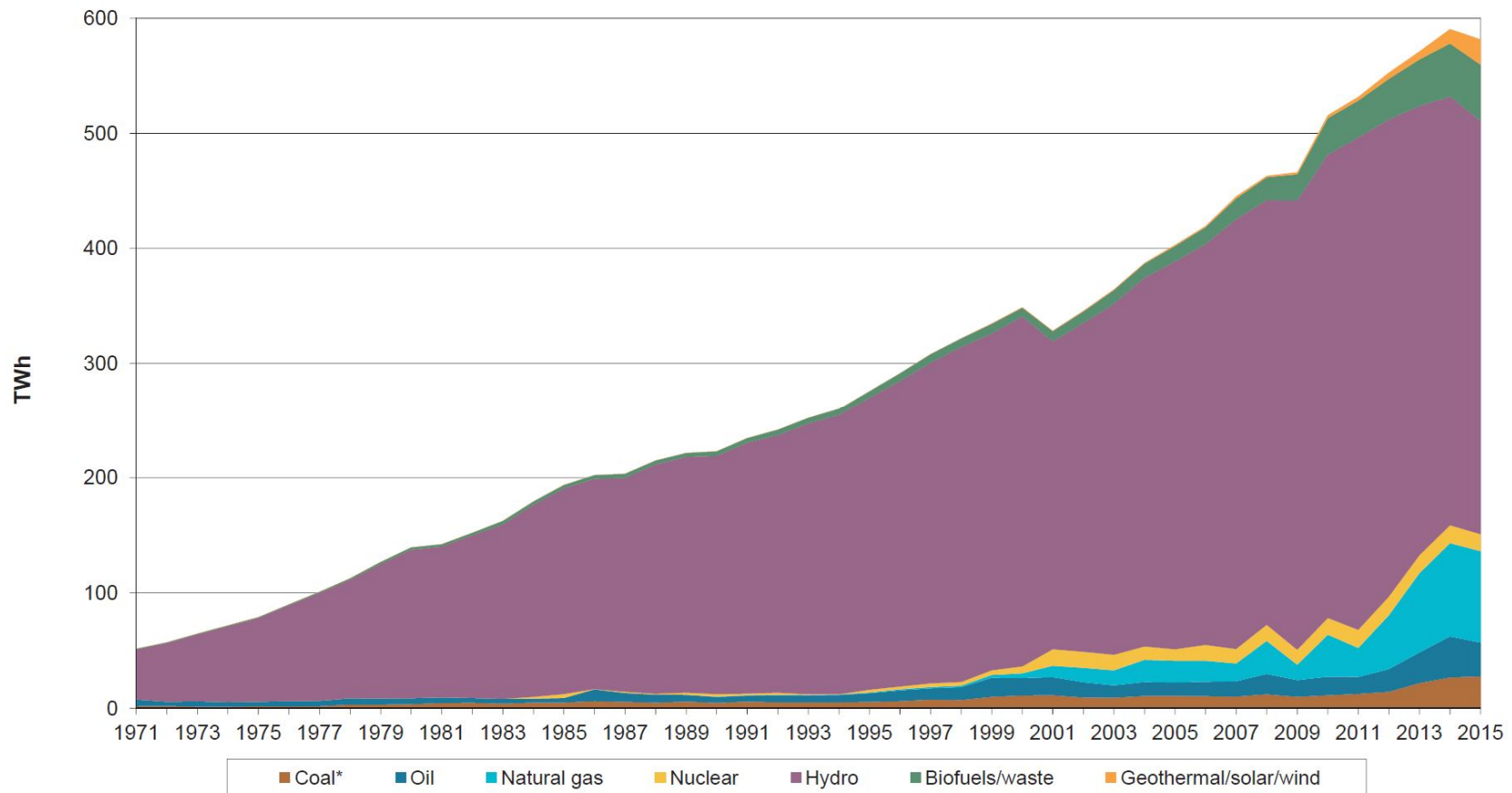# Decentralization of the Electric Sector
Experience from the German energy transition

