# RISK MANAGING EUROPEAN POWER SECTOR DECARBONISATION: POLAND CASE STUDY

**Europe needs to largely decarbonise its economy by 2050 and all current analysis suggests that this will be achieved most cost-effectively by taking early action in the power sector. However, member states have very different technology mixes and therefore are willing to move at different speeds. This analysis illustrates that Poland has the opportunity to ensure that its economy is robust to manage the risk of decarbonising its power sector without incurring additional costs.**

## Brief methodology

> E3G commissioned Redpoint Energy/Baringa Partners to carry out an analysis of the costs and risks of decarbonising power sector in Poland, UK and Germany by 2030. This analysis did not use conventional equilibrium modelling that assumes perfect foresight. Instead, it adopts an 'agent-based' approach and simulates real investor behaviour, reflecting real world uncertainties. In particular, it recognises that investors do not have perfect foresight, and therefore it is more useful in testing the way the market responds to unforeseen but credible events. The model also allowed the incorporation of interventions from policy makers to respond to any deviations from the delivery of the policy objective. Good policies will ensure that delivery of required outcomes is not dependent on a restricted number of possible future events. They need to be designed to deliver those outcomes under all plausible futures. The future cannot be known, but risks can be actively managed. The approach adopted in this study aims to test the resilience of policies in an uncertain future.

> The analysis established two technology pathways that could potentially deliver levels of power sector decarbonisation in 2030 that are currently expected by national Governments. For Poland, we assumed a reduction in power sector emissions by 2030 of about 40%, in line with the updated energy demand projections of Agencja Rynku Energii[1].

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[1] ARE (2011) Aktualizacja Prognozy zapotrzebowania na paliwa i energię do roku 2030. http://www.mg.gov.pl/files/upload/11099/ARE%20MG_2011_Raport_koncowy_01_09_2011.pdf

> One pathway was established using only carbon price[2] and it gives rise to a technology mix that evolves largely in line with the current Polish energy strategy (Carbon Price scenario baseline). The key difference being that our central assumptions suggested that CCS is likely to be cheaper than nuclear and is, therefore, the preferred option to be built in the late 2020s.

> A second pathway (Technology Support scenario baseline) sees continued use of technology specific support measures for renewables continued to 2030, alongside a low but slowly increasing carbon price[3]. In the Polish case study, gas-fired generation is also subsidised as opposed to other case study countries. Overall, this aimed to establish a more balanced technology mix involving increased early deployment of renewables and gas-fired generation. The robustness of these two pathways was then tested by imposing unforeseen but credible events (see the slidepack for detailed assumptions, generation mix etc.).

> **This analysis is not a forecast of the future or an attempt to justify one technology choice as opposed to another.** Instead it is intended to illustrate the significance of future uncertainties and highlight the responsibility of Governments to ensure that their policies are effectively managing these risks for citizens and not purely focused on short term considerations or dependent on a particular view of the future. In addition, implications for network infrastructure and the security of gas supplies were not considered.

## Key conclusions we have drawn from the analysis are as follows:

> **Poland has a number of viable options to reduce power sector emissions by 40% in 2030.** The other countries analysed are currently targeting much higher levels of reduction over these timescales and, in the UK, these reductions have been established in law. The approaches being implemented in these countries suggest that there is scope for Poland to contemplate more ambitious reductions.

> **More ambition on renewables deployment is not more expensive than relying on nuclear or CCS to deliver decarbonisation**. Furthermore, it increases Poland's resilience to uncertainties. This is because renewable deployment is more incremental and predictable and less exposed to major events.

> A diversified technology mix will be more resilient than one that depends heavily on a particular technology. It is extremely unlikely that a diversified mix will emerge as a result of a single carbon price [Fig 1] and complementary measures, such as technology specific subsidies, will be required. The analysis showed that where renewables and gas were supported alongside a lower carbon price, cost increases to consumers were limited to 8%. In a carbon price driven approach, where coal and CCS lignite dominate, consumer costs could increase by up to 20% [Fig 2,3]. This highlights the risks of relying

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[2] A 'shadow' carbon price was generated by the model. It iterated on the carbon price to find the required level in order to achieve the objective of emissions reduction from 144.2 Mt CO2 in 2008 to 84.2 Mt CO2 in 2030 in electricity generation

[3] In line with the carbon price projection by the European Commission Energy Roadmap 2050

on a particular technology – the analysis considered systemic failures to CCS but the same issue applies to nuclear.

