

The German transition towards a high renewable energy share - a socio-technical challenge

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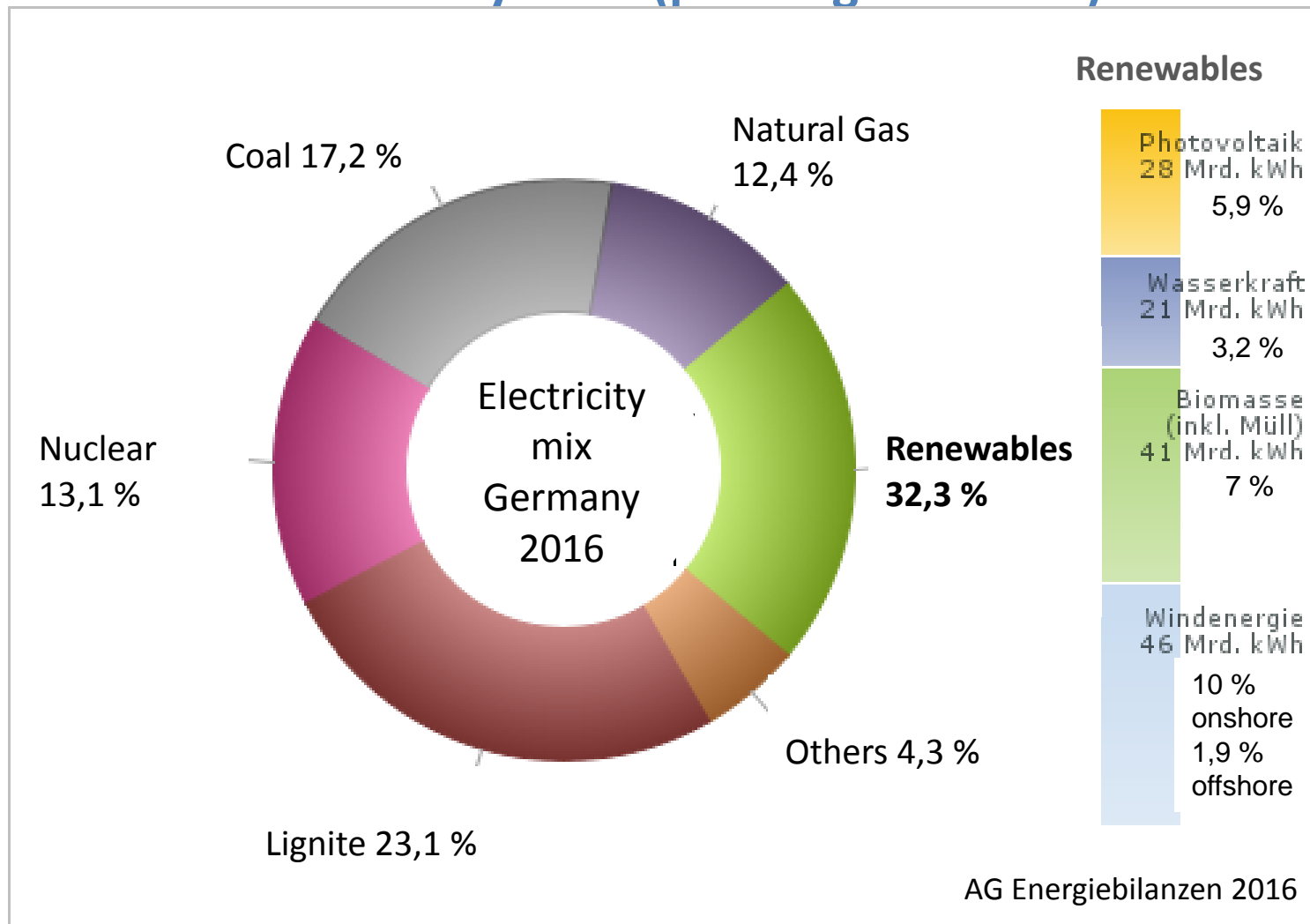


„Energiewende“ in Germany

Goals in German climate and energy policy

- nuclear phase out by 2022
 - 80 - 95% reduction of CO₂ emissions by 2050 (compared to 1990)
 - 80% renewable energy share in gross electricity consumption by 2050
[50% by 2030; 65% by 2040]
 - improve of energy efficiency:
Reduction of primary energy consumption of 20% by 2020
and of 50% by 2050 (compared to 2008; NEEAP)
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- **What are the achievements we reached until today?**
 - **What are driving forces and obstacles in the German multi level system?**
 - **What are the main actual challenges for Germany to reach the targets?**