Dr. Thilo Schaefer
Cologne Institute for Economic Research

17 Oct 2017, Rio de Janeiro

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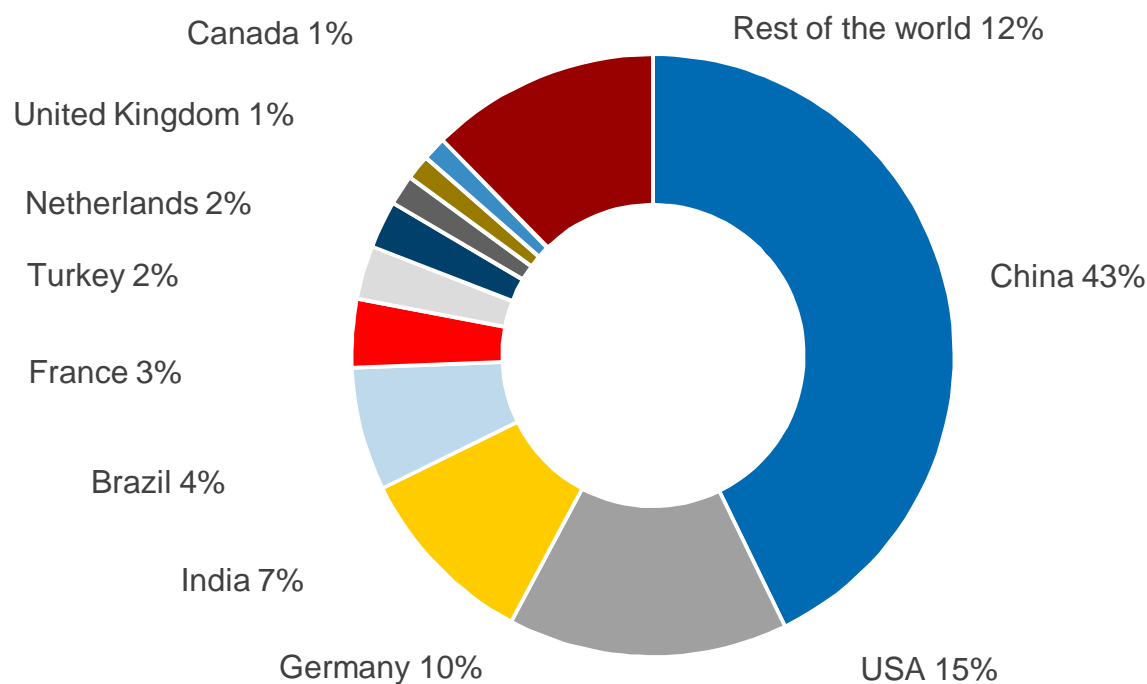*Cologne Institute for Economic Research*

Electricity generation in Brazil

Source: OECD / IEA (2017)

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Newly installed wind capacity in 2016

MW

Canada 1%

United Kingdom 1%

Netherlands 2%

Turkey 2%

France 3%

Brazil 4%

India 7%

Germany 10%

Rest of the world 12%

China 43%

USA 15%

Source: Global wind energy council

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Wind installations not necessarily decentral

Source: fotolia (nikilove)

Big solar „plants"

Source: iStock (querbeet)

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Growth of renewable installations

More small, decentral suppliers and big consumers

Electricity supply	Electricity demand

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Locations of supply and demand in Brazil

supply

demand

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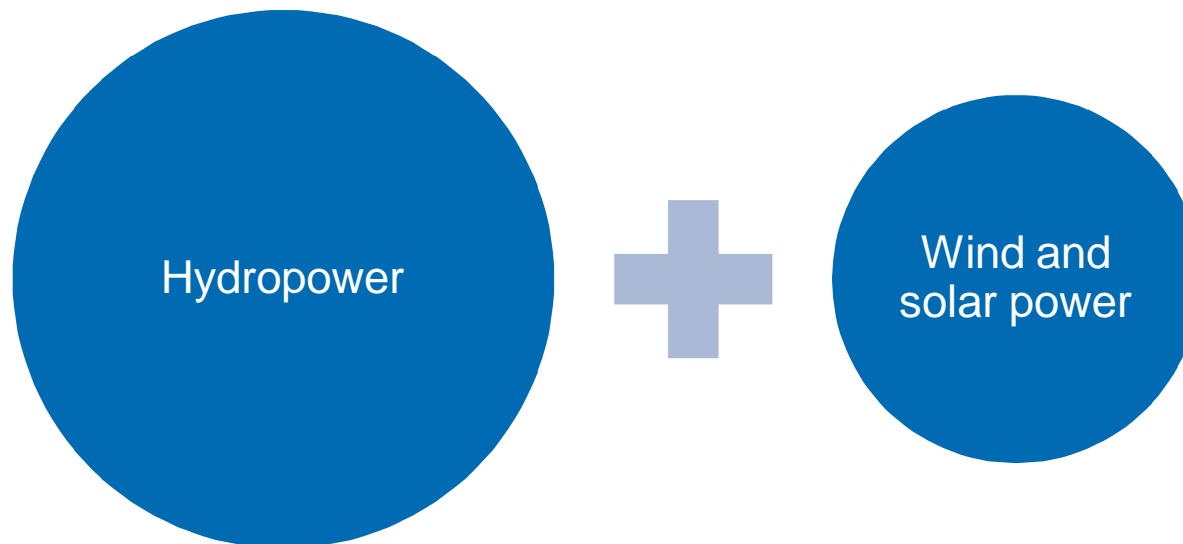*Cologne Institute for Economic Research*

The prospect of a (more) decentralized energy system

Possible advantages	Challenges
• Supply closer to demand • More flexibility • Less market concentration	• Grid connection • Congestion management • Security of supply • Pricing