- Delivering electrical efficiency is a critical strategic policy since it is the most effective weapon against escalating power system costs. The analysis showed that uncertainty around electricity demand had a significant impact on power sector costs [Fig 4] and successful delivery of electrical efficiency policies could save €10-26bn in generation costs out to 2030.
- **Without enhanced deployment of renewables, Poland risks embedding a long term exposure to gas.** Where gas and renewables deployment is promoted to achieve a diverse technology mix, power sector gas consumption is around **10bcm** compared with **4bcm** in coal and CCS heavy pathway. However, if Poland bets solely on large scale deployment of nuclear or CCS lignite, and these technologies fail to materialise, it must choose between wide-scale deployment of gas fired generation or incur rapidly escalating prices. For instance**,** gas demand could go up by **six times to 24bcm in 2030** [Fig 5].
- In addition to enhanced renewables deployment, switching from coal to gas fired generation provides an effective way to reduce the costs of power sector decarbonisation. However, this approach requires that gas can be reliably sourced at international market prices and these issues were not considered by the study. Indeed, it is likely that additional gas supply infrastructure would be required to enable further diversification in the fuel mix.
- **CCS emerges as a more cost-effective low carbon technology than nuclear, given underpinning cost assumptions.** Where CCS fails or is twice as expensive, nuclear emerges as a cost-effective alternative. CCS technology does, therefore, present a potentially attractive option for deployment within Poland if the technology can be demonstrated to be robust and cost-effective.
- UK and German policies currently assume more ambitious power sector decarbonisation than that currently envisaged within Poland. The cost of increasing decarbonisation ambition to levels matching Germany is lower under a diversified technology approach and would add €11.7bn to power sector costs over the period out to 2030 [Fig. 6]. This could involve a very diverse portfolio of low carbon technologies including large scale deployment of renewables, CCS and nuclear [Fig 7].

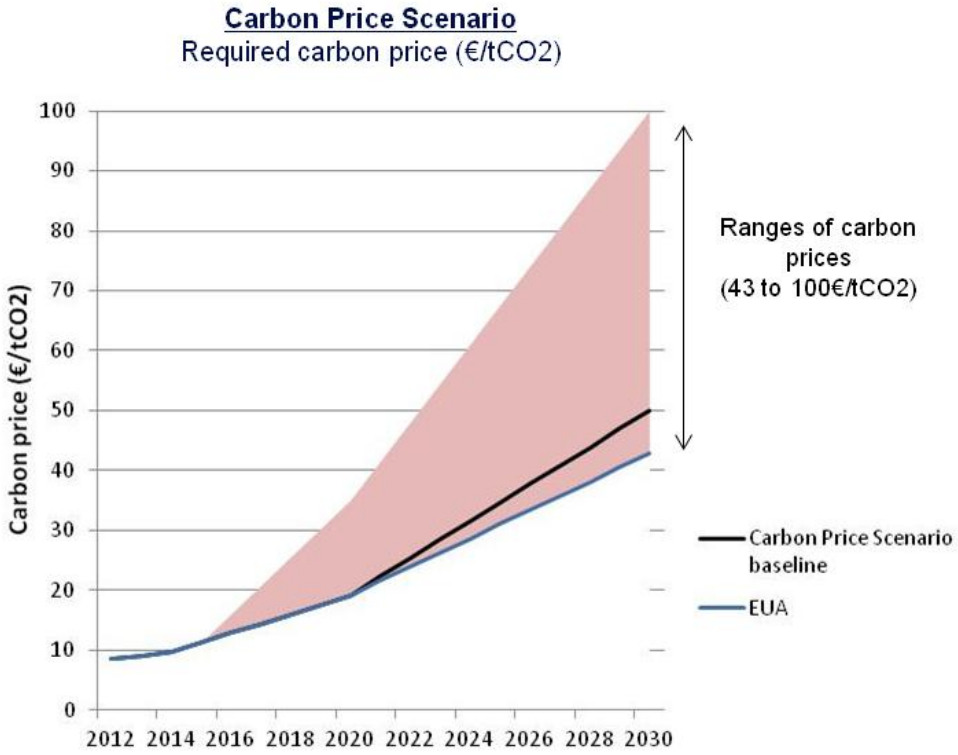
## Policy implications for Poland's energy choices:

