Department for
Business, Energy
& Industrial Strategy

INDUSTRIAL HEAT RECOVERY SUPPORT PROGRAMME

Programme design and evidence collection

October 2017

INDUSTRIAL HEAT RECOVERY SUPPORT PROGRAMME

Programme design and evidence collection

The consultation [and Impact Assessment] can be found on the BEIS section of GOV.UK: https://www.gov.uk/government/consultations/industrial-heat-recovery-support-programme

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IHRS.enquiries@beis.gov.uk

Foreword

BEIS Foreword from the Minister of State

Improving energy efficiency will be key for achieving the Industrial Strategy's aims of reducing business energy costs, improving industrial productivity and competitiveness, and driving clean economic growth. The recovery of waste heat from industrial processes is an energy efficiency measure that can immediately deliver all of these things, by reducing fuel requirements and helping industry avoid energy waste. The associated reduction in carbon emissions will also help the UK meet its legally binding Carbon Budgets.

Industrial Heat Recovery is a technique by which heat generated for an industrial process, that otherwise would be wasted, is recovered and reused. This waste heat can be reused in a number of ways, including within the same industrial facility, by another end-user (e.g: through a heat network), or by converting the waste heat to power. A number of manufacturers have already invested in industrial heat recovery technologies, and many more have expressed an interest, but deployment continues to fall short of its economic potential of 7 TWh per year because of a range of commercial, technical and information barriers. This means that less than half of the potential is commercially viable at present.

The aim of the Industrial Heat Recovery Support Programme is to increase industry confidence in identifying and investing in opportunities for recovering heat from industrial processes, and increase the deployment of the technologies needed to do it in England and Wales. The programme is estimated to deliver industrial energy bill savings of up to around £0.5 bn, and carbon savings of up to 6 million tonnes over the course of its lifetime. It will therefore make a significant contribution to delivering clean economic growth and maximising the economic benefits from the UK's transition to a low carbon economy.

Contents

General information

Purpose of this consultation

Government plans to introduce a support programme to increase industry confidence in identifying and investing in opportunities for recovering and reusing waste heat from industrial processes and increase the deployment of recoverable heat technologies in industry. This will allow industry to re-use heat on-site or sell it to a third party, leading to the more efficient and productive use of energy, lower fuel bills or a new revenue stream for industry, and a reduction in carbon emissions.

The purpose of this consultation is to:

- Test the proposed design of the Industrial Heat Recovery Support Programme (IHRS);
- Gather additional evidence on the enablers and barriers to recovering industrial waste heat, to ensure the programme is appropriately designed and maximises value for money; and
- Start to identify a potential pipeline of projects from across industry sectors.

This consultation builds on previous stakeholder engagement through the Industrial Decarbonisation and Energy Efficiency Roadmaps project. The Roadmaps project has focused on eight energy intensive industry sectors[1], aiming to help them transition to a low carbon future whilst improving their competitiveness, but we propose to open the IHRS to a wider range of industrial sectors to maximise the opportunities in this area and ensure good value for money.

This consultation is relevant to anyone in the manufacturing industry with an interest in industrial heat recovery technology.

Issued: 12th October 2017

Respond by: 4th January 2018

[1] Cement, ceramics, chemicals, food & drink, glass, iron & steel, oil refining and paper & pulp.

Enquiries to:
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Department for Business, Energy & Industrial Strategy,
1 Victoria Street,
London, SW1H 0ET

Email IHRS.enquiries@beis.gov.uk

Consultation reference: Industrial Heat Recovery Support Programme

Territorial extent:
England and Wales only.

How to respond

When responding please state whether you are responding as an individual representing the views of an organisation. If you are responding on behalf of an organisation, please make it clear who the organisation represents by selecting the appropriate interest group on the consultation form and, where applicable, how the views of members were assembled.

You can reply to this consultation online at
https://www.gov.uk/government/consultations/industrial-heat-recovery-support-programme

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Confidentiality and data protection

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If you want the information that you provide to be treated as confidential please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

We will summarise all responses and place this summary on the GOV.UK website. This 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 consultation has been carried out in accordance with the Government's Consultation Principles.