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Renewable sources in Brazil

Advantage: complementary rather than alternative

Hydropower **+** Wind and solar power

Locations of supply and demand in Germany

Images: fotolia

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Renewable energy in Germany

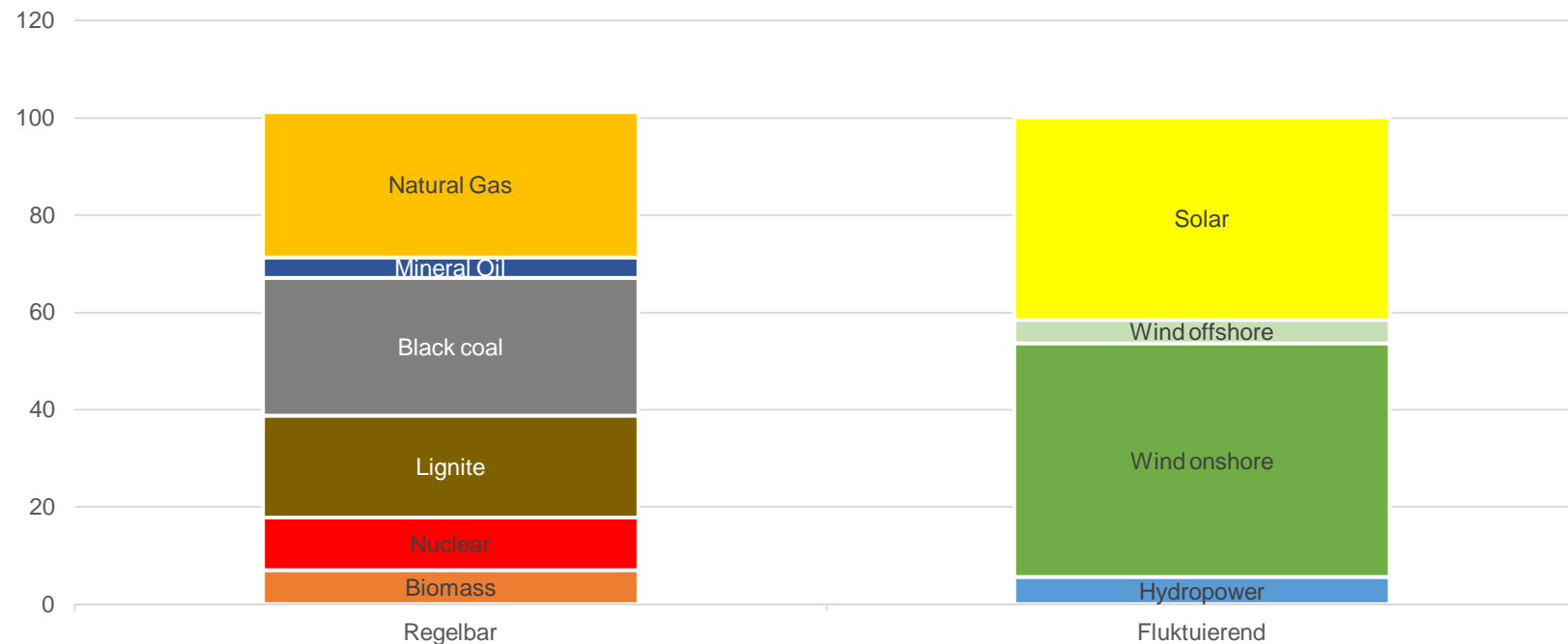## Share of electricity generation from renewable sources in percent
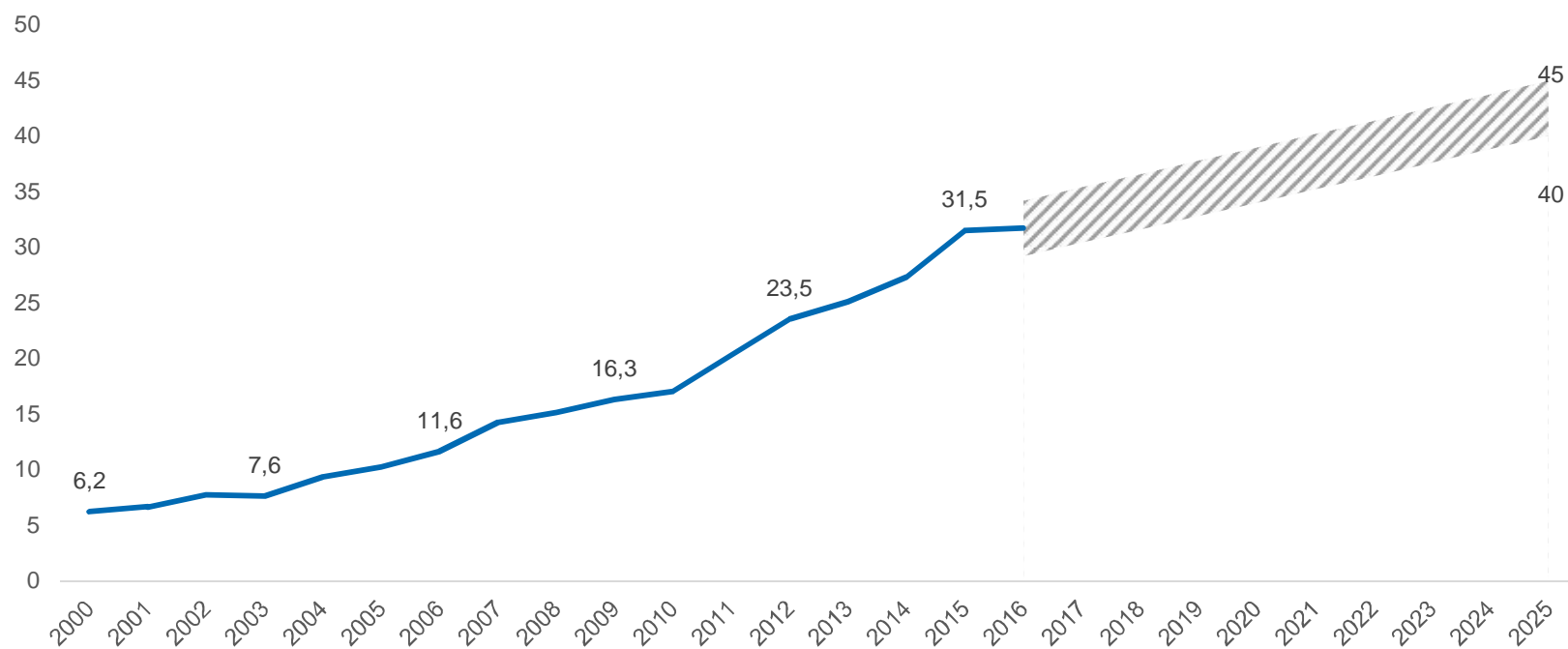
Source: German Federal Ministry for Economic Affairs and Energy