Current 'wait and see' policies mean that there is a risk that Poland finds itself stranded in a high carbon economy when the rest of the international community are decarbonising. It is possible for Poland to manage this risk at a relatively low cost and ensure that its economy remains competitive into the longer term. This requires Poland to consider the potential future uncertainties and to implement policies that are robust to a broad range of future outcomes.

Our analysis suggests that a well-balanced risk management strategy for the Polish power sector would need to include:

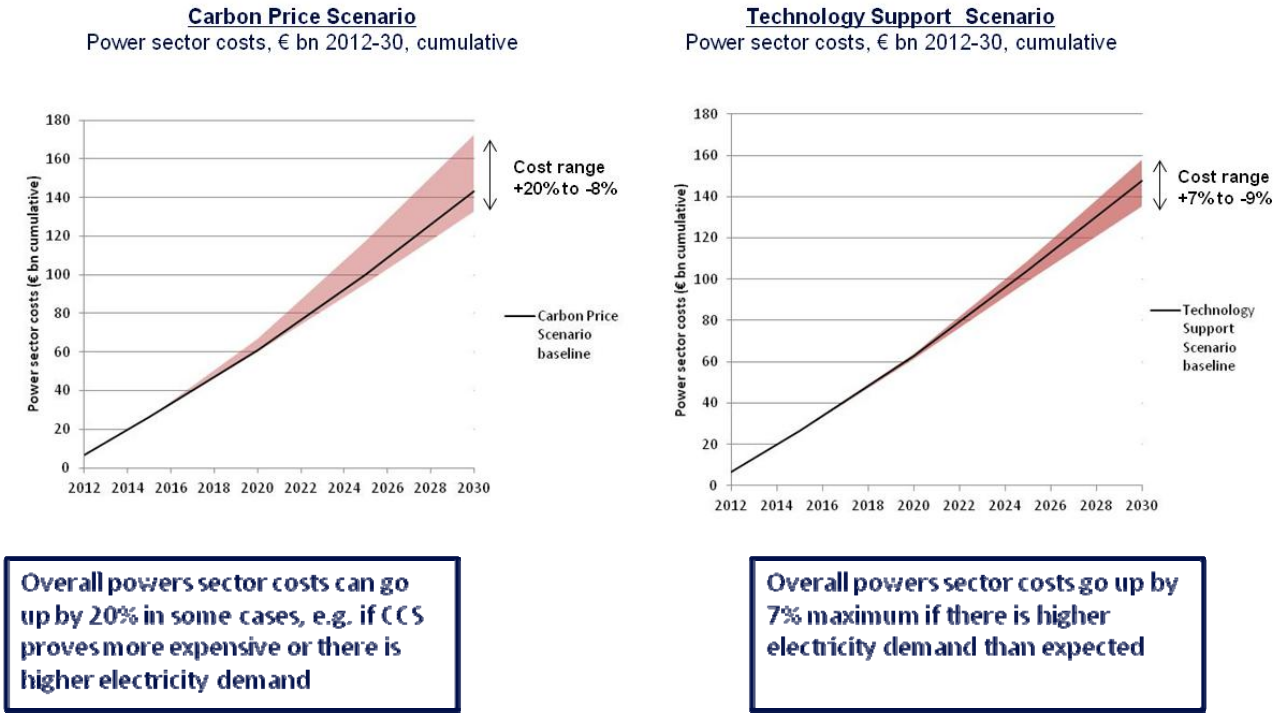
- Technology specific support to ensure **a steady deployment of renewables out to 2020 and beyond.** In particular, a significant increase in the share of wind generation (doubling Polish energy plan projections for 2030) seems an effective way to deliver the policy objectives;
- **Putting the delivery of electrical efficiency as top priority** given its potential to manage cost risks and generate significant savings for consumers. Poland must consider the mix of policies that will capture any 'low hanging fruit' over the short term whilst developing new demand-side markets to drive long term innovation;
- **More aggressive action for demonstrating CCS lignite/coal** since this creates a potentially high value technology option. It is also important to realistically evaluate the cost and delivery risks associated with nuclear power;
- **Regional cooperation**, in particular with Germany, on gas and electricity infrastructure since this has the potential to reduce costs and risks.

