

Black Diamond or Black Death: Diverging transition pathways towards a future without coal consumption in the United Kingdom, Germany and Poland

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Hanna Brauers and Dr. Pao-Yu Oei



Guest Researcher at the German Institute for Economic Research (DIW Berlin) and Research Associate at Technical University Berlin, Workgroup for Infrastructure Policy (WIP)




Coal is currently an important factor for global economies but also the single biggest contributor to climate change.

Coal used to generate
41 % of global electricity.

Coal was used in
70 % of global steel production.

Coal was responsible for
39 % of total EU ETS emissions.

Coal (& steel) **historically** played a crucial part for the EU in terms of its creation, employment, its economy, etc.



Paris Agreement
entered into force in
November 2016

How can a reduction in coal consumption in line with the 2°C target be achieved in the EU?

Research outline and methodology

Starting point Analysis

A coal phase-out is crucial to reach emission reduction targets. It needs to be actively **structured to enable a socially acceptable transition**, to avoid e.g. capacity or grid constraints and to overcome vested interests.

Research Questions

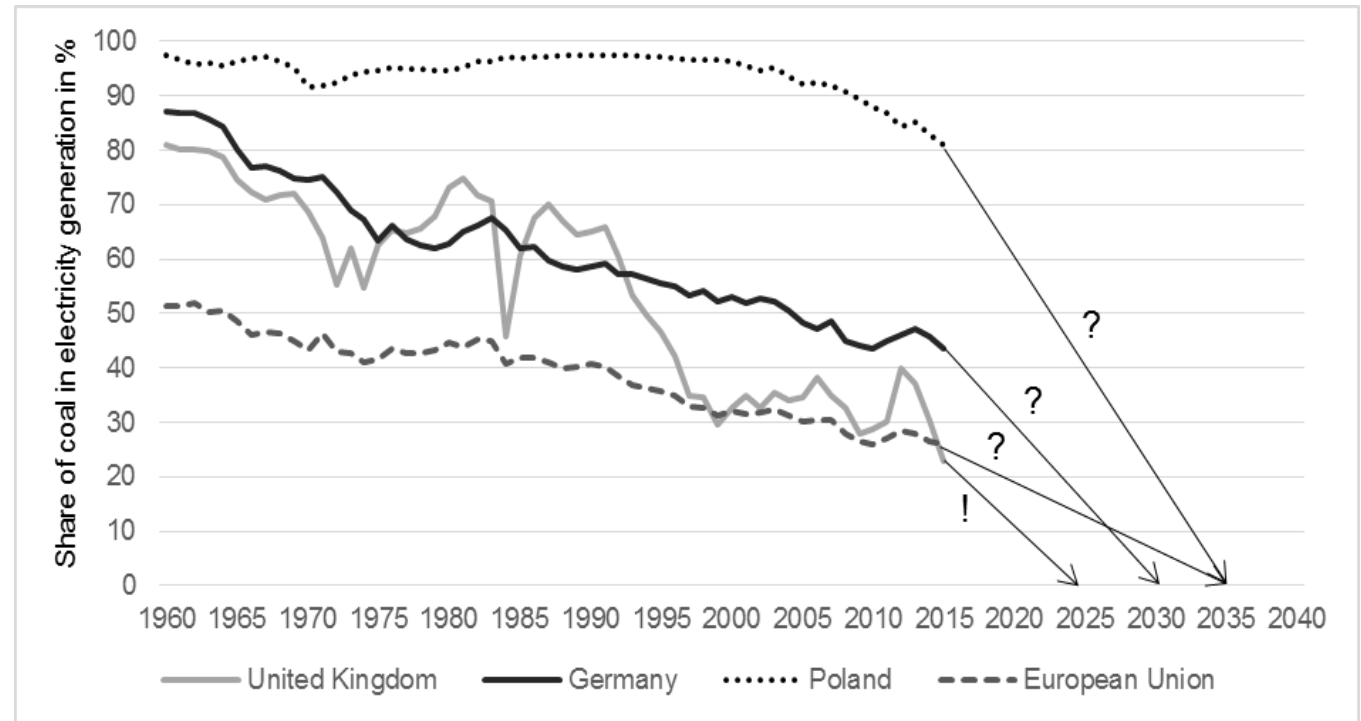
Approach

Results

Why analyse an EU coal phase-out through the UK, Germany & Poland?

▶ The UK, Germany and Poland are the biggest producers, importers and consumers of coal.

▶ Different dependencies on hard coal & lignite production and imports.



Own depiction based on World Bank (2017) and Agora Energiewende (2016).

Various quantitative analyses (Breevoort et al. 2015; Climate Analytics 2017; Shearer et al. 2017; Rockström et al. 2017; Oei et al. 2015, etc.) **have shown that to comply with the Paris Agreement, coal consumption will have to end around 2030.**

▶ ***But how can a coal phase-out be achieved?*** ◀

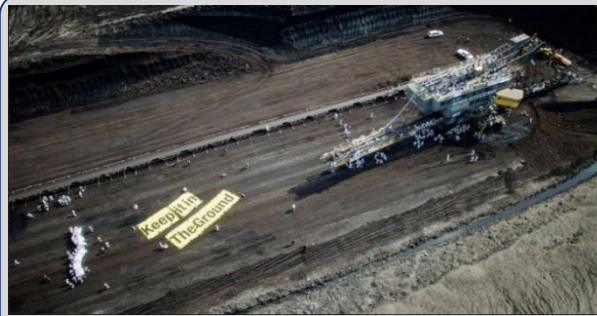
Necessity to phase-out coal vs. current status quo.

United Kingdom



- Installed coal capacity: 15 GW.
- Import dependence coal: 88%.
- First country to mainly use fossil fuels (steam engine 18th century).
- 52% drop in coal use in 2016 compared to 2015.
- Coal phase-out: by 2025.

Germany



- Installed coal capacity: 49 GW.
- Import dependence coal: 45%.
- Biggest lignite producer globally, biggest hard coal importer EU.
- Coal phase-out plans currently discussed on political level, no fixed date set.

Poland



- Installed coal capacity: 27 GW.
- Import dependence coal: -8%.
- EU's 1st hard coal & 2nd largest lignite producer.
- Bad mining conditions, domestic coal more expensive than imports.
- Expansion plans for coal mines and power plants.

Sources: Amazon (2016); Deutsches Polen-Institut Darmstadt und Forschungsstelle Osteuropa(2016); Politico (2015); RBB 24 (2016).

Research outline and methodology

Starting point Analysis

A coal phase-out is crucial to reach emission reduction targets. It needs to be actively **structured to enable a socially acceptable transition**, to avoid e.g. capacity or grid constraints and to overcome vested interests.

Research Questions

Which factors led to the **diverging developments** of the coal market in the UK, Germany and Poland?

Which factors have **enabled coal regime destructions** in the past, and which ones have **prevented the transition**?

Approach

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Research outline and methodology

Starting point Analysis

A coal phase-out is crucial to reach emission reduction targets. It needs to be actively **structured to enable a socially acceptable transition**, to avoid e.g. capacity or grid constraints and to overcome vested interests.

