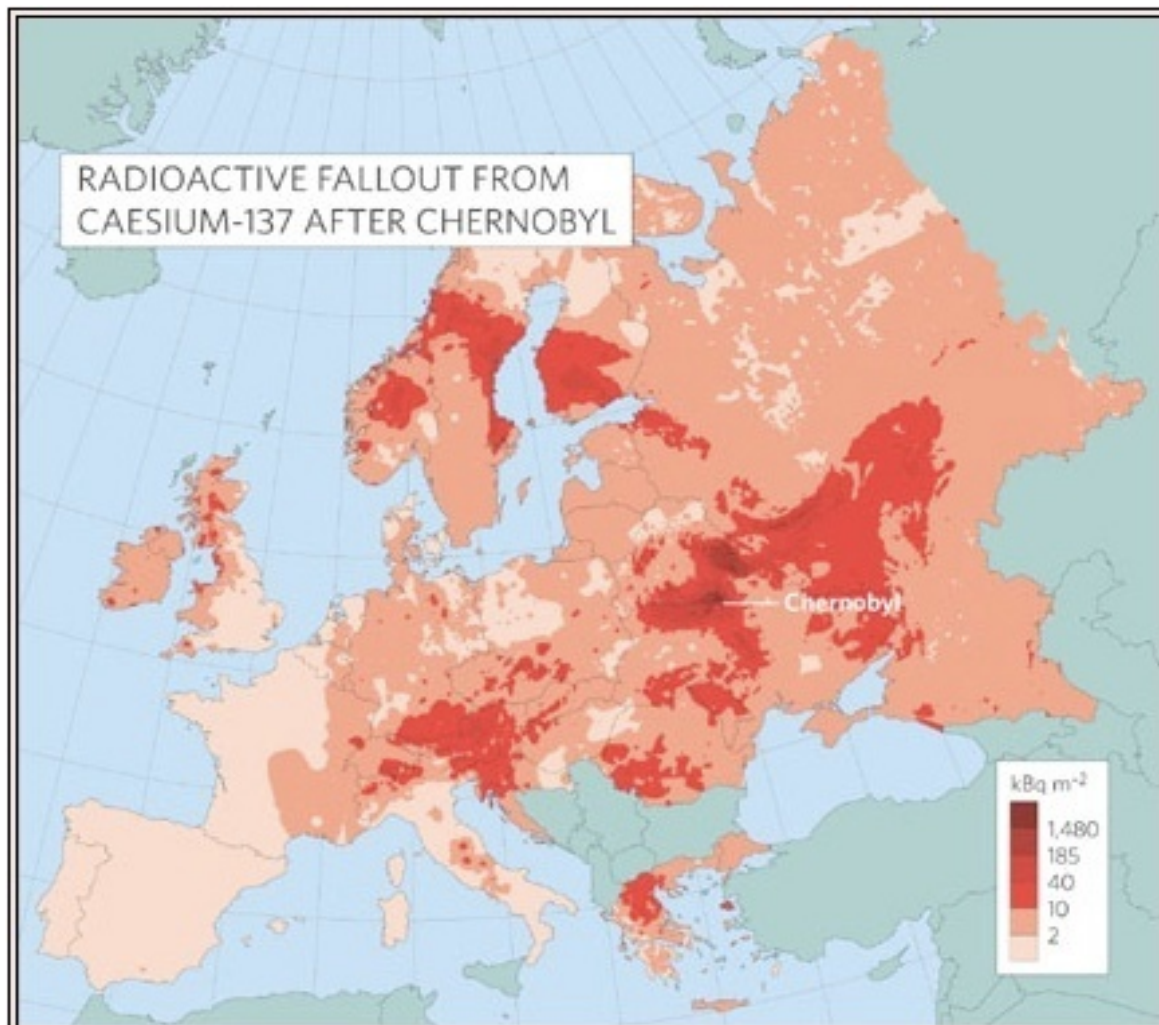
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Looking at Germany – what is the country doing?

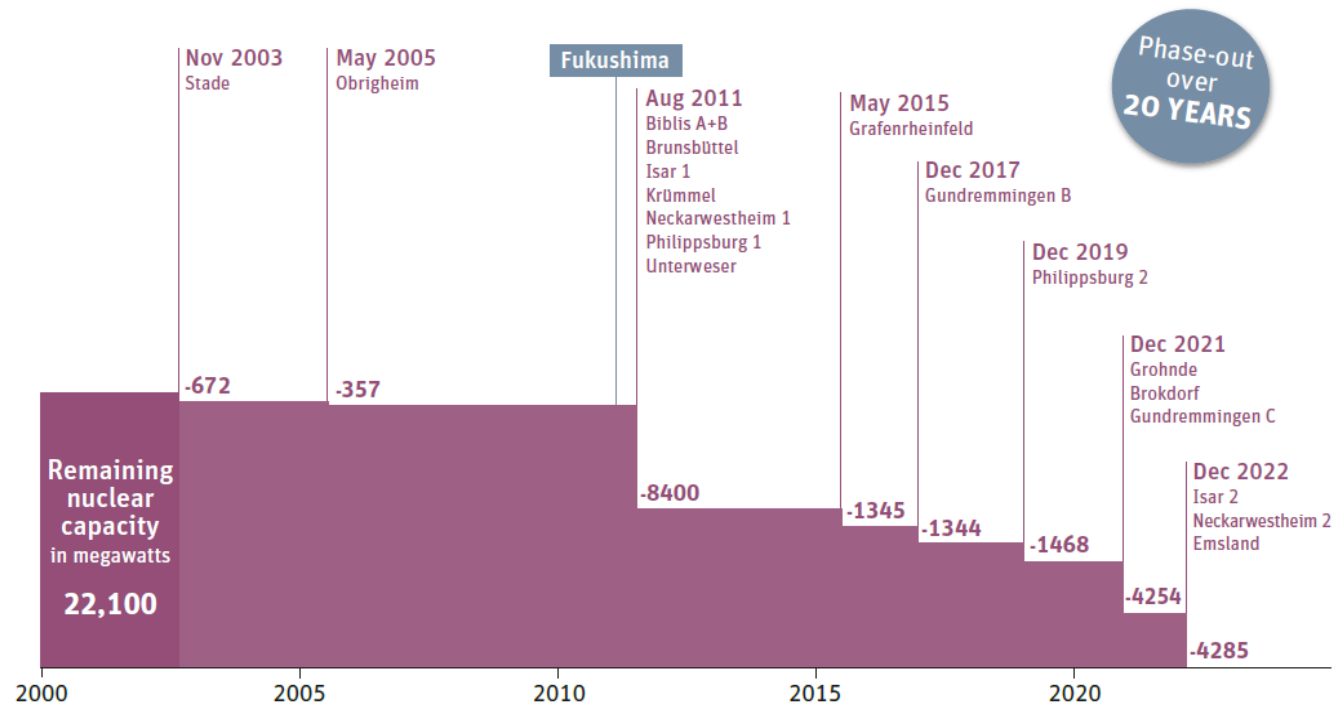


The
Energiewende
did not start with Fukushima

Germany is gradually shutting down all nuclear power plants

Declining nuclear energy installed capacity in Germany, 2000–2022

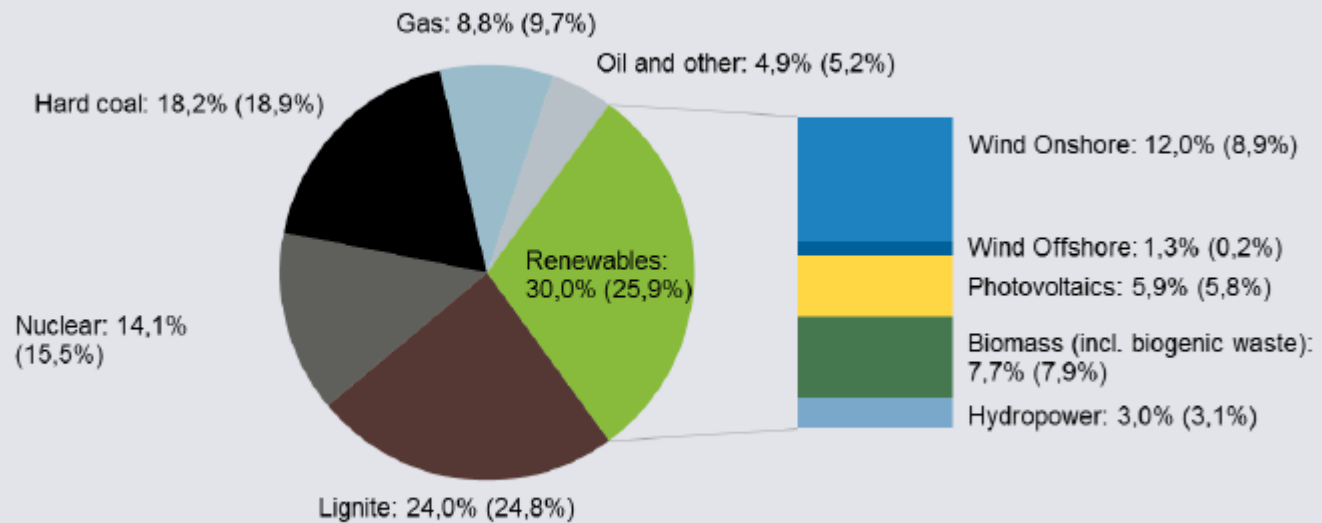
Source: Institute of Applied Ecology, BMJ, own calculations