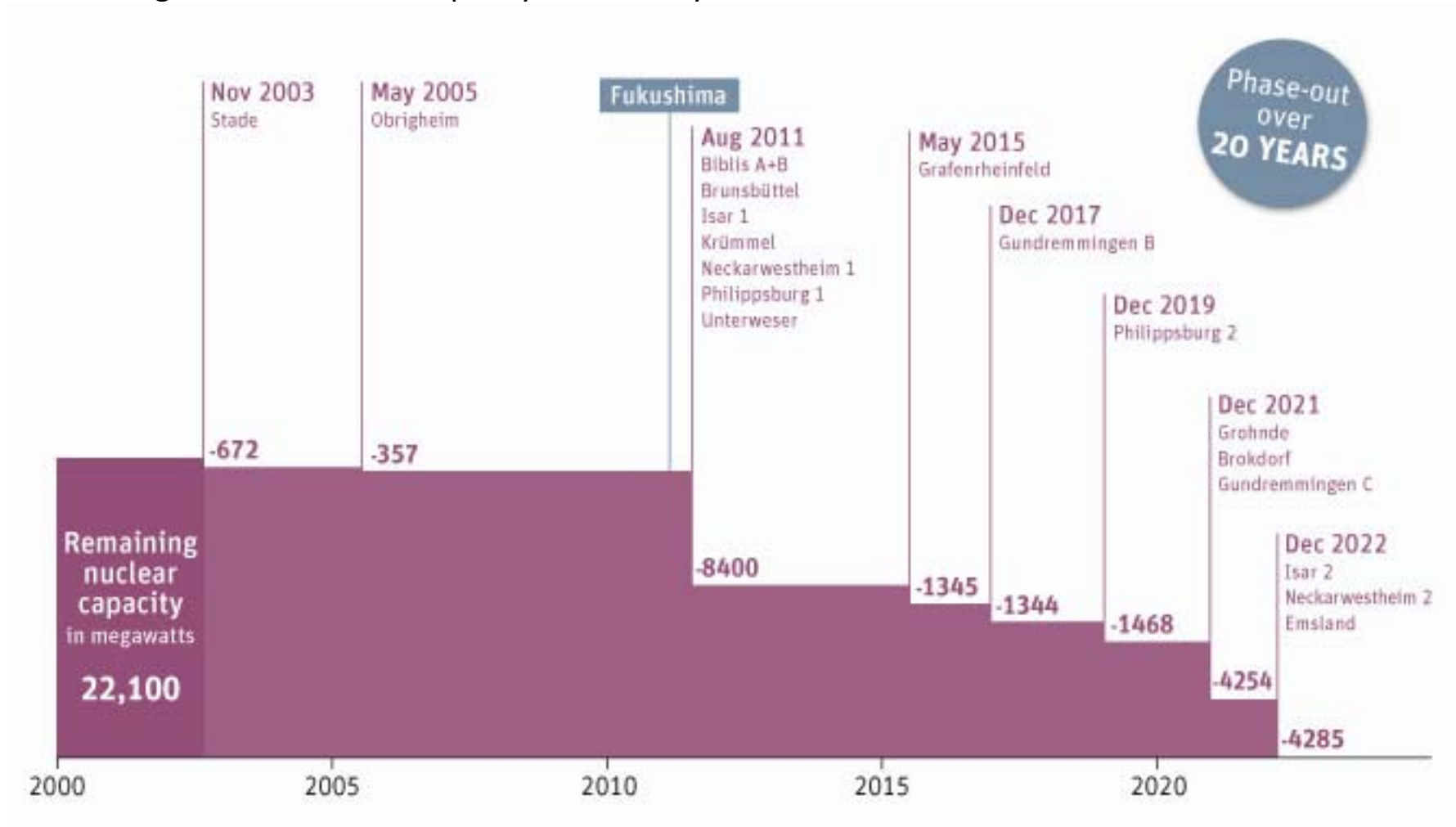
Achievements: Power mix in Germany 2015 (power generation)



share of electricity from renewables grew from about 6% in 2000 to about 33% in 2016