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Installed net-power for the production of electricity

Capacity in GW in Germany (2016)

Quelle: Agora Energiewende (2017)

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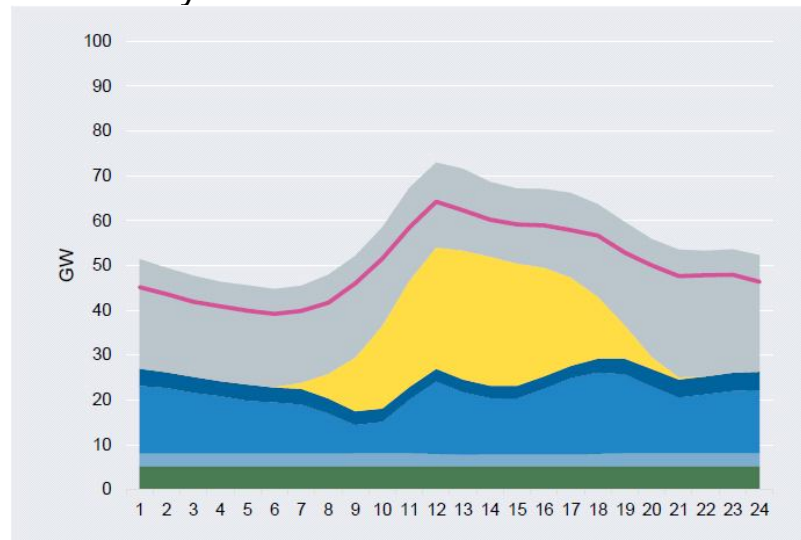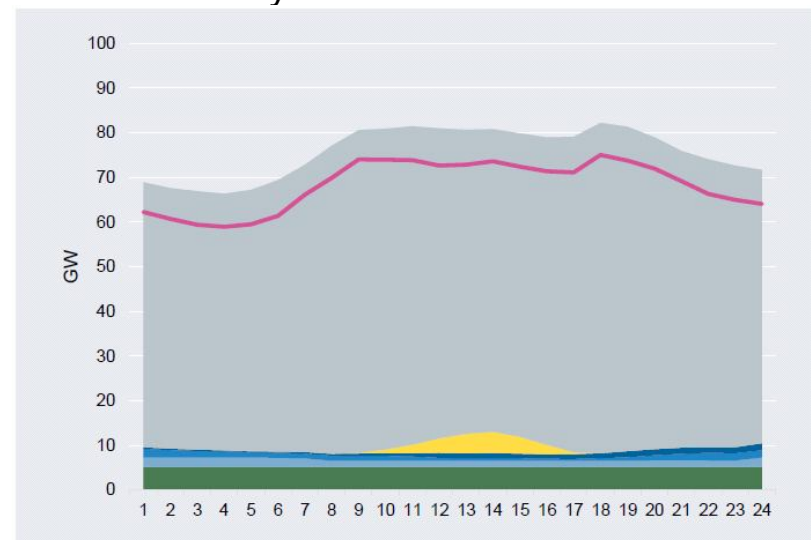
Highest to lowest proportion of renewable energy