Phase-out over 20 YEARS

Renewables are Germany's single biggest power resource

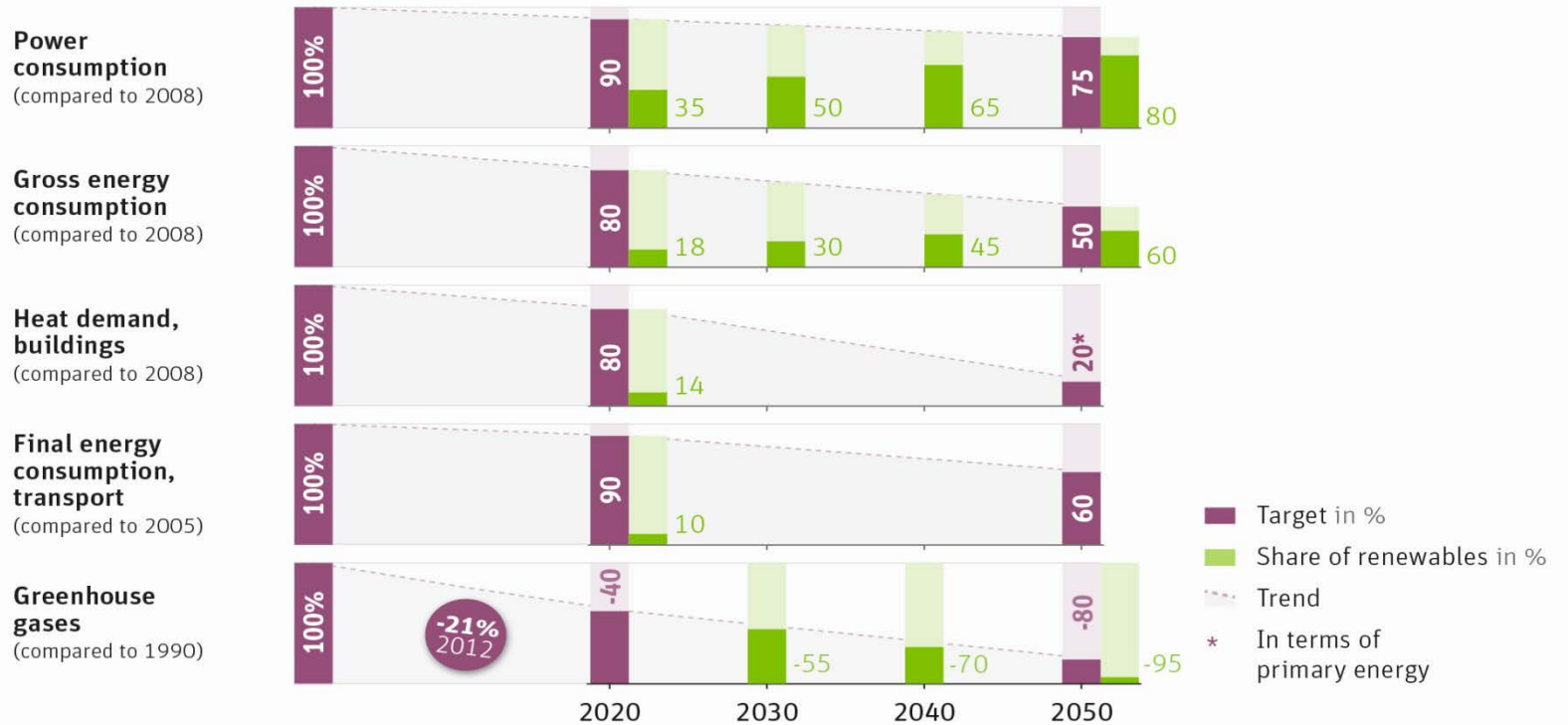
2015 power mix (2014 values in brackets)



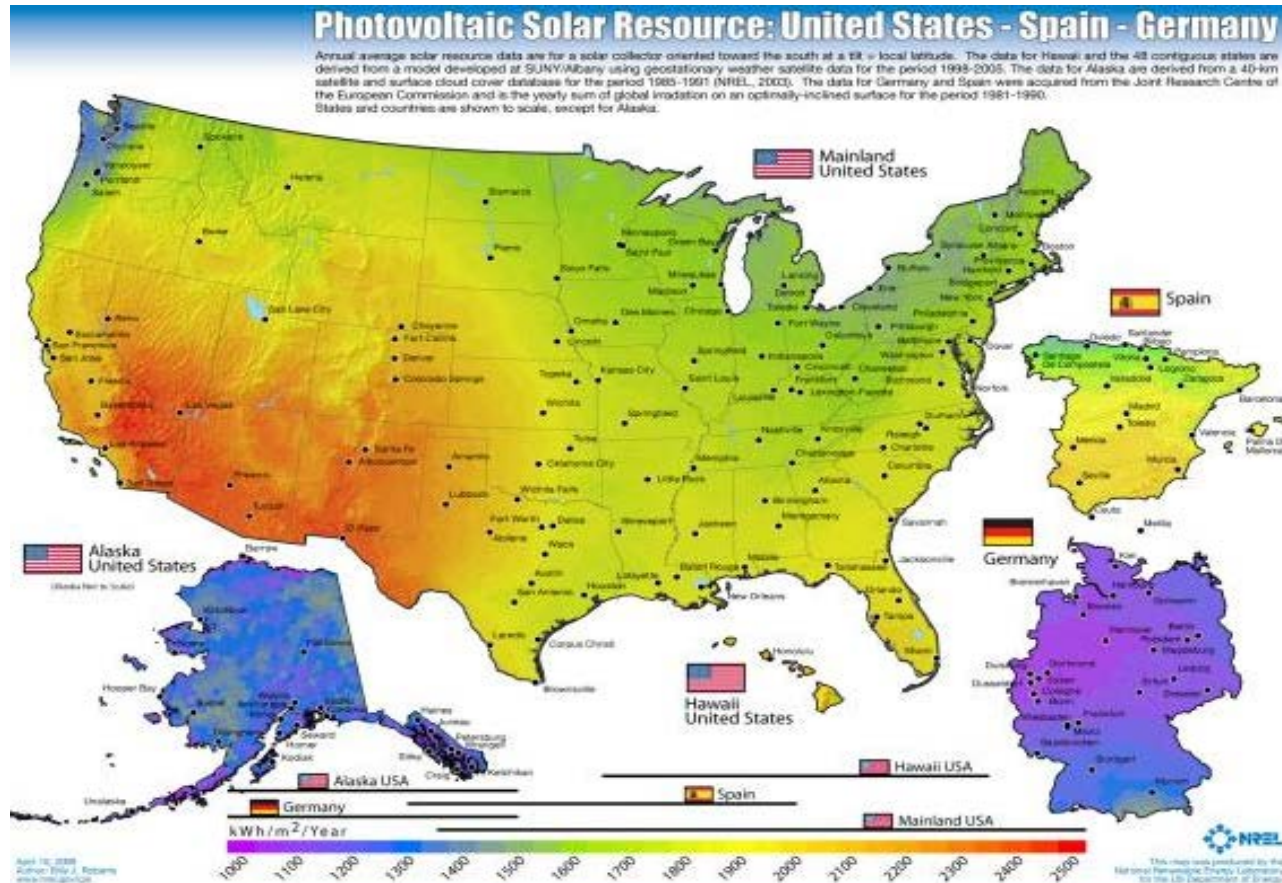
German energy transition: high certainty with long-term targets

Long-term, comprehensive energy and climate targets set by the German government in 2010

Source: BMU



Why is Germany undergoing the energy transition?



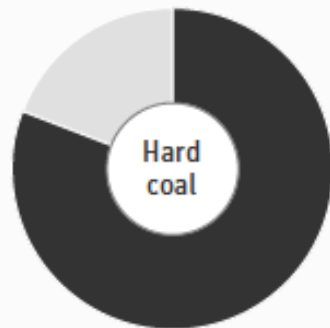
A map of the relative direct solar-energy availability in the United States, Spain, and Germany. Red = highest, purple = lowest.

Illustration courtesy of the National Renewable Energy Laboratory.

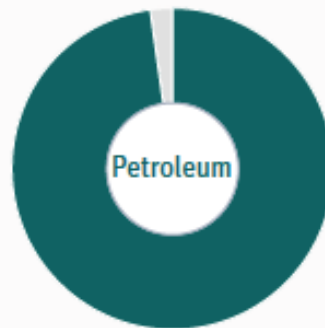
More renewables strengthen Germany's energy security

Share of imports of conventional energy sources in Germany 2012

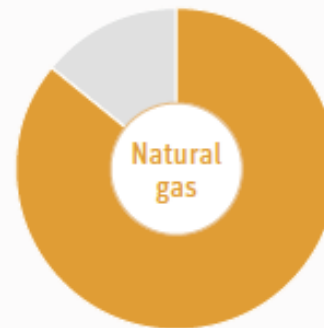
Source: BMWi



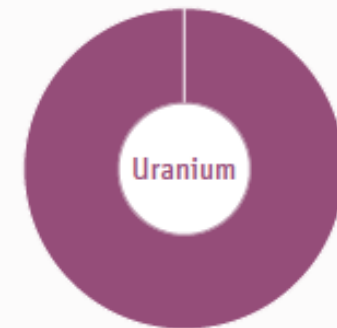
81%



98%



86.0%

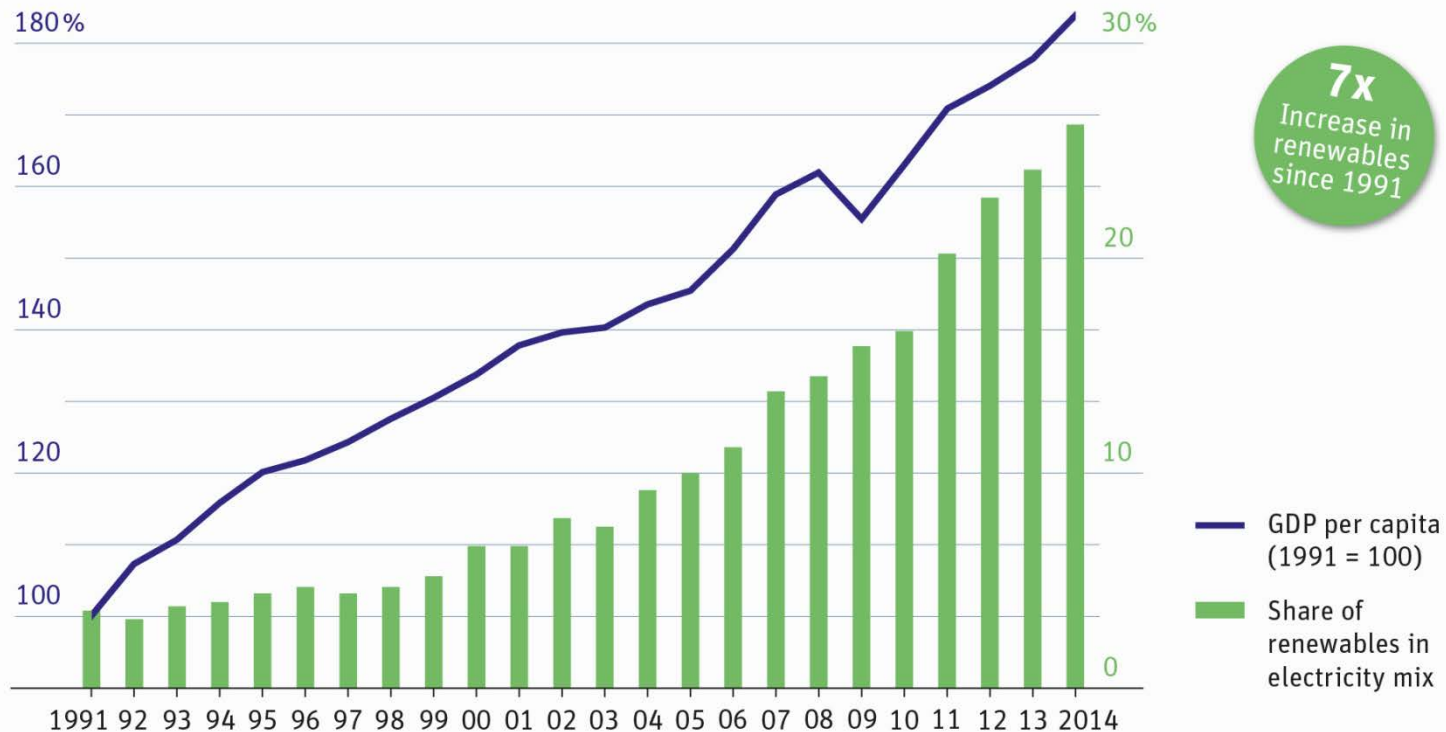


100.0%

Renewables do not hurt Germany's economy

Gross Domestic Product and share of renewables in power generation from 1991–2014, Germany

