E3G

Risk managing cost-effective decarbonisation of the power sector in Europe

The case of Germany and Poland

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KAS-SWP-PISM 'Germany and Poland – Towards an Energy Transformation Partnership'

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- Strategic context
- Understanding risks
- Objectives and methodology of the analysis
- Key conclusions
- Final remarks and inputs for discussion

Strategic context

- Europe needs to largely decarbonise its economy by 2050 to meet climate targets. All current analysis suggests that this will be achieved most cost-effectively by taking early action in the power sector.
- Following Fukushima, many countries reviewing the role of nuclear in their electricity generation mix. Germany decided to phase-out nuclear by 2022.
- Under current fiscal conditions, limited appetite in Treasuries to push for expensive low-carbon technologies instead of cheaper alternatives in the short term
- Large scale domestic exploitation of shale gas in the US had a significant impact on the domestic market and imports from elsewhere, and global prices responded. Some EU countries, such as Poland, keen to replicate.
- Each of the narratives is associated with a range of technical, financial and geo-political risks, which are not fully recognised

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Understanding risks and uncertainties (I)

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- Currently on BAU baseline trajectory of 3℃ to 4℃ by 2050. However, **climate change is not yet considered a critical enough national interest**
- Recent analysis suggests that ‚shale gas revolution' could turn into a bubble:
  - Low gas prices arose from **overproduction of natural gas**
  - US **shale gas and shale oil reserves are likely to be overestimated by a minimum of 100% and by a maximum of 400-500%**
- New Lord Stern-Carbon Trucker report warns of 'carbon bubble' :
  - Only 31% of current fossil fuel reserves could be burned for an 80% chance of keeping global temperature below 2℃. **HSBC estimates that 40-60% of the market capitalisation of oil and gas companies are at risk**
  - S&P's could downgrade credit ratings of oil companies over 2014-2017

Understanding risks and uncertainties (II)

- **Future of oil and gas price development highly uncertain**
  - Oil price rose from $25 a barrel in 2002 to $110 in 2012. Industry's annual capital spending more than tripled in the past 10 years – **$674 bn allocated by the top 200 oil and gas and mining companies in 2012** for new reserves and extracting tecniques. Yet **reserve replacement ratio only 92%**
  - **Assessing remote, undeveloped frontiers is no guarantee for increasing producton**, locked industry into **more expensive cost structure**, and **increases unforseen stresses** on personnel, equipment and environment
- **Technology cost uncertainties** remain high between major low carbon generation sources to 2030 such as offshore wind, CCS and nuclear.
- **Political uncertainty** on ambition levels at EU and International level
- **Future EU energy market regulation unclear** – Huge potential savings from sharing resources across the EU (€416 bn by 2030)
- **Complex policy and regulatory environment** - How to deploy low-carbon technology? How to unlock economic benefits? How to achieve climate security?

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Objective of the analysis

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WHAT IT IS	WHAT IT IS NOT
• An attempt to change the way people think about technology choices from cost minimisation to **risk management**	• An attempt to forecast the future
• Something different from traditional 'equilibrium' modelling studies	• An assessment of market design choices (e.g. what drives investment, capacity mechanisms, welfare allocation) and cross-border effect
• Credible and interesting from the member state perspective as well as at a European level	• An analysis of the future role of ETS and 2030 carbon caps
• Provides a focus on the role of RES and gas	• An evaluation of nuclear power
	• An evaluation of interconnection and optimising resources across the EU

Methodology

- The Investment Decision Model developed is an **agent-based** investment model. It realistically captures investor behaviour by assuming **no perfect foresight** and a **five-year market foresight**.
- Focuses on the **resilience and robustness of the decarbonisation pathways** to test the market responds to unforeseen but credible events
- A similar analysis was carried out for Great Britain to represent different Member States' circumstances and reflect European-wide issues

