

Energy Future: Possible Transformation

by

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on the occasion of

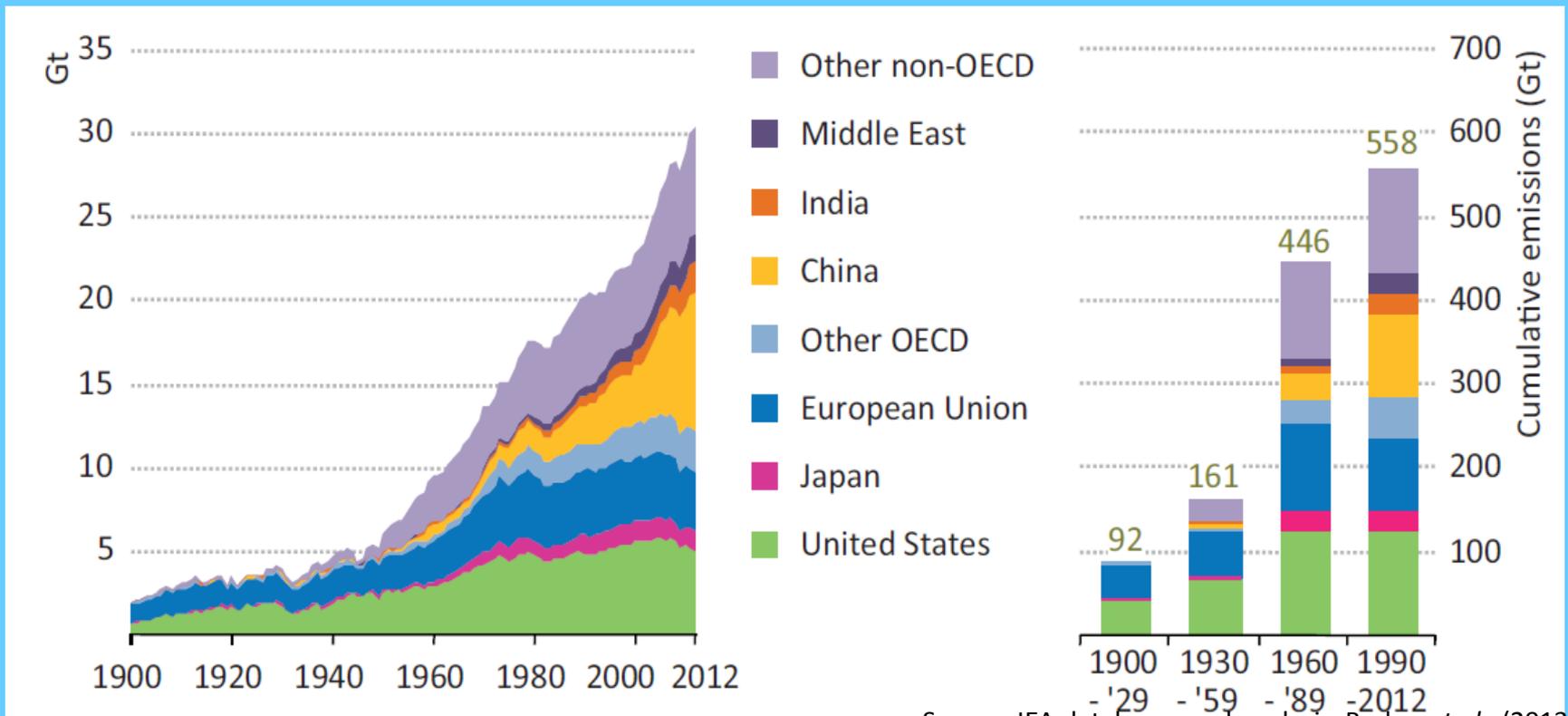
**10th Edition of Environment and Energy Conclave
„The Transforming Face of Energy –
A Convergence towards Sustainability“**

Kolkata

23rd and 24th August 2017

What are the needs for transformation?

GHG emissions from energy sector by region, 1990 – 2012



Source: IEA databases and analysis, Boden *et al.*, (2013).