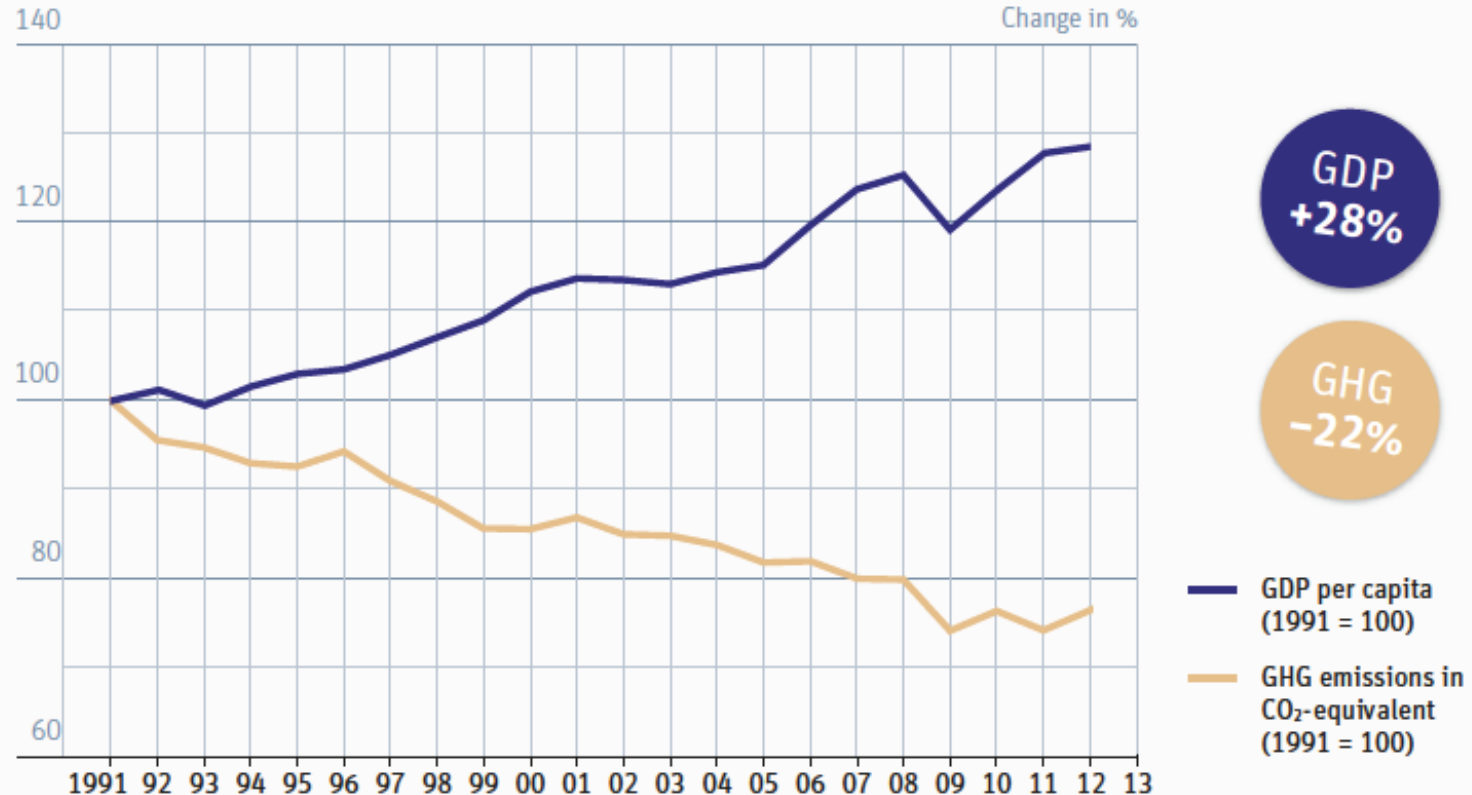
Source: BMWI, AG Energiebilanzen, Destatis



Germany: growing economy, declining emissions

Change of Gross Domestic Product (GDP) and Greenhouse Gas (GHG) emissions in Germany, 1991–2012

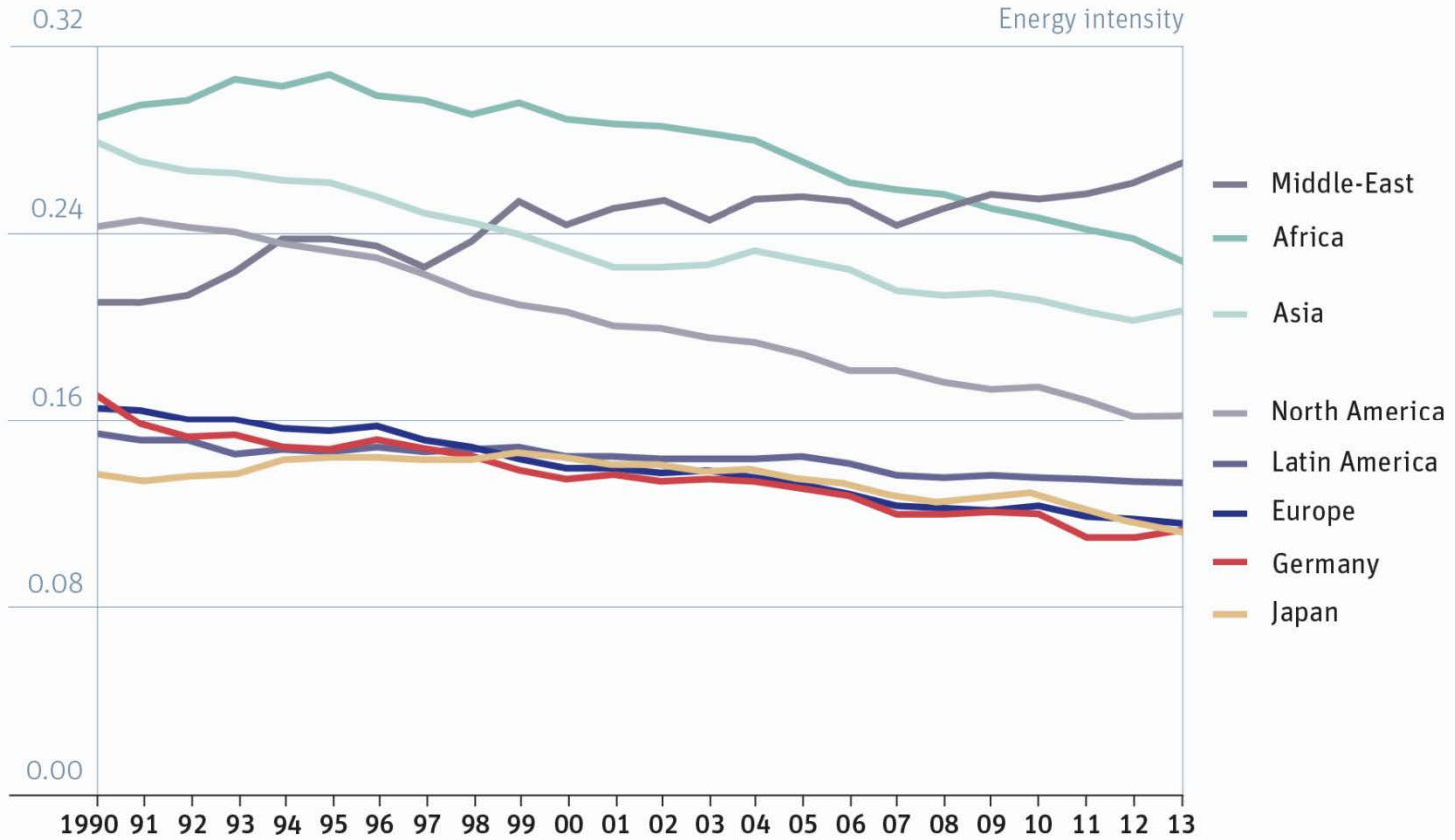
Source: BMU, BMWi, Destatis



Germany continues to produce more GDP with less energy

Energy intensity (=energy use per unit of GDP) of different world regions, 1990-2013