Production and consumption of electricity- Wind/Solar/Conventional in GW 2016
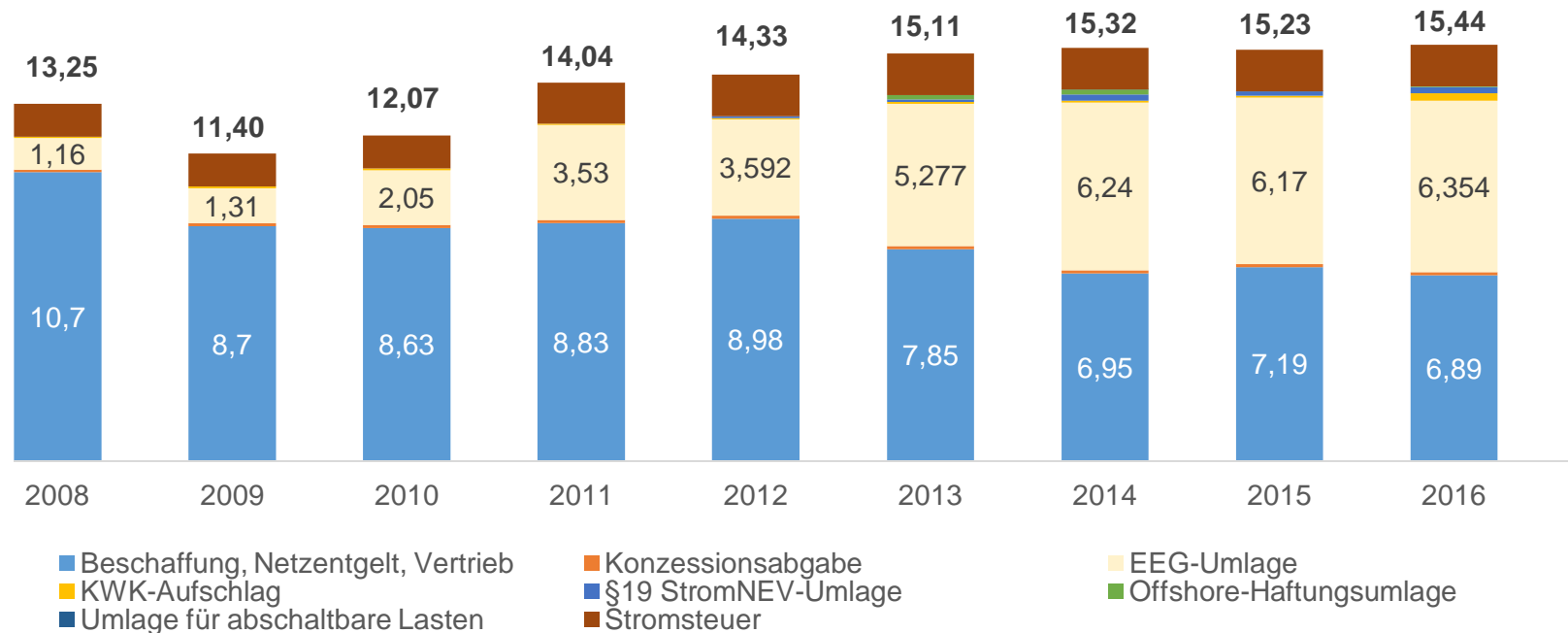

on 8 May 2016

on 21 January 2016

■ Conventional power stations ■ Solar ■ Wind onshore ■ Wind offshore ■ Hydroelectric power ■ Biomass

Quelle: Agora Energiewende (2017)

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Development of the components of electricity costs

Data in cents per kWh

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total	13,25	11,40	12,07	14,04	14,33	15,11	15,32	15,23	15,44
EEG-Umlage / Stromsteuer	1,16	1,31	2,05	3,53	3,592	5,277	6,24	6,17	6,354
Beschaffung, Netzentgelt, Vertrieb	10,7	8,7	8,63	8,83	8,98	7,85	6,95	7,19	6,89