Overview of the baseline scenarios

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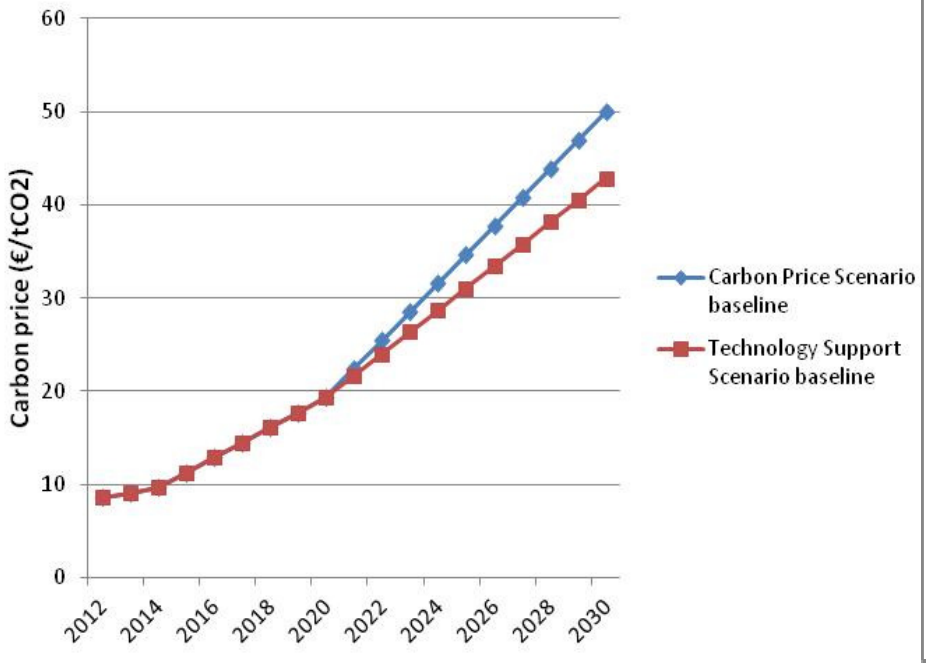
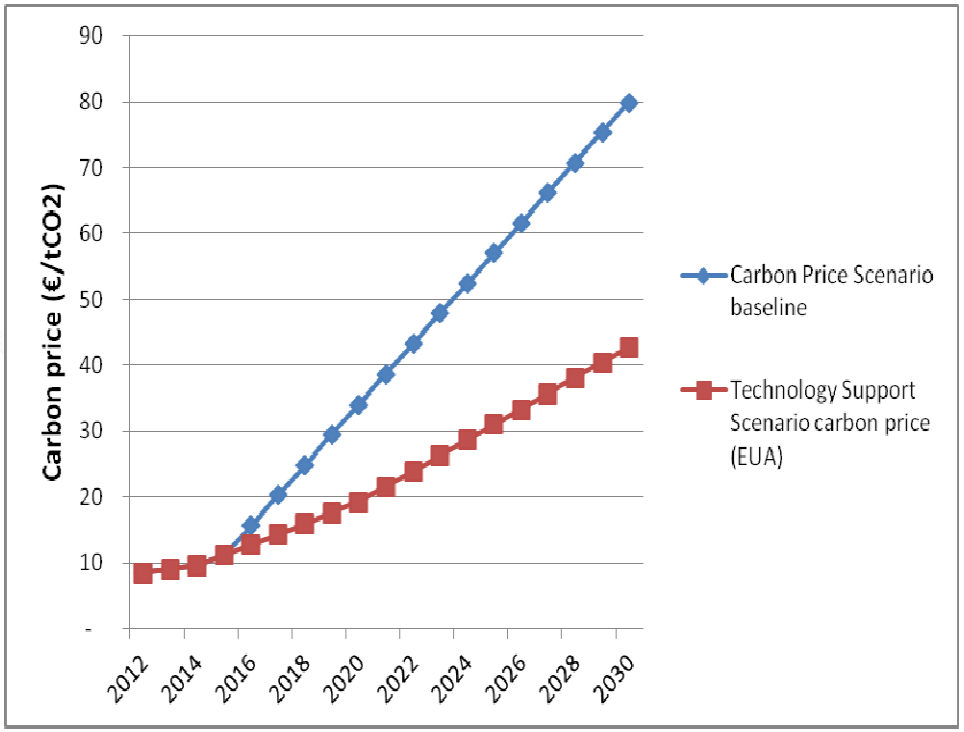
Carbon Prices in the baseline scenarios for Poland



Two baseline policy scenarios reflect competing approaches to delivering power sector emissions reduction in line with ARE 2011 analysis **40% reductions** in carbon emissions in electricity generation by 2030

Carbon Prices in the baseline scenarios for Germany



Two baseline policy scenarios reflect competing approaches to delivering power sector decarbonisation in line with the power sector carbon target of **95 MtCo2 pa** in 2030 based on the Leitstudie 2011A scenario**.**

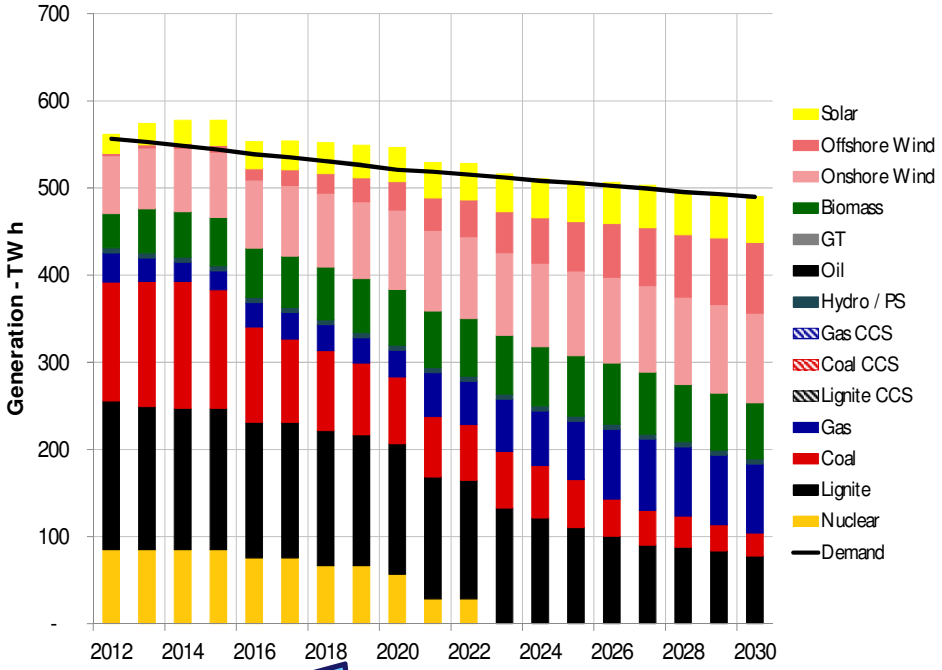
Scenario analysis and sensitivities

- Establish two baseline scenarios which set out credible technology pathways by 2030. For each scenario the model shows:
  - New Build
  - Generation capacity and mix (see graphs)
  - Power sector and wholesale electricity costs
  - Emissions by fuel
- Impose **unforeseen** changes in key uncertainties such as:
  - Electricity demand (high vs low demand)
  - Gas price (high vs low)
  - RES deployment (e.g. high vs low offshore wind)
  - CCS deployment and costs (high vs low)
  - Ambitions (high vs low)

Generation mix in Germany - Unabated hard-coal and lignite is replaced with offshore wind and gas

