THE POLITICAL ECONOMY OF ENERGY TRANSITIONS IN THE USA AND GERMANY

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How to manage an energy transition?

- The switch towards using new resources in the USA (shale + RES) and Germany (RES) results in *a new energy mix* where different *fossil and non-fossil resource sectors are interdependent*
- In both cases actors find it difficult to reconcile their *interests* and control the outcomes of their choices because of the interdependencies between the fossil fuel and RES sectors, and further *structures shaping their choices, domestically and internationally*

- We respond to the calls for interdisciplinarity in the IPE of energy by applying the purposefully open *structuration approach* to the study of energy transitions

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Research questions & basis for comparison

1. *What interests and cognitive frames drive the choices of actors in the energy transitions in the USA and Germany?*
2. *How do the complex structures of political economy enable and constrain their conduct, and with what consequences?*

- Very few direct comparisons exist so far of these landmark cases for the IPE of energy
- Two very different transitions, but they are interlinked, have global implications and both witness significant R&D, increasing share of RES and less emissions

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The structuration approach covers a broader scope of structures shaping energy transitions than e.g. sociotechnical systems or institutionalist approaches

Federal, state & local governments	Producers; equipment, service & consultancy companies	Infrastructure developers	Consumers, prosumers	Financial institutions

Interests **and** ***frames*** **of actors vis-a-vis the energy system: environmental stewardship; security of supplies; socioeconomic implications incl. employment; profits & fiscal gains; R&D; foreign economic relations; foreign policy; efficiency**

Structure (policy environment): constraints and enablers

Resources, technology & infrastructure	*Finance, markets and business models*	*Institutions*	*Ecology*
Resources used for energy production (fuels; electricity and heat, industrial needs)	Investment and production costs; taxation regime	Formal institutions incl. regulation (EU/NAFTA/federal/state); agreements, contracting, permits and licenses	Risks to natural environment (accidents, water pollution, etc.)
Network infrastructure incl. pipelines, railroads, terminals, transmission & distribution networks; local networks and microgrids	Organisation of energy markets incl. subsidies & trading systems; balance between supply and demand	Informal institutions including relations among authorities, producers, consumers and NGOs including citizens	Use of land and space for energy extraction and production vs. other economic activities and recreation
Technologies incl. extraction, conversion, storage, network automation, gas turbines, wind turbines, solar panels	Energy business models incl. services, maintenance, management	Global and regional institutions influencing governance and order among energy actors and stakeholders	GHGs and other emissions into the air and atmosphere

Outputs: similarities and differences in the energy transitions of the USA and Germany