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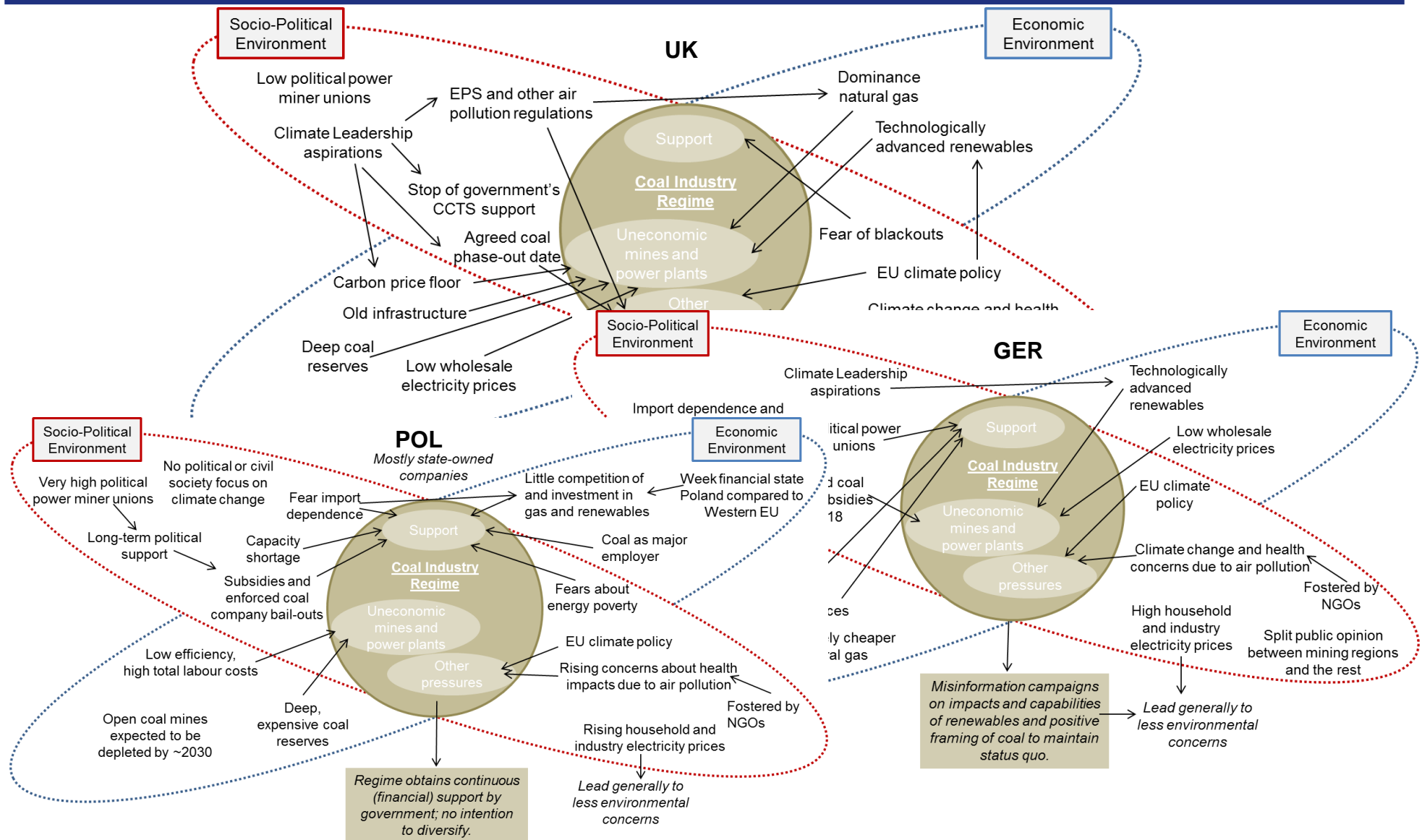
Approach

An approach needed that incorporates political, social, economic, environmental and technical factors.

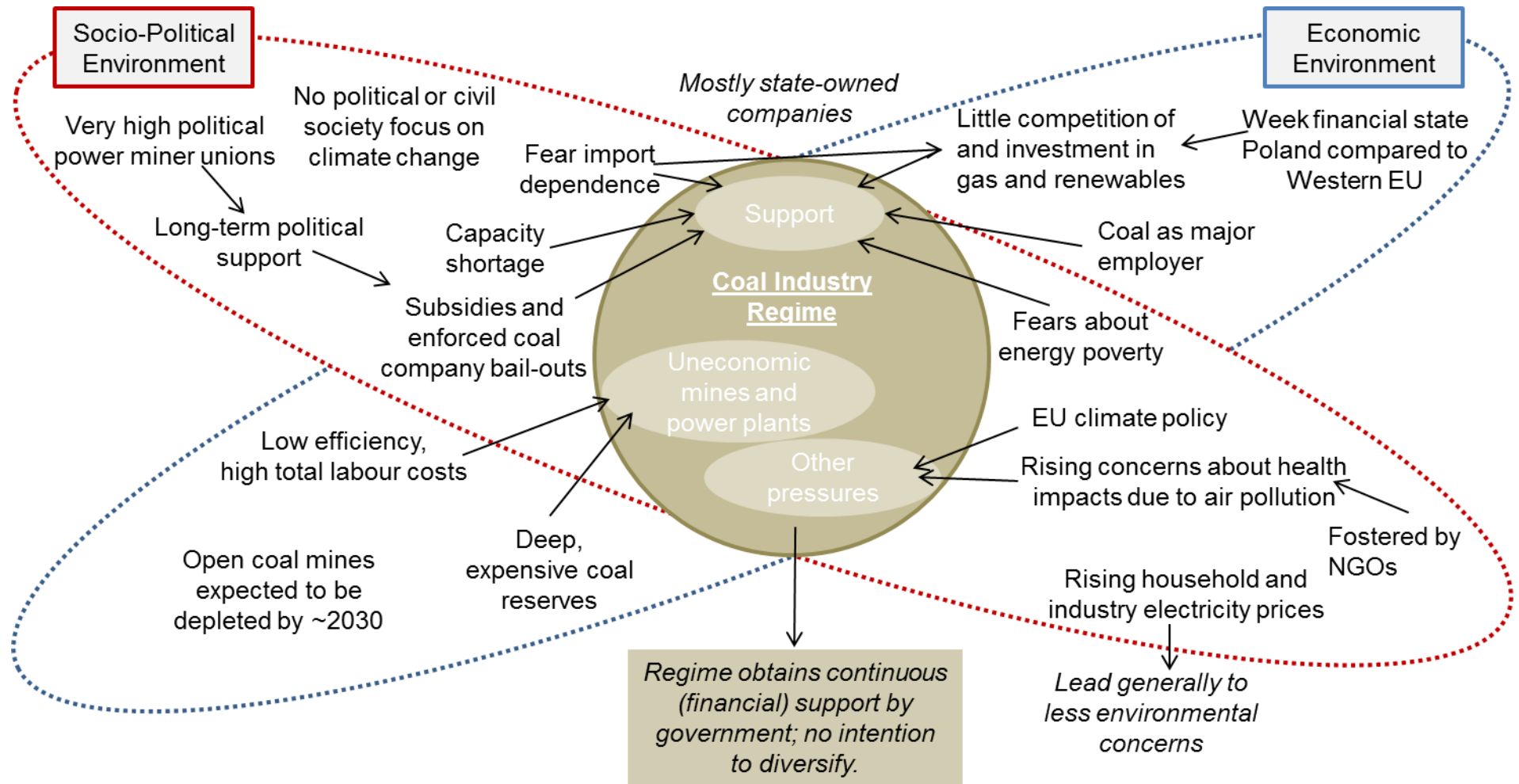
Application of a **stakeholder analysis** combined with the **Triple Embeddedness Framework** by Geels (2014).