CO₂ – Concentration in the atmosphere

Period 2010 – 2016

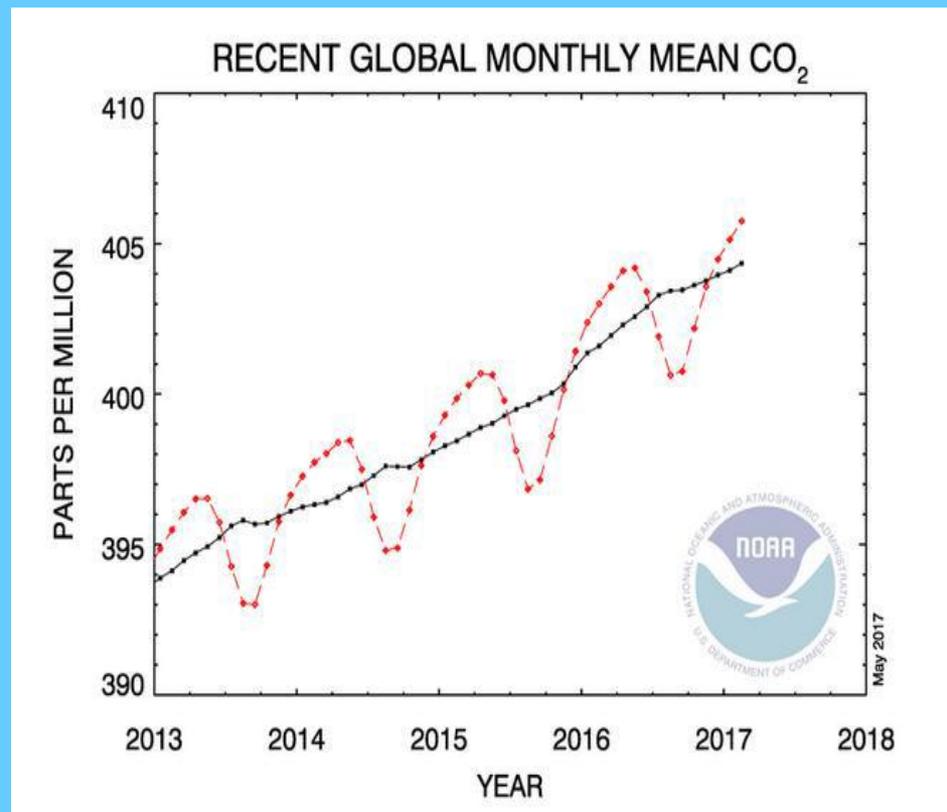
CO₂ concentration in the Atmosphere:

2010: 389 ppm

2016: 404 ppm

2010: 39% above pre-industrial level

2016: 44% above pre-industrial level



Consumption trends are not sustainable

IEA, World Energy Outlook – **reference** scenario:

- **Global primary energy consumption to rise by more than half up to 2030**
- **Share of fossil fuels in global energy consumption to increase up to 2030**
- **In 2030 the global energy balance will be dominated by oil and coal – use of natural gas increasing more slowly than previously expected – nuclear energy and biomass declining – strong increases**
- **Energy prices will rise sharply due to the excess demand**
- **Global energy-related CO₂ emissions to increase by 55 % up to 2030 – with over three quarters of this increase occurring in developing countries.**

**Are there economic reasons to
transform?**

Let's take Germany?

Facts and History

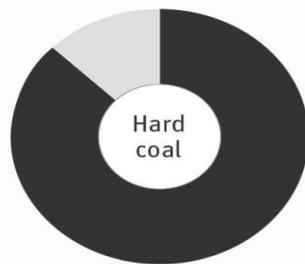
- **1950/60's: Germany has been a coal and steel society and economy**
- **Germany is poor of resources → dependence on imports of raw material and energy → possible threat to energy security**
- **Economic backbone: Engineering and Trade**
- **Strong dependence on exports → huge transfer of welfare from Germany to energy exporters**
- **geographical location in the centre of Europe – of major importance for our neighbours**

Germany heavily relies on fossil fuels import, which makes is vulnerable to external shocks

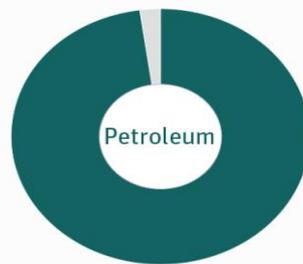
More renewables strengthen Germany's energy security

Share of imports of conventional energy sources in Germany, 2013

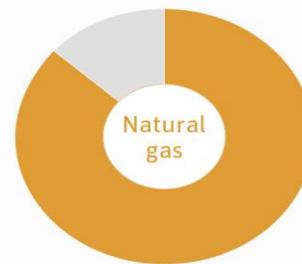
Source: BMWi



87.2%



97.7%



86.8%



100.0%

Through a 25y process Germany established long term targets for the required decarbonisation of the German society and economy