Source: Enerdata Yearbook



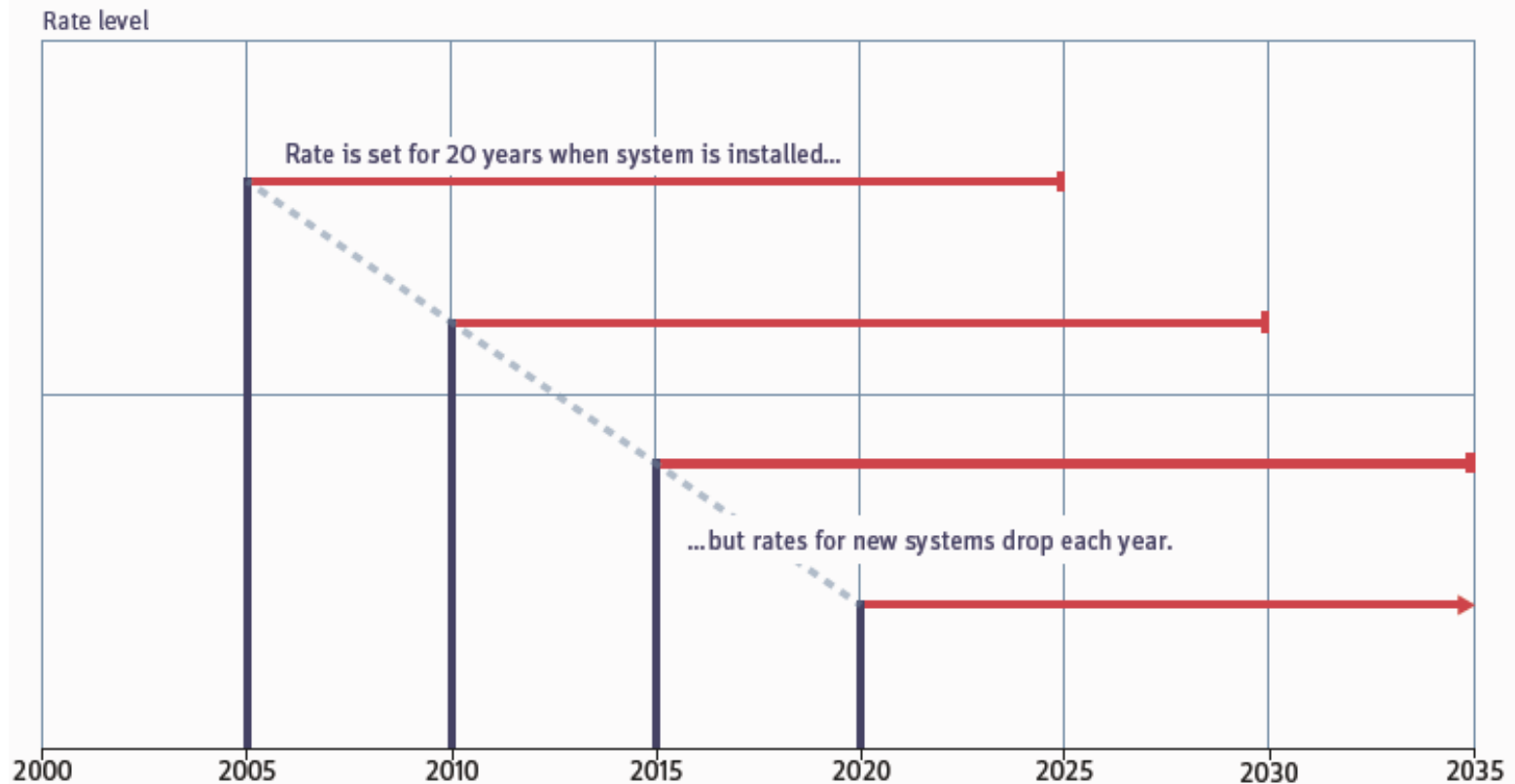
How? Feed-in Tariffs (FIT) – High investment certainty for renewable energy (first phase)

- 1. Fixed payments for 20 years
(depending on technology and size) eliminate risks to investors and banks**
 - 2. Guaranteed grid access
Rewarding renewable electricity production, not investment; open for all citizens; not a government subsidy**
- > This has provided market access for all renewables, giving them a fair share to enter the market and become competitive.**

