



Department for
Business, Energy
& Industrial Strategy

SAP 10.2 – updates for heat networks

Government Response

Covering proposals to natural-gas CHP, the Products Characteristics Database, Biomass and recovered heat factors



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General Information

This document sets out the Government's response to the consultation [Standard Assessment Procedure \(SAP 10.2\): proposals for updates for heat networks](#). The consultation ran from 15th March to 10th May 2021. We had a total of 26 respondents to the consultation from energy consultancies, local authorities and wider local government organisations, district heating energy companies, the heat network trade associations, wider charitable organisations involved in the net-zero transition and a number of interested individuals.

Contact details

For questions relating to the consultation please contact heatnetworks@beis.gov.uk.

Introduction

The Government is committed to achieving net-zero greenhouse gas emissions by 2050. As set out in our [Heat and Building Strategy](#), meeting this legal commitment will require virtually all heat in buildings to be decarbonised, and heat in industry to be reduced to close to zero carbon emissions. Presently, heating of homes and businesses is responsible for around a third of the UK's greenhouse gas emissions.

Heat networks transfer heat (hot water and/or cooling) from a central source or sources to buildings including domestic dwellings, public buildings, businesses, factories, sport facilities, hospitals and universities. They are uniquely able to unlock otherwise inaccessible large-scale renewable and recovered heat sources such as waste heat from industry and heat from rivers and mines. They currently provide 2% of UK heat demand and the Committee on Climate Change (CCC) has estimated in 2015 that with government support, they could provide 18% of heat demand by 2050 in a least-cost pathway to meeting carbon targets. Delivering more and larger heat networks in the right places is crucial to achieving cost effective decarbonised heat and minimising costs for the consumer.

The Standard Assessment Procedure (SAP) is used to assess compliance with Building Regulations. It is also the methodology behind Energy Performance Certificates (EPCs), the rating system used to grade the energy efficiency of all homes in the UK.

To ensure that heat networks are able to reach their potential contributions to the UK's net-zero target we must ensure that the rules for assessing their carbon emissions and energy usage are as accurate as possible. This will give property developers and residents confidence in their chosen heating system and will better allow them to make informed choices and comparisons between them. It will also ensure industry is able to understand the impacts of different design choices for heat networks. This consultation response sets out our proposals to improve the approach of SAP 10 to two important aspects of heat networks that require updating in the forthcoming version of the Standard Assessment Procedure (SAP 10.2 to be released this December):

- homes connected to heat networks that use recovered heat
- homes connected to heat networks using Combined Heat and Power (CHP)

Whilst the inclusion of new factors for recovered heat sources will be welcomed by many heat networks we recognise that the proposed changes for heat networks using natural gas Combined Heat and Power plants are more challenging. When combined with the Government's planned trajectory for new-build standards for homes and businesses this will mean changes to plans in the 2020s for the expansion of some schemes. We have listened carefully to the feedback given in this consultation to ensure that the changes are as fair as possible.

From June 2022 there will be an uplift in the Part L Building Regulations thresholds for carbon dioxide (CO₂) emissions and primary energy standards for new buildings.

The permitted CO2 emissions from homes, for example, are expected to drop by around 35%. This policy change, combined with the proposed emissions factors for gas CHP given in this document, would mean that gas-based heat networks that are already built, or are in the latter stages of development, would have struggled to pass the ‘interim uplift’ to Part L Building Regulations from June next year in CO2 and primary energy terms.

The heat networks industry is in the early stages of growth and heat network infrastructure is different from the installation of individual building solutions because the installed heat sources can be changed over time. Government is committed to legislating this parliament to regulate the heat networks sector and to use those regulations to ensure that all heat networks meet the 2050 net-zero decarbonisation target.

We have consulted with the heat network industry and green building groups on a proposal that in the interim uplift next year most existing networks (i.e already built or where already under construction before June 2023) would be able to pass the uplift in CO2 and PE terms. We have taken on board feedback from these stakeholders and propose to adjust the notional building in both domestic and non-domestic Part L Building Regulations to be equal to the actual building as long as the actual is equal to or better in CO2 and PE terms than a threshold based on a gas CHP based heat network with 33% overall distribution losses. The gas CHP threshold system is assumed to be a system with 70% gas CHP (with electrical efficiency of 38% and thermal efficiency of 42%) and 30% communal gas boiler (with efficiency of 85%) giving the heat delivered thresholds below:

CO2/kWh	Primary Energy kWh/kWh
0.350	1.450

All heat networks should be able to use the fuel source entries in SAP to calculate whether they are above or below this threshold. The threshold has been set to enable most existing heat networks to pass the interim uplift in Part L of the Building Regulations to enable them to continue to connect to new buildings.