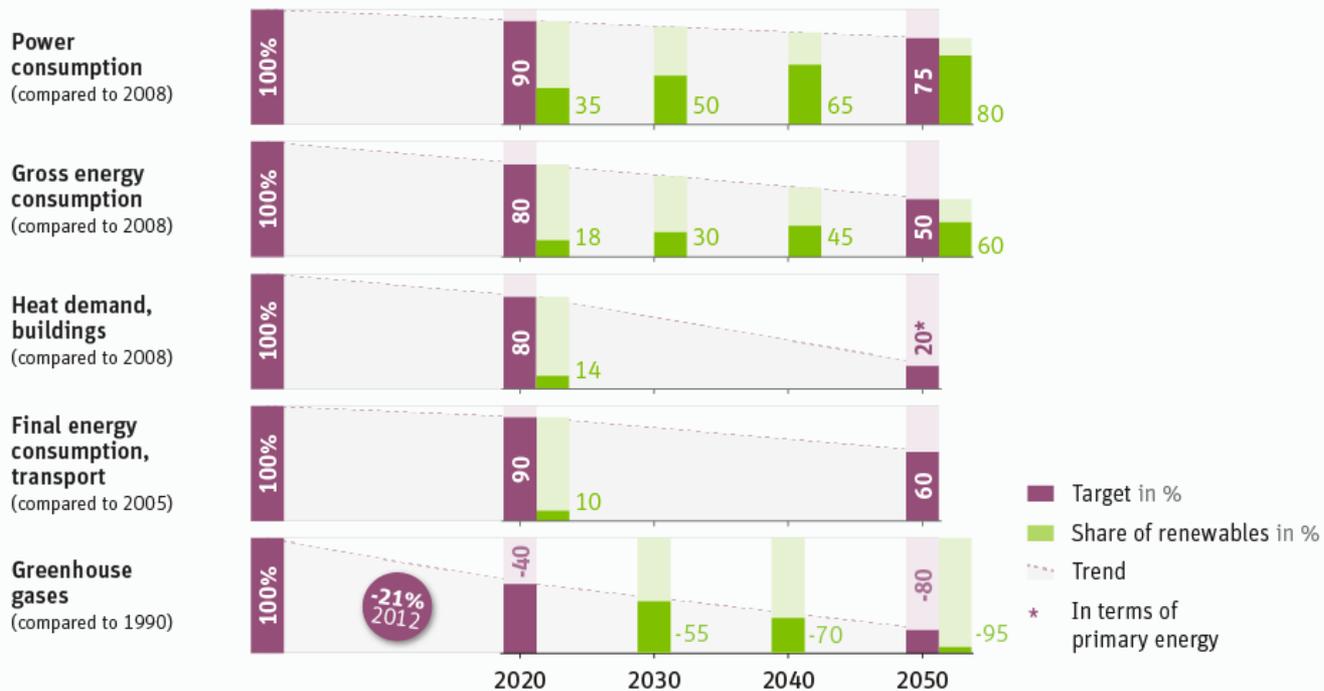
		2020	2030	2040	2050
Climate	Greenhouse gases (vs. 1990)	min. - 40%	min. - 55%	min. - 70%	min. - 80 to - 95%
	Share of electricity	min. 35% (2025: 40-45%)	min. 50% (2035: 55-60%)	min. 65%	min. 80%
Renewable energies	Overall share (Gross final energy consumption)	18%	30%	45%	60%
Efficiency	Primary energy consumption	- 20%			- 50%
	Electricity consumption	- 10%	- 25%		
	Energy consumption in buildings	20% heat demand	80% primary energy		

High certainty with long-term targets as policy goals for the German energy transition

