SUBMISSION TO THE DEPARTMENT OF ENERGY AND CLIMATE CHANGE ON THE CALL FOR EVIDENCE FOR THE 2050 PATHWAYS ANALYSIS

Executive Summary

- The current set of assumptions on the relative role of coal and gas in the 2050 Pathways analysis overlooks the key role which gas generation (unabated and with CCS) can play in meeting the UK 2050 emission targets.

- In the short to medium-term replacing coal power stations with gas can lead to significant cumulative emission reductions in the period 2010-2030, and it is therefore important to review the assumptions and methodology of the 2050 calculator to be able to capture the benefits of unabated gas generation over coal.

- In the longer-term, the different emission, efficiency and cost characteristics of coal and gas plants with CCS merits their being separated and treated as different technologies so that the impacts of adopting each of these technologies on the 2050 Pathways can be considered.

Introduction

1. Shell welcomes the publication of the 2050 Pathways analysis and calculator. It is a very useful tool in exploring the high-level trade-offs involved in deploying different low-carbon technologies or with reforming energy use in different sectors. A key positive characteristic of the calculator is the transparency of both the methodology used and the underlying assumptions. Shell would therefore like to contribute to the development of this analysis by responding to the Department of Energy and Climate Change's call for evidence on the 2050 Pathways Analysis. Our submission below mainly responds to question 3(g) on how the relative role of coal and gas out to 2050 could be different than the one currently used in the analysis.

2. The calculator is a good way of considering the extent to which different technologies can contribute to de-carbonising the UK economy. However, in order for it to be more informative we would hope that further versions use a modelling approach that allows these pathways to demonstrate solutions that achieve a number of objectives, namely: energy security, medium and long-term carbon targets and minimising cost. In addition, we recognise that a number of generation technologies, such as fossil fuel generation, wind and nuclear among others, will be important in helping the UK reduce its emissions from the electricity sector, and it is important the model treats the different generation technologies with the same level of detail and complexity. DECC may wish to consider approaches in other models including, for example, the Energy Technologies Institute's Energy System

Model, in further developing the 2050 Pathways calculator and to inform the analysis going forward.

The relative role of coal and gas in the short to medium term

3. The 2050 pathways analysis focuses on the low carbon energy supply sectors and although it tries to capture the implications for coal, gas and oil use, it does so in a more simplified manner. In particular, the model uses fossil fuels after having used all the available low carbon energy in each pathway. In addition, when looking at fossil fuel power generation it is assumed that the use of coal and gas generation is deployed in a manner that retains today's proportion of these two fuels in the generation mix (the assumed ratio is coal: gas, 0.86:1). One of the drawbacks of this approach is that the model does not allow for any substitution of coal for gas, which is a cost-effective, secure and low risk way of achieving significant CO2 reductions.

4. Modern CCGTs emit half the CO2 of modern supercritical coal plants, and 60-70% less CO2 than old steam turbine coal plants. Shell analysis has shown that replacing existing coal plants with gas would reduce cumulative CO2 emissions to 2050 by 20% compared to a scenario when coal is allowed to run until it is replaced with nuclear. Most of the gains in emission reductions are in the period 2010-2030[1] (see Figure 1). These figures are based on the comparison of two illustrative scenarios, one in which coal is rapidly replaced by gas and one in which coal persists, and in reality the actual energy mix may lie somewhere in between. Comparing these two scenarios however clearly illustrates the benefits of gas generation. This analysis is also supported by a report carried out by Poyry Energy Consulting for Oil and Gas UK[2], in which they have estimated that substituting coal for gas in one of the published DECC 2050 pathways, pathway Alpha, would lead to cumulative emissions savings in the period 2010-2020 of 501MtCO2, with further gains of 143MTCO2 being made in the period 2020-2050.

5. New gas plants are much cheaper and faster to build than any other new-build source of electricity. They require less than half the capital cost of coal per MWh; less than one-third the cost of nuclear; and less than 20% of the cost of wind. Gas plants are also a fully developed technology, with very low risk associated with their construction and operation. Replacing coal plants with gas plants is therefore an effective, fast, cheap and low risk way

[1] **Replace goal with gas:** Shut-down all coal electricity between 2011 and 2017. Replace coal with gas.CCS on gas from 2025 onwards. **Keep coal**: Keep coal running until it can be replaced with nuclear, coal CCS from 2020, gas CCS from 2025.