As confirmed in the consultation response to 2020 Future Homes Standard consultation the previously applied mandatory in-use factor of 1.15 for heat networks will no longer be applied and will be determined as part of the Products Characteristics Database (PCDB) entry allowing it to be varied depending on the nature of the source of the data.

This approach will not mean any relaxation in standards of fabric efficiency for new buildings as the dwellings will still be expected to comply with the notional fabric efficiency standards set out in Appendix R.

For those heat networks that find that they comply with the standard notional building approach of assessment, they will be able to continue to use that to evidence compliance and will be able to demonstrate any relative savings in CO2 emissions or primary energy consumption that this approach indicates.

Importantly any new networks built after June 2022 will be required to pass the interim uplift in Part L Building Regulations as it is currently planned and would not benefit from this notional building adjustment.

We believe this policy is necessary to continue to allow the growth of the heat network industry in England. This will enable heat networks to grow in areas which would otherwise be very difficult to decarbonise with individual building solutions and also allow heat networks to adopt more efficient and lower-carbon sources in the long-term.

Government is committed to working with the heat network industry and local government partners in this transition. With this consultation response we are ensuring that the true carbon performance of systems is reflected where necessary but we are also creating a new market structure through Heat Network Zoning so that some schemes can more easily transition away from connecting to new developments and instead increase the proportion of connections to existing buildings where they can deliver greater carbon savings and build to a scale that delivers lower-cost heat for consumers. Our consultation on Heat Network Zoning in England closed on 19th November and can be found [here](#).

Summary of Comments and Government Response

SAP Appendix C – recovered heat sources

The consultation outlined current guidance in SAP Appendix C relating to classification and description of recovered heat sources for heat networks. These classifications are: ‘*waste heat from power stations*’ and ‘*geothermal heat (or other natural sources)*’ – both listed in Appendix C4; ‘*heat pumps utilising recovered sources*’ – listed as a heat generator permutation in Appendix C5. It was noted that this categorisation does not fully reflect the ranges of recovered and/or waste heat sources available to heat networks.

It was also noted that although it is a common heat source for heat networks, a classification or description for heat recovered from Energy from Waste (EfW) plants is not included in Appendix C, but instead captured within a BRE technical note¹.

Building on recent work with industry, the consultation proposed expanding the number of categories in C4 from two (existing) to five (proposed). This included updates to two existing categories, and the introduction of three new categories. The proposed categorisations (and whether they were new categories or updated) are:

- Heat recovered from waste combustion (new);
- Heat recovered from power stations (updated);
- Heat recovered from other industrial processes (new);
- Heat recovered from other commercial processes (new);
- Heat recovered from geothermal or other natural sources (updated).

Question 1 – Do you agree with the proposed additional recovered heat categories? If you disagree, please provide reasoning, including alternative approaches.

Question 1	No. of responses	% of responses to Q1	% of all responses
Yes, agree	11	57.9	44
No, disagree	8	42.1	32
Did not respond	6	-	24

Respondents that agreed with the proposals for the proposed additional recovered heat categories believed that they would reflect, support and encourage the modelling of wider sources of heating, enabling more accurate SAP ratings. It was noted that these heat sources could facilitate cost, energy and carbon emissions savings.

¹ https://files.bregroup.com/SAP/BRE_Technical_Note-Energy_from_Waste_Facilities_%28ERF%29_1.0.pdf

Respondents that disagreed with the proposed categorisations noted that the use of a single figure for emissions factors may not be appropriate or accurate in each case, for example where an EfW plant extracts heat both from the turbine (as per the z-factor approach), and from exhaust gases. It was also suggested that the approach of assuming a z-factor of around 10 may be too high where networks are retrofitted to existing EfW plant. Respondents suggested that a bespoke calculation of emissions factors may be more appropriate. It was suggested that further clarity would be helpful regarding the definition of air source and water source heat pumps, and which categorisation these best fall into.

Two of the respondents that disagreed with the proposed categorisation did so to indicate that there could be additional categories included: agricultural processes, and pyrolysis for EfW. Respondents also queried the *heat recovered from power stations* approach of using power rating/efficiency to distinguish between heat recovered from power stations, and CHP.

Government response to Question 1

We believe that the additional proposed categorisation will allow Appendix C to account for the majority of recovered heat sources for heat networks, and propose to retain these within this document (see also response to Q2 below). Where categorisation of recovered heat sources may fall outside of this broad range, we believe that the PCDB (e.g for agricultural processes, biogas certification and pyrolysis) will be an appropriate route to account for that categorisation (see also response to Q7).

Question 2 – Do you agree with the description of each of the proposed categories? If you disagree, please provide reasoning, including alternative descriptions.