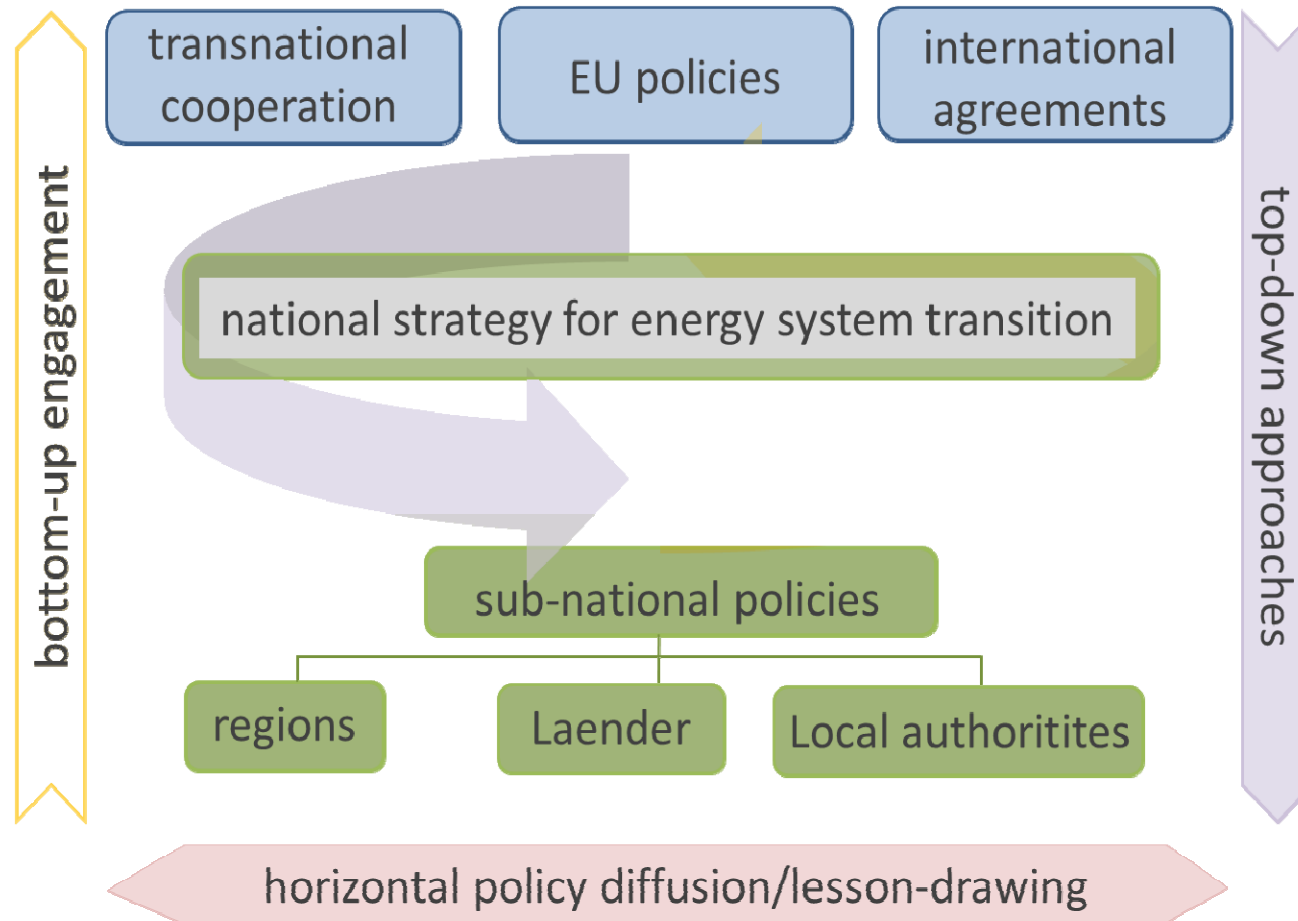
Achievements: Germany incrementally shuts down nuclear power

Declining installed nuclear capacity in Germany, 2000-2022



Germany is still a net exporter of electricity !

