Department for
Business, Energy
& Industrial Strategy

Combined Heat and Power: the route to 2050

Summary of call for evidence responses

December 2020

Any enquiries regarding this publication should be sent to us at: CHPPolicy@beis.gov.uk

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Executive summary

Clean Growth is one of the four grand challenges of the UK Government's Industrial Strategy and energy efficiency and decarbonising heat are vital parts of the ambition. In June 2019, the UK committed in legislation to bring all greenhouse gas emissions to net zero by 2050.

Combined heat and power (CHP) is an efficient process that captures and utilises the heat that is produced in power generation, this is usually electrical but can in some instances be mechanical. By generating heat and power simultaneously from the same fuel, CHP can reduce carbon emissions by up to 30% compared to the separate generation of heat through a gas-fired boiler and an electricity power station. Where a demand for both heat and electricity exist in the same location, CHP can reduce energy costs whilst reducing carbon emissions and air pollution.

CHP schemes can encompass a range of different generation technologies and can be fuelled by fossil fuels or renewables e.g. biomass. CHP generators may export power not used on site. As dispatchable generation CHP can adjust its exported power output to provide flexibility services to the electricity network. CHP plants are used by a wide variety of sectors and in particular by, chemicals, food and drink, paper and refining industries. Large buildings with high heat demands also employ CHP, such as hospitals, and CHP plants are a key technology for heat networks, which in high heat density areas are the most cost-efficient low-carbon infrastructure.

Government provides support to improve the commercial case for investing in CHP because of its relatively long payback period, the environmental benefits of cogeneration, and technical complexity. The CHP Quality Assurance Scheme (CHPQA) is an annual assessment process, that ensures that all CHP plants that benefit from government support meet a required level of energy efficiency.

Since the introduction of the CHPQA scheme, the UK generation mix has changed considerably, with renewable and low carbon generation providing increasing proportions of the national electricity needs. As this has happened, the emission reductions delivered by CHP electricity generation are reduced. Previous modelling work on the impact of new natural gas CHP plant on the GB electricity market concluded that from 2032 new natural gas CHP capacity stops displacing generation by natural gas fired combined cycle gas turbine (CCGT) power stations and begins to displace an increasing proportion of low carbon generation, increasing carbon emissions.

Successful achievement of our Carbon Budget targets on the transition to net zero greenhouse gas emissions by 2050 will require virtually all heat and electricity demands to be decarbonised and significant action taken to help industrial processes to decarbonise. We held a call for evidence from 12th June to 4th September 2020 to seek views to support the Government as it considers what the role for CHP technologies may be in the transition to 2050. We are considering the possible opportunities and technological developments which may be combined with CHP technologies, along with appropriate incentives and support for deployment to meet these goals. Having considered the responses to the call for evidence during 2021, we plan to publish a detailed consultation on the future of CHP. Air quality was not specifically addressed in the scope of this call for evidence.

General information

Why we consulted

The Government sought initial views on the current benefits from Combined Heat and Power (CHP) and the future role of CHP generation of all types in the transition to achieving net zero greenhouse gas emissions by 2050, and in particular how the technology may support the decarbonisation of heat and industry.

We recognise the current challenges facing the economy and this call for evidence was not indicating the removal of support at this time but requested feedback from all CHP stakeholders to shape the future approach.

Call for Evidence details

Issued: 12 June 2020

Closed: 4 September 2020

Response published: 11th December 2020

Enquiries to:

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Consultation reference:

https://www.gov.uk/government/consultations/combined-heat-and-power-chp-the-route-to-2050-call-for-evidence

Audiences:

We were keen to hear from CHP operators, Heat network operators, energy companies, network operators, technology suppliers, large businesses, SMEs, financial institutions, Energy Service Companies (ESCOs), Local Enterprise Partnerships, Non-Governmental Organisations, academics and anyone else with an interest in this area.

Territorial extent:

UK

Confidentiality and data protection

Information you provided in response to this consultation, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

We processed your personal data in accordance with all applicable data protection laws. See our privacy policy.

We will summarise all responses and publish this summary on GOV.UK. The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality assurance

This call for evidence was carried out in accordance with the Government's consultation principles.

If you have any complaints about the way this call for evidence was conducted, please email: beis.bru@beis.gov.uk.

1. Questions With Response Summaries

A total of 45 responses were received to the call for evidence (see table 1). Summaries of the points made from the comments received are listed below each question.