Results

Illustration of Triple Embeddedness Framework (TEF)



TEF analysis results for Poland as illustration for methodology



Vested interests in Polish coal prevent a transition

	Poland
Socio-political pressures	<ul style="list-style-type: none">- Strong political power of miners and unions- Concerns about import dependence on Russia (gas)- Laws restricting wind power expansion- Rising opposition mainly due to air-pollution- High energy poverty levels create resistance to change- ...
Techno-economic pressures	<ul style="list-style-type: none">- Hard coal mining sector loss making, dependent on state support- Open lignite mines expected to be depleted by ~2030- Electricity capacity shortage- ...
Firm-level responses	<ul style="list-style-type: none">- State enforced bail-outs of (majority state-owned) coal corporations- Lobby against renewables to avoid more competition and losses- Continued production leads to mounting coal stockpiles- ...

Main results of TEF analysis for each case study country

▶ **UK:** The **Carbon Price Floor** and **Emission Performance Standards** were successful tools to drive coal out of the market.

Cautionary tale: mere **switch to natural gas** needs to be prevented in other countries.

▶ **GER:** The overall increase of **renewable energies** is not enough to drive coal out of the market, due to successful lobbying of major electricity corporations and unions against e.g. the climate levy and for **continued (financial) support** for coal.

▶ **POL:** **Uneconomic coal** is not enough to end its production due to **strong relations** between the **state and corporations** and **powerful unions**. **Dwindling resources** and rising resistance against **air pollution** might accelerate coal's decline.

Research outline and methodology

Starting point Analysis

A **coal phase-out is crucial to reach emission reduction targets**. It needs to be actively structured to enable a socially acceptable transition, to avoid e.g. capacity or grid constraints and to overcome vested interests.

Research Questions

Which factors led to the **diverging developments** of the coal market in the UK, Germany and Poland, and to the East-West divide?
Which factors have **enabled coal regime destructions** in the past, and which ones have **prevented the transition**?

Approach

Approach necessary that can incorporate political, social, economic, environmental and technical factors.
Application of a **stakeholder analysis** combined with the **Triple Embeddedness Framework** by Geels.

Results

Which **policies** could best **support** a coal phase-out at a domestic and EU-wide level?

Politically feasible measures to foster coal phase-outs

MEASURE	POSSIBLE ADVANTAGES	POSSIBLE SHORTCOMINGS	PROSPECTS OF IMPLEMENTATION
CO ₂ floor price (and ceiling)	If implemented EU-wide: no cross-border leakage effects; targets several sectors besides electricity; more planning security	Politically feasible prices probably too low incentivise renewable investments on the necessary scale	EU-wide: Possibility UK: Implemented Carbon Price Floor GER: Possibility POL: Unlikely
Coal phase-out law	Increasing investment security and reducing long-term emissions	Outcome of auctioning of allowances would be difficult to predict	UK: Coal phase-out by 2025 GER: Possibility POL: Unlikely; no political ambition
Emissions performance standard (EPS, for new plants and retrofits)	Prevention of CO ₂ -intensive investments and future stranded assets (possibly increasing resistance)	Minor short-term reduction in emissions	UK: EPS introduced in 2013 GER: Likely, but German utilities committed to stop investments in new plants by 2020 POL: Possibility
Emissions performance standard (EPS, for existing plants)	Preservation of generation capacities; short-term emission reductions	Negative impact on economic efficiency of power plants might lead to unintended closures of older blocks	Updated BREF standards (adopted by the EU in 2017; not for CO ₂); distinction for different ages unlikely to be implemented in any of the three countries
Ending coal subsidies by 2020	Shut-down of uneconomic coal assets	Might cause too rapid shut-downs, causing supply security problems and resistance	UK: Unlikely; supply security concerns GER: Questionable POL: Unlikely, supply security & economic concerns

Main results as a basis for further research

- ▶ **Tailored solutions** for each country need to be developed to **address concerns** about rising energy prices, job losses, energy security, etc.
- ▶ Ending coal consumption is **technologically feasible** but **power, vested interests** and **social costs** need to be taken into account when designing and implementing coal phase-out strategies.
- ▶ **Hurdles** but also **opportunities** to enable a coal phase-out for each case study country have been identified and (preliminary) policy recommendations were derived.

Further research:

- ▶ Implementation of findings as **realistic scenarios** in energy models (like e.g. DynELMOD).
- ▶ In depth analysis of the **impact** of politically feasible **policies** on electricity prices, grid stability, system costs etc.

Thank you for your attention.

Hanna Brauers

hbrauers@diw.de

German Institute for Economic Research (DIW Berlin) and
Research Associate at Technical University Berlin, Workgroup for
Infrastructure Policy (WIP)



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Backup

Reasons to abandon coal

Matching Policies

Impediments to abandon coal

Civil Society

- Health, air quality and climate change concerns

Government

- Long term energy security
- UK&GER: Emission reduction commitments
- POL: Financial burden subsidies & EU pressure

NGOs

- External effects
- Civil society's interests

Unions

- Coal jobs will be destroyed long-term regardless: incentives to negotiate

Coal regime

- Long-term existence
- POL: Dwindling resources & uncompetitiveness

Civil Society

- Rising electricity prices
- Regional economic dependence

Government

- Influence unions/ voters/ coal regime
- Short-term energy security
- POL: Financial constraints for alternative investments

NGOs

- Potential financial burden on civil society and job losses

Unions

- Job losses
- Less well-paid jobs

Coal regime

- Core business is coal
- Electricity corporations not diversified (enough)

Reasons to abandon coal

Matching Policies

Impediments to abandon coal

Civil Society

- Health, air quality, climate change concerns

Government

- Long term energy security
- UK&GER: Employment commitments
- POL: Financial subsidies & E

NGOs

- External effects
- Civil society's

Unions

- Coal jobs will be lost
- long-term regional incentives to n

Coal regime

- Long-term existence
- POL: Dwindling subsidies & uncompetitiveness

- Increased subsidies for R&D and low-carbon technologies
- Structural support for regions: creation of new jobs and retraining programmes
- Short-term closure of most inefficient and polluting mines & power plants
- CO₂ floor price
- End of fossil-fuel subsidies by 2020
- Redesign of capacity payments
- Energy price support for poorest households and crucial industries
- Financial and capacity building support between EU states
- ...