Technology Support Scenario baseline

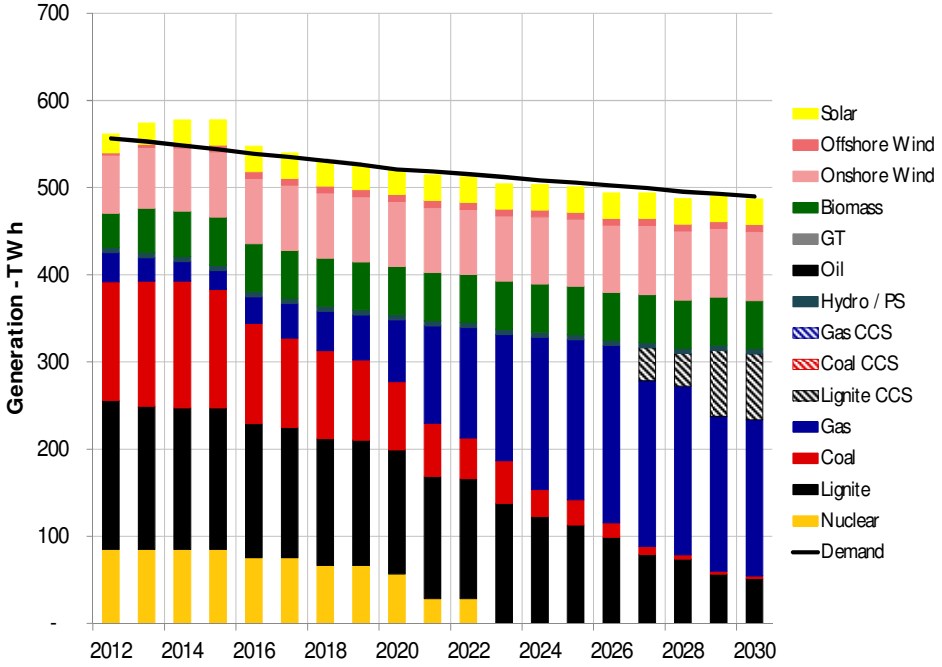
Generation Mix (TWh)



Despite significant reductions, lignite and, to a certain extent, unabated hard-coal remain in the mix up to 2030 and CCS capacity is not required

Carbon Price Scenario baseline

Generation Mix (TWh)



Unabated gas increases its share of the generation mix significantly, as a result of the higher carbon price and CCS capacity is required

In Poland, a higher carbon price drives investment in gas and CCS lignite; on the other hand, technology subsidies bring more RES and gas capacity

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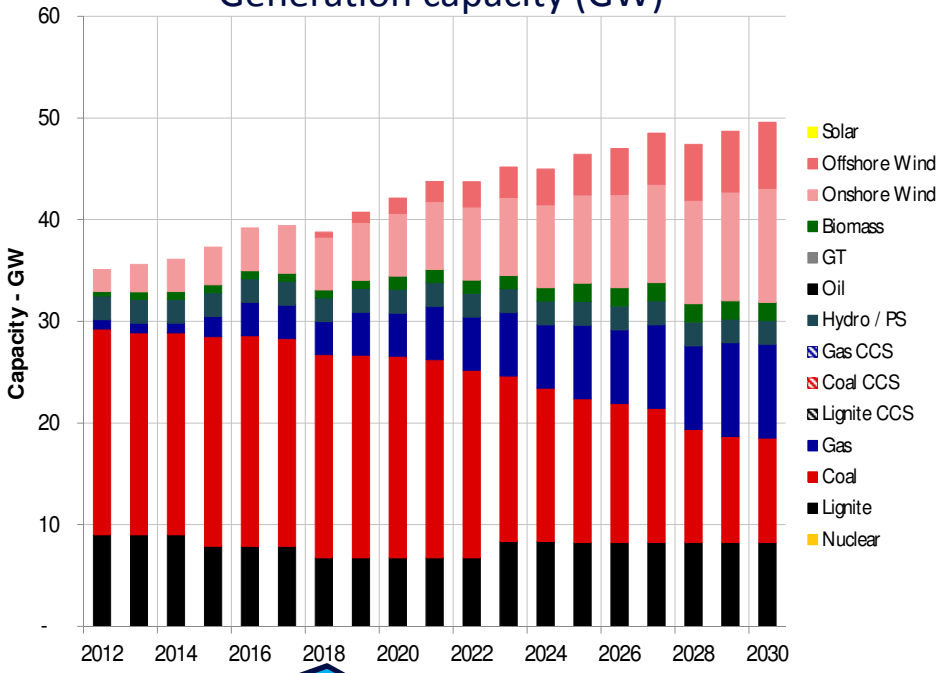
Technology Support Scenario baseline

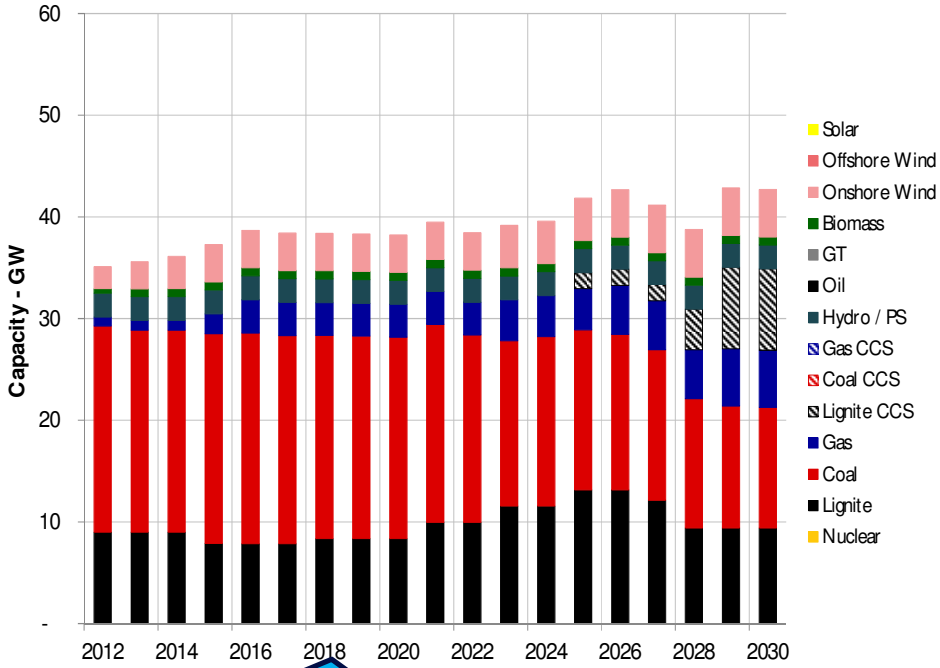
Generation capacity (GW)