If you have any complaints about the consultation process (as opposed to comments about the issues which are the subject of the consultation) please address them to:

Email: enquiries@beis.gov.uk

Executive Summary

Introduction and Policy Context

Industrial heat recovery is a process by which heat generated in or for an industrial process, that otherwise would be wasted, is recovered and reused. This waste heat can be reused in a number of ways, including within the same industrial facility for heat or cooling, by another end-user (e.g. via a heat network), or by converting the waste heat to power.

Industrial heat recovery has the potential to realise significant energy bill and carbon savings for industry, through a reduction in primary fuel use. It therefore contributes to the Government's aims of achieving a low cost, clean and secure energy system, and can also provide competitiveness and productivity gains, giving it strong links with the Industrial Strategy.

However, evidence suggests that the deployment of industrial heat recovery is falling well short of this potential at present. This is due to a number of barriers including insufficient knowledge and information, technical barriers associated with the complexity of fitting heat recovery technologies to certain industrial processes, and commercial barriers regarding the payback of investments and availability of capital. As a result, a recent study by Element Energy found that 11 TWh/yr of industrial heat use in 2014 could have been technically recovered from industrial processes in eight key energy intensive sectors, but that only 5 TWh/yr of this would have been commercially viable[2].

The Industrial Heat Recovery Support Programme

The Programme aims to overcome these barriers to help increase the deployment of industrial heat recovery technologies, and boost industry confidence in identifying and investing in heat recovery opportunities. Phase 1 plans to overcome knowledge, information and technology barriers by providing support for feasibility studies, to help identify industrial heat recovery opportunities and assess their costs and benefits. Phase 2 intends to then provide financial support, delivered through competitive grant funding, to projects that have additional financial barriers to overcome.

[2] https://www.gov.uk/government/publications/the-potential-for-recovering-and-using-surplus-heat-from-industry

This Consultation:

- Seeks views on the design of a proposed Industrial Heat Recovery Support Programme (IHRS), as outlined further in this document;
- Gather additional evidence on the barriers and enablers affecting industrial heat recovery, to ensure the Programme is appropriately designed and maximises value for money; and
- Start to identify a potential pipeline of projects from across the industry sectors.

Next Steps

BEIS will review stakeholder responses to this consultation and refine the design of the Programme in light of them.

Policy Background

What is Industrial Heat Recovery?

1. For the purpose of this Programme, industrial heat recovery (also referred to as recoverable heat) is a process by which heat generated in or for an industrial process, that otherwise would be wasted, is recovered and reused. This waste heat can be reused in a number of ways, including within the same industrial facility for heat or cooling, by another end-user (e.g. via a new or existing heat network), or by converting the waste heat to power.

2. Extending the amount of heat that can be recovered economically in industry will help ensure the UK has a more reliable, lower cost and cleaner energy system. The efficiency and productivity gains that stem from it will also help boost industrial competitiveness, strengthen the UK economy and reduce carbon emissions. There are a number of different technologies and techniques that can be used through the stages of the heat recovery process. These can be categorised as follows:

    - Recovery Technology – recovering the waste heat that would otherwise be rejected to the atmosphere
    - Conversion Technology – converting the heat to a more useable form of energy, such as a higher temperature heat or power
    - Storage or Distribution – allowing heat to be transported to another place or stored over time

Aim of the Consultation

3. Government intends to introduce a support programme to increase the deployment of industrial heat recovery by overcoming key barriers, and increase industry confidence in identifying and investing in opportunities for recovering heat from industrial processes. This will lead to a more efficient and productive use of industrial energy, lower fuel bills or a new revenue stream for industry, and a reduction in carbon emissions.