Figure 1. Carbon price is effective in driving coal to gas switching but does not lead to a diverse technology mix and leaves costs exposed to technology failure or high demand

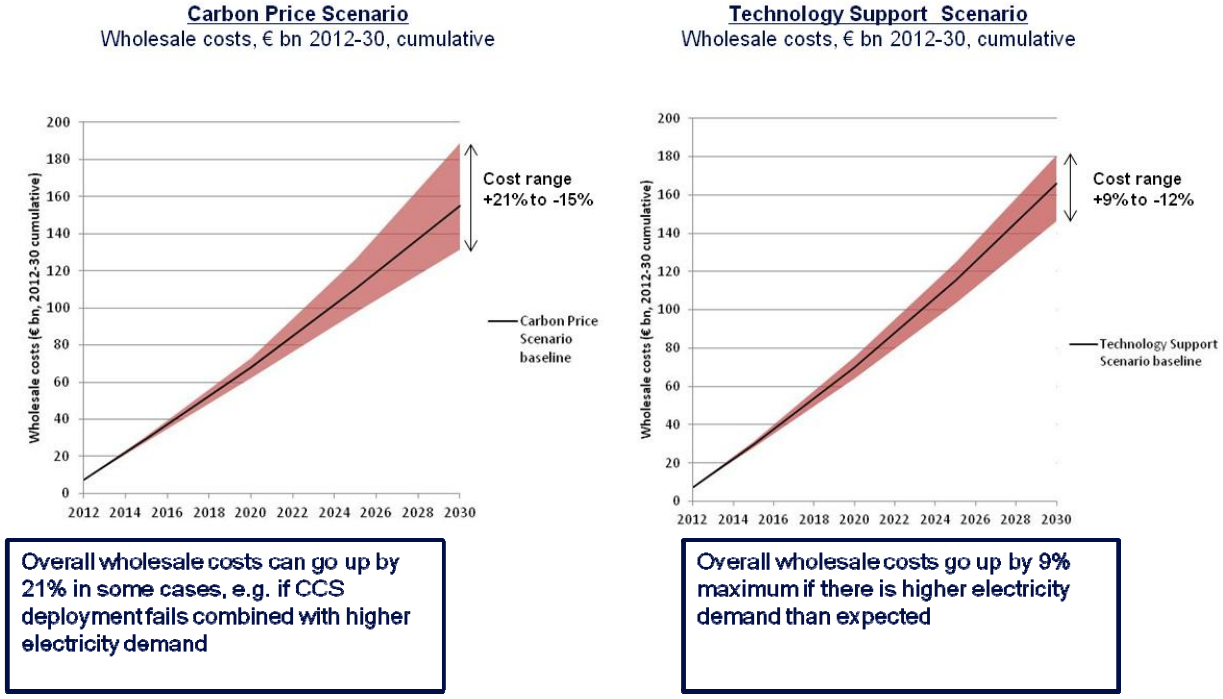



**High demand and failure to deploy CCS (due to cost or policy/technology failure) requires much higher carbon prices (about 100€/tCO2) to achieve policy objectives**