Question 2	No. of responses	% of responses to Q2	% of all responses
Yes, agree	9	47.4	36
No, disagree	10	52.6	40
Did not respond	6	-	24

Several respondents that agreed with the proposed category descriptions noted that the process for assessing these technology types should include some level of independent verification of input information. It was also noted that where heat can be captured from industrial/commercial processes, that these processes themselves should be decarbonised over time (particularly where they are fossil-fuel based).

Where respondents disagreed with the proposed category descriptions, it was noted that some of the descriptions could be better defined, for example ambient heat recovered under Appendix C4.5 and moving to definitions of high/low grade heat rather than commercial/industrial processes. It was also noted that ambient loop networks and shared ground arrays were not specifically referenced in the proposed definitions.

It was noted that the drafting of category ‘*Heat recovered from power stations*’ should correctly read: *plants rated at more than 10MWe and operating at a gross power efficiency above 35%, otherwise it is considered as CHP*, rather than ‘below’ as stated.

Government response to Question 2

Several of the respondents that disagreed with the description of each of the proposed categories suggested further clarity in drafting – we propose to take on board these comments and consider amending descriptions as follows:

- C4.2 – Heat recovered from power stations (amended);
 - Amended drafting to simplify definition of power station as a unit that is rated as generating more than 30MW of electricity output. For units that fall outside of this definition they look to use heat recovered from industrial processes or the emissions factors for CHP if appropriate.
- C4.3 – Heat recovered from other industrial processes (new);
 - Amending drafting to more broadly reflect use of high-grade heat, regardless of whether the process that generates the heat is ‘industrial’ or not;
- C4.4 – Heat recovered from other commercial processes (new);
 - Amending drafting to more broadly reflect use of low-grade heat (requiring elevation of temperature), regardless of whether the process that generates the heat is ‘commercial’ or not;
 - Adding drafting to clarify use of centralised heat pumps within this categorisation;
 - Adding drafting to more specifically reference ambient loop systems and others where there may be heat pumps both within an energy centre and within a dwelling.
- C4.5 – Heat recovered from geothermal or other natural sources (updated).
 - Adding drafting to clarify why centralised heat pumps are not included within this categorisation.

Question 3 – Are there any recovered heat sources not covered by the proposed categories which are likely to contribute to decarbonising heat networks? Please state which.

Question 3	No. of responses	% of responses to Q3	% of all responses
Yes, additional recovered heat sources suggested	11	57.9	44
No, no additional recovered heat sources suggested	8	42.1	32
Did not respond	6	-	24

Responses to Question 3 suggested that the following should be considered for inclusion, or referenced within existing categories:

- Ambient loop networks;
- Heat recovered from cooling (commercial or domestic);

- Heat recovered from electricity Transmission and Distribution stepdown;
- Heat recovered from underground transport ventilation shafts;
- Heat recovered from mines (distinguished from geothermal heat);
- Pyrolysis from EfW;
- Existing heat networks providing heat through connection of new/additional load (either building(s) or adjacent networks).

It was suggested that given there may be complex technology/heat source combinations for heat networks that use recovered heat, a way of deriving bespoke emission or PE factors would be useful. Respondents noted that this would require independent verification.

Government response to Question 3

We believe many of the categories above can be considered as falling under the new definitions proposed in the government response to Question 2. It is intended that where more bespoke permutations of recovered heat exist, the PCDB will be the primary route for inputting these (see also response to Q7).

Primary Energy factors for recovered heat sources

The recent Future Homes Standard consultation² proposed the introduction of a Primary Energy (PE) target as a part of compliance with Part L of the Building Regulations. SAP has historically calculated PE, but with the proposed changes to Part L, this output has gained more importance.

Currently SAP suggests that waste used to produce energy should be assigned a PE factor of 1, with any subsequent energy use of losses prior to delivery added. Following engagement with industry, the consultation proposed assigning a PE factor of 0 (plus any relevant additional electrical energy) to all recovered heat sources, to better align approaches to recovered heat sources for other technologies within SAP. We consider this to be appropriate because the PE used to generate that heat is typically assigned to the original purpose, e.g. generating electricity by burning municipal waste.

The consultation proposed PE factors for the recovered/waste heat technology categories as listed on page 12 of the consultation document – as well as listing the proposed PE factors (based on SAP 10.1 factors) this outlined where additional PE allowance for pumping energy and/or ‘z-factor’ would be required.

Question 4 – Do you agree with the proposed approach to Primary Energy factors for recovered heat sources for heat networks? If you disagree, please outline why.

Question 4	No. of responses	% of responses to Q4	% of all responses
Yes, agree	8	53.3	32
No, disagree	7	46.7	28
Did not respond	10	-	40

²https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

Respondents that agreed with the proposed approach to PE factors noted that this would encourage heat to be used that might otherwise be wasted. It was suggested that this approach may also support some networked (heat pump) solutions to compete on a carbon/PE basis against individual heat pumps. Further comments where respondents broadly agreed with this approach included a request for further detail/clarification of heat recovery in commercial processes, and separate detail on the contributions of pumping to PE emissions.

