Department
of Energy &
Climate Change

Bespoke Gas CHP Policy

Summary of Analysis Results & Conclusions

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Contents

Executive summary

The Government's heat policy publication "*The Future of Heating: Meeting the challenge*" identified the potential for additional natural gas fired Combined Heat & Power (CHP) plant to reduce whole system carbon emissions. It committed DECC to developing a bespoke policy to support new, Good Quality natural gas CHP, subject to confirmation that this would not displace lower carbon generation.

This report summarises the results of analysis commissioned and conducted to examine a range of different financial support options. The analysis examined the amount of additional natural gas CHP capacity that might be brought forward by a subsidy compared to a Business As Usual scenario, how this capacity might interact with other forms of electricity generation, the resulting carbon impacts and the net impact on costs to society.

The analysis suggested only a relatively small amount of additional gas CHP would be brought forward by a bespoke CHP subsidy. This is partly due to difficulty targeting the support to the CHPs that need it and partly due to non-financial barriers. The analysis suggests that more CHP capacity would be brought forward by the Capacity Market, provided that CHP developers participate in it.

Electricity produced by the additional gas CHP capacity that is brought forward primarily displaces electricity which would have been generated by natural gas fired Combined Cycle Gas Turbine powerplant. As a result gas CHP delivers carbon savings throughout the 2020s. However, over time an increasing proportion of low carbon generation is displaced and, in consequence, operation of additional gas CHP increases carbon emissions from 2032.

In general the subsidy options considered resulted in a net cost to society.

As, gas CHP does offer near term carbon savings and significant energy cost savings for business users we are keen to see deployment of gas CHP which is cost effective under current policy arrangements. Indicative findings from qualitative research suggest that non-financial barriers might constrain this deployment. We will therefore be developing options to address these non-financial barriers and to encourage CHP participation in the Capacity Market.

The analysis does not however suggest that there is a strong case for introducing a new bespoke gas CHP subsidy on carbon saving grounds.

Introduction

1. Combined Heat and Power (CHP) is a technique whereby heat and power are generated in a single energy efficient process. It reduces fuel consumption, relative to separate generation of heat and power from the same fuel, by up to 30% and consequently can reduce carbon emissions. In view of this “Good Quality”[1], natural gas CHP is eligible for benefits under a number of existing policy regimes such as Enhanced Capital Allowances, Climate Change Levy and, from 1st April 2015, Carbon Price Support.
2. The Government’s heat policy publication “*The Future of Heating: Meeting the challenge*” identified the potential for additional natural gas fired CHP plant to reduce whole system carbon emissions. It committed DECC to developing a bespoke policy to support new, “Good Quality” natural gas CHP, subject to confirmation that this would not displace lower carbon generation.
3. This document summarises the results of analysis of options to support gas CHP and the conclusions drawn.

Evidence Strands

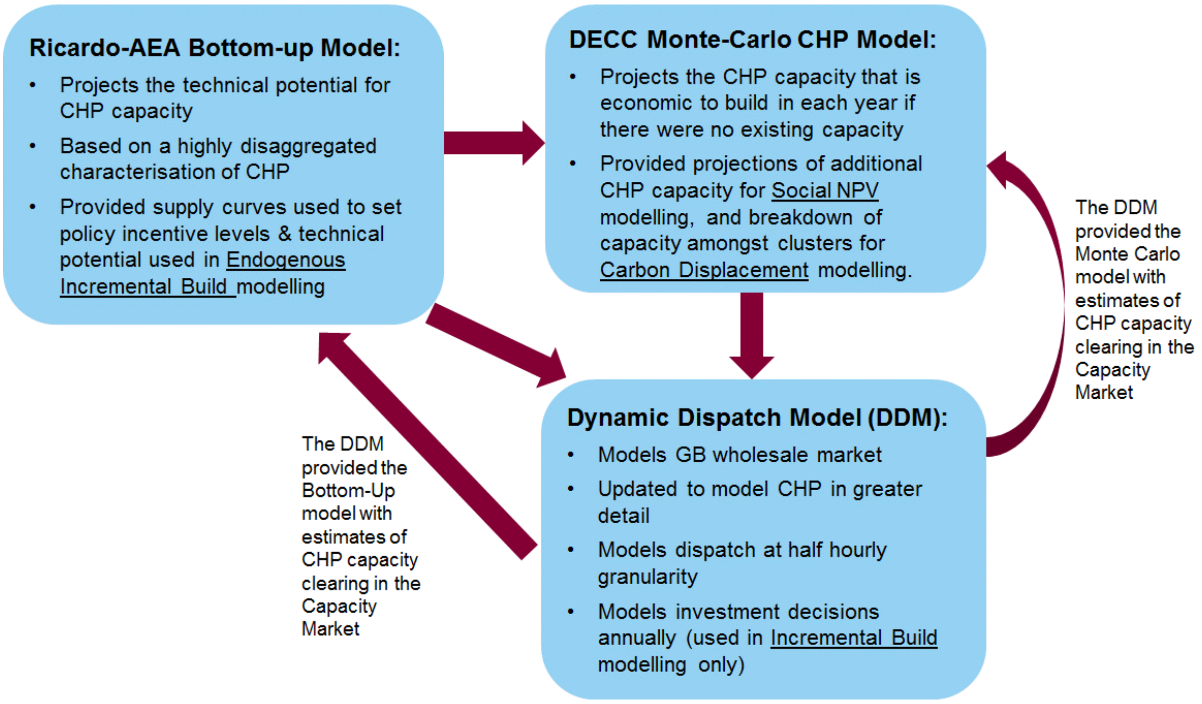
4. To examine the impacts of potential options for a bespoke policy to support new gas CHP capacity DECC commissioned / conducted analysis covering the four following elements;