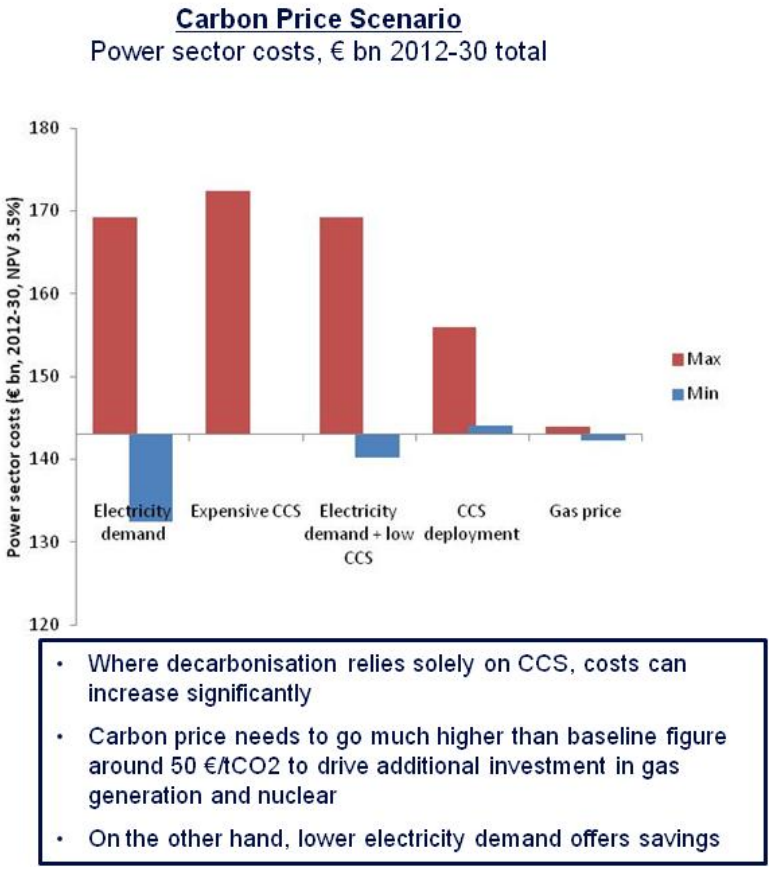
## Figure 2. Subsidising coal to gas switching and renewables increases policy resilience without increasing power sector costs