4. The aim of the consultation is to:

    - Seek views on the design of a proposed Industrial Heat Recovery Support Programme, as outlined further in this document;
    - Gather additional evidence on the barriers and enablers affecting industrial heat recovery, to ensure the Programme is appropriately designed and maximises value for money; and

- Start to identify a potential pipeline of projects from across industry sectors

Programme Definition of Industrial Heat Recover and its Uses

5. It will be essential to base the Industrial Heat Recovery Support Programme on a very clear definition of 'industrial heat recovery' and what uses will be supported in order to achieve the policy aims. We therefore propose that the Programme will support the recovery of heat which meets the following criteria:

    a. The heat should be generated in or for an **existing industrial process**, but is currently rejected to the environment once utilised.

    b. The heat should be carried in **specific flows**, including (but not limited to): hot flue gases, exhaust air, cooling fluids from cooling systems, hot product or waste product, hot water drained to a sewer, super heat or condenser heat rejected from refrigeration;

    c. The heat should be recovered from these specific flows via an appropriate heat recovery technology and used in one of the following ways:
        i. **Immediate use on-site,** to satisfy existing or potential commercially viable heating or cooling demand.

        ii. **Use off-site**, to satisfy existing or potential commercially viable heating or cooling demand, potentially through a new or existing heat network.

        iii. **Conversion to electrical or mechanical power,** for use on-site or another industrial site to satisfy existing or potential commercially viable power demand, or for export to the national grid or private wire system.

    d. The recovered heat should be capable of being metered or otherwise estimated, as this will help with monitoring and evaluating the Programme, and will increase industry awareness of heat recovery opportunities.

6. Rather than focus on one specific type of heat recovery, it is our intention that the Programme will be technology neutral, allowing for maximum flexibility and innovation within the design and supply chain.

7. It is not our intention to fund technologies that are still being trialled at pilot scale (below Technology Readiness Level of 6) as this is an implementation programme as opposed to a research programme[3].

8. The recovery of waste gases, which are subsequently combusted and the heat of combustion utilised is not within the scope of this programme, because its focus is on waste heat only.

9. For the avoidance of doubt, the objective is to maximise use of any waste heat regardless of how it is first generated. The fuel used to make the heat (which could be gas, oil, coke or biomass, for example) does not determine the value of finding a way of re-using heat. This programme, for example, does not therefore seek to distinguish between renewable and fossil fuel sources. The carbon saving comes in the fact that heat which would otherwise be wasted can be used to satisfy a genuine, commercially viable heat demand.

10. Research by Element Energy[4], published in 2014, identified a large amount (13 TWh/yr) of waste heat from solid streams (e.g. hot solids, primarily iron / steel from blast furnace steel production), and we understand that there may be existing technologies that could recover this heat. This route may be more challenging than hot water, air or steam routes, as the technologies are not yet thought to be practical on a cost-effective basis, but the recoverable heat potential is large. We are keen to gather more evidence on the potential in this area.

Policy Context: the importance of Industrial Heat Recovery and its potential

11. Delivering affordable energy and clean growth is a key pillar of the Industrial Strategy, which identifies energy productivity as an important way of driving down energy costs and improving economic productivity more generally. Industrial heat recovery can rapidly improve energy productivity, by reducing fuel requirements and helping industry waste less energy. The Programme has the potential to reduce total industrial energy bills by over £500m over its lifetime, bringing industrial competitiveness and productivity gains and helping to insulate industry from future energy price fluctuations[5]. It also helps cut heat-related carbon emissions and improve industry's competitive resilience over the longer term in an increasingly carbon constrained world. It is estimated that up to

[3] Technology Readiness Level (TRL); a relative feature of the maturity of evolving technologies. TRLs are measured on a scale of 1 to 9; where TRL 1 refers to basic research on a new invention or concept, and TRL 9 to a fully commercialised technology.
[4] https://www.gov.uk/government/publications/the-potential-for-recovering-and-using-surplus-heat-from-industry
[5] Internal BEIS analysis

6 $MtCO_2e$[6] could be saved over the lifetime of the Programme, equating to societal benefits of an average cost of -£74/tCO_2e abated[7]. This means that the societal benefits of each tonne of carbon dioxide equivalent the Programme saves, such as fuel cost savings and improved air quality, exceed the total cost of the Programme.

12. Improving overall industrial energy efficiency can contribute towards meeting our legally binding carbon reduction targets, and has the potential to save up to 3 $MtCO_2$ per year. The Industrial Heat Recovery Support Programme will contribute to industrial energy efficiency and can be a cost effective way to reduce the UK's greenhouse gas emissions and so can contribute to the UK's climate obligations.