Legend:
- Beschaffung, Netzentgelt, Vertrieb
- Konzessionsabgabe
- EEG-Umlage
- KWK-Aufschlag
- §19 StromNEV-Umlage
- Offshore-Haftungsumlage
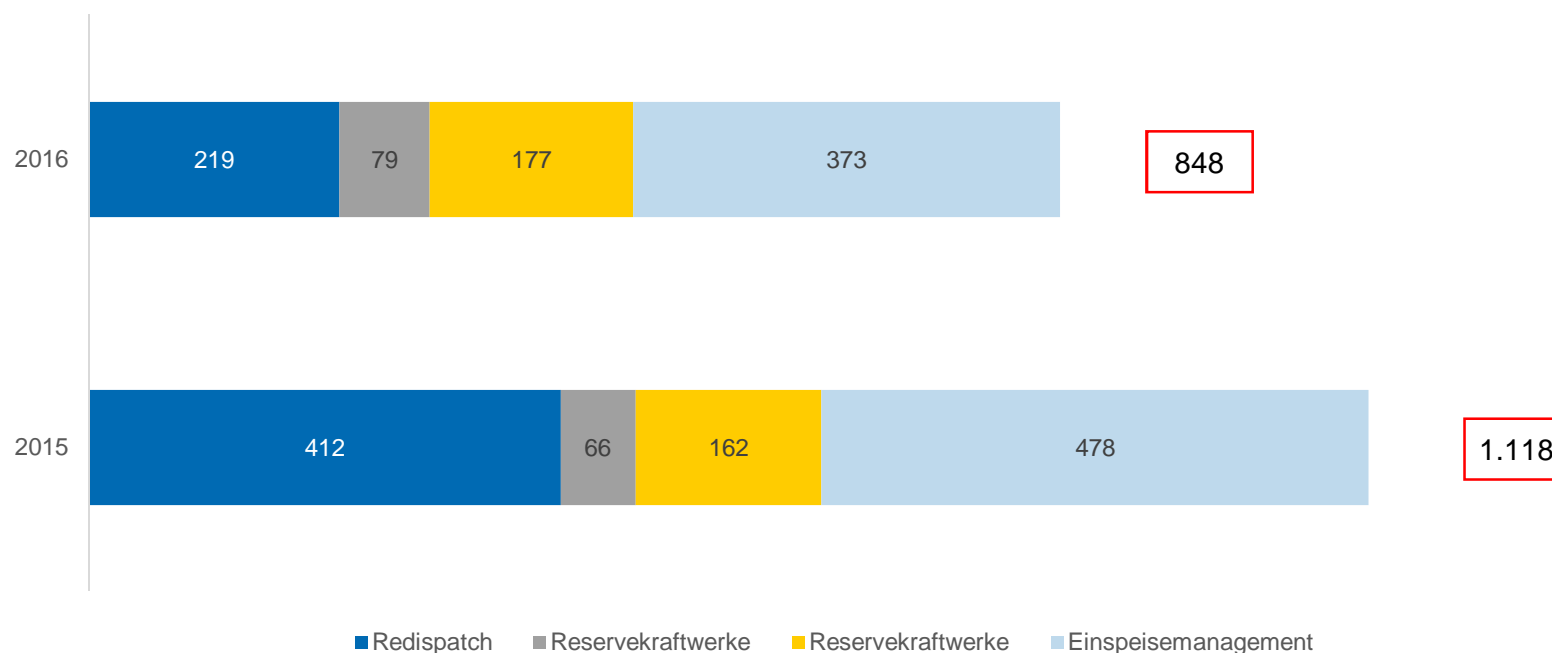- Umlage für abschaltbare Lasten
- Stromsteuer

Quelle: BDEW

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Cost of congestion management in Germany

in million Euro

Quelle: Bundesnetzagentur

New Risks: Security of Supply?
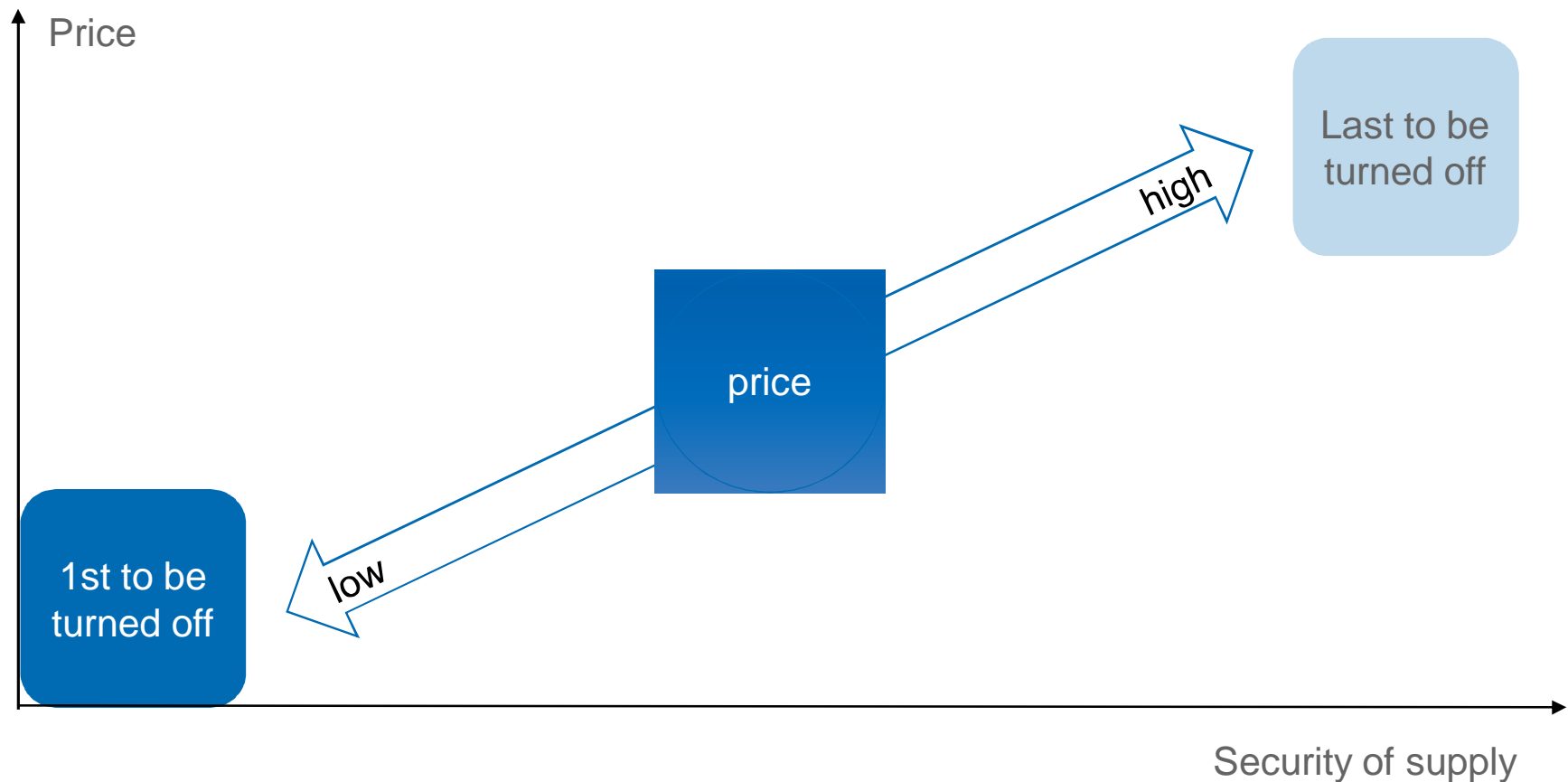
► Electricity from guaranteed capacities is needed in a system that highly relies on fluctuant energy sources.