## Figure 3. Wholesale costs are also more resilient to uncertainties where technologies are supported



## Figure 4. Electricity demand has the biggest impact on power sector costs



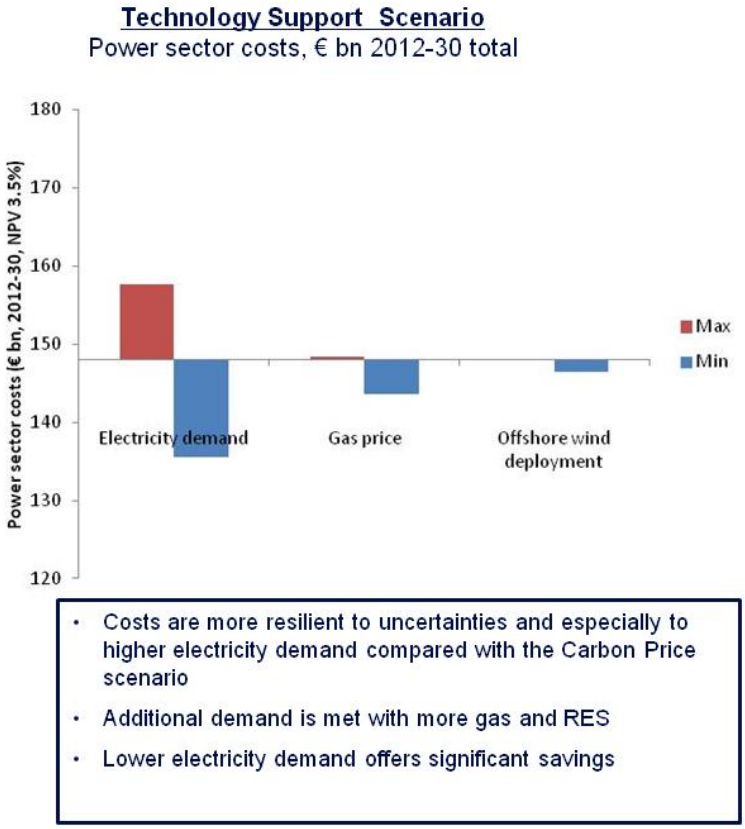
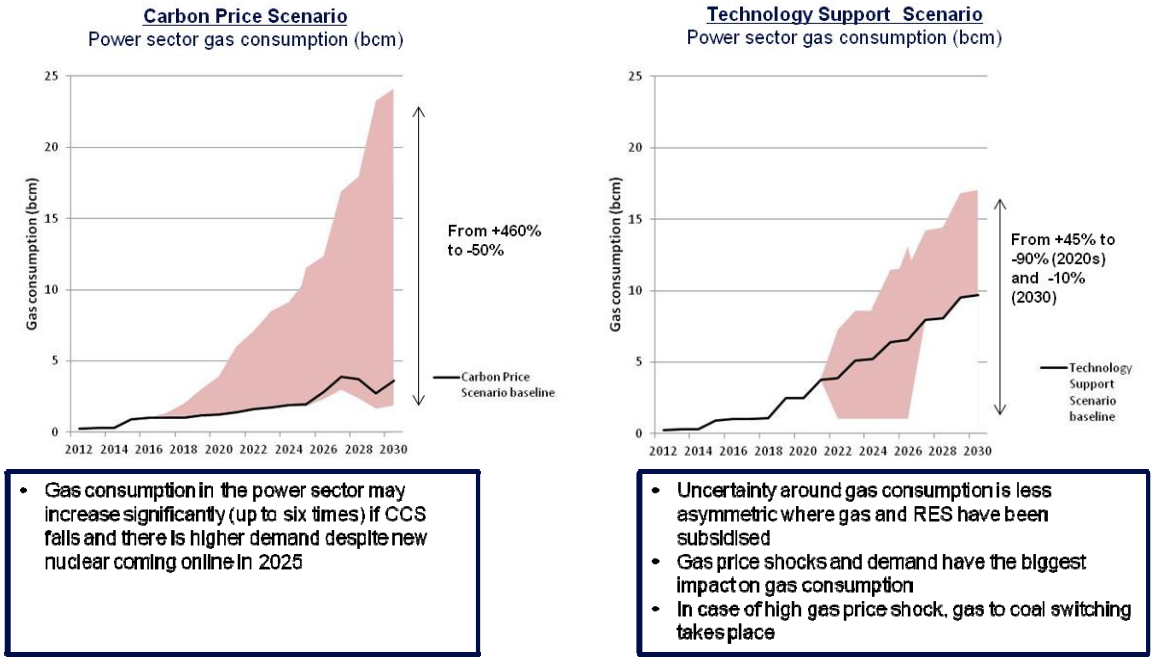