13. Recovering waste heat from industrial processes has been identified as an effective and high value way of improving industrial energy efficiency, with significant potential to deliver savings this Parliament. The 2013 Heat Strategy[8], published by a previous Government, noted the potential for more recovery and re-use of waste heat for decarbonising industry. The Industrial Decarbonisation and Energy Efficiency Roadmaps project[9] identifies heat recovery as a key decarbonisation option for eight key energy intensive industrial sectors, and highlights the need for Government and industry to take more action in this area. It found that industrial heat recovery has the potential to save up to 1.75 $MtCO_2$ by 2050 for those sectors, accounting for 3% of cross-sector carbon reduction potential under the maximum technical potential for decarbonisation in the sector. The Committee on Climate Change also recognised the importance of heat recovery for decarbonising non-residential buildings in its advice in October 2016 on the fifth carbon budget[10].

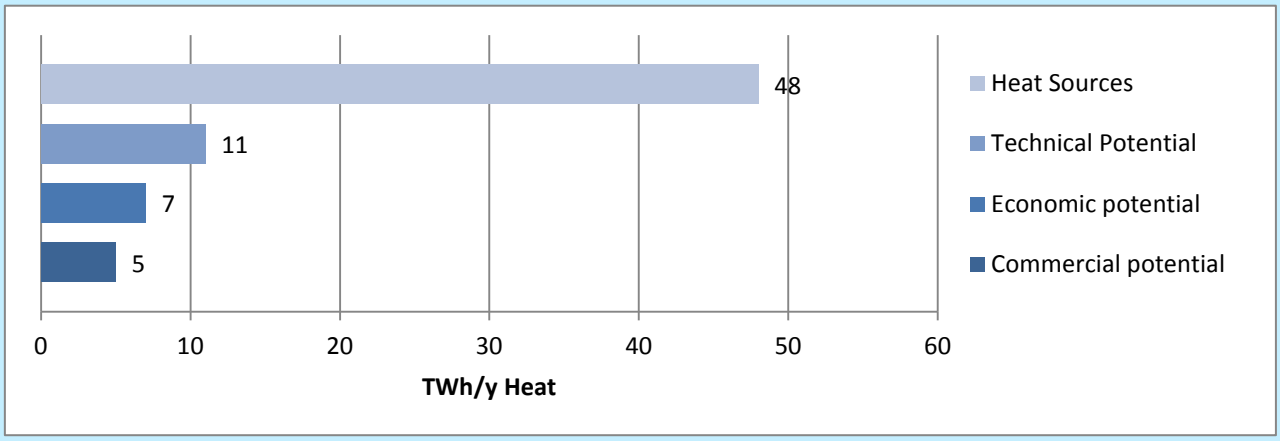
14. Evidence suggests that considerable potential exists to increase the volume of economically-viable industrial heat recovery, and that a relatively low level of support would be sufficient to make a significant impact on deployment levels. Element Energy[11] found that 11 TWh/yr of industrial heat use in 2014 could have been technically recovered from industrial processes in eight key energy intensive sectors[12], but that only 5 TWh/yr of this would have been commercially viable[13] (refer to Figure 1). Stakeholder input to the Industrial Roadmaps project confirmed the need for support to overcome barriers to accessing finance, such as investments failing to meet internal hurdle rates

[6] Around 30% of these savings are expected to be in the non-traded sector, although this figure will depend on the nature of bids submitted. This is consistent with the split of total industrial emissions between the traded and non-traded sectors.
[7] BEIS Internal Analysis, based on Element Energy Report 2014
[8] https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge
[9] https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050
[10] https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf
[11] https://www.gov.uk/government/publications/the-potential-for-recovering-and-using-surplus-heat-from-industry
[12] Chemicals, Cement, Ceramics, Glass, Food & Drink, Paper & Pulp, Oil Refining and Iron & Steel
[13] Have a payback period of less than 2 years.

and the high cost of external finance, and the need to address knowledge and information barriers too. This is discussed further in the next section.

Heat sources: TWh/yr of total heat consumption rejected in a waste stream which may reasonably be available for recovery (but not already used)

Technical potential: TWh/yr of heat sources within 40km (including onsite) of a sink of suitable capacity, medium, and temperature, taking into account availability / capability of technology.