Several respondents noted that the PE factors are derived from the grid electricity factors – they suggest that this should be based on a marginal, rather than average, basis. Respondents noted that a methodology for correctly reflecting the PE of ambient loop networks could be better described/reflected in Appendix C. It was suggested that a zero-rating PE factor should only apply where a zero-carbon generator is involved in the process or waste heat generation.

It was also queried whether PE is an appropriate metric, and whether carbon targets for buildings based on a carbon/m² approach may be better suited to encouraging carbon reduction.

Government response to Question 4

We propose to take forward the Primary Energy approach as outlined in the consultation – we believe that this will encourage and support heat networks projects wishing to decarbonise through the use of recovered heat sources, and transition away from fossil fuel heat sources.

We will include guidance for ambient loop networks in upcoming updates to the PCDB guidance document and worksheet (see also response to Q7), including allowances for PE associated with both the heat source/generator, and the dwelling level heat generator. The approach to deriving PE factors for pumping energy is described in the draft Appendix C3.2 – i.e. the electricity used for pumping water through the distribution system are allowed for by adding electrical energy equal to 1% of the energy required for space and water heating.

We will consider the role for marginal emissions factors for energy recovered from waste combustion as part of a broader look at the role of marginal emissions factors in preparation for SAP 11.

Question 5 – If you disagree with the proposed approach to Primary Energy factors for recovered heat sources for heat networks, please outline your views on alternative approaches, including relevant evidence?

Question 5	No. of responses	% of responses to Q5
Views on alternative approaches provided	8	32
Did not respond	18	68

Several respondents provided views on alternative or modified approaches to PE factors. These included:

- Varying PE factors based on temperature of the recovered heat source, and the network operating temperature;
- Further research into different types of EfW operation to derive more representative EfW PE factors;
- Only applying a zero-rating PE factor where a zero-carbon generator is involved in the process or waste heat generation;
- Alternatives to the CO₂ / PE approach which may allow poor efficiency dwellings to achieve compliance through a recovered heat source.

It was also suggested that further detail on / consideration of the PE factor approach to grid power would be helpful in understanding how the grid factors track renewable power generation.

Government response to Question 5

We propose to take forward the Primary Energy approach as outlined in the consultation – we believe that this will encourage and support heat networks projects wishing to decarbonise through use of recovered heat sources, and transition away from fossil fuel heat sources.

Insufficient evidence was submitted to suggest that expanding the list of PE factors / recovered heat categorisations to account for factors such as network operating temperature and heat source temperature would have a material impact on PE assessments of dwellings. We will continue to engage with EfW industry stakeholders to understand the extent to which different types of heat recovery from waste combustion configurations/technologies are likely to be used as sources for heat networks in future.

In most cases the categorisations of recovered heat for heat networks are those where an existing process is already taking place and the recovered heat would be wasted if not captured for a heat network. These may or may not involve zero-carbon generators serving that process. Whilst we agreed that it is highly desirable for processes (e.g. industrial) from which heat can be recovered to become zero-carbon over time, we do not think discouraging heat off-take where the source is not zero-carbon is the correct approach. In the short term this would discourage use of this recovered heat and reduce opportunities for moving away from fossil-fuel based heat sources.

We believe that proposed mechanisms within Part L relating to fabric energy efficiency standards will support delivery of dwellings which both minimise demand, and generate energy using low carbon or renewable sources.

Product Characteristic Database (PCDB) approach

In addition to SAP Appendix C4 (*heat networks that use recovered heat*) proposals for updated and new categories for recovered heat sources for heat networks, the consultation included drafting updates to SAP Appendix C5 (*permutations of heat generators*). The purpose of these drafting updates was to: update wording and guidance to be consistent with Appendix C4; clarify wording around different ambient and recovered heat sources for heat pumps; clarify that heat sources/generator permutations not covered by Appendix C5 should be inputted by a PCDB entry.

The latter purpose is primarily to ensure that new or innovative heat generator permutations have opportunity to be correctly reflected rather than applying an inaccurate heat source category. An update to both the PCDB worksheet and guidance document is being released alongside this consultation response.

Question 6 – How could the SAP methodology recognise the potential role of biomass in decarbonising rural, harder to decarbonise areas?

A significant proportion of respondents (12) to the consultation did not engage with this question and of those that did answer the question were almost evenly split in supporting (6) and opposing (7) the idea of adjusting the biomass Primary Energy factor in order to enable its use in rural harder to treat locations.

Of those who opposed adjusting the factors a large number believed that government should not adjust factors in SAP to suit policy needs but that the factors should be as objective as possible. In addition, respondents made points about how burning biomass for heat was an inefficient use of a limited resource and that heat pumps were a more reasonable solution for decarbonising heat in buildings.