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

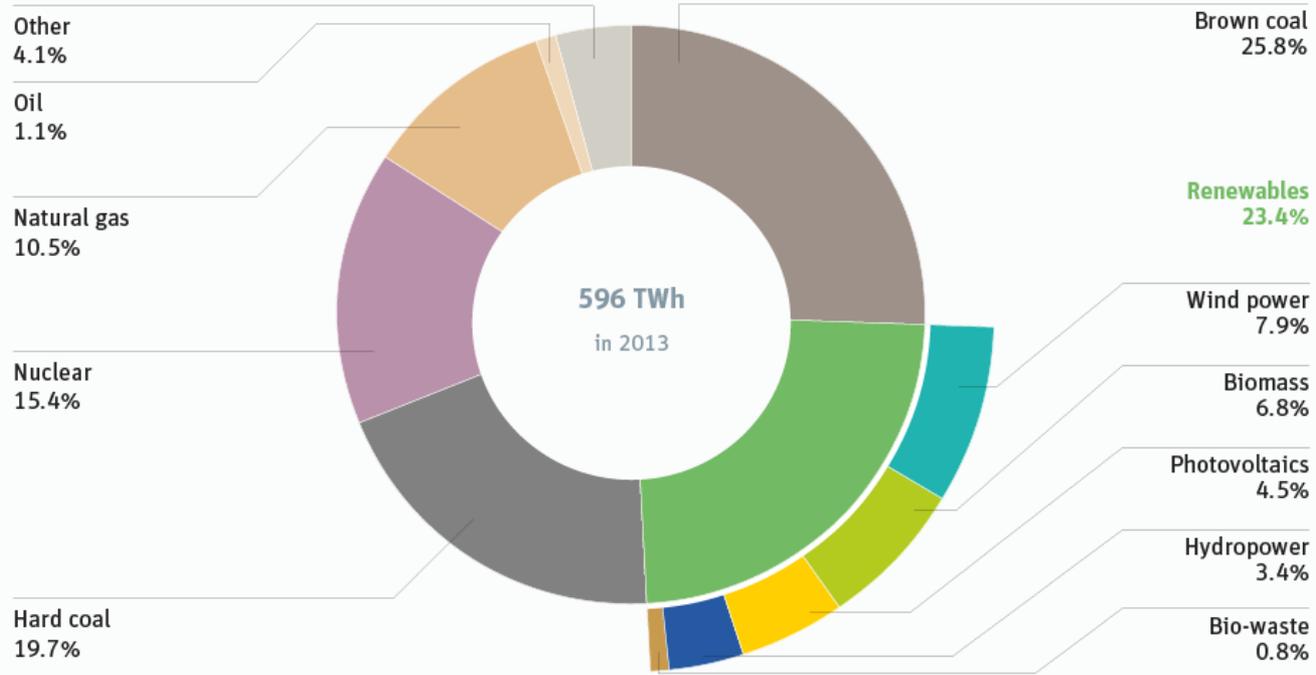


Renewables cover more than 30% of the power consumption in Germany

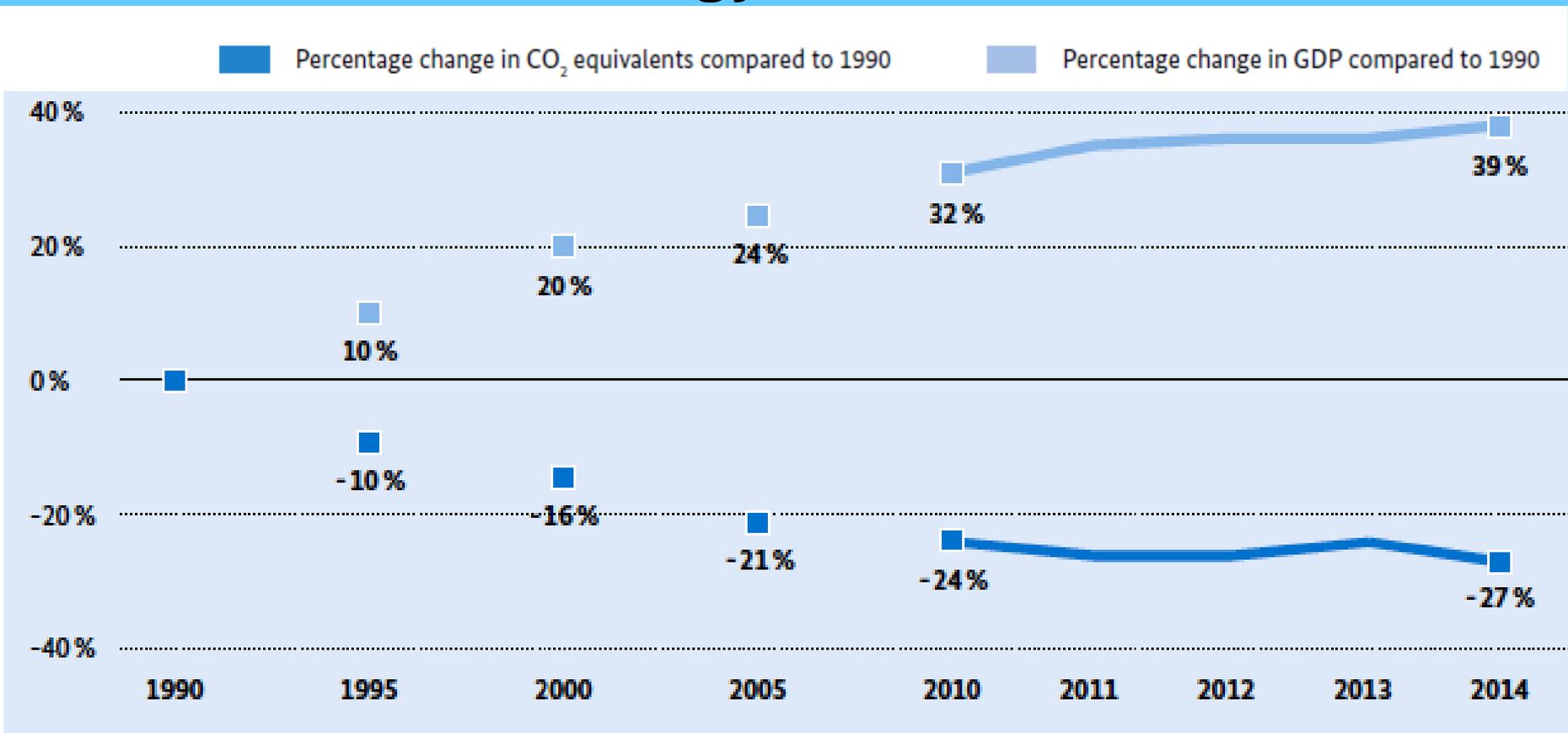
Renewables are a strong and growing pillar in power supply

Share of renewables in Germany's gross electricity generation including exports, 2013

Source: AGEB



Decoupling: Growing economy, reducing energy consumption, declining emissions – the role of energy and resource efficiency and switching energy sources