Economic potential: TWh/yr of the technical potential that has a positive business case

Commercial potential: TWh/yr with payback <2 years (not including cost of process risks such as shut downs)

Figure 1: Element Energy Findings on Industrial Heat Recovery Potential

15. Recovering industrial waste heat also has the potential to deliver additional benefits. For example, a reduction in total fuel use through the recovery of waste heat may deliver reductions in the emission of air pollutants such as nitrogen oxides and particulate matter in addition to the reduction in CO_2 already identified. The Government is firmly committed to improving the UK's air quality and cutting harmful emissions, where possible, actions which deliver improvements in air quality and a cleaner energy system should be encouraged[14].

[14] https://www.gov.uk/government/news/new-air-quality-plan-published-for-consultation

Consultation Questions

Consultation Question – Definition of Industrial Recoverable Heat

1	Do you agree with the definition of ‘industrial heat recovery’ [set out in paragraph 5] and the proposed uses that will be supported through this programme? Are they sufficient for meeting our policy aim of increasing industry confidence in identifying and investing in recoverable heat opportunities? If you think they should be changed, please provide specific comments / evidence.
2	Are there any reasons to exclude waste heat from solid streams, or from any other specific streams, from the Programme? Please provide evidence to support your response.
3	Do you have any comments or concerns regarding the technology and fuel neutral approach outlined here?
4	Do you have any further evidence on the potential for heat recovery from different industry sectors? This could include evidence gathered from academic or research institutions or through the experience of industrial companies.
5	Do you have any comments or concerns on potential secondary impacts of industrial heat recovery, for example, changes to emissions of air pollutants or other environmental impacts which you think should be considered?

Evidence of Barriers and Enablers for Heat Recovery Projects

16. This section highlights the evidence we have on the barriers and enablers for industrial heat recovery investment. It asks for feedback on these, as well as evidence from potential and pre-existing heat recovery projects.

17. A 2016 report by Madano and Element Energy[15] looked to increase our understanding of the barriers to industrial heat recovery and what can enable the take up of heat recovery technologies. These are summarised in Table 1.

Table 1: Barriers and Enablers to Industrial Heat Recovery

Barriers		
Practical & technical Associated with identifying sources and uses for waste heat	**Commercial** Typically described as the most important barrier.	**Corporate** Factors related to organisation and corporate culture.
Identifying source & output Identifying an appropriate source and use of waste heat can be problematic, especially for low grade waste heat (under 250 °C).	**Availability of CAPEX** Industry tends to lack the funds for investment in general and energy efficiency initiatives in particular.	**Limited resources / skills** Many organisations lack the skills or resources to carry out detailed investigations into heat recovery opportunities.
Integrating with existing kit/site Technical issues or limitations within an industrial process can make heat recovery more challenging. There also may be practical issues around, for example, plant shutdown.	**Short payback needed** Heat recovery opportunities do not always pay back within 3 years, which tends to be the threshold for investment.	**Competing priorities** Other priorities can take precedent over energy efficiency if companies view them as 'core business', e.g. sales & marketing.

[15] https://www.gov.uk/government/publications/barriers-and-enablers-to-recovering-surplus-heat-in-industry-a-qualitative-study

Performance & payback uncertainty The bespoke and complex nature of some processes means not all technologies can be replicated, companies may be distrustful of them, and their payback periods may be uncertain.	**Competition for investment** Heat recovery can be in competition with other energy efficiency or process improvement projects that have shorter payback periods and/or incur less disruption or down time to processes.	**Unaware of opportunities** Limited knowledge about energy efficiency in general and heat recovery technologies in particular. Particularly noted in smaller companies without a dedicated energy manager.
Enablers		
Factors that could stimulate or facilitate investment in heat recovery equipment		
Organisational survival For highly energy intensive sectors, reducing energy costs through efficiency can be a key way to reduce operational costs.	**Reducing risk** Could be actual or perceived risk, related to payback periods or confidence in performance of the technology.	**Appropriate Business Case** Strong evidence on performance, benefits and return on investment can build up a convincing case for investment in heat recovery.
Wider site development plans General refurbishments or installation of new equipment can be an ideal time to install heat recovery equipment.	**Financial incentives** Provision of financial incentives, through grants or tax breaks, can improve commercial viability of investment.	**Compliance** Heat recovery can contribute to energy efficiency / emissions requirements on companies.