Electricity prices
economic

regions/ voters/ coal

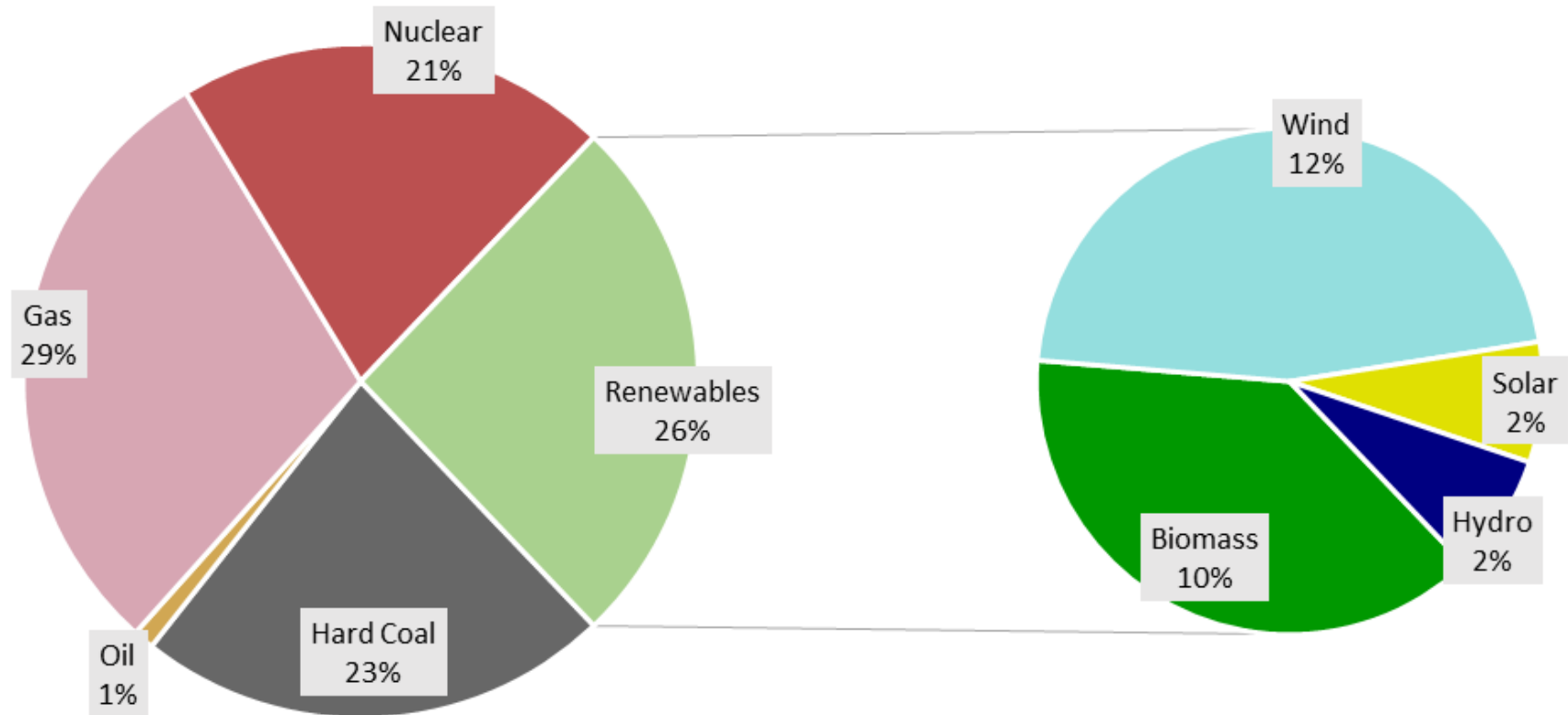
energy security
structural constraints for
investments

financial burden on
regions and job losses

jobs

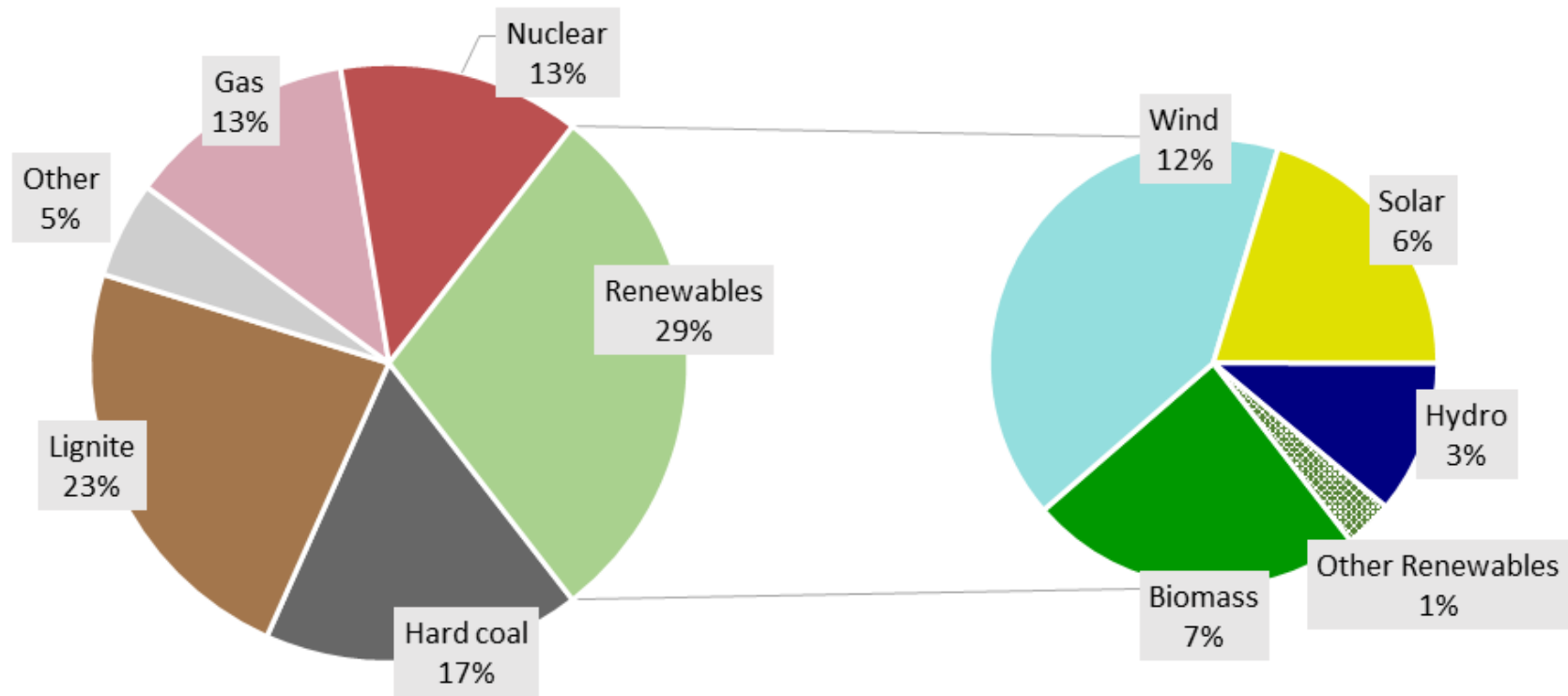
There is coal
corporations not
(enough)