1. **Do you agree with our characterisation of the benefits and incentives?**

2. **Do you have any additional points to make on the current incentives?**

3. **Do you receive any non-financial or alternative benefit(s) for achieving CHPQA certification?**

The response summaries to these three questions have been combined.

The majority of respondents agreed with the characterisation of the benefits, recognising that natural gas CHP could bring efficiency benefits acting as a “bridging fuel” whilst transitioning to lower carbon fuels. The majority of respondents considered that incentives and ongoing support are vital to UK business competitiveness but have been eroded, particularly for renewable fuelled CHP, damaging investor confidence to support future investment. Uncertainty over future carbon pricing policy and the Emissions Trading System (ETS) were also significant concerns.

It was suggested that opening CCL and business rate exemptions via CHPQA to all sectors would be beneficial. Some respondents also mentioned that recognising biomethane in building regulations would encourage decarbonisation of heat where heat pumps are not feasible.

Most respondents noted that financial benefits are key to the success of the CHPQA scheme and future CHPQA updates should include evidence of heat use (not just demand) and air quality benchmarks.

4. **Do you agree with our summary of the direct and indirect benefits of CHP? Can you describe any other monetary or non-monetary benefits you are aware of?**

Most respondents agreed with the summary of the direct and indirect benefits of CHP. Additional benefits included the ability to modulate and accommodate demand side response during peak demand, security of supply during network outages, stability via rotational inertia and heat storage which should be incentivised to encourage flex within the grid. These benefits were noted to increase as the grid incorporates more renewable electricity, but it was also noted that some sectors are restricted in their ability to provide such flexibility and support to the network. Fuel cell CHPs were suggested as a clean non-combustion option with added air quality benefits. CHP supports the business case for heat networks through offering flexible capacity for the power network, making development and/or extension of heat networks possible and helping to smooth heat demand.

5. **In what circumstances would the business case for CHP deployment remain sufficiently positive, in the absence, reduction or closure to new entrants of the incentives described above in sections 2.1 and 2.2? How will this differ in the short, medium and long term?**

Most respondents were clear that changes to the current incentives without replacement would negatively impact the financial business case for CHP and international competitiveness. It was noted that amending incentives to encourage movement to low carbon fuelled CHP would be welcomed and would improve the environmental business case, but the future of CHP policy and incentives needs to be clear to allow for long term financial planning. The comments indicated that gas CHP has a carbon saving contribution to make over the short to medium term compared to separate heat and power generation. The flexibility of CHP is an advantage but respondents suggested there needs to be compensation for any future reduction of run hours to maintain a viable business case. There was concern that energy intensive industries may continue to use inefficient equipment without a clear framework of incentives to aid renewal and upgrading to lower carbon alternatives.

6. **Are there any barriers to CHP acting as a flexible system asset that are specific to the technology? How does this differ for industrial scale plant, CHP used in heat networks and small-scale plants?**

Some respondents claimed there were currently no barriers to CHPs acting as a flexible system asset, however this view varied across respondents from different sectors. The CHPQA scheme was viewed as not incentivising flexibility and problems with oversizing or on-site heat demands in some sectors can be barriers to increasing capacity. The electricity network charging regime impacts will neutralise the economic case for flexibility. The future policy framework and the network need to recognise the full benefits CHPs can bring and seek to remove barriers to avoid dis-incentivising CHP. Respondents suggested lack of clarity over heat decarbonisation, future hydrogen strategy and incentives for Carbon Capture Utilisation and Storage (CCUS) with industrial CHP, biomethane with CHP and CHPs role in importing and storing renewable power may present barriers to acting as a flexible system asset.

7. **How do you consider the changes to the network regulatory framework (e.g. Targeted Charging Review, introduction of RIIO-2 etc) will influence the decisions of both new and existing CHP plant operators?**

Respondents outlined that ongoing uncertainty within the regulatory and policy framework is not good for investors and that there needs to be clarity concerning balancing mechanism reform, carbon pricing policy and access and forward-looking charges reform. Concern was raised that carbon factors for SAP building regulations are likely to impact heat networks and new funding proposals for heat networks are unlikely to support existing CHP. It was considered that the Targeted Charging Review (TCR) will penalise CHP supplying on site electricity demand, remove additional benefits, reduce cost of grid electricity and income for

generators which will impact the commercial case. Removal of benefits from Triad periods was viewed as pressurising the network with no incentive to generate off peak. Concerns were raised over what was regarded as the limited notice and consultation by Ofgem on these changes. CHP is seen as providing key support for the network by mitigating issues of fluctuation of renewable generation, but the level of support available does not reflect this added value. Respondents noted that removing benefits from heat network operators for the power trading side of the business will be challenging unless alternative support can be designed.