Feed-in tariffs provide investment certainty and drive costs down

Simplified generalization of feed-in tariff with 20 year duration

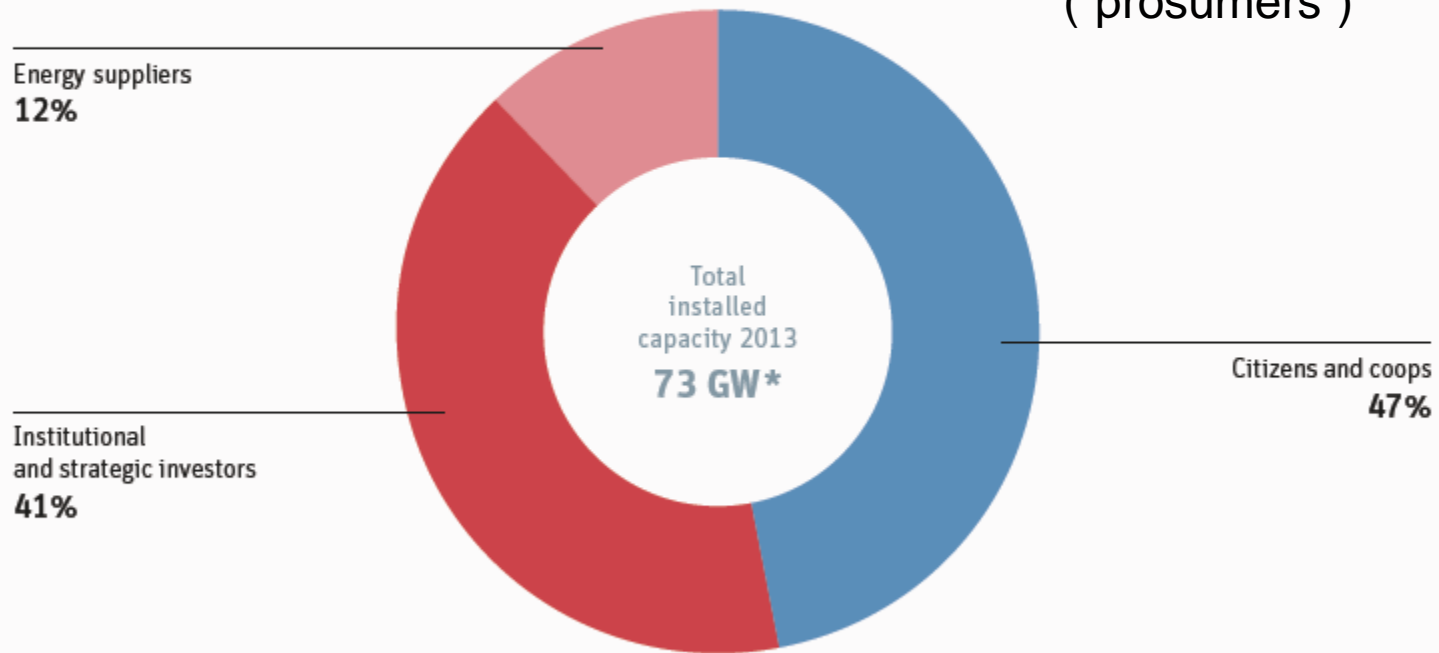
Source: Own estimates based on WFC



German energy transition is a democratic movement

Ownership of renewables in 2012

Source: AEE, www.unendlich-viel-energie.de

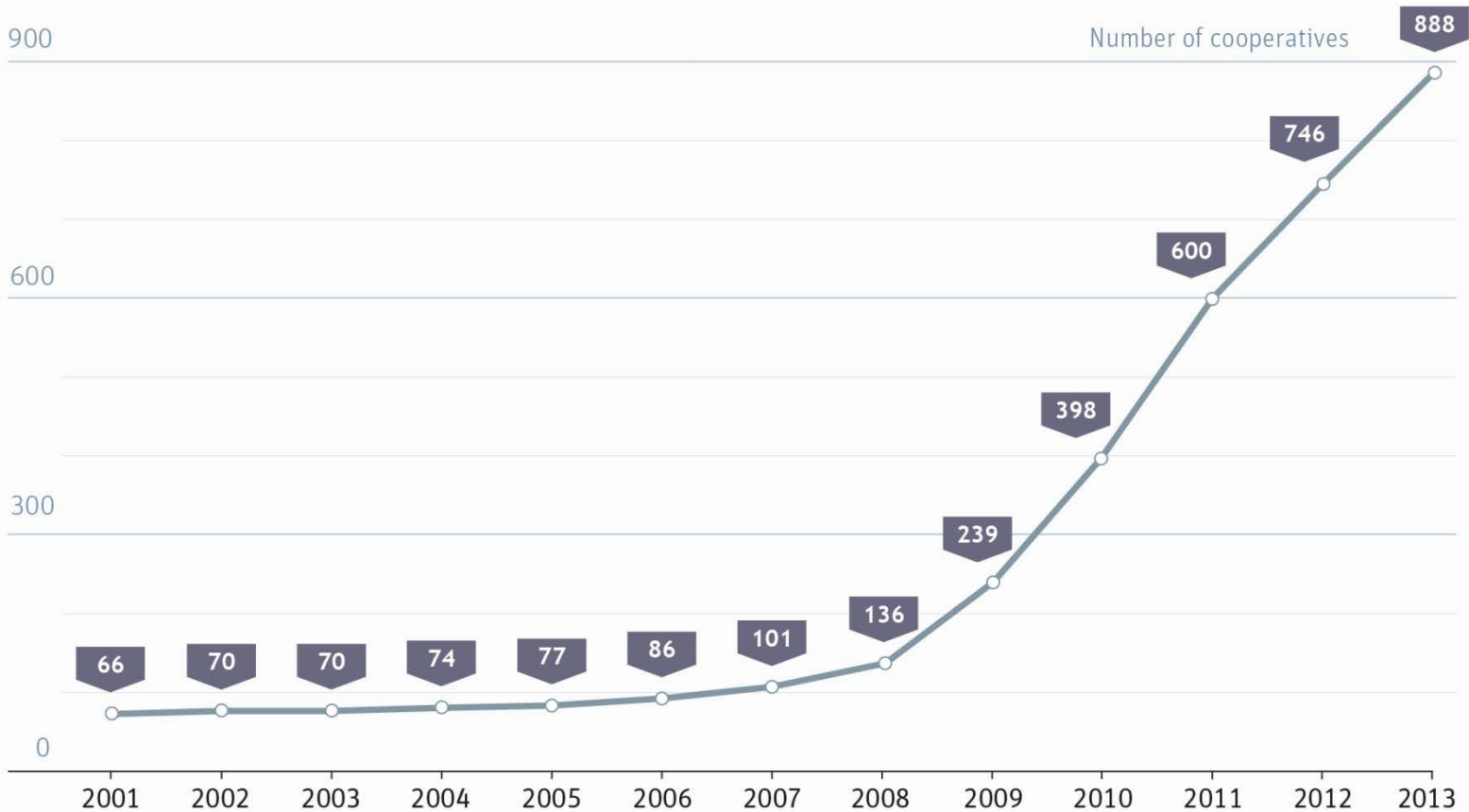


* excluding PSW, offshore wind, geothermal and bio-mass

Citizens form cooperatives to drive the energy transition

Number of energy cooperatives in Germany, 2001-2013

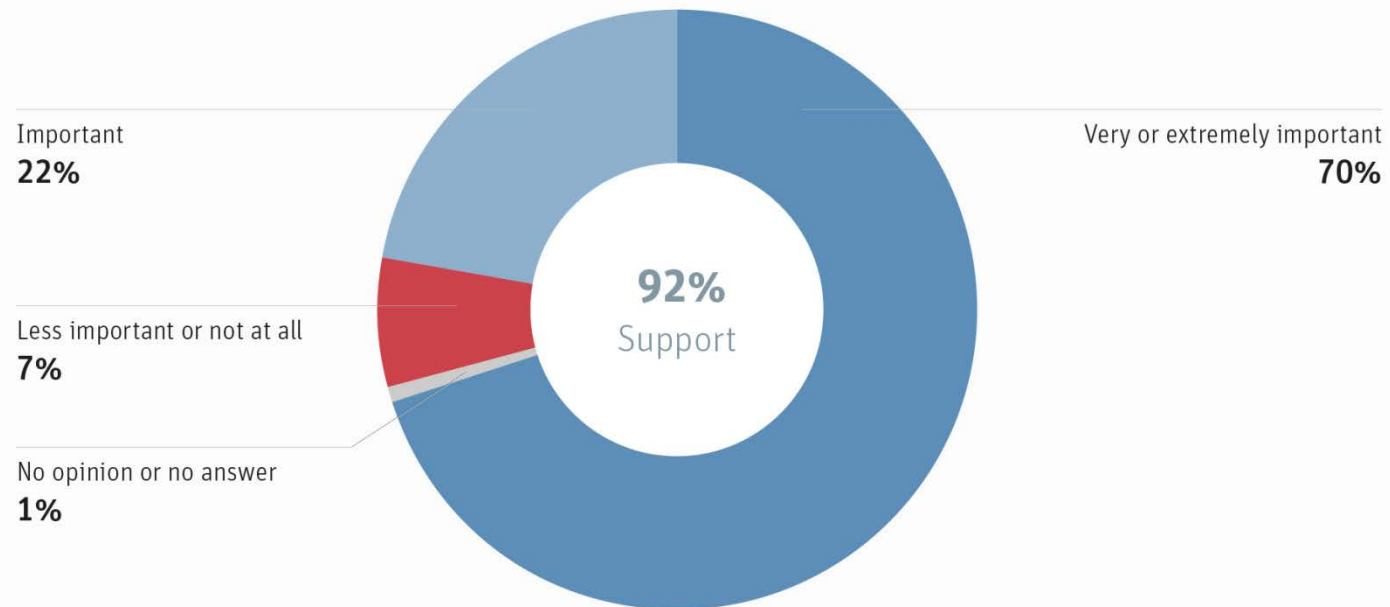
Source: www.unendlich-viel-energie.de



92 percent of Germans support further growth of renewables

"The use and growth of renewable energy is ...", survey from October 2014

Source: VZBZ



Grid reliability and renewable growth seem to go hand in hand

Minutes of power outages per year (excl. exceptional events), based on Saidi

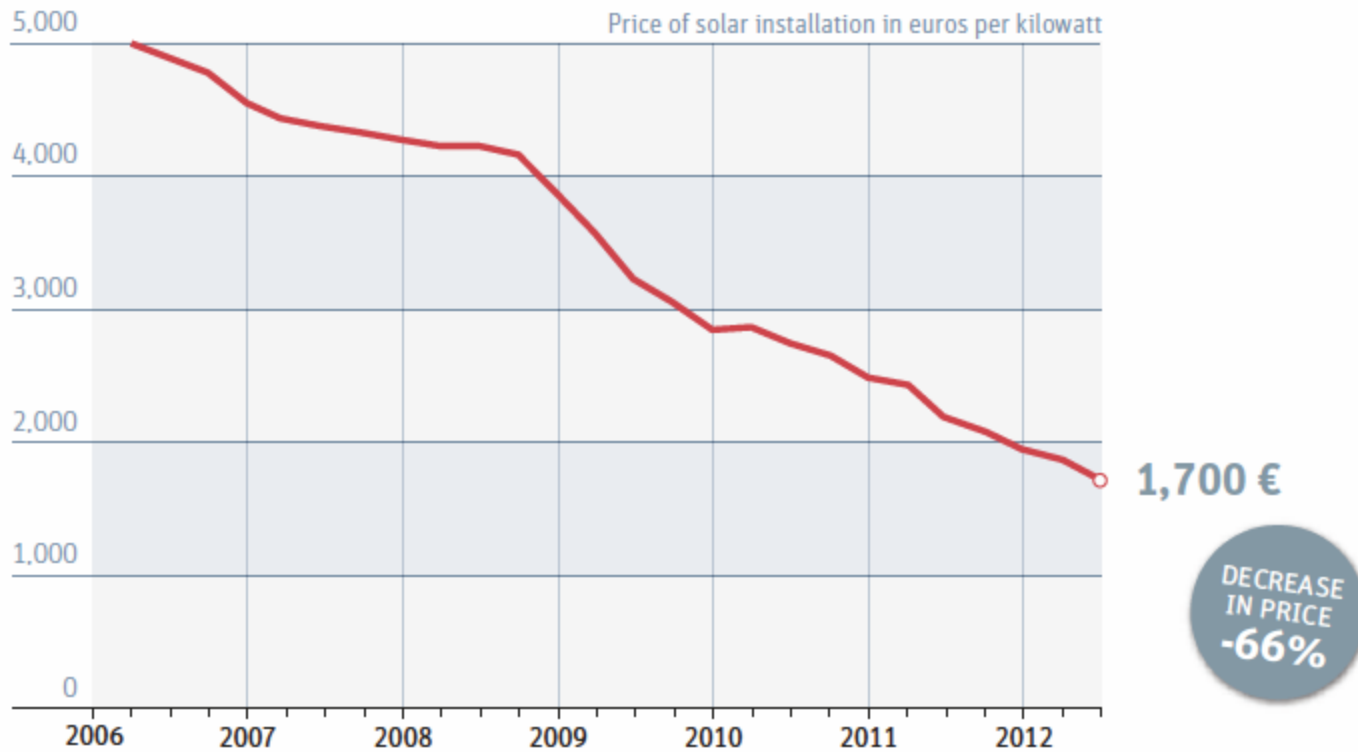
Source: CEER and own calculations



Price of solar down in Germany by 66% since 2006

Average system price for installed rooftop solar of up to 100 kilowatts

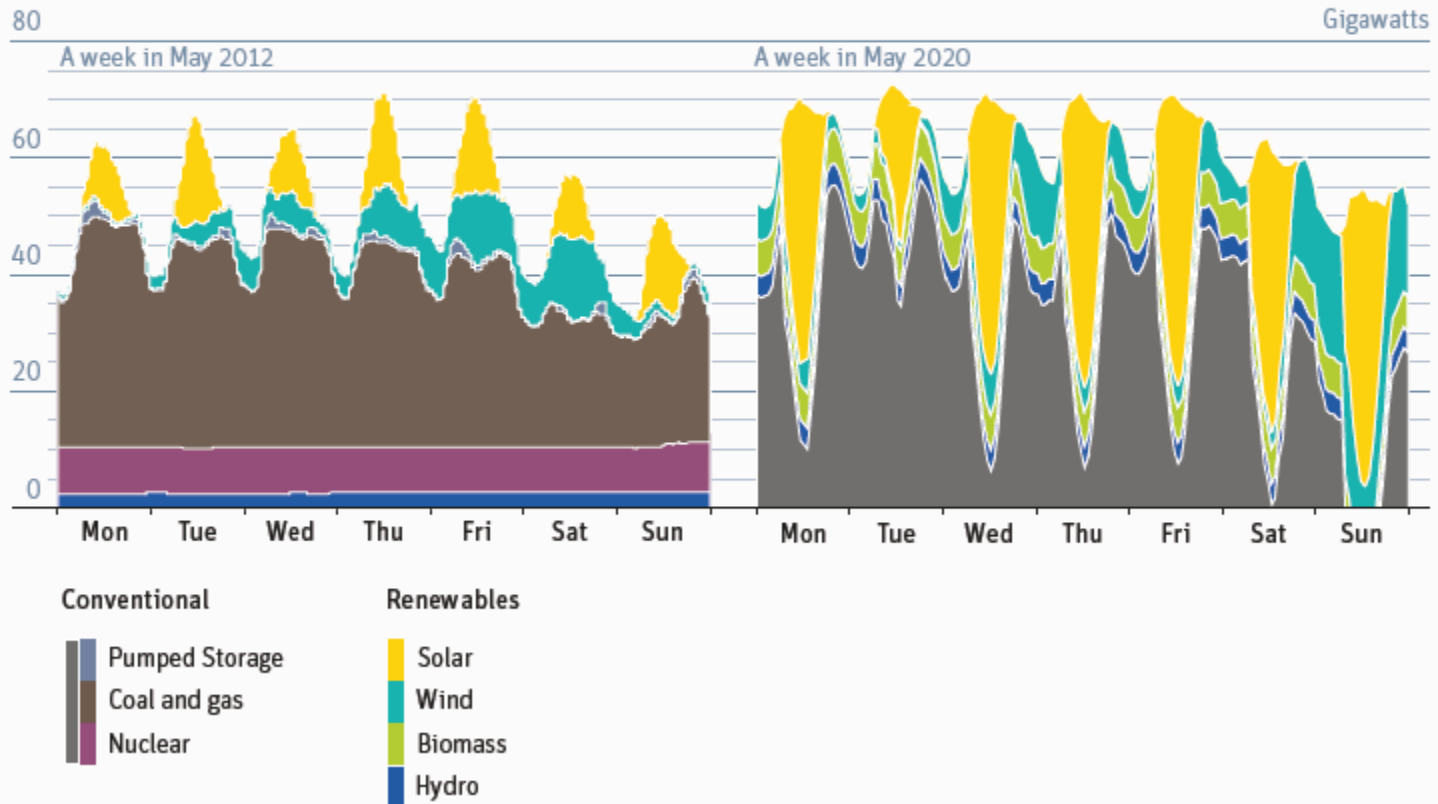
Source: EUPD Research and BSW-Solar



Renewables need flexible backup, not baseload

Estimated power demand over a week in 2012 and 2020, Germany

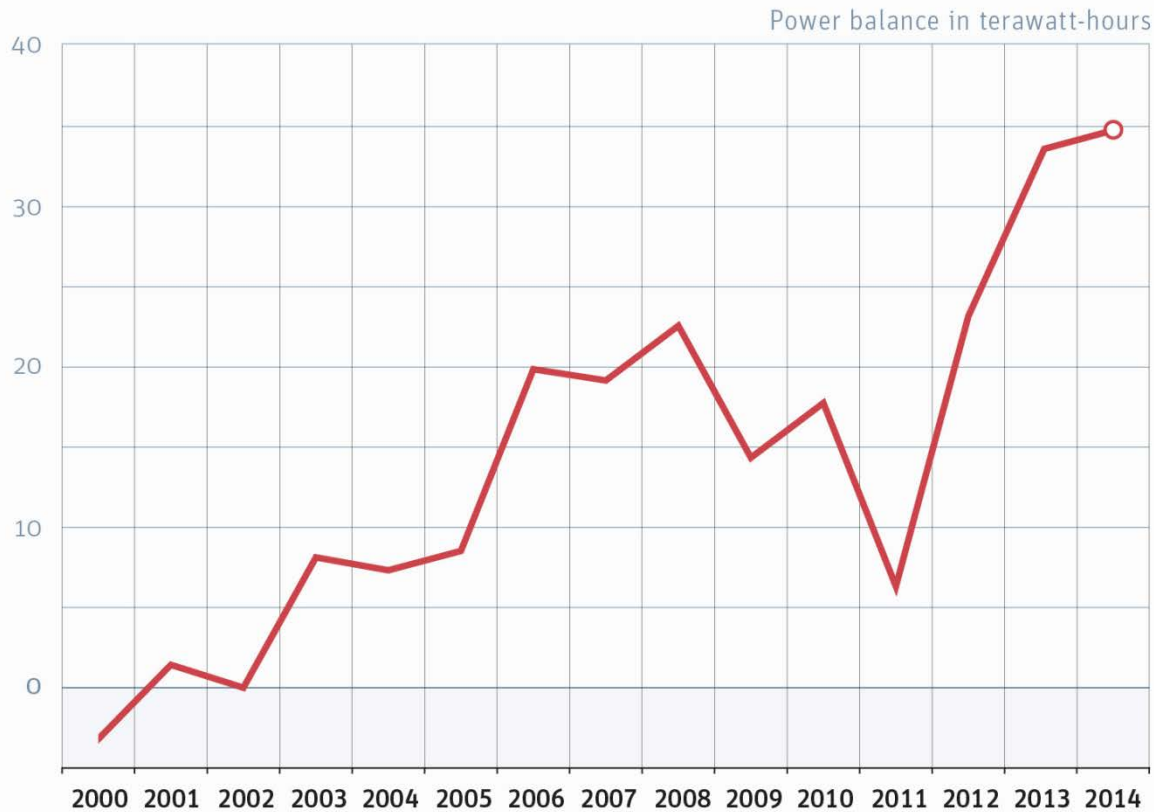
Source: Volker Quaschnig, HTW Berlin



German power exports continue to rise

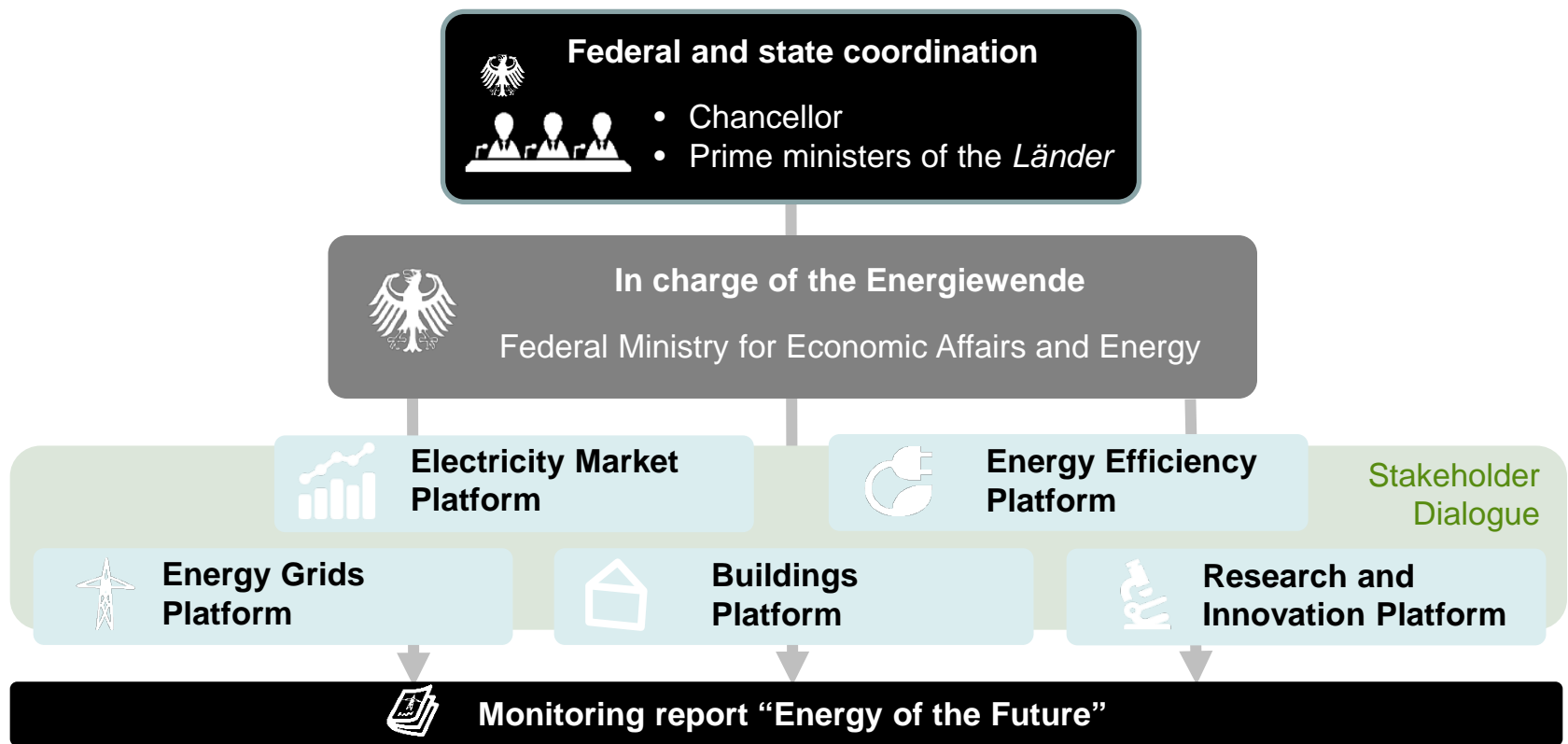
Net power exports from 2000-2014 in TWh.

Source: Agora Energiewende, AGEB



RECORD
NET EXPORT
BALANCE
+34 TWh

Central steering of the *Energiewende*



What are the main characteristics of the German energy transition?