Electricity Generation United Kingdom 2015



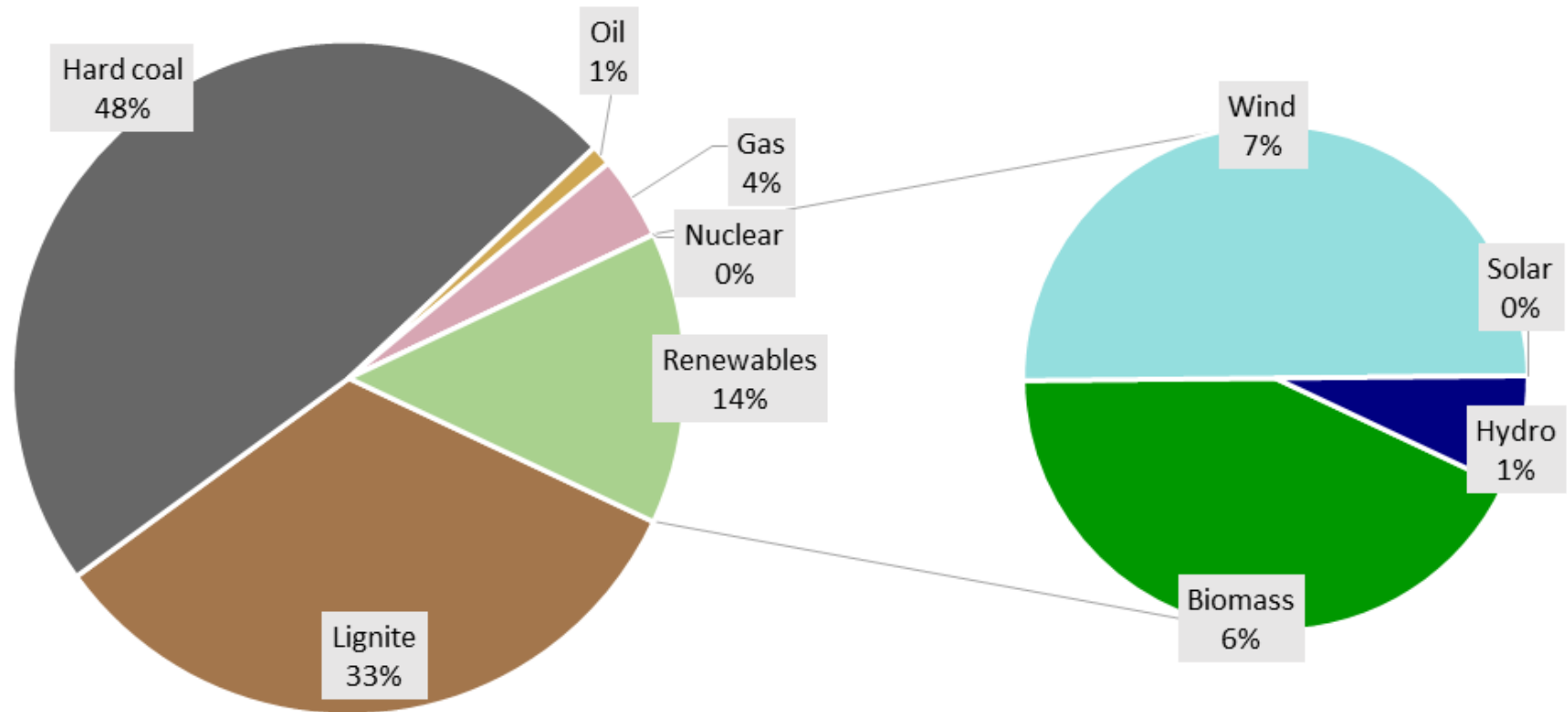
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Electricity Generation Germany 2016



Source: AG Energiebilanzen e.V. 2017. 'Stromerzeugung nach Energieträgern 1990 - 2016'.
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Electricity Generation Poland 2015



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lignite production, hard coal production & imports

Hanna Brauers
DIW Berlin and TU Berlin

A glimpse of factors influencing the national coal regimes.

	United Kingdom	Germany	Poland
Socio-political pressures	<ul style="list-style-type: none"> - Coal phase-out by 2025 - Low political power of unions - Climate Leadership aspirations - EPS and other air pollution regulations - Stop of CCTS support - Rising electricity prices and fear of black-out lead to opposition to change 	<ul style="list-style-type: none"> - Lignite as domestic resource reduces import dependence and stabilises the electricity grid - Nuclear phase-out - (Inter-)national climate commitments - Strong civil society participation, climate change concerns - Rising electricity prices create opposition to the energiewende 	<ul style="list-style-type: none"> - Fear of import dependence on Russia and energy poverty - Strong political power of miners and unions, coal sector major employer - Failed attempts of fracking and nuclear energy, laws restricting renewables expansion - Rising opposition due to air-pollution - Weak financial state Poland compared to Western EU
Techno-economic pressures	<ul style="list-style-type: none"> - CPF made coal uncompetitive - Expensive exploration stopped domestic mining - Dash for gas created dominance of gas - Renewables competitor, especially large scale solutions - Old infrastructure 	<ul style="list-style-type: none"> - Competition renewables strong - Low wholesale electricity prices, comparably high natural gas prices - End of hard coal subsidies 2018 (reversing now) - Lignite reserve payments - Low EU ETS prices (making lignite competitive) 	<ul style="list-style-type: none"> - Losses hard coal mining sector since 1990s, not internationally competitive - Open coal mines expected to be depleted by ~2030 - Low efficiency and high costs mining - No existing alternatives in installed electricity capacities - Capacity shortage
Firm-level responses	<ul style="list-style-type: none"> - Closure of deep-pit mines - Closure of most coal plants - Switch to biomass-co-firing and natural gas - Framing: 'Keep the lights on' debate, to create fears of blackouts - No investments in CCTS infrastructure 	<ul style="list-style-type: none"> - Lobbying against climate levy, enforcing capacity payments - Company splits (RWE, E.ON) - Framing of coal as partner of the renewables, bridge technology - Presenting renewables as unfit for electricity market 	<ul style="list-style-type: none"> - State enforced bail-outs of coal corporations - Mounting coal stockpiles - Lobby against renewables to avoid more competition and losses

Recent policy developments concerning coal.

United Kingdom

- Former period of climate leadership, with carbon floor price.
- Coal phase-out announcement.
- Capacity concerns – “keep the lights on” discourse.
- Now slashing of REN support, CCS funding.
- Implications of Brexit still uncertain.

Germany

- Effective support for REN and phase-out of nuclear power.
- End of hard coal subsidies but continued support for lignite.
- Rejection of commission with exclusive focus on coal phase-out, climate levy, etc.

Poland

- Elections of PSI won (also) on coal-promises.
- Collision course with EU climate policies, hostile REN policies.
- Coal mining, electricity generation and electricity grid mainly state owned.
- Government enforces rescue of loss-making coal companies.

EU: Main instrument EU-ETS; emission directives & standards; development funds, refusal of 2030 climate and energy target adaptation to Paris Agreement.

Subsidies for Coal in the UK, Germany and Poland

Post-tax subsidies for coal in 2015			
	in US\$ billions (nominal)	as a percentage of GDP	in US\$ per capita (nominal)
United Kingdom	29	0.95%	440
Germany	41	1.04%	501
Poland	48	8.02%	1,253