8. How do you plan to address the declining carbon reduction of natural gas CHP, where it is currently the preferred technology?

Responses recognised the declining carbon emission savings of natural gas CHP, highlighting potential options from low carbon fuel switching. Respondents also suggested access to wholesale pricing and the targeted use of CHP flexibility benefits to displace fossil fuel use on the grid as steps to be taken during a future transition to alternative fuels e.g. hydrogen to achieve net zero emissions by 2050. Respondents expressed interest in the future development of heat pumps, fuel cells, heat storage for low grade heat, solar, energy from waste and bioenergy with carbon capture and storage (BECCS). It was noted that industry currently have limited short to medium term options to move away from gas CHP, which is viewed as better than combined cycle gas turbine (CCGT) in terms of carbon emissions, until a viable hydrogen strategy and supply market is developed. Respondents also suggested that CHPQA could increase the benchmark for heat utilisation, CHPs could introduce a blend of hydrogen with minimal retrofitting required in some circumstances, and that incentives through CHPQA could help move towards low carbon fuelled CHP. Some respondents suggested certain sectors will face more barriers in trying to move away from natural gas CHP.

9. How could these schemes support moving CHP to better achieve energy efficiency and decarbonisation objectives for your circumstances/system?

Suggestions for the schemes to support moving CHP to better achieve energy efficiency included the need to recognise the wider value of CHP and decentralised generation such as system inertia and inherent efficiency. Incentivising hydrogen ready plant, fuel switching, thermal storage, CCUS, generation of zero-carbon electricity and heat were widely mentioned alongside more incentives for renewable, BECCS, CCUS, anaerobic digestion (AD), to improve air quality and efficient use of CHP. A further suggestion was for carbon emissions to be more directly recognised in the CHPQA calculations. There was support for hydrogen being prioritised for CHP to maximise efficiencies and assist the transition of hard to decarbonise industry and CHP led heat networks.

10. What scope is there to increase the use of alternative, low carbon and renewable fuels for use in CHP plants? Are there any specific considerations in relation to hydrogen?

There was a wide variety of responses detailing routes to increase use of alternative fuels in CHP applications including use of biomass and low/zero carbon fuel or CHP with heat pumps for heat networks and support for anaerobic digestion (AD) in rural settings to remove oil and coal use. It was suggested that renewables such as biomass and energy from waste (EfW) also need more incentives and that there was scope for solar and heat stores to help heat recovery. BECCS was seen as a valuable emerging technology and heat pumps were viewed as a potential interim solution to be combined with CHP until the production and supply of hydrogen is developed. Respondents requested that the hydrogen strategy should provide clarity on hydrogen in industrial settings, production, volume and location identifying the wider infrastructure developments required. Respondents suggested that current high production costs need to be addressed via a policy review of network charges and carbon pricing during transition.

11. What are the challenges and benefits of converting existing natural gas CHP to new fuels? Are you taking steps in this area or are you aware of other projects which are?

Respondents agreed that the estimated 30% efficiency advantages of utilising a single fuel source with CHP would remain when used with alternative fuels, therefore CHP could be the most efficient use for limited or expensive fuels. Multiple respondents agreed that a blend of circa 20% hydrogen could be achievable in some CHP set ups with minimal modification requirements. However, others noted that challenges to conversion included the fact that tests and redesigns for alternative fuels for both CHP and the network would take considerable time and experience and that extensive trials were needed. Some manufacturers are currently exploring conversion options but a defined demand pipeline is required to justify production. Some industrial clusters are developing plans for getting ‘hydrogen ready’ now with CCUS and local infrastructure and storage. To do this, facilities need to be commissioned and developed for hydrogen/blended gas. Other fuels need to be supported and considered to reduce initial reliance on hydrogen which could be limited in supply and expensive. Biogas, biomass and biomethane are all seen as potentially attractive while a comprehensive hydrogen infrastructure develops, this would create potential for BECCS with CHP and CCUS in business models.

12. Which key technological developments have greatest potential to be combined with CHP? Would these enhance performance and improve efficiency of CHP?

Several technologies were suggested to enhance CHP potential including replacing engine generators with fuel cells for use in low temperature and pressure district heating systems and combining with heat pumps using low carbon fuels for heat networks. Where a CHP can be combined with a range of energy and heat storage, batteries, low carbon fuels, or hydrogen

production, it could add value for customers and improve both network flexibility, performance and efficiency. Respondents suggested that CHP with CCUS would help enhance network resilience whilst maximising decarbonisation opportunities and accelerating technological development. Some respondents also suggested more opportunities for tri-generation and increased use of EfW and AD plants.