Path dependencies

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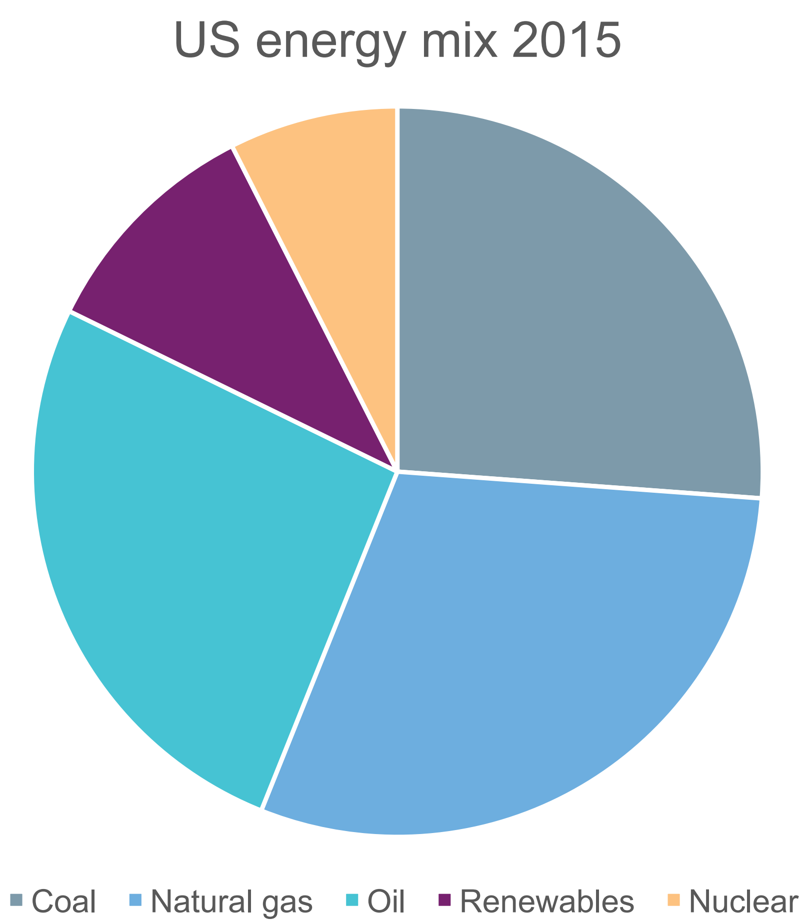
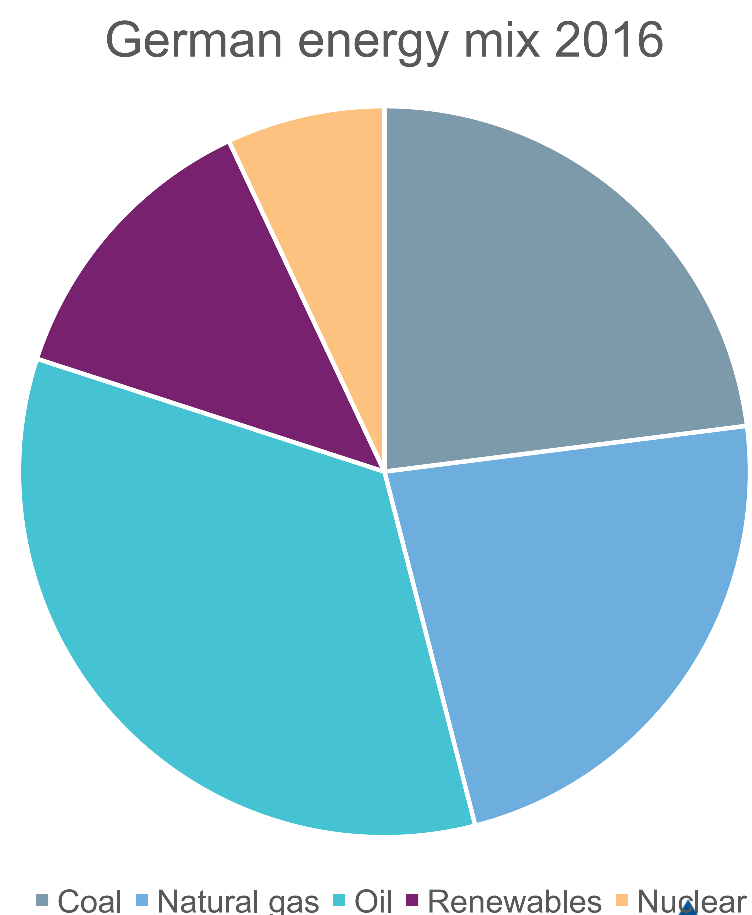
Fossil fuels and renewables depend on each other if we wish to further all interests prevailing vis-a-vis the energy system





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Results: in the USA 'energy mix' is a goal of its own, in Germany it is a transitory state