Unabated lignite capacity remains roughly stable over time while unabated coal is slowly pushed out of the market. The share of gas and renewables capacity increases steadily.

Carbon Price Scenario baseline

Generation capacity (GW)



The amount of unabated Lignite and Coal capacity remains stable until about 2025, after which CCS takes an increasing share.

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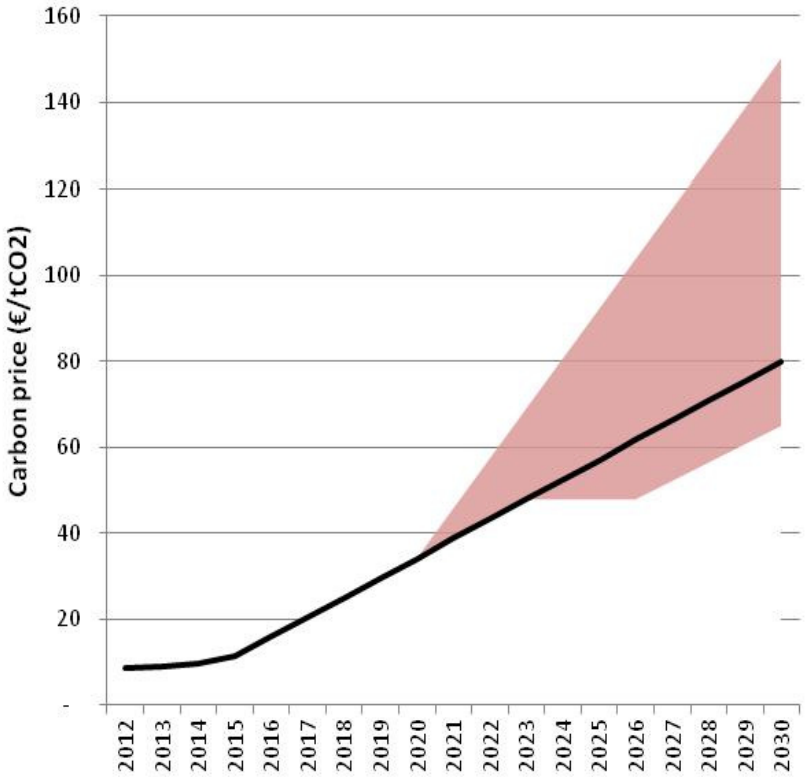
Key high-level conclusions for Germany (I)

- **The carbon price is an effective driver in increasing or reducing power sector carbon emissions yet very vulnerable to structural risks**



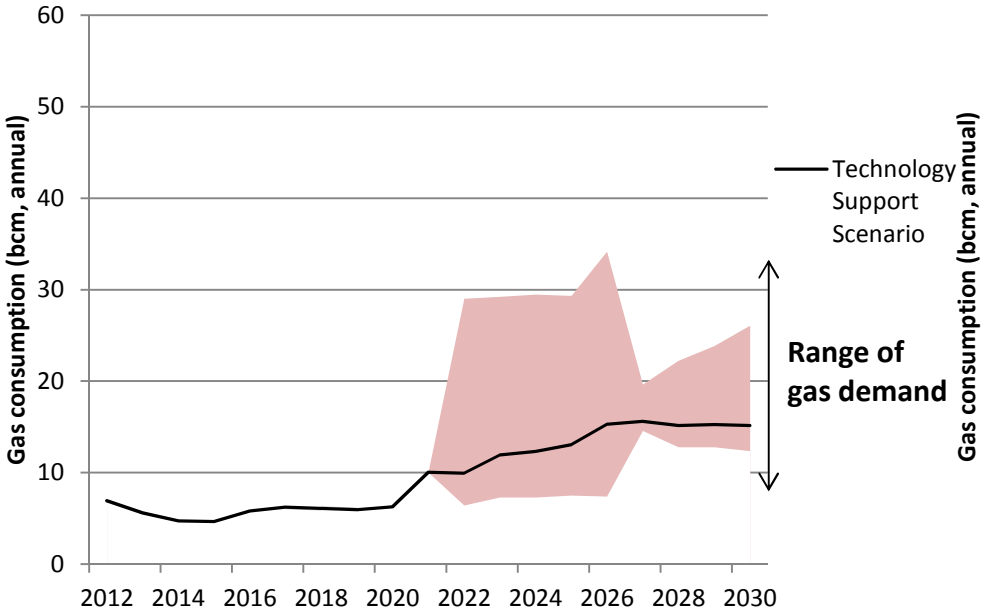
Ranges of carbon prices (52 to 150 €/tCO2)

Failures to deploy energy efficiency and CCS would mean that very high carbon prices would be required to quickly attract significant level of renewable energy.