► Decreasing revenues of conventional power plants (less production hours, lower prices)

► Investment restraints within the conventional power plant sector

But: This is not necessarily a signal for market failure = Ongoing Debate

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Security of supply as a product?

Demand side management increases flexibility

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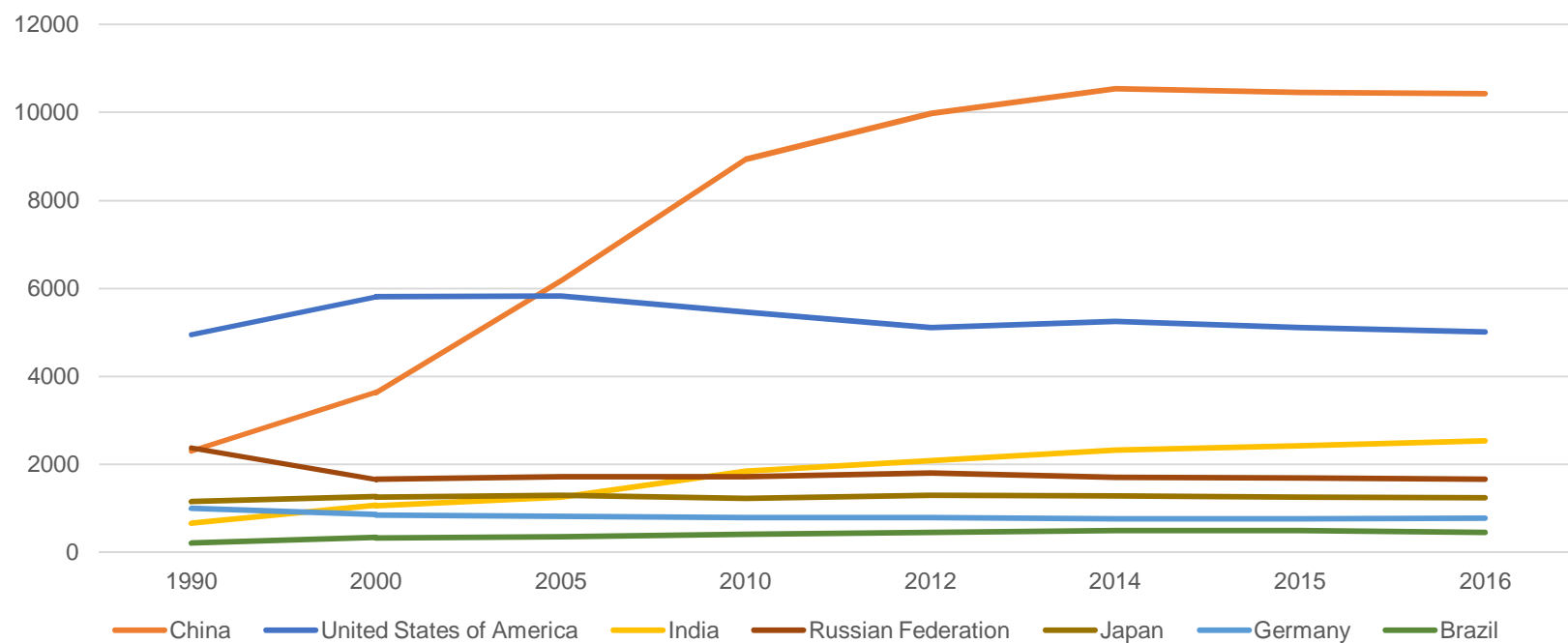*Cologne Institute for Economic Research*