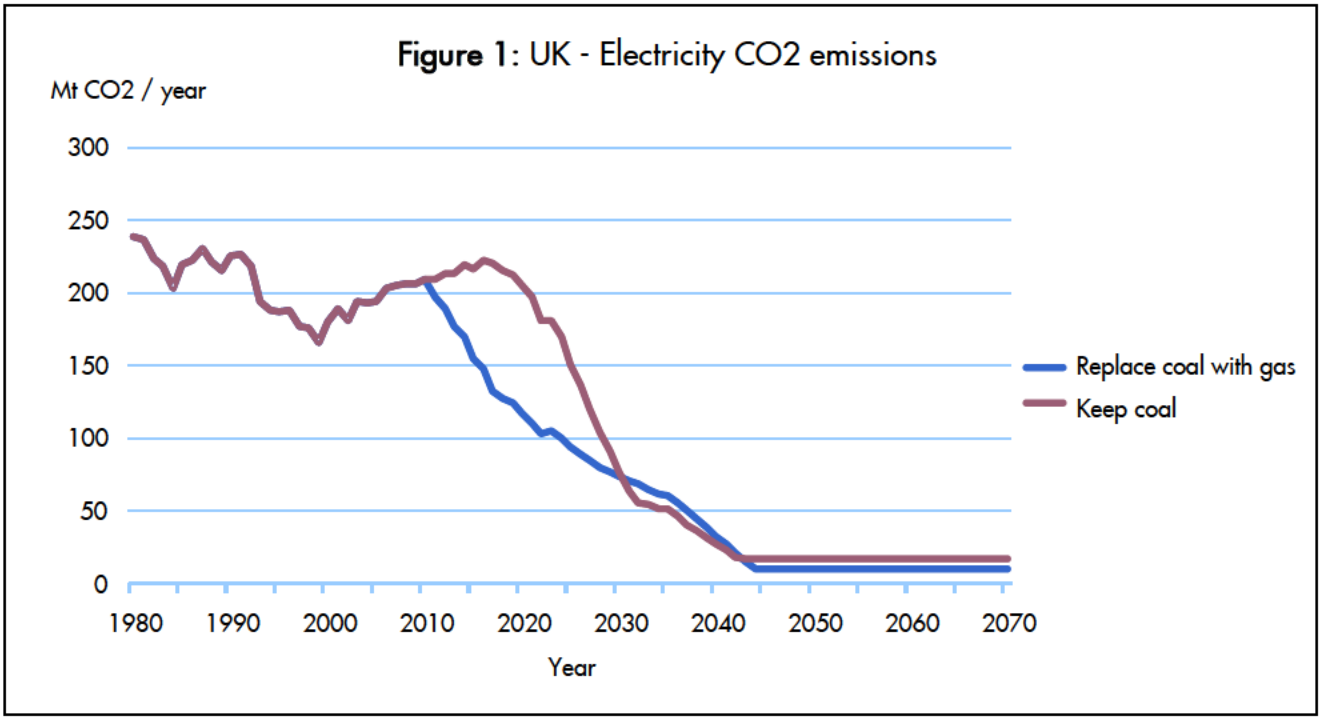
[2]Poyry Energy Consulting (September 2010). "Gas: at the Centre of a Low Carbon Future.' http://www.oilandgasuk.co.uk/Role_of_gas.cfm

of reducing carbon emissions from the power sector. The impact such a switch could have on the UK's cumulative emissions would also reduce the need to undertake costlier emission reductions in other sectors, thus reducing the overall cost to the UK of achieving the 2050 emission targets.

6. This switch is not just theoretical as gas generation can be deployed now. Indeed, in their last Seven Year Statement, National Grid looked at the generation capacity already under construction or consented and estimated that in the period 2009/2010-2016/2017, 17.1 GW of new CCGT capacity will come online (43% of the total increase in generation capacity over that period), whereas 8.5GW of coal fired generation is coming out of commission and only 4.4GW of new coal is being built. Market factors such as the relative prices of gas and coal and the lower cost of building CCGTs have been important factors in this development, but carbon pricing has also played a role. The market and existing market mechanisms are therefore already helping to create an energy sector pathway with lower CO2 emissions. Hence, going forward Shell believes the most efficient policy approach for reducing emissions remains the use of market-based instruments, in particular cap-and-trade rather than Emission Performance Standards which risk making the EU ETS ineffective. Governments could provide targeted support for new energy technologies, such as CCS, while they are still in their demonstration phase in order to drive down costs and secure public acceptance but a market based approach must be applied when putting in place long term energy solutions.