- Modelling of required subsidy levels and additional capacity brought forward in response to these subsidies. Incentive levels and CHP technical potential were modelled by Ricardo-AEA, using their Bottom Up model which provided the input for DECC to estimate capacity brought forward using our Monte Carlo CHP model. Capacity brought forward in the Oil & Gas and District Heating sectors, which are outside of DECC’s Monte Carlo CHP model, was estimated separately by Ricardo-AEA.
- Modelling of the interaction of additional gas CHP capacity with other electricity generating capacity and the resulting impacts on carbon emissions. This modelling was conducted by Lane Clark & Peacock (LCP) using an upgraded version of the Dynamic Dispatch Model, which LCP developed for DECC. The Dynamic Dispatch Model is DECC’s primary tool for electricity market modelling.
- Modelling of the social costs and benefits (social Net Present Value) of the additional CHP capacity modelled as being brought forward by subsidy options, bearing in mind its interaction with other electricity generating capacity. This was conducted by LCP using the Dynamic Dispatch Model and DECC’s Monte Carlo model estimates of CHP capacity brought forward by the subsidy options.
- Qualitative research on gas CHP investment decision-making, to identify barriers and market failures preventing the installation of new CHP capacity and enablers to help

[1] Good Quality CHP is CHP which has been certified to DECC’s CHP Quality Assurance programme as delivering at least 10% energy saving.

support gas CHP uptake. This research was conducted by Ricardo-AEA, BRE and University College London.

5. The diagram below summarises the models used for the first three quantitative analysis strands and the interaction between them in this project.



6. In addition to the core scenario results summarised in this document, the detailed reports on the evidence strands provide the results of sensitivity analyses. The sensitivity analyses included independently modelling CHP capacity brought forward in response to subsidy options using the Dynamic Dispatch Model (Endogenous Incremental Build), for comparison with DECC's Monte Carlo CHP model results.

Policy Options Modelled

7. Following discussion with stakeholders and qualitative analysis of a long list of potential policy options, the following five policy options were selected for modelling.

- Capital Grants providing a proportion of the capital cost of new gas CHP projects.
- A Premium Feed in Tariff for electricity from new gas CHP i.e. a payment per MWh of electricity produced.
- A Primary Energy Saving incentive for new gas CHP i.e. a payment per MWh of energy saved, relative to separate generation of heat and power from the same fuel.
- A Quality Index weighted Heat incentive i.e. a payment per MWh of heat produced, weighted to reward plant with a higher Quality Index (the CHP Quality Assurance programme's measure of a plant's overall efficiency).

- A Quality Index weighted Capacity incentive i.e. a payment per kW of capacity, weighted to reward plant with higher Quality Index.