Of those who supported the idea of adjusting the biomass factor they made the points that even with an adjustment in the primary energy factor biomass would still be difficult to employ in many settings because of necessarily stringent air quality laws. For these respondents the factors that have been given to biomass are unnecessary barriers to the deployment of biomass in settings where there are no better options for reducing carbon emissions from heating.

Some respondents suggested that SAP should incorporate air quality ratings.

Government response to Question 6:

On balance we agree with those who are opposed to changing the primary energy factor for biomass in heat networks. Insufficient evidence was submitted to convince us that the current factor for primary energy from biomass is incorrect and we disagreed with the suggestions that SAP factors could be amended to suit policy needs. SAP and the factors included within it are an objective representation of the carbon emissions and primary energy consumption of different fuels. Adjusting only some factors to make it easier to install certain devices would undermine faith in the system of assessment and would potentially lead to inconsistencies with other similar fuel categories such as those for wood logs and pellets etc under solid fuel.

We were however swayed by arguments that waste-wood biomass should not be treated the same as virgin biomass used in heat networks. The underlying definition of Primary Energy as outlined by BRE in a technical note in 2019 ‘energy from renewable and non-renewable sources which has not undergone any conversion or transformation process’. We consider that waste-wood used as biomass has already undergone a conversion or transformation process and that we will enable waste-wood biomass to receive a lower primary energy factor in SAP 10.2 and the PCDB.

Question 7 – Do you agree with the approach of using PCDB entries for permutations of heat generators not covered in bullets 1-6? If you disagree, please state why, providing alternative approaches.

Question 7	No. of responses	% of responses to Q7	% of all responses
Yes, agree	12	80	48
No, disagree	3	20	12
Did not respond	10	-	40

Responses were strongly in agreement with the use of the PCDB entries for permutations not covered by proposals. Several respondents noted that the PCDB would be an appropriate route for more complex heat network technology combinations, with the possibility of generating bespoke emissions factors. It was suggested that this would need to be a simple process with clear guidance and independent oversight, to avoid this becoming a barrier to innovation. Concern was expressed that if this is considered as the most appropriate route for inputting ambient loops, that sufficient engagement and consultation with industry is carried out to ensure proposals are reflective.

Of the respondents that disagreed with this proposal, there were concerns expressed regarding the potential complexity of a PCDB approach which could hamper innovative approaches to delivering low carbon heat. It was also suggested that there may currently be mistrust within industry of the PCDB claims made by heat network suppliers.

Government response to Question 7

We propose to use the approach of using PCDB entries where systems are not listed in Appendix C, including innovative or bespoke technology combinations. We are currently updating documents *Application Form: APPF:01 – Application guide for entry of heat network performance data in SAP Products Characteristics Database*³ and the *Application workbook for entry of heat networks in SAP PCDB*⁴ for issue alongside SAP10.2. It is intended that this update will cover generator permutations not covered by Appendix C4 or C5, including guidance on approach to ambient loop systems. We have discussed these updates with industry and will be releasing them to the market alongside this consultation response document for comment ahead of formal acceptance.

Entries submitted under the PCDB will be scrutinised by BEIS and BRE who currently deliver SAP on behalf of Government.

³ <https://www.ncm-pcdb.org.uk/sap/filelibrary/pdf/Applications/APPF-01---Application-guide-for-entry-of-heat-network-performance-data-in-SAP-PCDB---V1.1.pdf>

⁴ <https://www.ncm-pcdb.org.uk/sap/filelibrary/pdf/Applications/Application-workbook-for-entry-of-heat-networks-in-SAP-PCDB-Format-1.2.xls>

Question 8 – Do you agree with the proposed factors for CO₂e & Primary Energy for natural gas CHP? If not, why not, and what would be a more accurate approach?

Question 8	Number of responses	% of responses to Q8	% of total responses
Yes, Agree	5	23%	20%
No, Disagree	17	77%	68%
No response	3	-	12%

A large majority of respondents (70%) did not agree with the proposed CO₂ and Primary Energy factors proposed for natural gas CHP units. Under 20% of respondents supported the proposed factors and the remaining did not provide a response.