- 1. ...there is an all-party agreement that climate change is real and needs to be addressed;**
- 2. ...there is broad support to switch to a renewable energy economy (priority for RE, no nuclear power);**
- 3. ...the energy policies are geared not towards large corporations, but SME and citizens which are driving the energy transition.**

...yet some challenges remain (second phase):

- 1. How to build new infrastructure in form of smart new power grids (north-south) and storage systems;**
- 2. How to coordinate the expansion of renewables while controlling the costs (from feed-in tariffs to auctions);**
- 3. How to coordinate renewable power production and distributive generation with the rest of the power system, particularly fossil fuels;**
- 4. How to continue limiting national CO2 emissions effectively (coal);**
- 5. How to think beyond *just* electricity (energy efficiency, transportation, heating);**
- 6. How to coordinate the *Energiewende* with European neighbors and into the Energy Union.**

Thank you!

German Energy Transition

Arguments for a renewable energy future.



Rebecca.Bertram@us.boell.org
www.energytransition.de

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EU Energy Policy: 2030 Goals

- **Climate:** A reduction in EU greenhouse gas emissions of at least 40% below 1990 levels
- **Renewables:** 27% of EU energy consumption to come from renewable resources
- **Efficiency:** No target yet

EU Energy Policy: 20-20-20

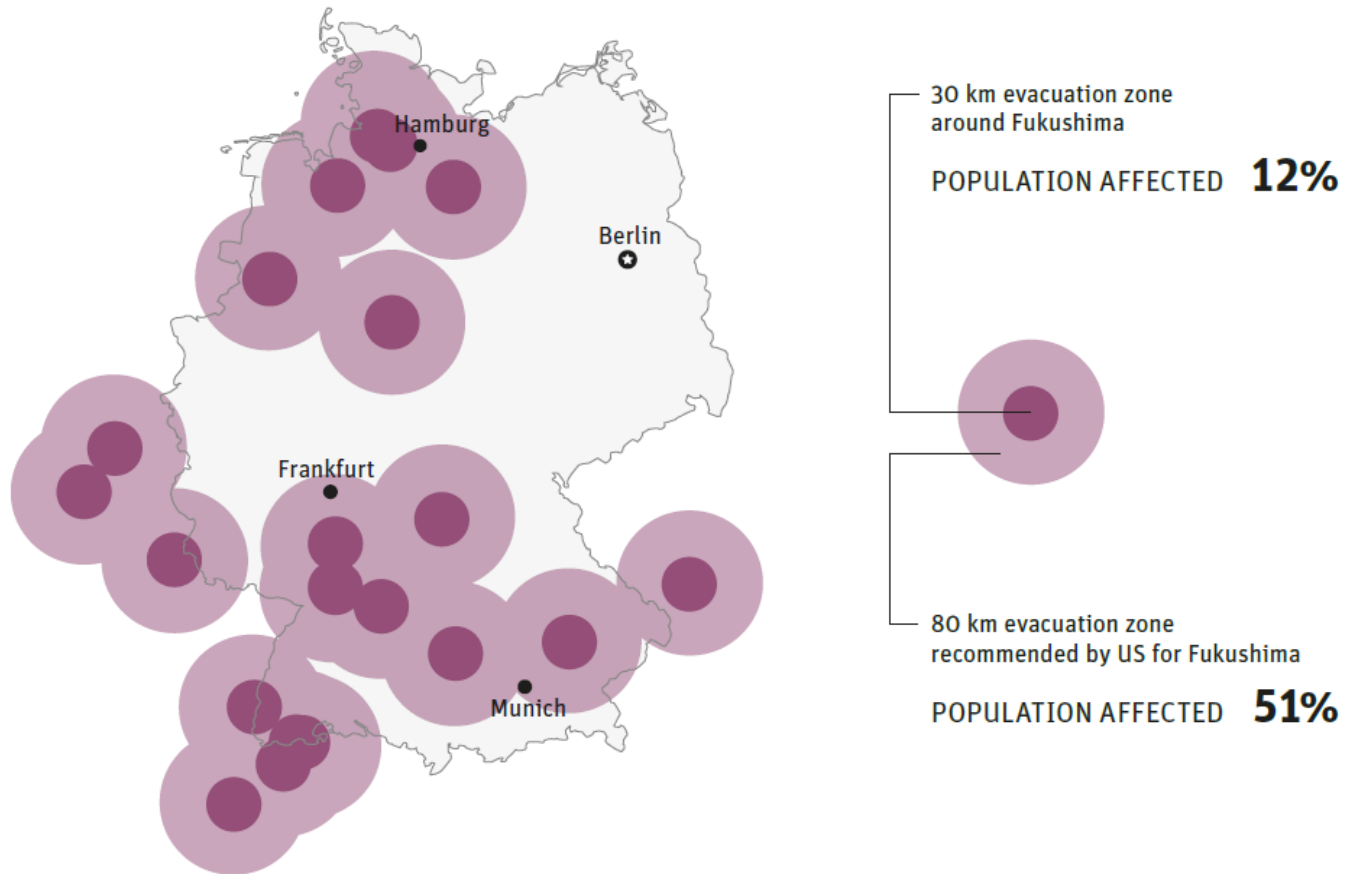
- **Climate:** A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels (e.g. Germany minus 40%)
- **Renewables:** 20% of EU energy consumption to come from renewable resources (e.g. Germany 18%)
- **Efficiency:** A 20% reduction in primary energy use compared with projected levels