Source: <http://www.umweltbundesamt.de/presse/presseinformationen/treibhausgasausstoss-im-jahr-2013-erneut-um-12>
and Working Group on Energy Balances (Arbeitsgemeinschaft Energiebilanzen): Selected efficiency indicators for Germany's energy balance

Figures for 2014 based on preliminary data

**What does that mean for the energy
policy?**

Overarching targets

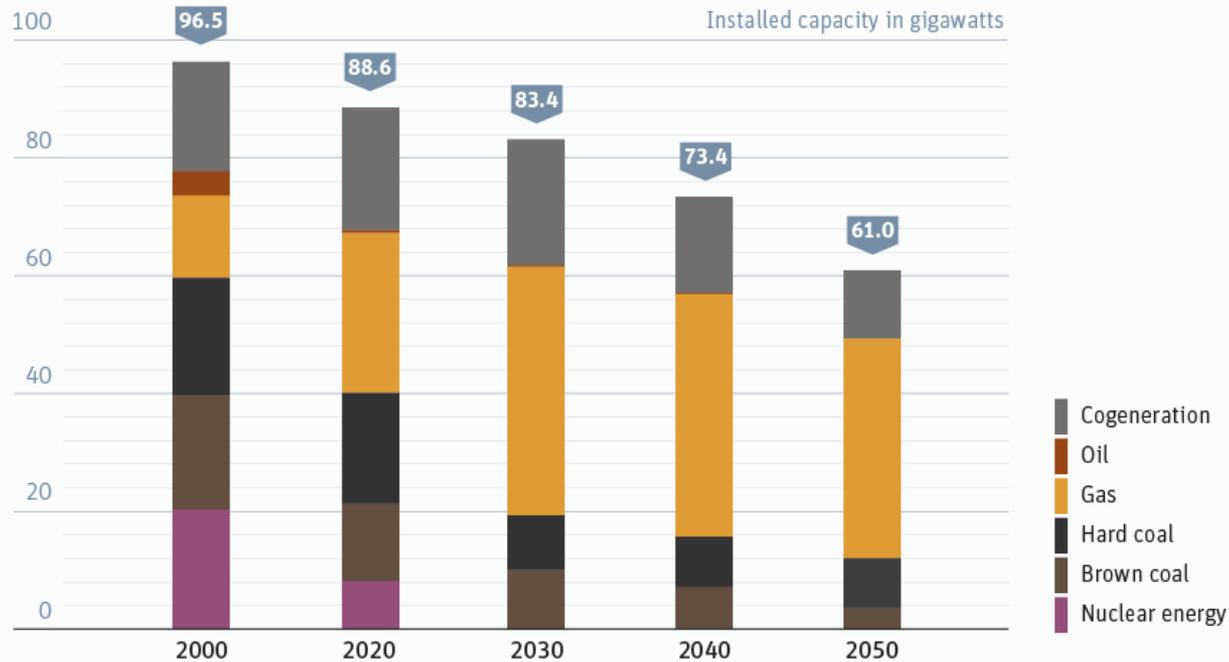
- **Energy security**
- **Affordability**
- **Environmental and Climate Protection**

Germany's plan: declining role for coal power

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Overall installed conventional electricity generation capacity, in Germany, 2000-2050