Decentralization is a possible market result

– not a sensible policy target

► Depending on the market design smaller decentral installations of wind and solar power are encouraged by the promotion of renewable energy

► Still, there are advantages of bigger (renewable energy) plants:

- Scale effects of bigger installations
- More efficient land use in windy / sunny areas
- Distance to residential buildings
- Transportation

► Net infrastructure needs to fit installation structure

► Prices should incentivize most efficient locations for installations

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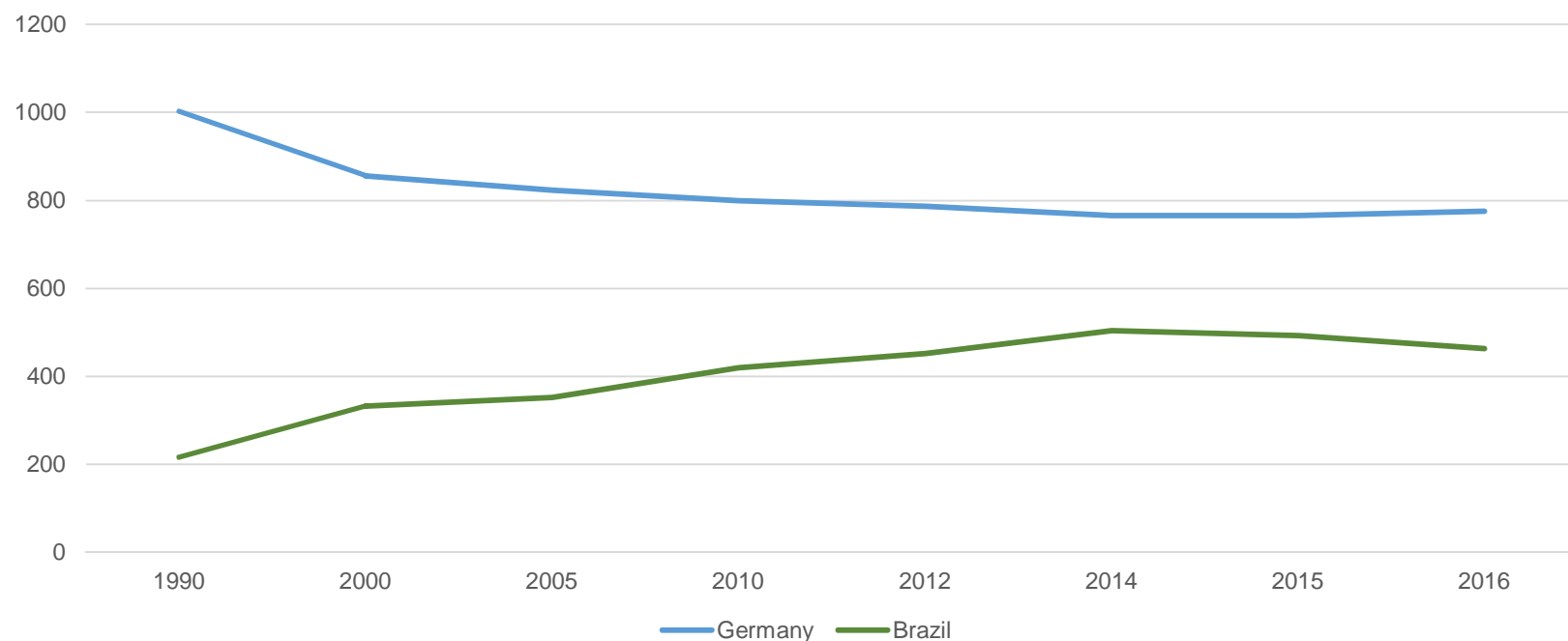
Trends in global CO$_2$ emissions

in millions of tonnes of CO$_2$

Source: EU Commission / EDGAR, 2017

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Comparison of CO$_2$ emissions in Germany and Brazil

in millions of tonnes of CO$_2$

Source: EU Commission / EDGAR, 2017

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Political implications

Inconsistencies will persist without internationally comparable CO_2 prices.

1st best solution	► **Global** emissions trading system resulting in consistent prices for greenhouse gas emissions
2nd best solution	► **Regional** emissions trading for all sectors with perfect carbon leakage protection for highly competitive sectors
Current situation	► Inconsistent regulation of different sectors ► Overlapping inconsistent instruments ► Higher costs due to additional national regulations

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Criteria for an efficient policy mix

► International agreements and/or instruments in place?

- Additional national targets or measures have no extra effect

► Which target(s) does a policy instrument address?

- Are other instruments adressing the same target(s)?
- Is there a priority / hierarchy of targets?

► Simple rule (Tinbergen):
one instrument ↔ one target