Characteristics of the ‚Energiewende‘ in Germany



The 'Energiewende' takes place in a multi-level governance system - integration of European, national and subnational energy policies required

Federal Level

Central instrument: Renewable Energy Act (EEG)

- guaranteed access to the grid
- priority feed-in for RES:
grid operators are required by law to purchase renewable power,
- investors in renewables receive sufficient compensation to provide a return on investment - irrespective of electricity prices
-> high level of investment security
- every three to four years, feed-in tariffs are reviewed and the law is amended
- degression brought down costs of RES
- copied worldwide

last major revision August 2014: Shift in support system

- auction system
- quotas (limited expansion): share of RES should not exceed 35 to 40% by 2020
- drastic reductions of feed-in tariffs (aiming at lower costs)
- mandatory direct marketing

-> risk of a backlash (instable phase) of the development

Strong federal (subnational) states RES policies

state		target
Baden-Württemberg [BW]	GEG	38% by 2020
Bayern [BY]	GEC	50% by 2021
Berlin [B]	GEG	17,8% by 2020
Brandenburg [BB]	GEC	90% by 2020
Bremen [HB]	ns	100% by 2050
Hamburg [HH]	EG	17% by 2020
Hessen [HE]	FEC	100% by 2050
Mecklenburg-Vorpommern [MV]	GEC	100% by 2050
Niedersachsen	GEC	90% by 2020
Nordrhein-Westfalen [NRW] (Wind)	GEG	15% by 2020
Rheinland-Pfalz [RLP]	GEC	100% by 2030
Saarland [SL]	GEC	20-40% by 2020
Sachsen [SN]	GEC	28% by 2022
Sachsen-Anhalt [ST]	GEG	35% by 2020
Schleswig-Holstein [SH]	GEC	300-400% by 2020
Thüringen [TH]	NEC	45% by 2020
Bundesrepublik	GEC	35% by 2020

Expansion Targets for RES in electricity supply

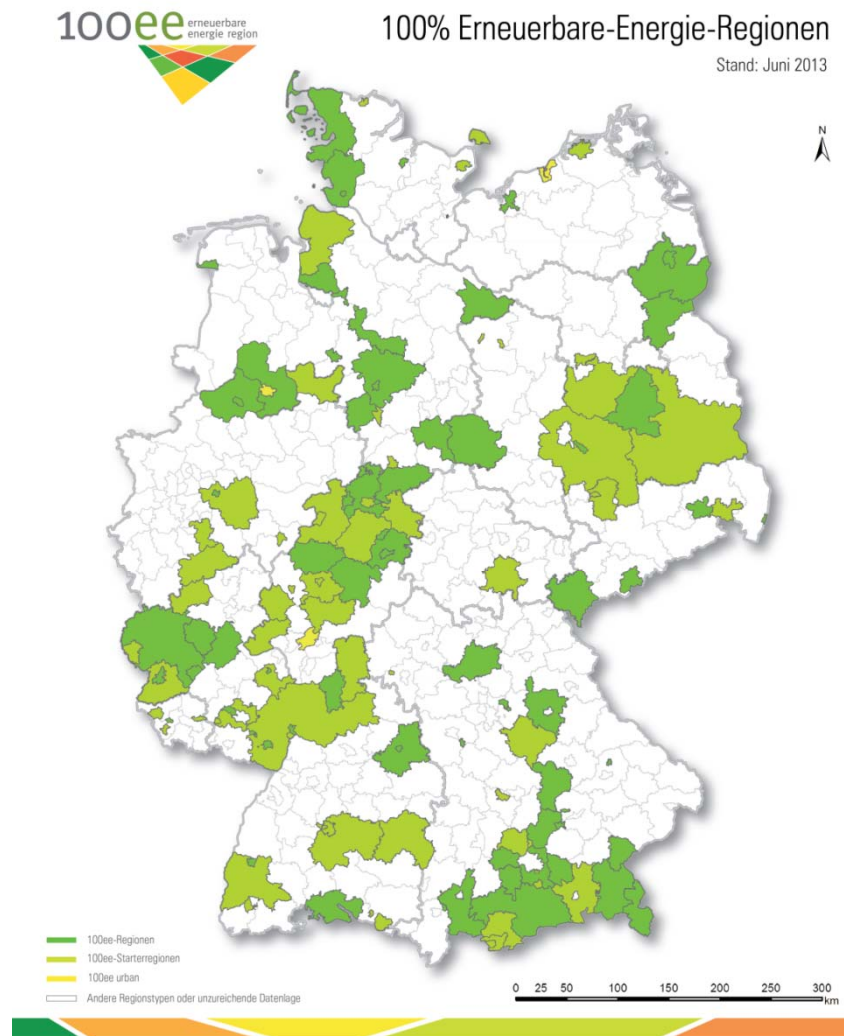
- national aim:
35% by 2020
- states (in total) will provide
ca. 50% by 2020

->exceed national goal !