Source: Fraunhofer IWES

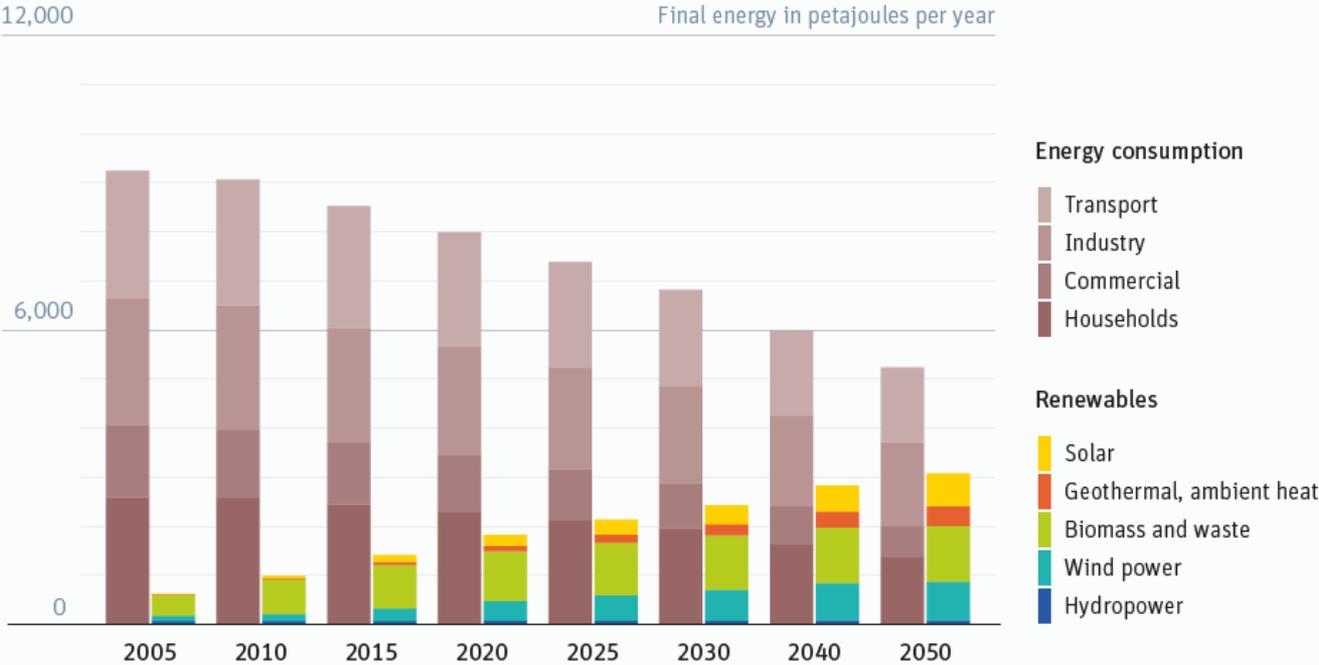


Germany`s plan: ramp up renewables, drive down at the same time energy consumption