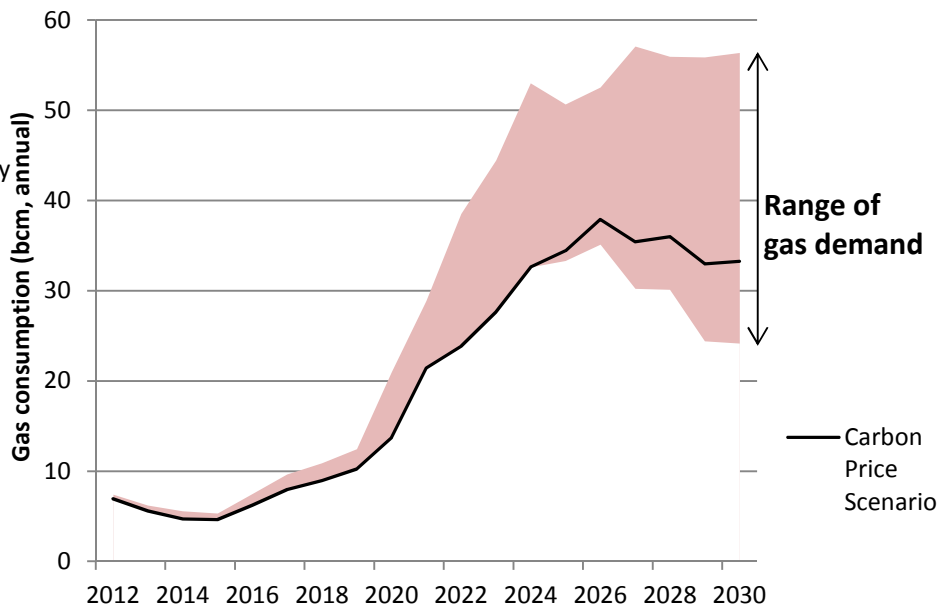
Key high-level conclusions for Germany (II)

- **There remains significant on-going potential for coal-to-gas switching and steady deployment of renewables.** However, **uncertainty remains over future investment required in gas infrastructure**

Technology Support Scenario
Power sector gas consumption (bcm)



Carbon Price Scenario
Power sector gas consumption (bcm)

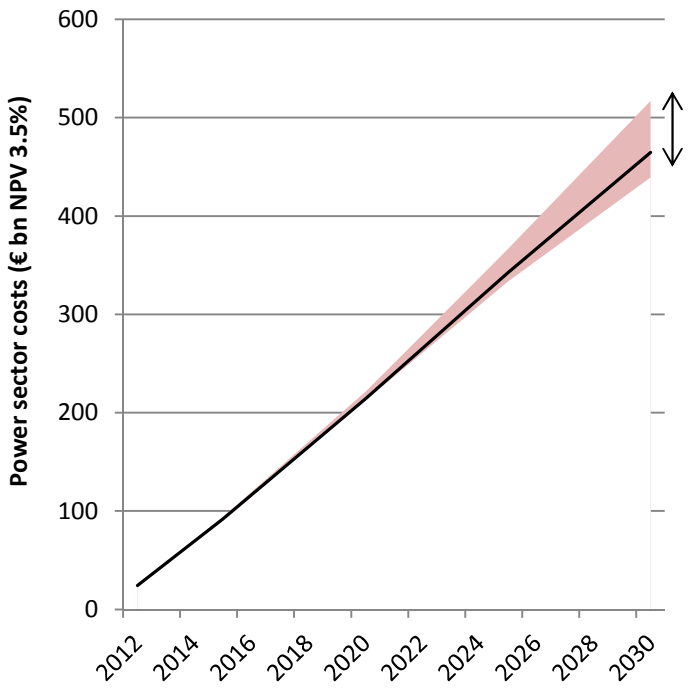


Key high-level conclusions for Germany (III)

- **Power sector costs are more predictable where technology are supported and not much higher than carbon price scenario.**