The respondents who disagreed with the proposals made a number of points against them:

- They argued that the assumptions in the modelling, particularly in the Dynamic Dispatch Model were not reflecting how price responsive and flexible the more 'smart' CHP units can be. These respondents argued that CHP units could be run to avoid displacing any lower-carbon generation.
- Respondents claimed that the natural gas factors used in SAP are inaccurate because they do not factor in forecasts of how the gas grid will decarbonise. Moreover, respondents believed this was inconsistent with how SAP represented electricity factors.
- One respondent said that the factors were wrong because the whole SAP system would be more accurate if it was based on exergy analysis
- Others criticised the proposal saying that SAP is not taking into account the carbon costs of removing already installed gas CHP units if SAP makes those units impossible to connect to new buildings
- A large number of respondents said that the analysis of interconnectors should be amended as it was using average rather than marginal emissions factors for the electricity assumed to be imported to the UK through interconnectors
- Respondents said that the assumptions on the percentages of electricity being exported/used on-site in private wire arrangements were incorrect as Ofgem and government policy changes are likely to change in the near future to make on-site usage more difficult
- Concerns were raised about how these factors were compatible with the Heat Network Investment Project where some projects based around gas CHP have been awarded funding on the assumption that they will be able to connect to new buildings in the 2020s
- Other respondents raised questions about how these proposed factors would align with SBEM assessments and the wider non-domestic system for assessing building
- Respondents called for more lenient treatment for heat networks that have a longer-term plan to decarbonise and where the gas CHP unit is more of a temporary heat source
- Respondents claimed that basing results on the modelling assumption of adding an extra 2 GW of gas CHP capacity was incorrect as it is unlikely that such a large amount of natural gas CHP capacity will be built

- Finally, some respondents appreciated the use of marginal analysis for gas CHP but claimed that this should be used more widely in SAP, particularly to the modelling for heat pumps

Government response to question 8

Given the large amount of critical analysis received for this question, we have reviewed carefully and have updated two assumptions that have a significant impact on the carbon and primary energy factors.

The overall methodology for the analysis, as described in the technical annex of the consultation, is not being updated but we have updated a number of assumptions that are used in the analysis. The updated assumptions are:

- Interconnector carbon intensity in the 'export only' analysis, and;
- The proportion of power used onsite and exported to grid.

We have also reconsidered some of the policy proposals for SAP and Building Regulations in light of these responses and have proposed the following changes:

- **Export only factor:** Introduction of a specific factor for gas CHP units which only export electricity (further details on page 12)
- **PCDB flexibility:** Greater flexibility in the PCDB to accept new entries for flexible gas CHP units or other more esoteric technology set-ups (p.15)
- **New category for older gas CHP units:** A new category for existing gas CHP units that were commissioned/operational before 2015 (detail on p.17)
- **Scheme flexibility:** Allowing greater flexibility for schemes that are looking to decarbonise over time. We can confirm that in the Approved Document to accompany the interim Building Regulations standard there will be discretion for projects to carry out their SAP assessment as if the heat network is already connected to a new heat source. This will be permitted as long as the new heat source has planning permission, a signed contract with the heat network to connect and the connection is planned for before December 2027.

Interconnector Carbon Intensity

There were multiple consultation responses which challenged the assumed carbon intensity of imported power, particularly the use of an average carbon intensity assumption.

Our updated assumption reflects that gas CHP, when exporting power to the grid, would likely displace higher cost generation in the connected country. Generation with higher short run marginal cost is either unabated gas generation or, in future, gas generators with carbon capture and storage systems. Given the uncertainty regarding the deployment of gas CCS in connected countries, our updated assumption is that gas CHP will only displace interconnectors if CCGT is the marginal generation plant in the connected country.

Therefore, the carbon intensity of imported generation in the displacement analysis is reflective of CCGT generation, in the exported series only. Responses to the consultation agreed that onsite power use does not respond to price signals on the grid, and therefore it is not appropriate to update this assumption. The onsite

displacement analysis, therefore, uses the same assumption regarding the carbon intensity of imported power, as described in the consultation.

Onsite/ Export Power Use

The original analysis that fed into the consultation assumed that there would be a relative increase over time in the proportion of generation which is used onsite rather than exported to grid. The logic being that the hours per year where gas CHP would export power to grid would decline over time as the grid decarbonises, while onsite use would stay constant.

This assumption has been updated to account for some proposed regulatory changes by Ofgem which may be expected to reduce the incentives for onsite power use. Responses to the consultation suggested that we should take these changes into account in the analysis. The confirmed proposal by Ofgem – the Targeted Charging Review – is expected to reduce the incentives for gas CHP plants to use their power onsite. The proposals would likely not be sufficiently strong so as to eliminate onsite use altogether, and therefore we have assumed that both onsite and export use both decline in proportion to the overall decline in gas CHP generation.

In addition to the above we have also taken-on-board responses to question 9 (below) to make the following amendments to the categories of gas CHP units:

New category for existing gas CHP schemes:

The analysis presented in the consultation demonstrated that when a gas CHP unit starts operating, it has a large impact on the relative lifetime emissions of the scheme. We have revisited our analysis and agree with respondents to the consultation that an additional set of factors for existing gas CHP units would be appropriate.

For the additional analysis we looked at the period before 2015 to consider whether plants that started operating before this point would have significantly different factors compared to those for the 2015-2021 category proposed in the consultation. The results of the additional analysis are shown below.