Germany`s plan: ramp up renewables, drive down energy consumption

Final energy supply and demand in Germany 2005-2050, scenario

Source: DLR Lead Study, scenario A

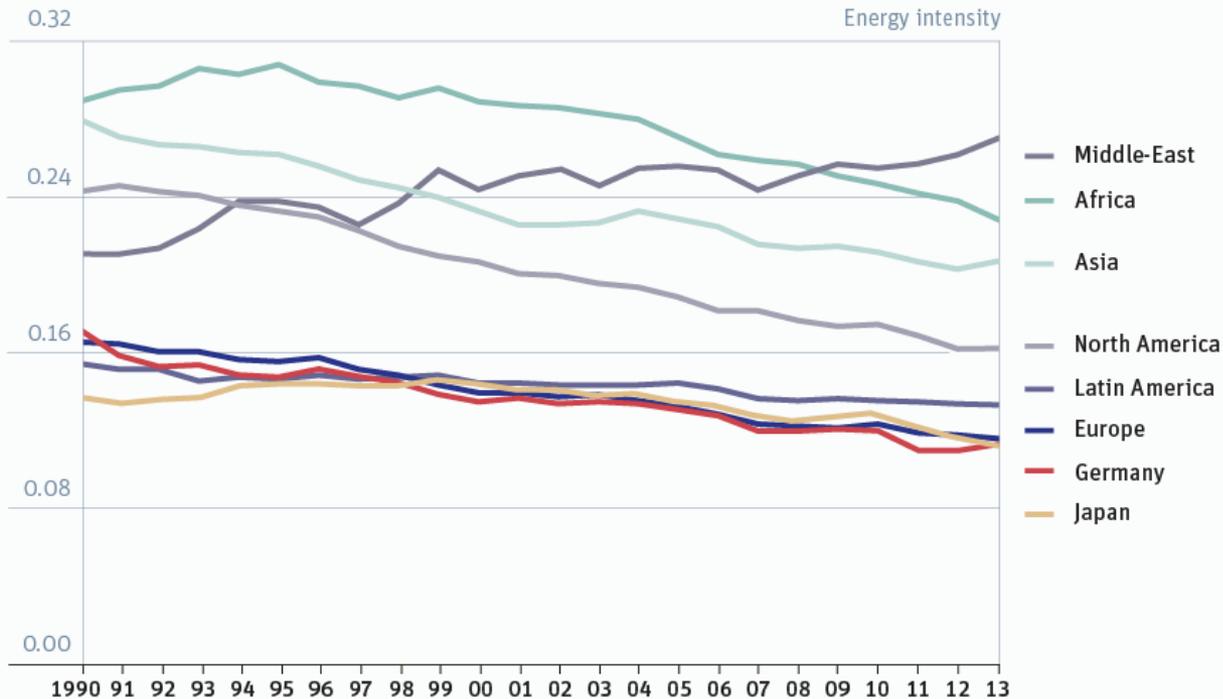


Germany continues to generate more GDP with less energy

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



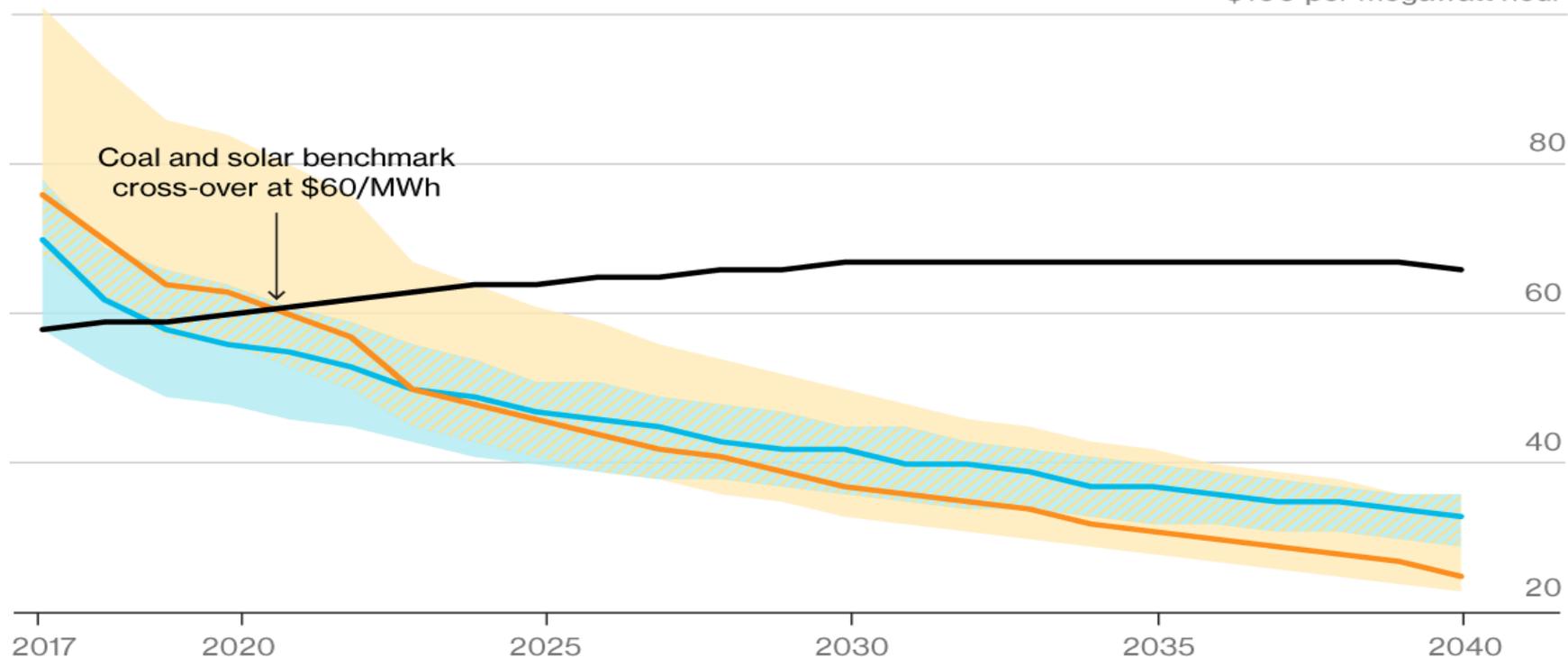
Analysis by Bloomberg on Energy Transition (May 2017)

China's Big Tipping Point

Within four years solar will be cheaper than coal

■ Coal ■ Onshore wind ■ Large solar farms

\$100 per megawatt hour



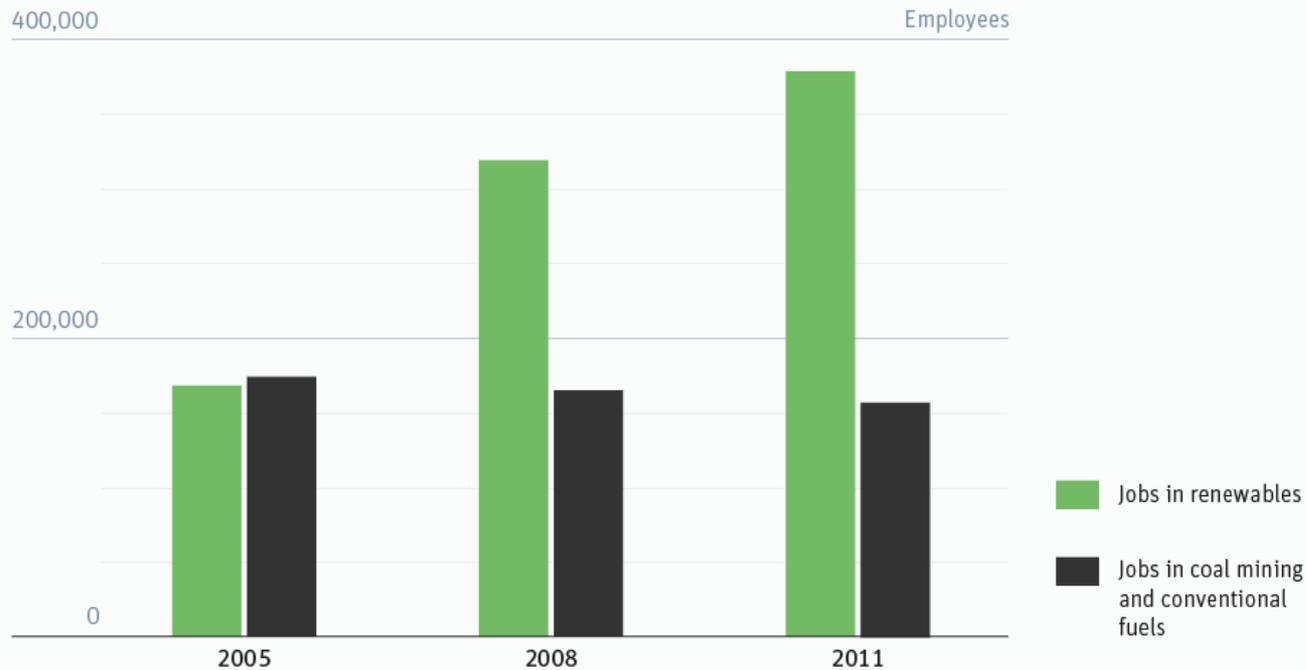
Levelized cost of energy based on realized load factors (2016 real). Source: BNEF