Technology Support Scenario

Power sector costs, € bn 2012-30, cumulative

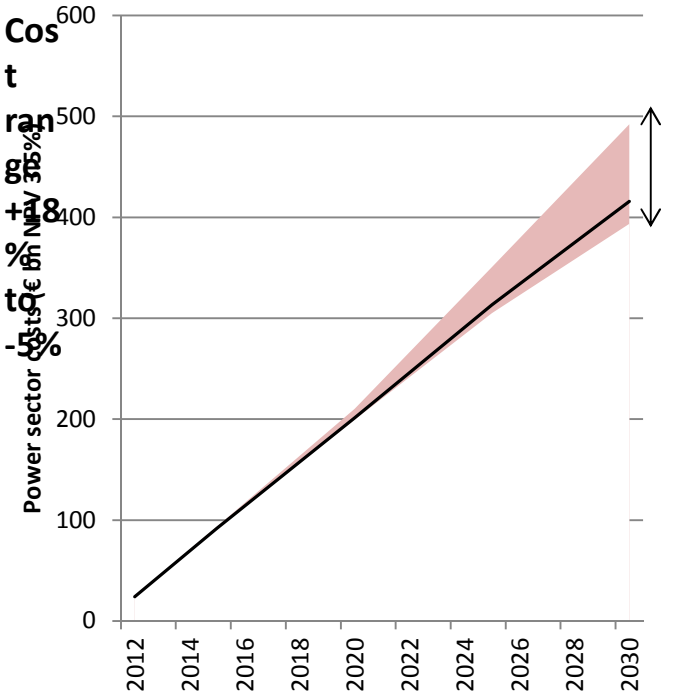


Cost range +11% to -5%

Technology Support Scenario

Carbon Price Scenario

Power sector costs, € bn 2012-30, cumulative



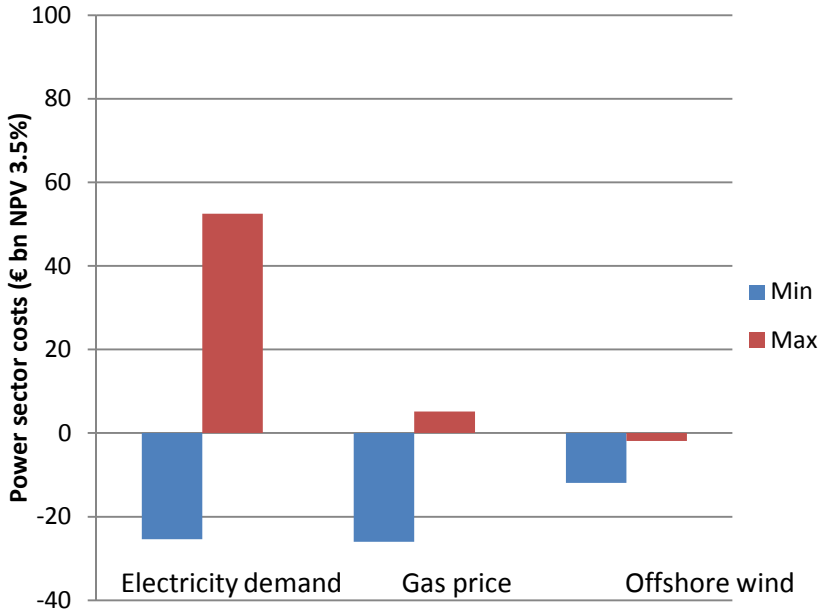
Carbon Price Scenario

Key high-level conclusions for Germany (IV)

- **Action to drive electricity demand reduction and demand response reduces future price risks** as costs increase significantly if electricity demand is higher than expected

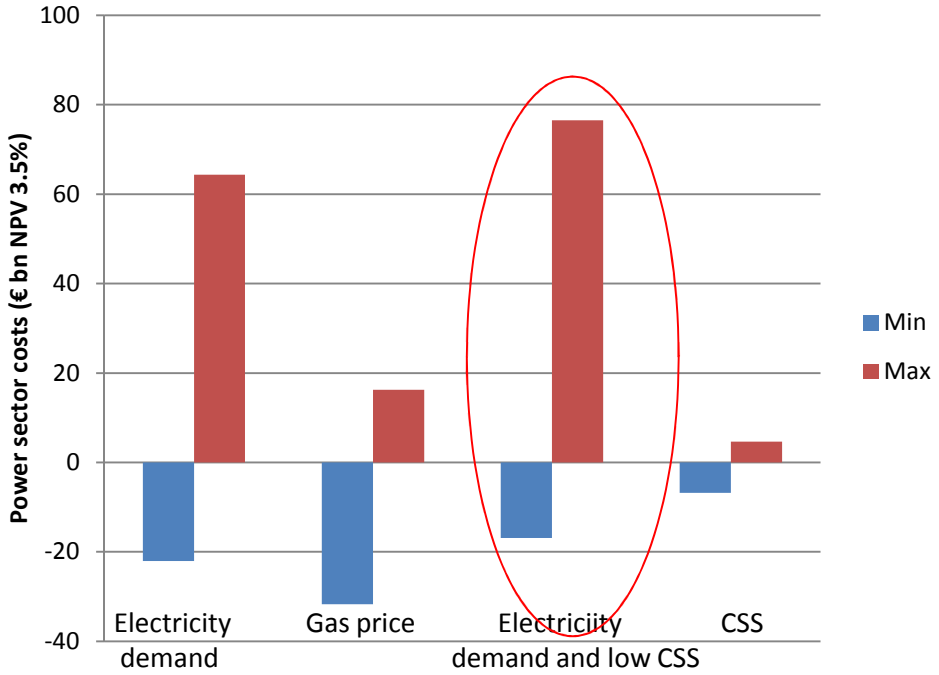
Technology Support Scenario

Power sector costs, € bn 2012-30, cumulative



Carbon Price Scenario

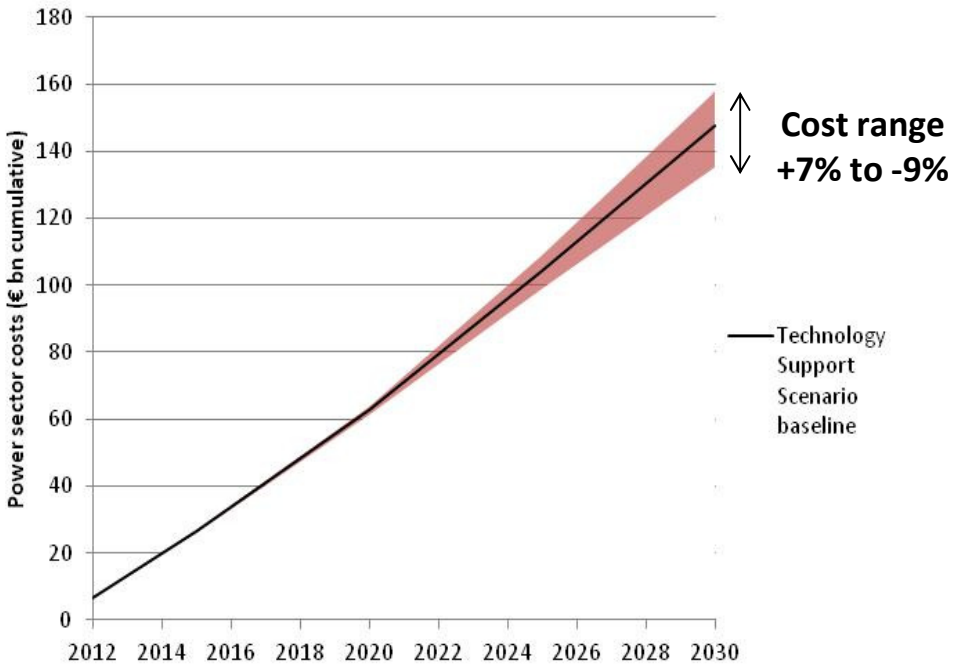
Power sector costs, € bn 2012-30, cumulative