We intend to include these new emissions factors alongside the set outlined in response to question 8 p.14. The heat networks claiming these factors will have to demonstrate to SAP assessors and Building Control that the gas CHP units were installed or commissioned before 2015.

These factors have been based on the same analytical techniques as the earlier factors.

Export-only factor: for those gas CHP units which only export electricity and do not supply any to buildings 'on-site' through private wire arrangements we are proposing a separate set of factors. We agree that electricity export is likely to be better from a carbon perspective than electricity which is used 'on-site' and so schemes which can evidence to SAP assessors and Building Control that they export all electricity (aside from whatever electricity is used as parasitic load) will be able to claim the factors below. These factors have been calculated in the same way as the export factors described in the original consultation.

Flexible operation factor: respondents to the consultation made the point that some gas CHP schemes can be operated to generate electricity only at times, and at prices, where they are only displacing the most high-carbon generation on the grid. Whilst limited evidence was submitted by respondents to evidence these claims we support schemes that want to reduce their CO₂ emissions by ensuring smart and flexible operation of their gas CHP unit. For these schemes we are proposing that they will be able to submit evidence of their scheme's flexibility through the newly reformed PCDB and that from its date of implementation they will be able to claim lower carbon and primary energy factors. These factors will be based on the evidence submitted by the project through the PCDB. Further information on this option will be published shortly.

Emissions factors

		Emissions Factor (kgCO₂e/kWh)
New	Export Only	0.394
New	Flexi Operation	0.420
New	Standard	0.311
Existing	Export Only	0.394
Existing	Flexi Operation	0.420
Existing	Standard	0.348
Existing (pre-2015)	Export Only	0.394
Existing (pre-2015)	Flexi Operation	0.420
Existing (pre-2015)	Standard	0.374

Primary Energy Factors

		PE Factor (kWh/kWh)
New	Export Only	2.345
New	Flexi Operation	2.369
New	Standard	2.107
Existing	Export Only	2.345

Existing	Flexi Operation	2.369
Existing	Standard	2.149
Existing (pre-2015)	Export Only	2.345
Existing (pre-2015)	Flexi Operation	2.369
Existing (pre-2015)	Standard	2.230

Question 9 – Do you agree with the assumptions described in the technical annex to this consultation? Please provide evidence to support your response.

Question 9	Number of responses	% of responses to Q9	% of total responses
Yes, agree	3	17%	12%
No, disagree	15	83%	60%
No response	7	-	28%

Responses to this question were very similar to question 8, with slightly higher rates of not answering. Comments suggested that respondents found it easier to provide their answers to 8 and 9 in one go for question 8.

Other respondents repeated their criticisms of the use of average emissions factors for interconnectors and that it would be more appropriate to use marginal factors. As described in the previous section this is something we have accepted for the factors to be adopted.

Some respondents pointed to their future plans to develop more flexible operating algorithms which would ensure that CHP units only operate when displacing more CO₂-emitting generators.

Other respondents to the consultation questioned why the factors have not been released in a monthly profile series as is the case for electricity emissions factors.

A small number of respondents claimed that their gas CHP schemes are run as 'heat-led' where the gas CHP is primarily used to generate heat when needed by customers rather than heat being a commercially valuable by-product of electricity generation when wholesale prices are high. This mode of operation is the opposite of the assumptions in the DDM analysis and is not how the majority of respondents to the consultation described their operations. We believe that this 'heat-led' approach to operations will have higher carbon emissions than the conventional approach as the electricity displacement will not be price sensitive and is therefore more likely to be displacing lower-carbon generation on the grid.

One respondent in particular highlighted the benefits of private wire arrangements which are not taken into account in SAP. These could include the security of supply benefits and some benefits for voltage control on the electricity network.

Of the minority who did support the proposed factors the majority said they believe that CHP is likely to displace some lower carbon electricity than gas CCGT.

Some respondents did not accept the use of 20% losses in modelling.

Government response to question 9

The majority of government’s response to question 9 is included in the previous response to question 8.

Additional response to the specific points raised by respondents is below:

- Additional benefits of private-wire arrangements: government does recognise that private-wire arrangements can bring a variety of benefits and costs. We do not believe that SAP’s scope should be expanded to include additional benefits which could arise from factors such as voltage control or local electricity grid resilience. These potential benefits are not directly related to SAP’s main objectives of assessing CO2 and primary energy consumption and extending the assessment boundary here would risk confusing SAP’s primary role and lead to additional administrative burden
- We understand the concerns from some respondents that 20% distribution heat losses are not representative of all heat networks. We have taken 20% as a necessary modelling assumption because this is the recommended overall heat losses in the most-recent version of the CIBSE Code of practice for heat networks. Whilst it may not be reflective of all heat networks we believe it is a useful benchmark to continue using for SAP and heat network modelling. In addition the 20% modelling assumption is not a requirement for systems in SAP, as part of our proposed reforms of the PCDB we will enable heat networks to enter their own losses as long as these are evidenced.