Principle: effort sharing

Recognizing the danger of nuclear power

30/80 km zones around nuclear reactors in Germany and nearby reactors of neighbouring countries

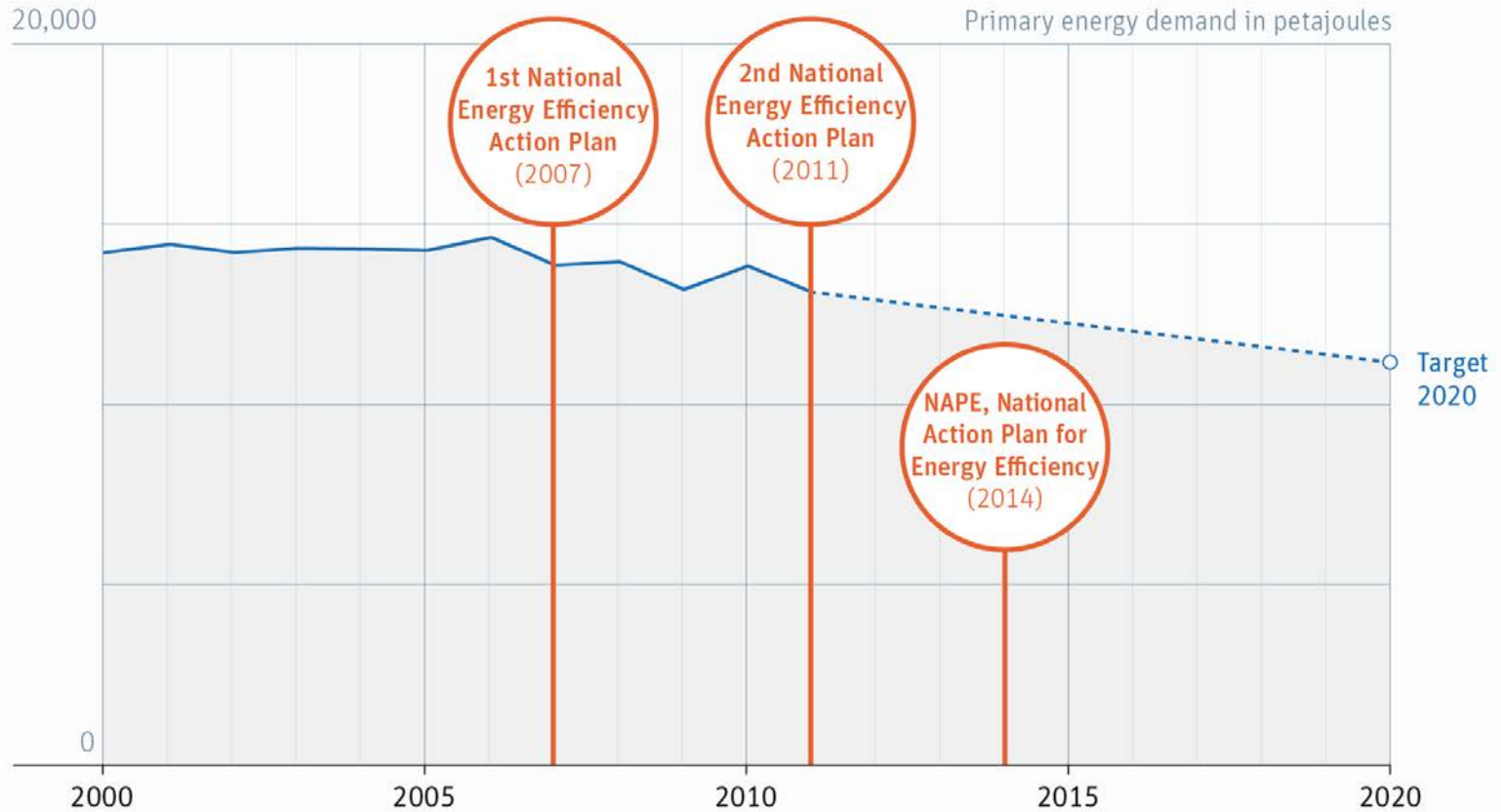
Source: <http://opendata.zeit.de/atomreaktoren>