**Figure 5. Poland is more exposed to dependence on gas where it is not promoted as part of a diverse technology mix**

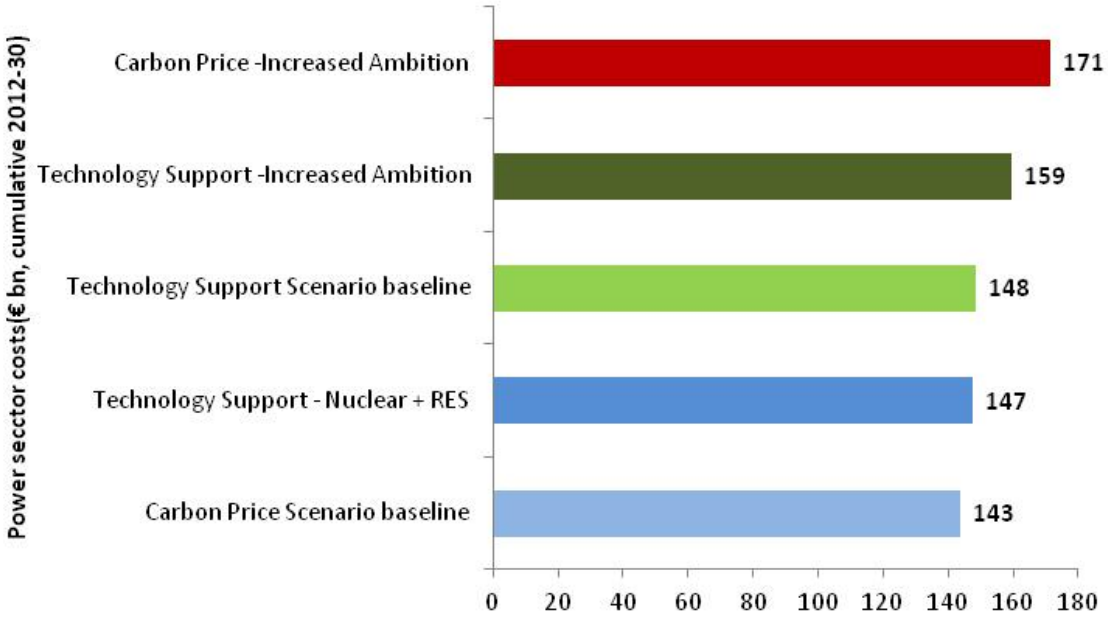


## Figure 6. The additional cost of increasing ambition can be acceptable while subsidising nuclear vs. gas has limited impact on costs

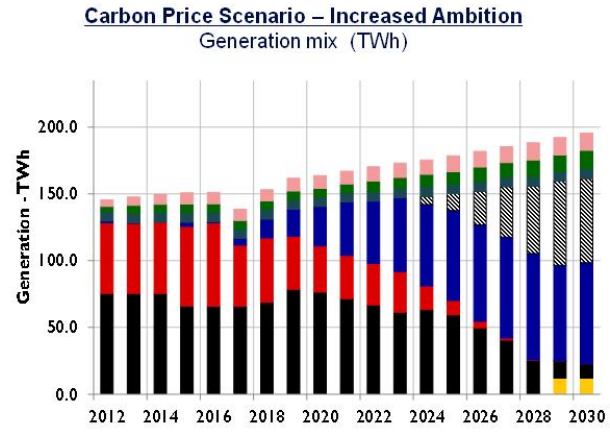
> Delivering increased ambition is overall cheaper under Technology Support scenario where gas and renewables were subsidised (€159bn vs €171bn):

- Under Carbon Price scenario, additional cost of higher ambition is €27bn between 2012-30. This would require a carbon price about 100€/tCO2 in 2030.
- On the other hand, where renewables and gas were subsidised additional cost of higher ambition is €11.7 bn between 2012-30.

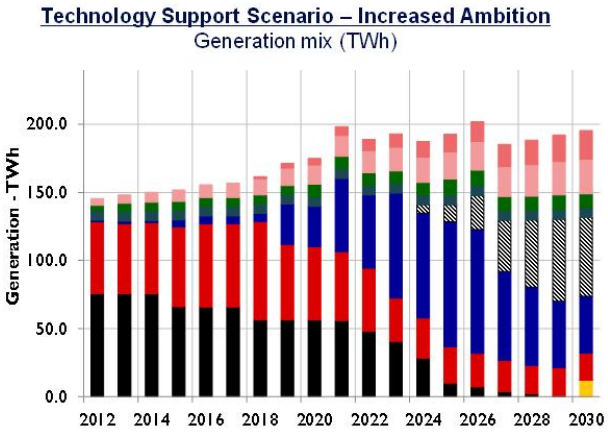
> Subsidising nuclear vs gas in addition to scaling up renewables had limited impact on costs up to 2030



## Figure 7. Increasing ambition to Germany's levels would require a very diverse mix, including RES, nuclear and CCS and near elimination of coal/lignite




- Compared with the baseline, coal is virtually eliminated; lignite is significantly reduced
- Gas generation significantly increased
- First commercial nuclear




- Lignite is eliminated; coal is significantly reduced
- First commercial nuclear and CCS lignite emerge in the mix