GEC = gross electricity consumption (Bruttostromverbrauch)
 GEG = gross electricity generation (Bruttostromeerzeugung)
 EG = electricity generation (Stromerzeugung)
 FEC = final energy consumption (Endenergieverbrauch)
 NEC = net electricity consumption (Nettostromverbrauch)
 ns = not specified

Source: www.foederal-erneuerbar.de, Energy Strategies of the Länder

Bottom-up movements from the regional Level

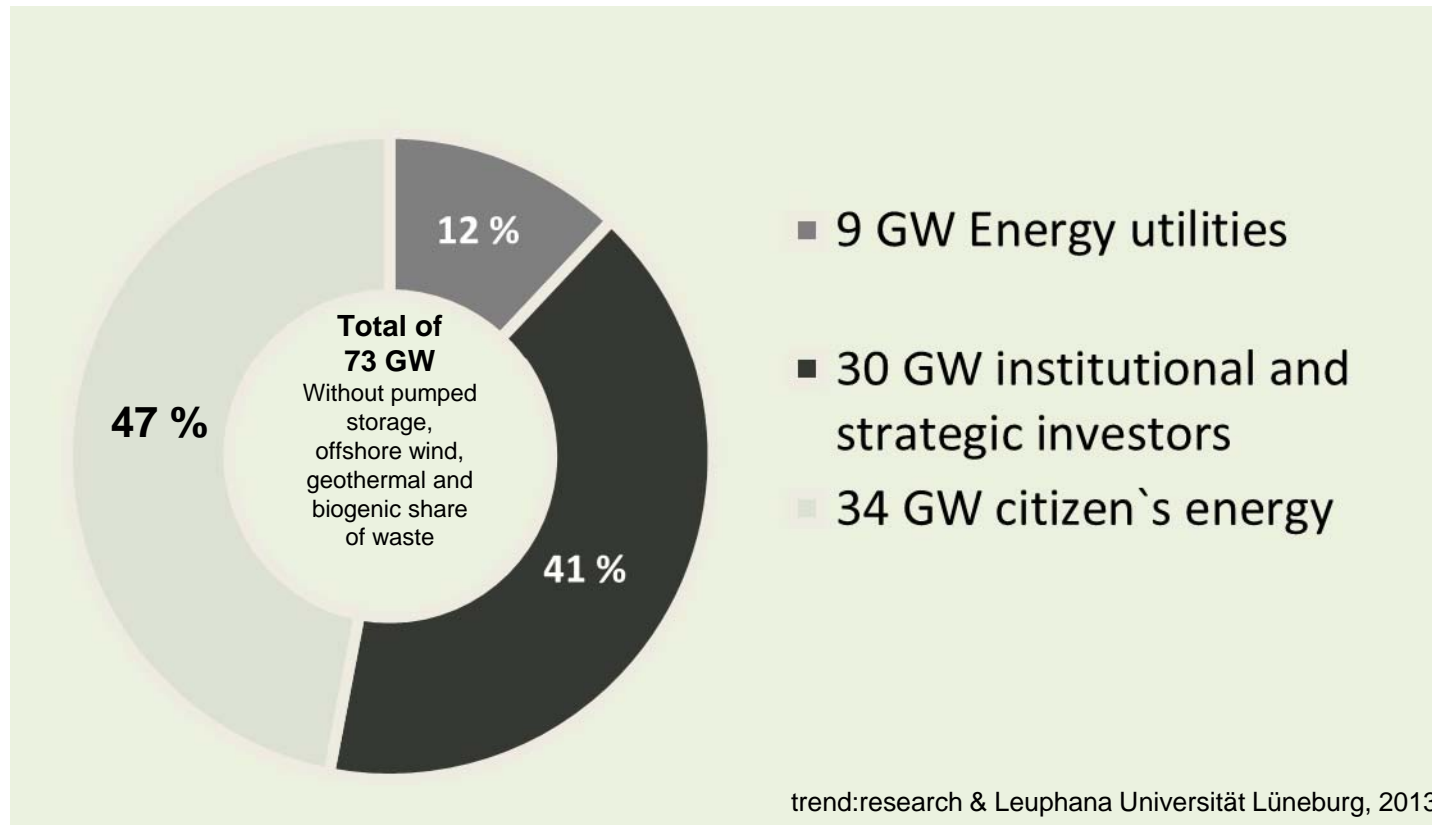


More than 130 municipalities, districts and regions in Germany are pursuing the goal of 100% RE supply - some have already achieved

Motivating factors for states, regions and municipalities to set ambitious targets for RES expansion

- more ecologically and climate friendly electricity
- motor for jobs
- driving innovation
- economic development, structural change
- trade tax revenues