Renewables creates more jobs than conventional energy does

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

Source: BMU, BMWI



Renewable energy offsets expenses for fossil fuel imports up to EUR 50bn in 2020 - equivalent of EUR 600 per capita for each German

Renewable energy offsets expenses for fossil fuel imports

Benefits of renewables in energy use, Germany

Source: AEE



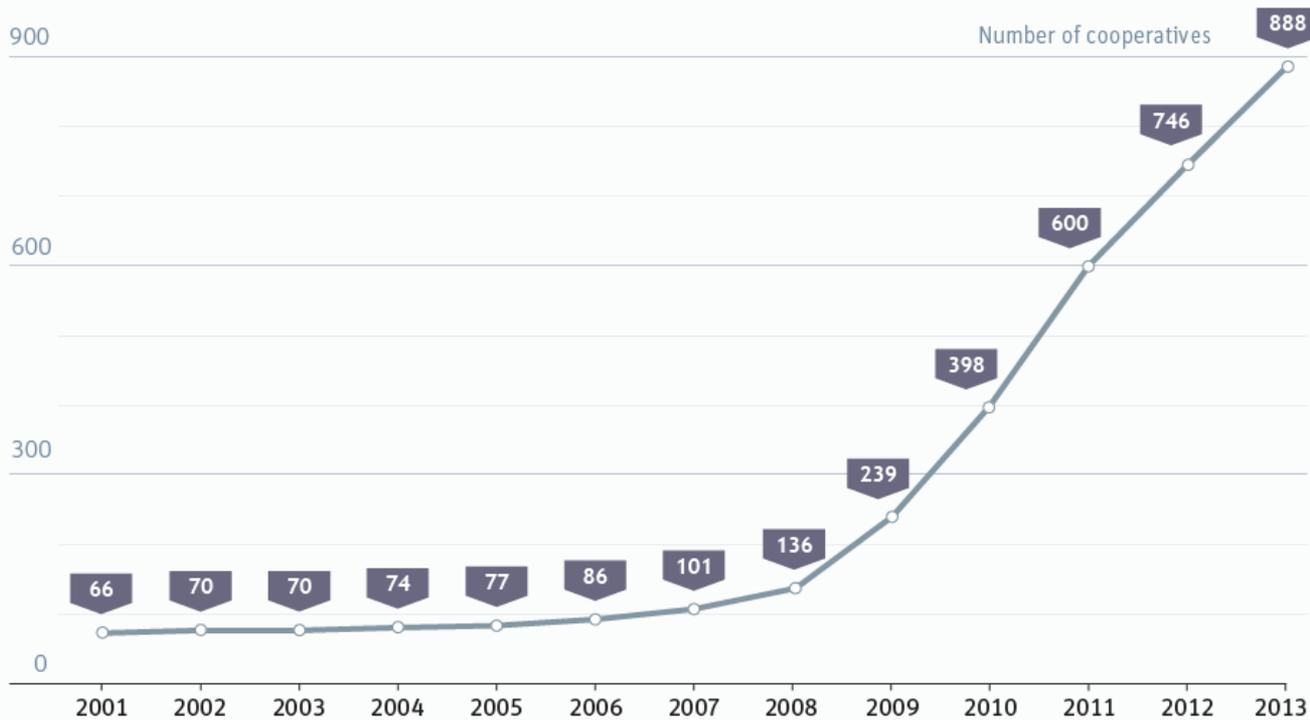
**It's not only a „top down“ approach,
but also a „bottom up“ process**

German citizens have taken on the opportunity to drive the energy transition

Citizens form cooperatives to drive the energy transition

Number of energy cooperatives in Germany, 2001-2013

Source: www.unendlich-viel-energie.de



A step by step process will guide us to...

- **...the replacement of traditional energy sources by renewables and energy efficiency**
- **...a more decentralised energy structure and power system**
- **...an intense coupling between supply and demand**
- **...sector coupling to use synergies**
- **...the use of information and communication technologies (digitalisation)**
- **...the use of different storages (p2H; p2G; p2L; batteries etc) and load management**

**Thank you very much for your
attention!**