Germany's plan: drive down energy demand

Primary energy demand in Germany, 2000-2020

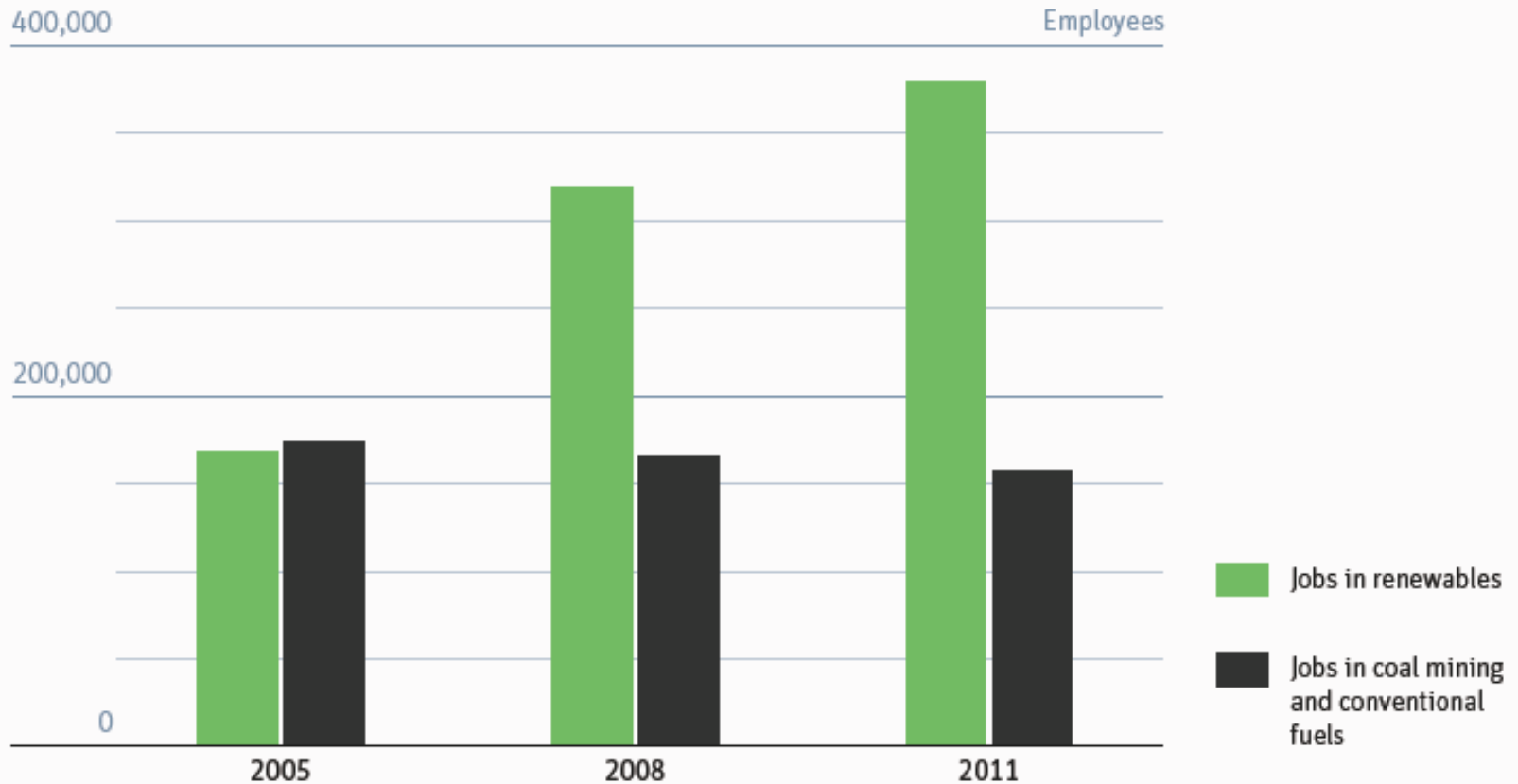
Source: AGEB, BMWi



Renewables create more jobs than conventional energy does

Employment in Germany in renewable and conventional energy sectors, 2005-2011

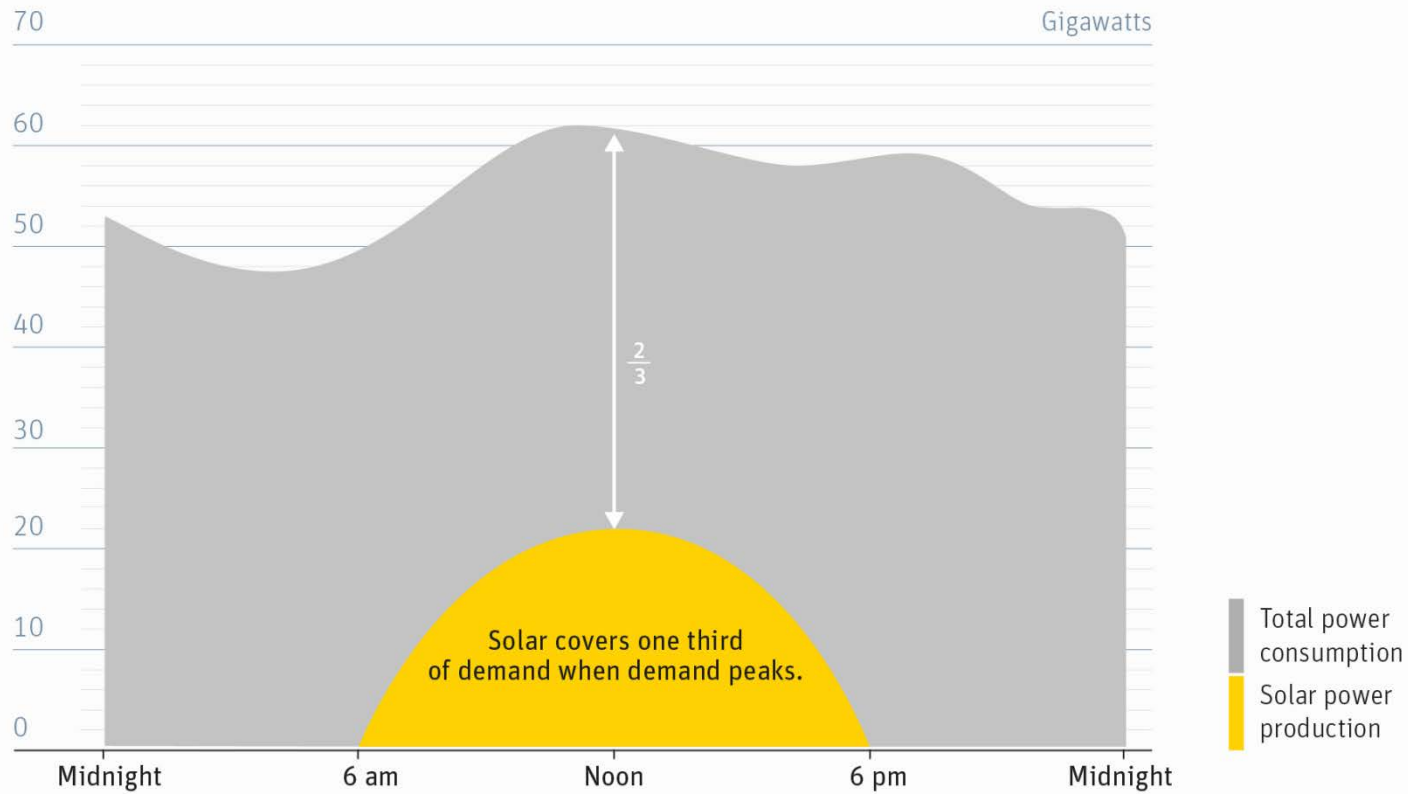
Source: BMU, BMWi



Solar PV can already cover a third of peak power demand

Power demand and solar power production in Germany. Estimate based on actual data from May 2012

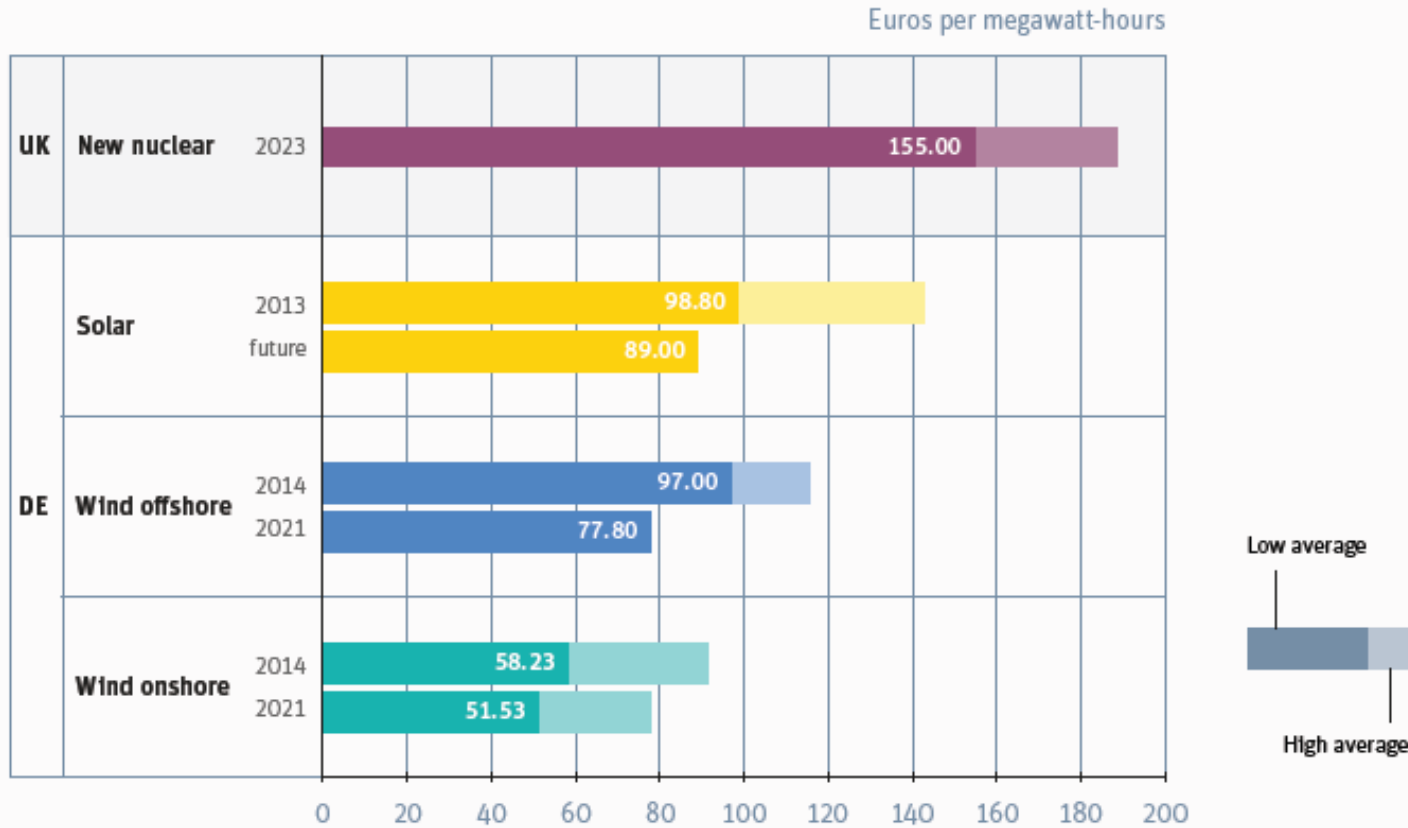
Source: Fraunhofer ISE, EEX



Price of new nuclear already higher than solar and wind

FITs for current and future solar and wind in Germany with strike price for nuclear at Hinkley

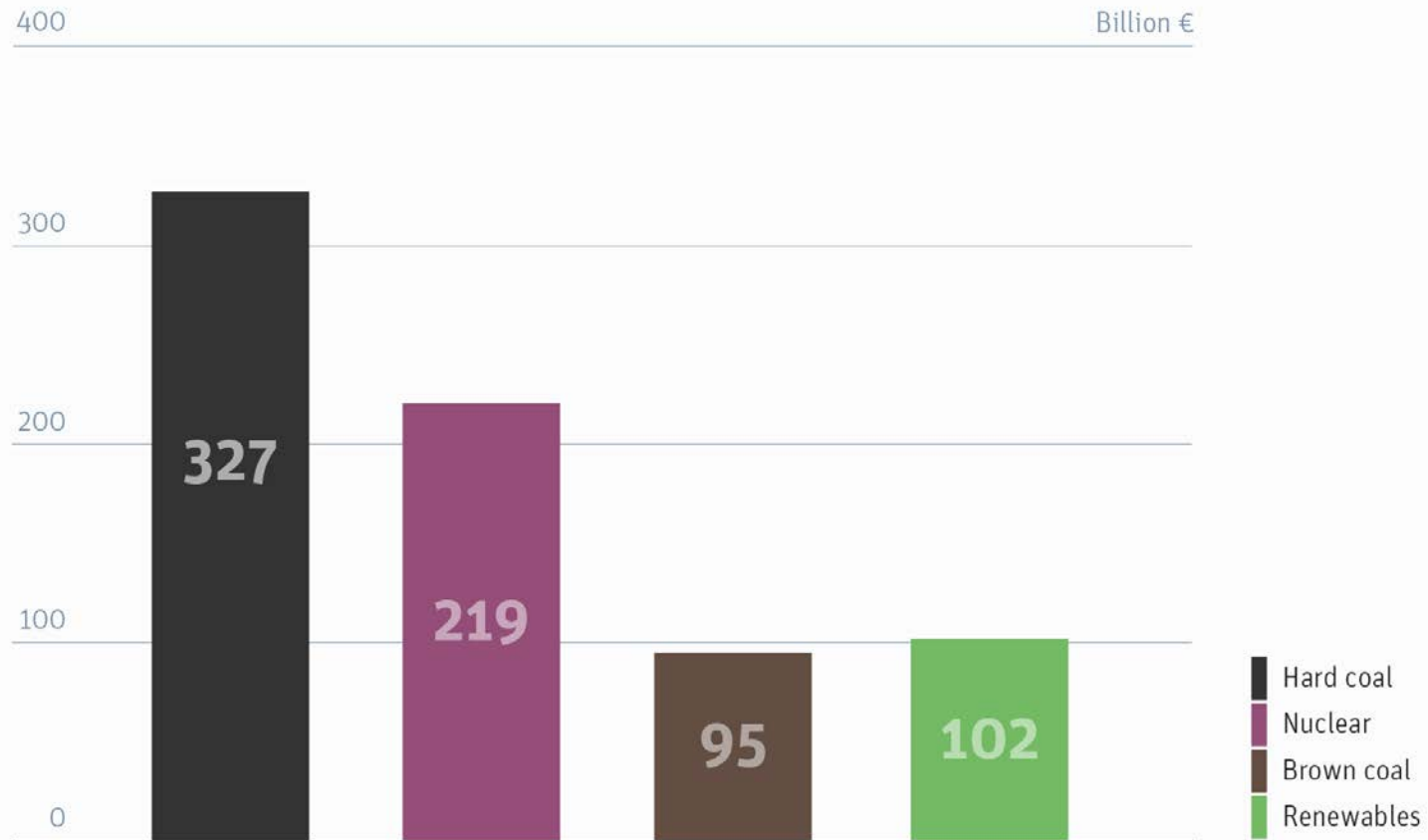
Source: Thomas Gerke, DECC, Agora Energiewende



Fossil and nuclear have received by far more subsidies than renewables

Energy subsidies in Germany, 1970-2014

Source: *Was Strom wirklich kostet*, FÖS, 2015



Renewable energy offsets expenses for fossil fuel imports

Benefits of renewables in energy use, Germany

Source: AEE