Installed capacity of renewable energy by owner groups in Germany



Citizen's energy

nearly half of the renewable electricity generation capacity (except offshore wind) is in the hands of small private investors: individuals, households, farmers, cooperatives, civil law partnerships, citizen initiatives

Auction system as market entry barrier for citizen energy

- for small projects with local character, the shift from feed-in tariffs to the auction system is a challenge
 - participation in tendering procedure requires high operating expenses, is time consuming, complex and costly
 - Citizen energy actors can't spread the risk, have a lower credit rating and no opportunity for interim financing
 - large providers have significant advantages over small ones
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- as a result, public energy investments and the annual start-ups of energy cooperatives have collapsed
 - from 167 (in 2011) to 40 (in 2015)
 - loss of important investor groups

‘Energiewende’ strongly driven from the bottom up

- Active subnational states, regions and communities
- citizen initiatives, cooperatives
- private owners of wind & solar plants

New stakeholder structure, new infrastructure design

- stakeholder structure of the formerly oligopolistic German electricity market has changed significantly during the energy transition process of the last two decades
- big energy supply companies (incumbents) have lost high market shares to smaller, heterogeneous actors (challengers) - distributive conflicts
- System is increasingly decentralized - advantages in terms of resilience, social acceptance, democratic participation, and the development of value added in municipalities and regions

Most important challenges for the future of the 'Energy transition' in the electricity sector

Phase out coal

- overcapacities in coal-fired power plants
- government aim: shut down eight old brown coal blocks by 2022
- monitoring report 2015 "Energy of the future": governmental plans are not ambitious enough
- risk of structural interruptions and economic risks in affected regions (e.g. Lausitz, Rheinland)

Only small steps in the field of efficiency, modernization of buildings and renewable heating systems

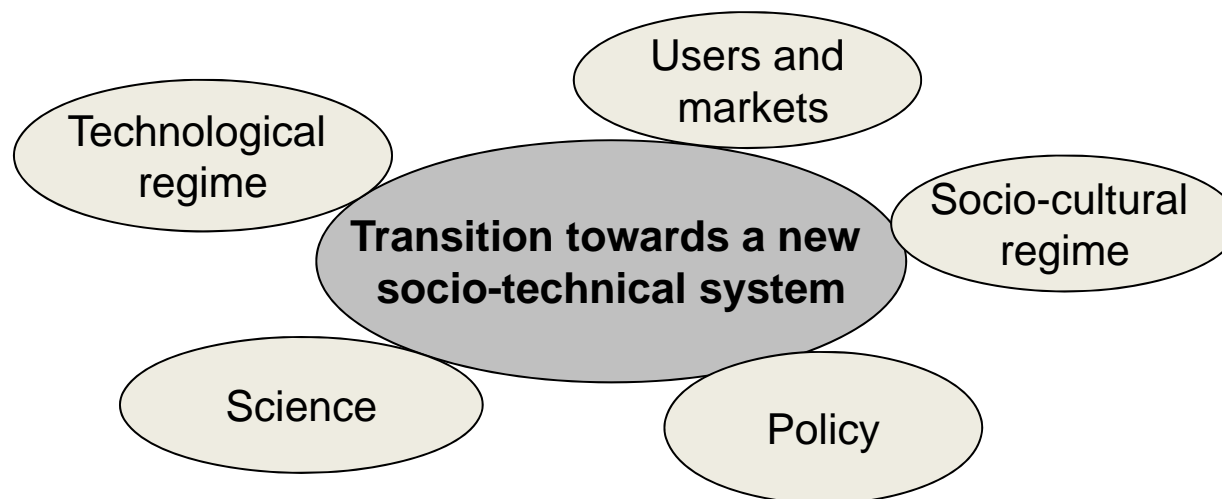
- Federal Government's efficiency targets are not met
- Heat generation from renewables stagnates at around 150,000 MWh annually since 2010

Mobility sector lags behind

- sale of e-cars fell by 7% in 2016 compared to 2015
- biofuel market has fallen from 45 TWh in 2007 to 30 TWh in 2015

Transition towards a new socio-technical system...

- ...involves all levels of governance
- ...involves co-evolution of several inter-connected sub-systems
- ...needs experimentation with new technologies and ideas (laboratories) and bottom-up engagement
- ...is a process of uncertainties, that needs progression through ambitious targets and negotiation of a conflicted process (rather than one optimal policy design)



Thank you

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