13. What are your views on the practicalities and potential costs and benefits of converting existing CHP plant to new uses or combining with new technologies?

A common theme of the responses was that some CHP can be converted with minimal modification whilst others would need significant work. CHPs that would incur high costs to convert could be forced to make the changes around scheduled down time as part of a cyclical maintenance and upgrade programme so it may not be able to happen immediately. Some respondents felt retrofitting may not provide as many benefits as full replacement, e.g. some very old plant may benefit from a full replacement with assets compatible with decarbonisation. It was also noted that trials would be needed to check whether converting or moving to zero/low carbon fuelled CHP would impact CHP efficiency or not. Respondents outlined that support would be required to encourage operators to consider fuel switching options or fitting CCUS at mid and end of life points of their CHPs. There was general agreement that production and supply of low carbon fuels is not at a sufficient scale yet to enable switching in the short term. Respondents requested that policy should set out a long term focus on incentivising fuel switching, efficiency improvements, reducing waste heat and supporting tax exemptions for low carbon options to give investor confidence and a level playing field with international competitors. Potential benefits to linking CHP with heat networks and utilising residual waste heat were noted, but it was identified that some CHPs have a high return temperature which can impact ability to combine effectively with heat pumps.

14. Taking account of all the previous sections, what changes would you propose to the incentive framework for CHP to be better targeted to achieve decarbonisation and energy efficiency, while not impacting on industrial competitiveness?

It was felt that there were currently too many schemes available for the different elements of CHP and that a clear and focussed simplification of support would be beneficial. There was also general consensus that current incentives would need to be maintained in the short term whilst a new support framework was devised and implemented. Reform of Carbon Price Support and expansion of CfDs were considered to be essential to businesses. It was recognised by multiple respondents that heat calculations should be included when considering the benefits of CHP compared to other options. Respondents felt that incentives should encourage low/zero carbon fuel uptake, flexibility capacity, efficiency, storage, low air quality impacts and being ‘hydrogen ready’ as they were felt to be of particular benefit to decarbonisation. Some respondents felt subsidies and exemptions should be removed from CHP plants using fossil fuels without any abatement and targets for greenhouse gas emissions and air quality impact could be strengthened. Introducing a carbon emissions saving requirement as part of CHPQA certification calculations was suggested to incentivise CHP improvements. Most responders wanted a clear framework of policy and support to enable

critical long-term investment decisions to be made to facilitate the staged transition away from natural gas CHP.

15. If the incentives described in section 2.1 were to change, how could the money be best used to support new energy efficiency measures and decarbonisation?

Many respondents did not support removal or reduction of the incentives arising from Good Quality CHP, at least in the short term. It was felt changes to incentives would impact the business case which has already been negatively impacted by previous policy changes and further changes would have unintended consequences for achieving net zero emissions by 2050. Some respondents suggested that changes to the current incentives could free up money to invest in large scale hydrogen and CCUS projects creating employment opportunities, stimulating local regions, levelling up and establishing low carbon sectors of the future. Another suggestion was that hydrogen ready CHP could be incentivised over others via a tariff or CAPEX grant to accelerate adoption, production and innovation. Expanding CfD for renewable fuelled CHP to include heat and power similar to RO uplift for renewable CHP was suggested by some respondents. Additional suggestions included focusing CHPQA support with direct consideration for decarbonisation, providing CAPEX for conversion or replacement of CHP for low/zero carbon fuels, only supporting renewable or low carbon technologies including supply chains and reviewing support across sectors differently based on intensity of energy demand and ability to decarbonise.

2. Responders

Responder Sectors	Quantity
Arm's Length Body (established by Council)	1
Council	5
Environmental consulting	1
Hospital/health	1
Individual	2
Investment & financial	2
Manufacturer	9
Member association	8
Oil refinery/ marketing	1
Operator	6
Private BEIS owned company dealing with Contracts for Difference (CfD) & Capacity Market schemes	1
Researcher	3
Supplier	5
	45

Table 1: Number of respondents per sector.

3. Next Steps

We intend to use the information supplied in the call for evidence responses to shape future policy options for CHP. It is our intention to publish a more detailed CHP consultation in 2021.

This consultation is available from: www.gov.uk/government/consultations/combined-heat-and-power-chp-the-route-to-2050-call-for-evidence

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