7. Increasing the UK's reliance on intermittent renewable electricity generation requires fossil fuel generation to remain in the energy mix, to act as a back-up and provide flexibility when additional electricity supply is needed to satisfy demand. As the 2050 Pathways calculator models the energy sector on an annual basis, it cannot fully consider the impacts of peaks in energy demand on the energy system. Fossil fuel generation is the only type of technology that can provide this back-up and flexibility, and gas is considered to be the most cost-effective and flexible form of backup generation, retaining a role for it in the generation mix.

8. The 2050 pathways calculator could therefore be amended to consider the impacts on emissions of switching current coal generation for gas. For example, the assumptions on plant closures for coal could be revised to allow for the early closure of these plants and their replacement by gas, making gas the only fossil fuel generation built in the future. The 2050 calculator could then be used to determine what impact this scenario would have on the different levels of effort required in the energy supply or demand sectors to meet the 2050 targets.



The role of gas CCS in the longer-term

9. The 2050 pathways calculator allows for the deployment of carbon capture and storage (CCS) as one of the ways of mitigating emissions from the power sector. However, in the current version of the calculator, coal with CCS is assumed to be the only type of abated fossil fuel plant that is deployed. The need for having simplified assumptions in order to make the calculator more accessible is understood. Nevertheless, by not including gas CCS in the model, the calculator cannot consider the impact of gas CCS on cumulative emission reductions or the costs associated with different pathways, and the appropriate trade-offs cannot be made across all sectors.

10. CO2 capture is as technically feasible for gas-fired as coal-fired plant, and possibly more so due to the presence of contaminants in flue gas from coal (which may tend to favour post-combustion solutions). There is no difference in the technology or technical considerations for storage of CO2 between gas and coal-fired plant, but of course the much reduced CO2 volumes emitted by burning gas will mean less than half the pipeline and storage capacity will be needed.

11. In addition, a recent report by Mott MacDonald[3] for DECC suggests that the unit capital costs of gas with CCS will be less than half those of coal plants with CCS. The report also

[3] Mott MacDonald (June 2010). 'UK electricity generation cost update'. http://www.decc.gov.uk/media/viewfile.ashx?filetype=4&filepath=Statistics/Projections/71-uk-electricity-generation-costs-update-.pdf&minwidth=true

shows that abated gas generation will be competitive with other low carbon technologies such as wind, as even on a lifetime basis gas with CCS projects starting in 2017 will be around 20% cheaper than offshore wind technology and will still be cheaper than the much improved offshore wind technologies expected post 2017.

12. In terms of detailed assumptions that could be included in the calculator, adding CCS to power generation plants will inevitably reduce their operational efficiency. Recent work by Shell suggests that by 2020 both coal plants (pulverized) and gas plants (CCGT) would be affected by around a 10% reduction in efficiency as a result of CCS installation. Ultimately, however, the post-CCS efficiency of gas plants (~45%) will still exceed that of coal.

13. All this evidence points to the fact that gas plants with CCS have many advantages over coal plants with CCS and therefore should be included as a potential generation technology and should also be treated differently given the different efficiencies, emissions and cost characteristics of coal and gas CCS. Separating the two technologies would also determine the cumulative impacts on emissions of including gas with CCS in the potential pathways to 2050. The lower cost of gas plants with CCS compared to coal plants would need to be considered in any review of the cost analysis carried out as part of this work.

Conclusion

14. The 2050 Pathways analysis does not fully explore the potential role of fossil fuels in the future UK energy mix, as it models fossil fuel energy in a more simplified manner than renewable energy. In addition, given the different characteristics of coal and gas plants, whether unabated or with CCS, we consider that they should be treated differently within the 2050 Pathways analysis. Separating them would improve the 2050 Pathways calculator by being able to analyse the contribution each type of generation can make to meeting the 2050 emissions target. It would also allow users to consider a greater number of scenarios, including one where gas replaces coal. It would also be possible to construct more cost-effective pathways than the current set of assumptions allows. The role of gas in helping meet the medium and long-term CO2 emission targets in a secure and cost-effective manner would therefore not be overlooked in determining potential pathways.

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5 October 2010