Consultation Questions

Consultation Question – Evidence of Barriers and Enablers

6	Do the barriers and enablers identified above relate to a situation you are familiar with? Are there other barriers that we have not identified?
7	Which of the barriers and enablers identified are the main ones you experience? Are financial (commercial) or non-financial (corporate / practical & technical) barriers greater?
8	Do you have any examples of feasibility studies you have already conducted that you are able to share? Please provide details on costs, technologies and possible uses of waste heat where possible, and if the study led to a full scale project.

9	Have you already investigated funding for a heat recovery project, or approached an Energy Services / Savings Company? Why did you decide to go ahead with / not go ahead with the project? What reasons were given for your success / lack of success in securing funding?
10	Can you provide examples of current heat recovery projects? We would particularly welcome details on technology, performance and cost data (capital expenditure and operating costs where possible). Case studies are welcomed from trade associations, industrial companies, technology providers, academics or other groups.
11	Can you provide examples of potential projects that could be brought forward through the provision of financial support? Please include reference to technology, expected use of recovered heat, which fuel(s) would be displaced and size of project. Please also provide details of the level of financial support you think will be required.

Programme Outline

18. This section sets out how the overall Programme is proposed to work, and invites views on the Programme design and the likelihood of investment. It covers support for feasibility studies, whereby companies can undertake an analysis and evaluation of a proposed project to understand if it is technically feasible and cost effective. It also covers capital support for projects, relating to investment in heat recovery equipment to be installed on a particular site.

19. Phase 1 of the Programme intends to support onsite feasibility studies, while Phase 2 intends to provide capital funding to support the implementation of heat recovery projects. The intention is that this will increase the deployment of recoverable heat technologies by overcoming key barriers, and increase industry confidence in identifying and investing in opportunities for recovering heat from industrial processes. This will lead to more efficient and productive use of industrial energy, lower fuel bills for industry and a reduction in carbon emissions.

20. Phase 1 of the project seeks to address some of the ‘practical & technical’ and ‘corporate’ barriers that currently inhibit mass deployment of industrial heat recovery, by providing funding to support feasibility studies. Specifically, it is intended that the feasibility studies will help identify opportunities for different types of heat recovery technologies on a particular site, as well as costed options for how the recovered heat could be used. It will also improve understanding of the costs and performance of the technologies in question and provide the necessary evidence for a company to develop a convincing business case for their board.

21. Phase 2 of the project will introduce direct financial support to encourage the deployment of recoverable heat in industrial sectors, delivered through competitive grant funding. It will target projects that are economically viable but require additional capital support to make them commercially viable. It is intended to fund projects that would not have otherwise gone ahead because their financials (such as Internal Rate of Return), whilst positive, are not attractive enough to secure funding. We will continue to learn lessons from the Heat Networks Investment Project and other Government funding programmes to ensure we achieve additionality and support strong projects with social and economic value that best align with the objectives of the Programme. This will reduce the risk of possible overcompensation or support for projects that would have gone ahead anyway, even without further funding. Thus we envisage that some

Phase 1 projects may proceed without capital support if there is insufficient proof of additionality.

22. For both phases, the aim is to award grants on a competitive basis, according to set assessment criteria (discussed in detail further down). These grants would be made on a match-funding basis, in line with State Aid General Block Exemption guidelines[16]. However, we would be interested to know whether other forms of financial support would be more appropriate in certain situations e.g: loans.

Scope

23. The scope of the project covers industrial manufacturing processes in England and Wales. Heating and cooling is a devolved issue in Scotland and Northern Ireland, with separate programmes and funding in operation, so this Programme does not cover these devolved administrations.