8. With the exception of the Capital Grant (a one-off upfront payment), all options were assumed to be limited to the first 5 years of operation, in order to maximise their impact on investment decisions and prevent long-term lock-in to supporting fossil fuel fired plant. All options were assumed to be available for CHP plant commissioning up until 2025, but no later in view of the likely declining carbon benefits of gas CHP due to decarbonisation of the electricity grid.

9. Although only a limited proportion of potential gas CHP appears cost effective under current energy prices, the analysis showed that a significant proportion becomes commercially cost-effective by 2020, under current policy and DECC's projected energy prices. These cost-effective plant were generally those which supply only on-site power demand and export little electricity to the grid. To minimise "deadweight" cost (i.e. support to plant which would be cost effective without support), subsidies were modelled as only being available for CHP which exports more than 20% of its power output.

Key Results

10. The analysis using DECC's Monte Carlo CHP model showed only a relatively small amount of additional gas CHP being brought forward by incentives (150-200 MW by 2025 in the core scenarios). This is partly due to difficulty targeting support to the CHP projects that need it and partly due to the modelling of the impact of non-financial barriers, which reduce the likelihood of projects being built even where they are nominally cost effective. The modelling suggests that participation of new CHP in the Capacity Market is likely to bring forward a greater amount of new CHP capacity (400 MW) than any of the above bespoke CHP policy options.

11. The modelling of the interaction of additional gas CHP capacity with the electricity market showed that the operation of additional gas CHP capacity will primarily displace electricity generated by natural gas fired Combined Cycle Gas Turbine powerplant. As a result, gas CHP delivers carbon savings throughout the 2020s. However, over time gas CHP displaces an increasing proportion of low carbon generation. In consequence, operation of additional gas CHP capacity results in a net increase in annual carbon emissions from 2032. CHP plant have a lifetime of around 20 years. The analysis suggests that plant deployed up until 2023 will deliver net carbon savings over their lifetime, but those deployed later will not.

12. The CHP capacity modelled as being brought forward by bespoke CHP subsidy options was largely outside of the ETS traded sector. This has the result of displacing power generation emissions from the ETS, where they are capped and relatively cheap to abate, into the non-ETS sector where they are not capped and abatement is more expensive. This, combined with the increases in emissions in the 2030s and 2040s, more than offsets the value of the near-term carbon savings.

13. Overall the policy options showed a net cost to society under the Government's standard appraisal methodology in all but one case. The exception was the Capital Grants option, where the use of cheap public sector finance decreased CHP financing costs sufficiently to result in a small net benefit. However, providing cheap public financing inherently improves the Social NPV of any privately financed investment, so this is not a strong argument in favour of introducing Capital Grant support for CHP. If finance costs are excluded from the assessment, all options showed a similar net cost to society.

14. The qualitative research did not identify any clear CHP-specific market failures and confirmed that, for most organisations, good financial performance is the key factor in deciding whether to invest in gas CHP. However, the research identified a number of non-financial barriers that might prevent investment in gas CHP, even where it is financially attractive. These were;

- Lack of senior champions to drive forward CHP investment decisions in some organisations.
- CHP opportunities only being considered when new or replacement heat capacity is required.
- In the case of Local Authorities and Small & Medium Enterprises, lack of technical expertise and resource to evaluate CHP opportunities.
- Lack of interest in engaging in energy export opportunities, other than simple arrangements to spill excess power to the grid.

15. The findings of the qualitative research should be treated as indicative due to the relatively small sample size. We plan to seek views from a wider body of stakeholders to confirm these findings.

16. The reports published alongside this summary document provide more detail on the central results and factors underlying them, and the results of sensitivity analysis on key assumptions.

Conclusions & Next Steps

17. The analysis confirms that gas CHP does offer near-term carbon savings. It is also likely to offer significant energy cost savings for business users. We are therefore keen to see continued deployment of gas CHP which is cost-effective under current policy arrangements and projected energy prices. However, the indicative findings from our qualitative research suggest that there are non-financial barriers which might constrain or prevent this deployment. We will therefore be developing options to address these non-financial barriers, to encourage CHP participation in the Capacity Market and help bring forward cost effective gas CHP.

18. The analysis of options for a bespoke gas CHP subsidy does not however show a strong case to introduce such a subsidy on carbon saving grounds. The additional capacity modelled as being brought forward is limited and its carbon impacts are equivocal. In addition, the subsidy options are modelled as having a net cost to society in general.

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