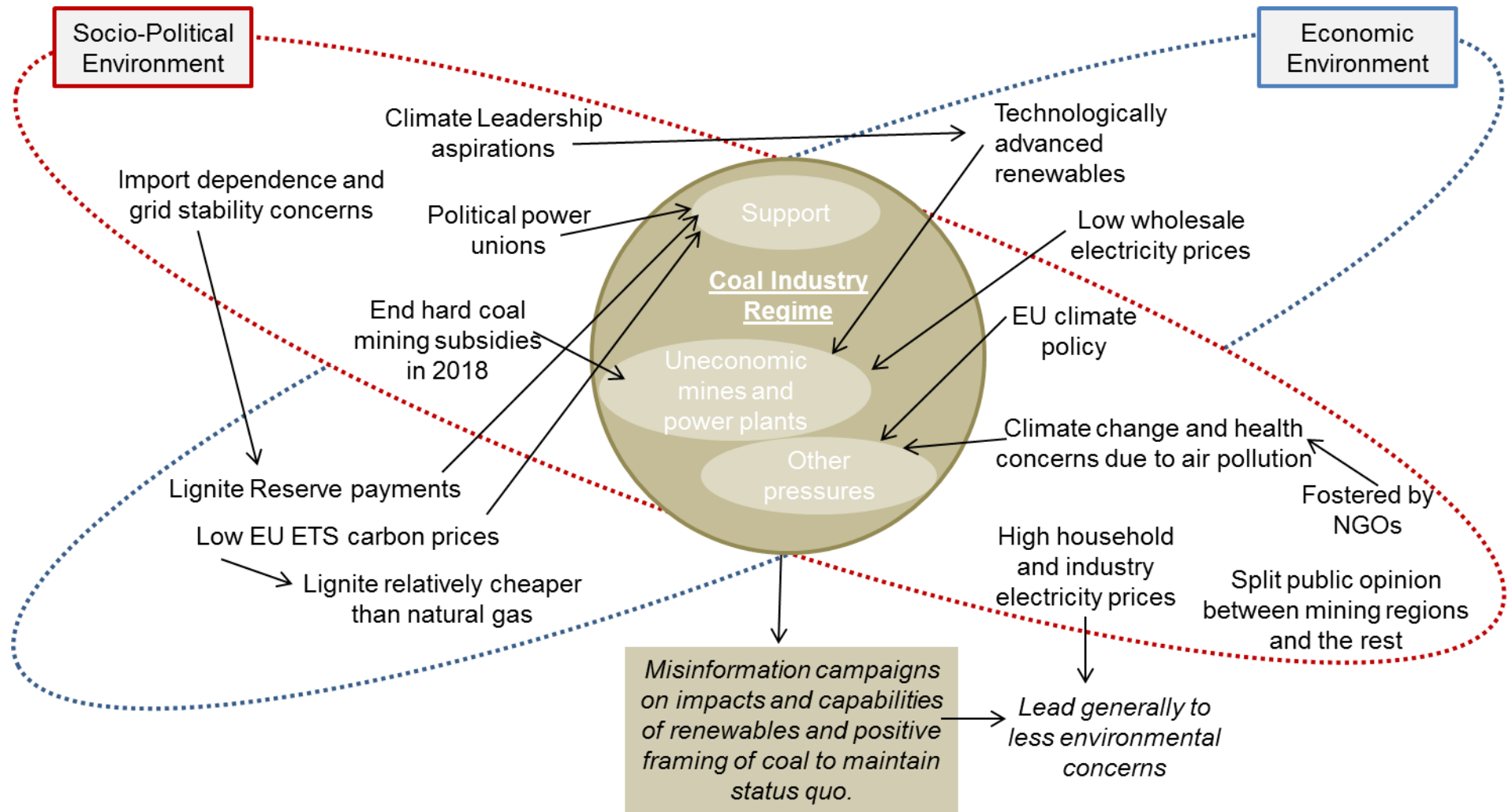
Subsidies for coal including externalities in 2015. IMF (2015).

	Coal subsidies in € million, annual average 2005-2016
United Kingdom	435
Germany	3202
Poland	920

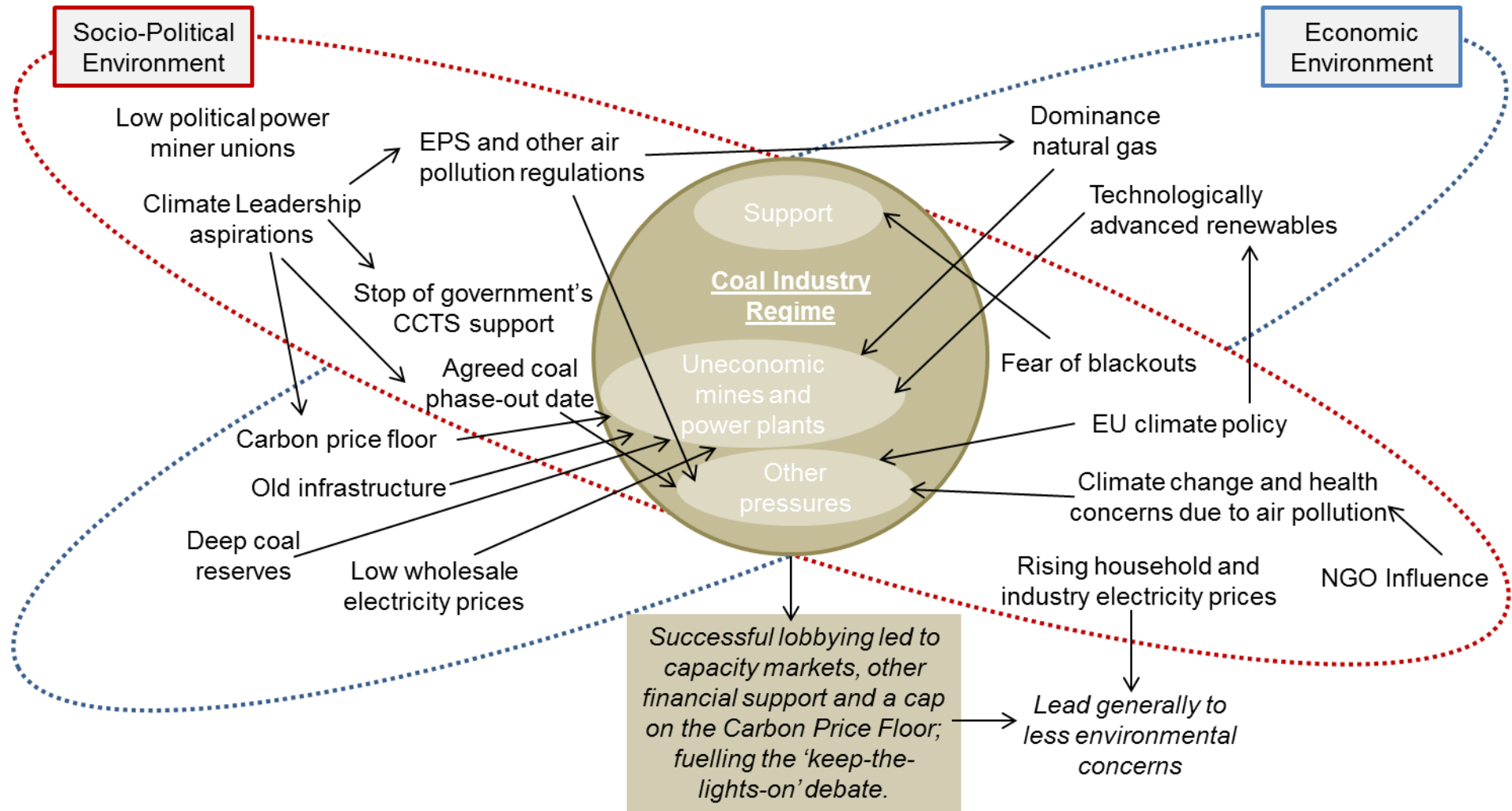
Direct coal subsidies, without externalities annual average 2005-2016.
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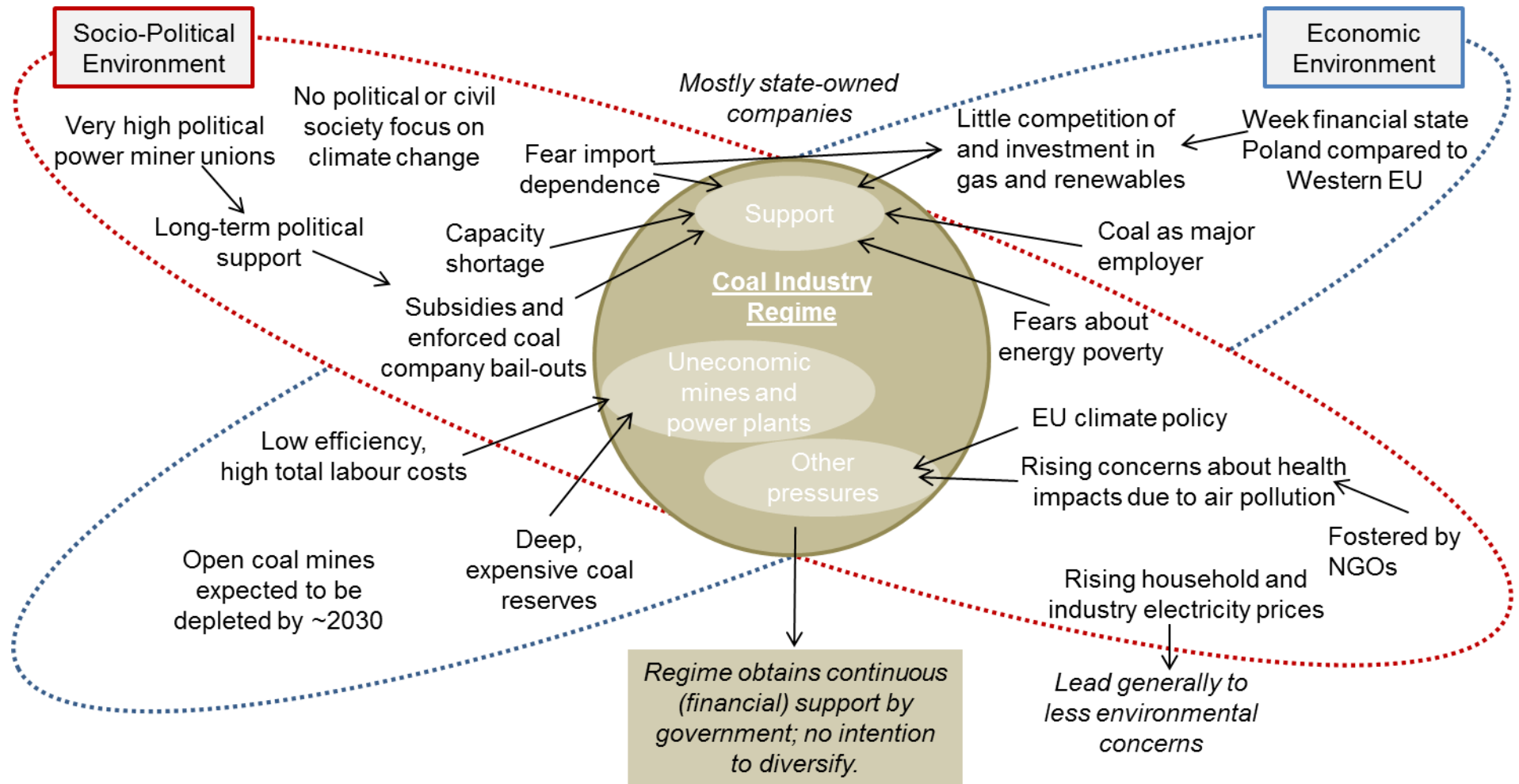
TEF Analysis Results Germany