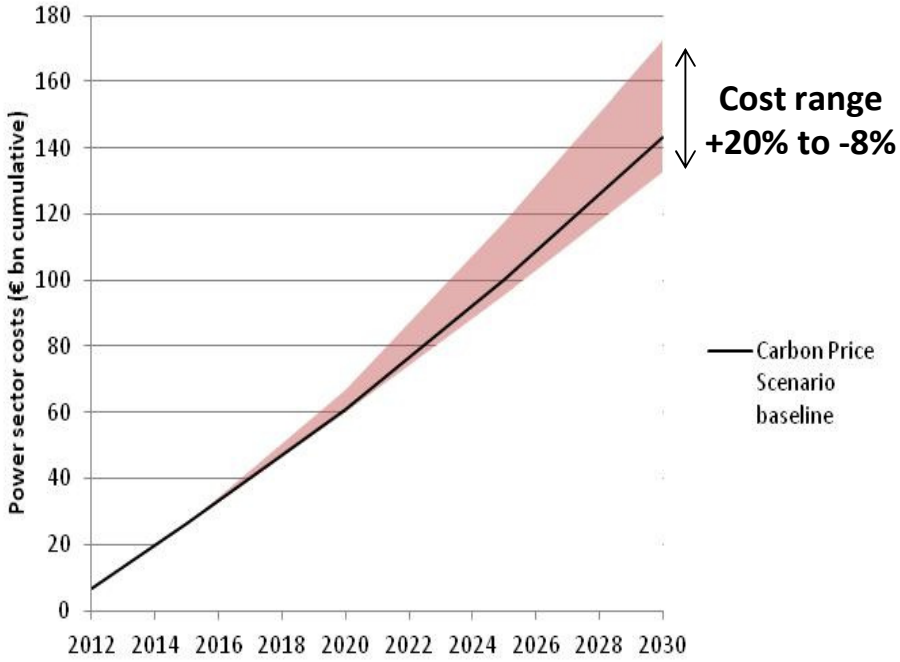
Key high-level conclusions for Poland (I)

- **Subsidising renewables and gas generation provides more policy resilience without increasing power sector costs. RES are not more expensive than relying on nuclear or CCS**

Technology Support Scenario
Power sector costs, € bn 2012-30, cumulative



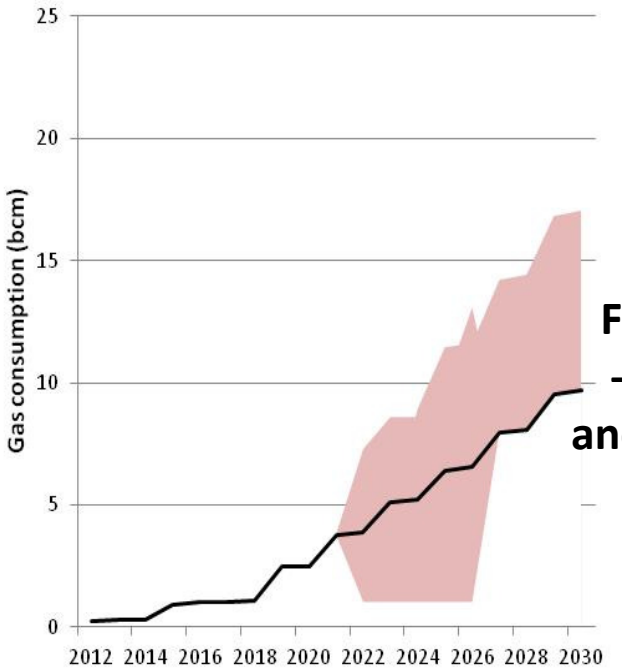
Carbon Price Scenario
Power sector costs, € bn 2012-30, cumulative



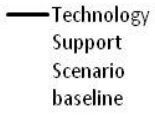
Key high-level conclusions for Poland (II)

- **Without enhancing deployment of renewable Poland risks embedding a long term exposure to gas** especially if CCS lignite or efficiency fail.

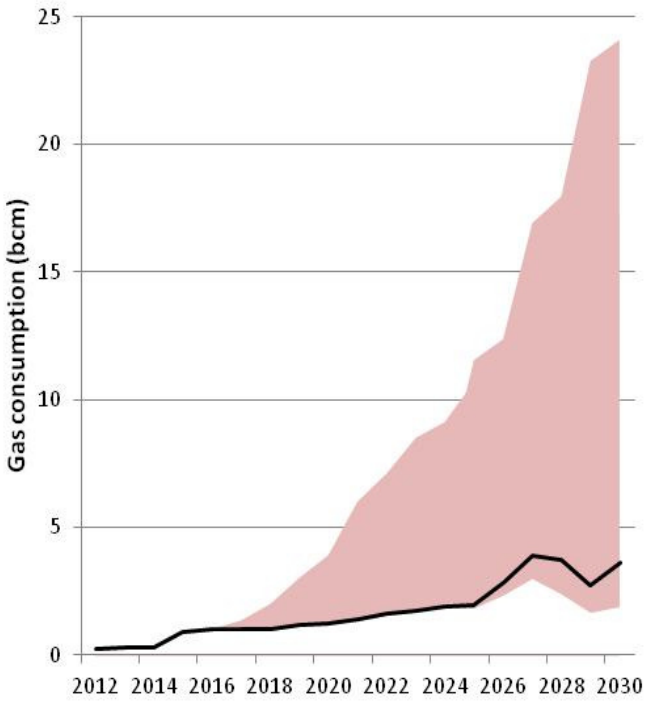
Technology Support Scenario
Power sector gas consumption (bcm)