Question 10 – Do you agree with our proposed classification of new and existing gas CHP plants?

Question 10	Number of responses	% of responses to Q10	% of total responses
Yes, agree	10	67%	40%
No, disagree	5	33%	20%
No response	19	-	40%

Half of respondents to the consultation did not respond to this question. Of those who did respond the majority supported the proposed classification of new and existing with 4 respondents opposing. Principally the opposition was linked to respondents’ opposition to the proposed emissions factors but on the specifics of new/existing factors the respondents made the following points:

- Respondents suggested that there should be an intermediate age category since the lifetime carbon impacts of gas CHP schemes will be very different depending on whether it was built in the 2010s or the 2020s

- They suggested that the analysis has not taken into account that Gas CHP units will run for fewer hours in the year as the electricity grid decarbonises and there are fewer hours when gas CCGT or other higher carbon generators are running.
- Some respondents raised the tangential point that gas CHP schemes can reduce their carbon emissions by either directly running on locally produced biogas or from buying certificate biogas/biomethane from producers who inject it into the national gas transmission system

Government response to question 10

Responding to the points raised in order as above:

- We agreed with the point made by some respondents that there should be an additional age category for schemes and proposals for how that can be introduced are outlined in our response to question 8.
- We disagreed with the point raised by some respondents that the Gas CHP units do not reduce their run-hours over the decades to 2050. As figures 1 & 2 (p.23) in the consultation showed the expected generation of natural gas CHP units declines substantially over the analytical period.

Question 11 – Do you agree with our assumption that gas CHP plants tend to operate under a ‘mixed exposure’ commercial arrangement? If not, please provide any evidence to support your response.

Question 11	Number of responses	% of responses to Q11	% of total responses
Yes, agree	5	42%	20%
No, disagree	7	58%	28%
No response	13	-	52%

A total of eighteen respondents to the consultation did not answer this question. Of those that did answer the question 3 agreed with the proposal and 5 were opposed. Of those that opposed the arguments advanced were:

- That it was difficult to engage with the question because the assumed operating profiles were not described in the analytical annex
- Other respondents said that there should be separate factors to represent gas CHP units which only export their electricity
- Others said that the assumed operating model should be forward-looking and should account for expected changes in government and Ofgem policy.
- A number of respondents went further than this and said that considering the societal costs of on-site power use and private wire arrangements that government should be removing this option as quickly as possible.
- Finally, some respondents said that a lot of CHPs operate with a power purchase agreement

Government response to Question 11

The government agrees with the idea that there should be an export-only emissions factor and we have outlined its values in our response to question 8.

The modelling assumptions of how gas CHP operates under a 'mixed exposure' operating regime were outlined in the 2014 LCP analysis and the consultation analysis copied these assumptions.

As discussed in response to question 8 we do not think it is reasonable to try and forecast the impacts of policy changes from Government and Ofgem which have not been announced yet. Whilst some respondents to the consultation think that the path of future legislation is clear the proposals published to-date by Ofgem would likely not be sufficiently strong so as to eliminate onsite use altogether, and therefore we have assumed that both onsite and export use both decline in proportion to the overall decline in gas CHP generation.

Government will continue to look at situations where gas CHP units operate with power-purchase agreements as we are interested in better understanding the effect that these agreements have on the overall CO2 emissions of gas CHP units.

Question 12 – Are respondents more likely to be building new or expanding existing gas CHP? If new gas CHP, what heating technologies would gas CHP be used in conjunction with? Would it be primary heating plant, or used alongside something else?

A total of eight respondents to the consultation did not respond to this question. Of those that did respond to the question the respondents gave nuanced answers. Many said that with the proposed factors for gas CHP would prevent existing networks from connecting to new buildings. A large majority of those that did respond to the question said that they were looking at developing new schemes where gas CHP would be operated more flexibly and that it would be operated in a way that follows electricity prices rather than generate to provide heat. For these new schemes the respondents said that they were mostly looking at combining the gas CHP with heat pumps or looking at combining it with waste-heat sources.

A small minority of respondents made other points, including one respondent who said that they were now reconsidering their strategy of developing new gas CHP plants and another who said that the consultation was reassuring as it showed that government was serious about preventing new gas assets being developed for new build homes.

We believe these points have been addressed in the government response to question 8 and have been very useful in further understanding the impacts of the proposed changes.

Next Steps

Alongside this publication, we are releasing updates to SAP 10.2 with the new emissions factors detailed in this document.

Government will also shortly be releasing the final copy of the Approved Document for Part L of the Building Regulations where we will be giving further information on the additional discretion for heat network projects mentioned on p.13.