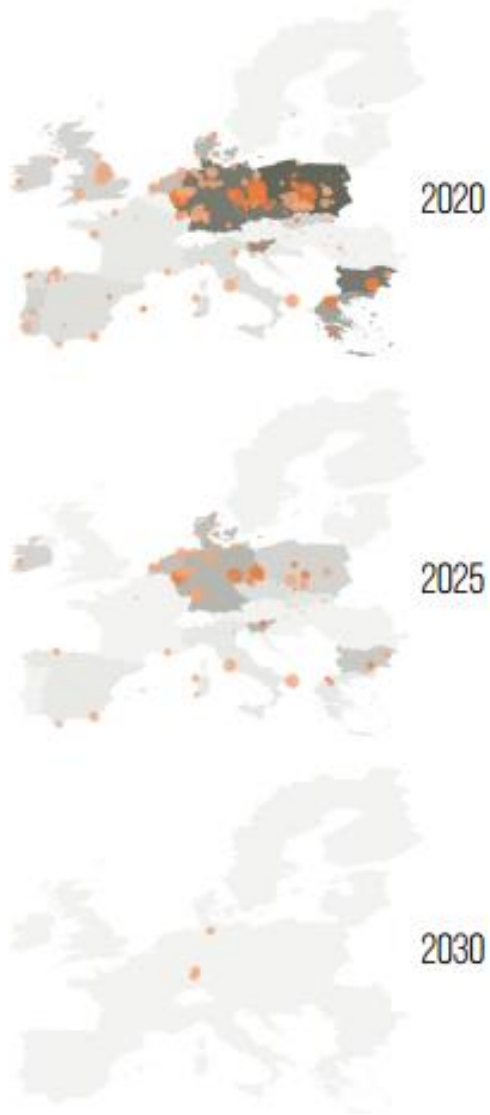
TEF Analysis Results UK



TEF Analysis Results Poland



Coal Phase Out Scenarios.



- Policies** aiming to achieve a coal phase-out will have a **strong impact** on the **profitability** of thermal power generation and utility business models.
- Should avoid **lock-in effects** and additional **stranded assets**
 - Should manage the deep systemic transformation with strong **distributional consequences** (corporations, local and state governments, workers, civil society and also between countries)

Poland's coal industry losses

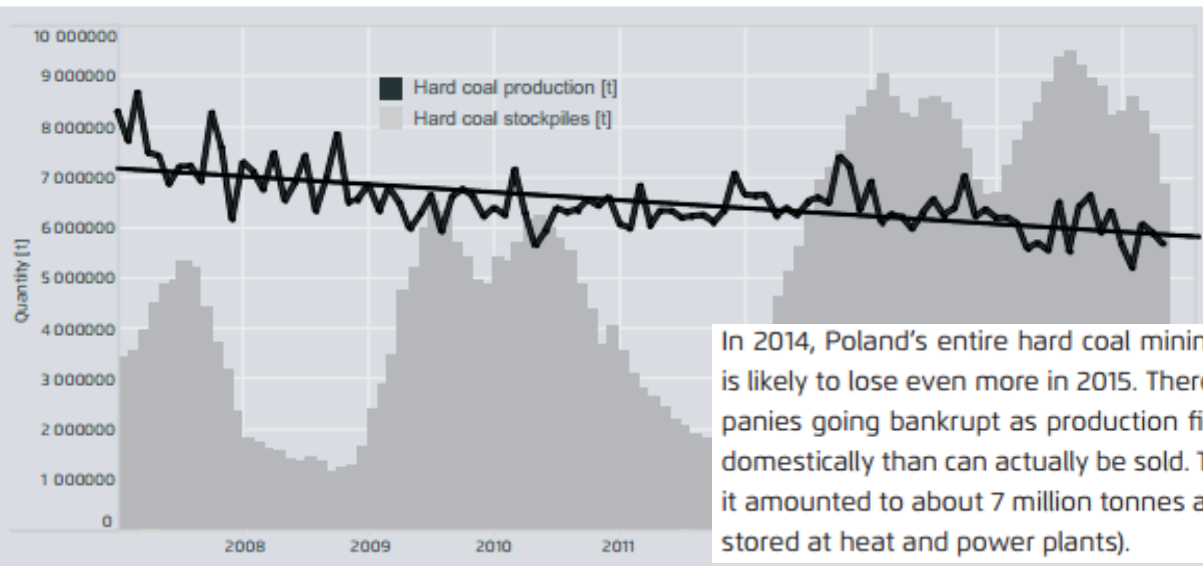


Figure 13. Poland's hard coal production and stockpiles
(source: ARP)