	Resources, technology & infrastructure	*Finance, markets and business models*	*Institutions*	*Ecology*
USA	Federal Government has supported both shale and renewable sectors by means of R&D, to serve the security of supplies interest, but with highly uneven outcomes across states, resulting in a decentralising energy infrastructure	Increasing competition between different energy sectors serves the security of supply interest and brings low prices, which do disservice to end-use efficiency; but difficult to balance fiscal and profit interests into a stable 'business frame'	Several rounds of regulation facilitated the breakthrough of the shale industry, supporting the profit and fiscal interests, mitigating the related environmental concerns & responding to security of supply issues	The academia and industry work together to control the environmental risks of the shale industry, which in the long run can only modestly lower GHG and other emissions
DE	Steady R&D support for RES to overcome the constraints of the resource base, but energy storage and batteries needed for the targeted long-term substitution of fossil fuels and nuclear power; reconciling the interests of centralised and decentralised infrastructure may affect the profit interests of all stakeholders	The FIT system has helped RES production to become more competitive, as intended, but its functionality vis-à-vis the wider business frame that should align the interests of public and private actors in support of the transition remains contested; business models revolve around support schemes	Regulatory continuity seeks to bring several incumbent and emerging market actors together but the wider business frame remains difficult to optimise vis-à-vis the evolving policy environment and the various interests therein	The long-term decarbonisation prospects are more genuine than in the USA, but progress slow owing to nuclear phase-out; but land use and maritime landscape issues set constraints for wind power

‘Clean energy combined’ employs 3MM+ workers in the USA, fossil fuels overall <3MM

Direct and indirect jobs in renewable energy

	Earlier	2012	2013	2014	2015	2016
	157,000 (2004)	370,000	371,000	371,000	355,000	334,000
	446,320 (2006)	612,000	625,000	724,000	769,000	**777,000**

Sources: IRENA 2011, 2012, 2013, 2014, 2016, 2017

In 2016, in the US oil and natural gas industry less jobs than in renewable energy (388,000 incl. shale, with a peak of 541,00 in autumn 2014); in coal 53,000 (174,000 in the 1980s…)

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Conclusions: comparison of the two cases

- R&D has expedited both transitions, increased the share of RES, served security of supplies interest and wider socio-economic interests in terms of creating more jobs than destroyed
- It is less noted how decentralisation also supports the resilience of the energy system – this is but one example of how actors have difficulty in assessing the emerging structural environment as the transition extends deeper into the demand side especially in Germany

- Transition requires new business frames in both cases and in the German case incumbents to adjust theirs
- Several path-dependencies need to be broken on the demand side in favour of a more decentralised energy system involving more citizen and prosumer participation and flexible consumption
- However, owing to nuclear phase-out and complex interrelationships among resource sectors, the German transition has not so far delivered more vis-à-vis its long-term objectives than the US case

Conclusions: the global level implications

- The German energy transition explicitly supports technology exports as a federal level objective, having first adopted wind power technologies from Denmark in the 1990s, and then diffusing these further:
  - Facilitates innovation, learning and cost reduction to gradually make subsidies redundant globally
- The *competitiveness of renewable energy* technologies and solutions *depends on the global prices and trade in competing energy resources*, including oil and natural gas, and the effects of the *shale revolution which increases competition*

Vs., or plus?

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Conclusions: the structuration approach

- R&D is a major driver of the transition. Our structuration approach reveals:
  - The *innovation niches*, pointed out by studies on socio-technical systems, belong in our framework to the dimension of *resources, technologies and infrastructure*, but depend on the dimension of *finance, markets and business models,* and on the *institutional dimension*
- Most US policies address supply side
- In Germany, demand side measures more widespread but hit institutional constraints: inadequate coordination vis-à-vis regulations on buildings and transport; and on our financial dimension in terms of insufficient policy innovation to keep up with market developments

- The German model creates demand for new services in planning, consultancy, equipment installation & energy efficiency; facilitates the emergence of prosumers and aggregators of small-scale production

Figure: Kotilainen, Sommarberg, Järventausta, Aalto (2016)

Some conclusions

- We found a multiplicity of interests in both cases, with some variance: this multiplicity is a function of our structuration approach, which does not prioritise any single actor or interest *a priori* and is uncomfortable with mono-causal explanations, particularly in a complex area such as energy transitions involving an expanding number of actors
- We analysed four analytically separable structural dimensions that remain interlinked in practice. Even if these interrelated structures we have analysed compromise theoretical parsimony, concomitantly they reveal the difficulty for actors 'out there' to consistently steer energy transitions in a given direction.