From +45% to -90% (2020s) and -10% (2030)



Carbon Price Scenario
Power sector gas consumption (bcm)

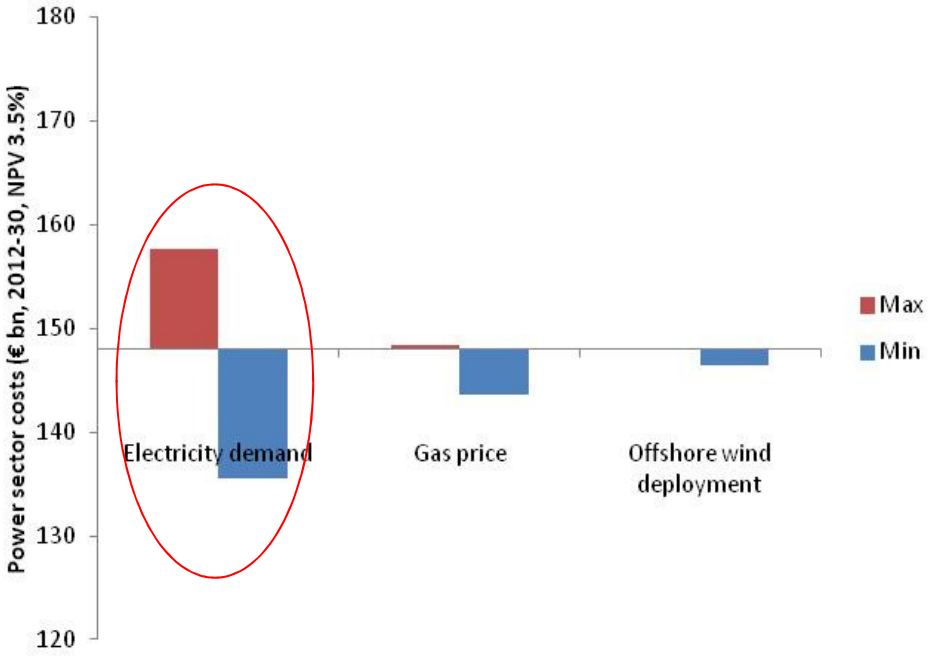


From +460% to -50%

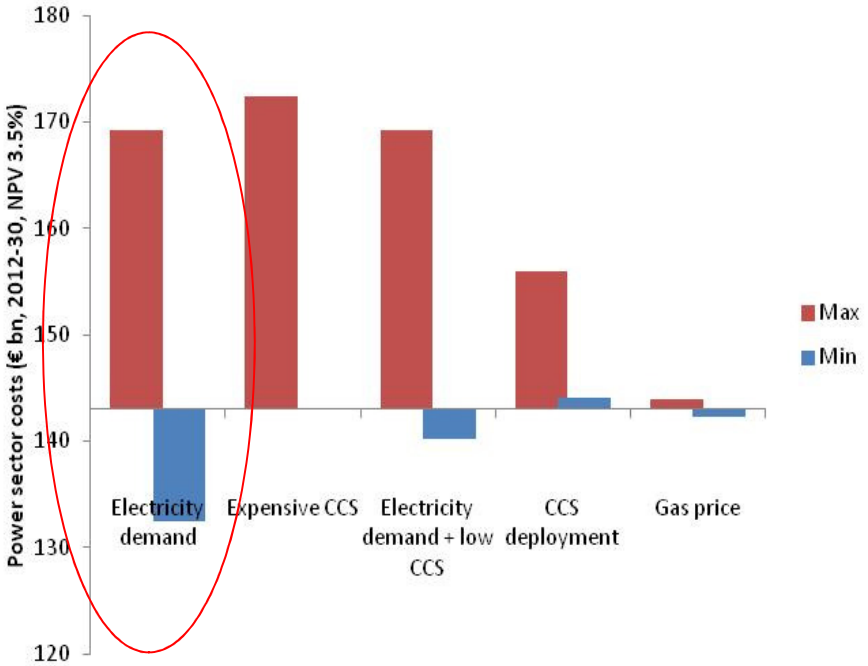
Key high-level conclusions for Poland (III)

- **Delivering energy demand reduction is a critical strategic policy since it is the most effective weapon against escalating power system costs leading to save up to €10-12bn in generation costs out to 2030.**

Technology Support Scenario
Power sector costs, € bn 2012-30 total



Carbon Price Scenario
Power sector costs, € bn 2012-30 total



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Final remarks

- The biggest value to the EU consumer would come from **builduing effective demand reduction and demand response markets across Europe**. This would have strong EU-wide benefits in reducing price risk, increasing system stability, reducing supply-side market distortions from capacity markets and improving the likelihood that decarbonisation targets are delivered.
- **Risk-managing the transition is key to deploy low-carbon technology**, to unlock the economic benefits that will flow from early action, and to secure the climate benefits
- Need to get the **governance right nationally, at EU-level and globally**
- **Better-informed and richer narratives to understand and manage risks** as well as more holistic understanding to help explain complex processes such as the low-carbon transition

Inputs for discussion

1. What does Germany need from the rest of the EU and the rest of the world to make the EW succeed?
2. What implications does the EW have for the choices for those outside Germany, e.g. Poland?
3. What might a post election German government do to shift the current debate from inward-looking analysis to outward-looking mode?

Contact and materials

Contact: luca.bergamaschi@e3g.org

The UK analysis is available here:
http://www.e3g.org/programmes/climate-articles/risk-managing-power-sector-decarbonisation-in-the-uk/

The German and Poland analysis will be available soon on:
http://www.e3g.org/

Please do not hesitate to get in touch for the full results of the analyses