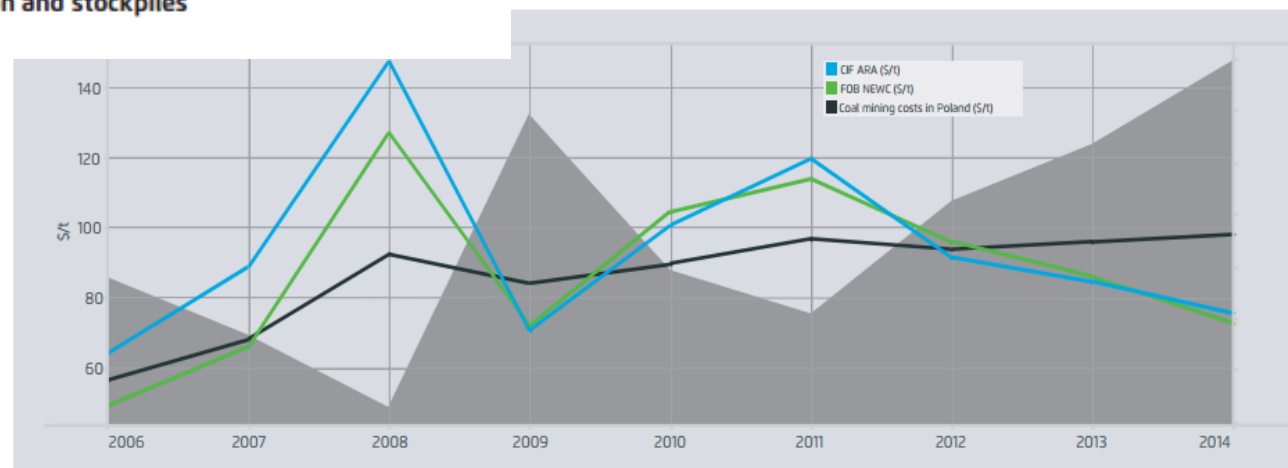
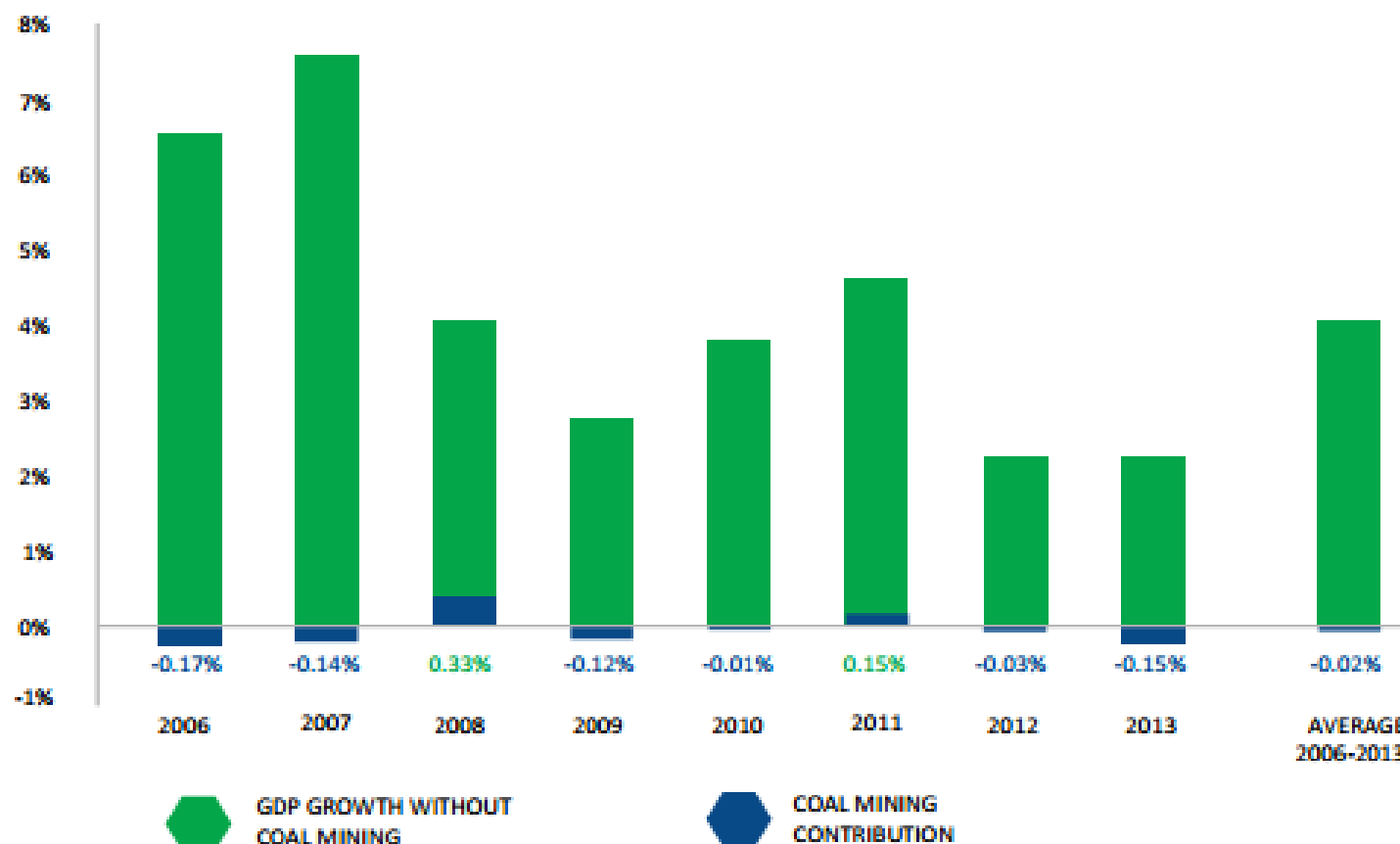


Figure 11. Coal mining costs in Poland vs. world market prices
(source: the Ministry of Economy, Deloitte analysis)

Coal industries contribution to real GDP Growth 2005-2013

CHART 2. COAL INDUSTRY'S CONTRIBUTION TO REAL GDP GROWTH IN POLAND AFTER 2005.



SOURCE: WISE INSTITUTE BASED ON DATA FROM THE CENTRAL STATISTICAL OFFICE OF POLAND AND EUROSTAT

Warsaw Institute for Economic Studies (2015): Whither are you headed Polish coal?