24. As outlined in the evidence section above, there is significant potential to increase industrial heat recovery in the eight energy intensive sectors covered by the Industrial 2050 Roadmaps project, and we expect the Programme to be applicable to these sectors:

    - Cement
    - Ceramics
    - Chemicals
    - Food & Drink
    - Glass
    - Iron & Steel
    - Oil Refining
    - Pulp & Paper

    Other significant heat consuming sectors include lime, gypsum, foundries, metal forming, non-ferrous metal processing, printing and wood panelling. Further sectors, such as plastics processing, are considerable consumers of cooling, from which heat is rejected and could be recovered.

[16] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014R0651&from=EN

25. To help maximise the opportunity and value for money we intend the Programme to be open to companies in all industrial manufacturing sectors as set out in the Office of National Statistics Standard Industrial Classification (SIC) codes 10 – 33. We are aware that there may be industrial heat recovery opportunities outside of these areas, such as in the water and power sectors, which have the ability to meet our policy aims. However we have limited information on the potential, costs and applicability of different types of heat recovery in these areas. We would welcome evidence to support the inclusion of other sectors.

Other Related Topics

26. On 23 June 2016, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. Until exit negotiations are concluded, the UK remains a full member of the European Union and all the rights and obligations of EU membership remain in force. During this period the Government will continue to negotiate, implement and apply EU legislation. The outcome of these negotiations will determine what arrangements apply in relation to EU legislation in future once the UK has left the EU.There are a number of policies that overlap with the Industrial Heat Recovery Support Programme, including EU policies and regulations, and domestic policies relating to energy efficiency and Heat Networks. We will also consider the design of the Industrial Heat Recovery Support Programme in the context of Brexit. It will be important to clarify how the Industrial Heat Recovery Support Programme interacts with these to prevent over compensation or the distortion of its policy aims.

27. We propose that heat recovery technologies supported by the following policies should not be excluded from the Industrial Heat Recovery Support Programme, but that the value of the support they receive should be declared by applicants and included under the cap of Government support permitted by EU State Aid law (see chapters on Phase 1 and Phase 2 design for details of this). We also propose that their value should be taken into account when assessing the value for money and additionality of bids:

    a. The EU Emissions Trading System (EU ETS) - This requires many industrial installations to buy allowances to cover their carbon emissions. Industrial heat recovery technologies could reduce companies' need to purchase such allowances, and help them qualify for other benefits (e.g: by helping them meet the required benchmarks for energy efficiency).

    b. Climate Change Agreements (CCAs) – These provide certain industrial sectors reduced rates of Climate Change Levy if they meet specific energy and/or emissions reduction targets, which industrial heat recovery technologies could help them to do.

    c. Policy support to incentivise the deployment of Combined Heat and Power (CHP) – These include Enhanced Capital Allowances, tax exemptions from the Climate Change Levy and Carbon Price Support, and subsidies for biomass-fuelled CHP such as the Renewable Heat Incentive and Contracts for Difference. Although combined heat and power is a separate technique from industrial heat recovery, involving the co-generation of heat with power rather than its capture subsequently, it is possible that the same technologies could be used for both.

d. Enhanced Capital Allowances (ECAs) – These are available for a wide range of energy efficiency technologies, potentially including those used for industrial heat recovery.

28. Government is keen to accelerate the deployment of heat networks in the UK, as a cost effective way of cutting carbon emissions and providing reliable and affordable heat to customers. As a result, a Heat Networks Delivery Unit has been established to support local authorities to explore heat network opportunities across England and Wales. A Heat Networks Investment Project (HNIP) has also been launched to provide £320m of capital support to increase the volume of heat networks being built. It is our intention that the Industrial Heat Recovery Support Programme will fund the enabling works required to recover heat, along with costs associated with any infrastructure required for the use and/or distribution of heat on-site. The HNIP funding can be used in conjunction with this funding for the construction / expansion of new or existing heat networks, in order to facilitate a connection to the industrial heat source. However HNIP funding cannot count towards the industry match funding that is a requirement for the Programme due to EU State Aid Law.

29. Under the Energy Efficiency Directive (Article 14(5)) industrial operators with combustion plant with a total thermal input exceeding 20 MW, which undergo 'substantial refurbishment', are required to explore the opportunities for recovering waste heat and supplying it to district heating schemes. It is our intention that such projects should be included within the scope of the Industrial Heat Recovery Support Programme as it would enable companies to use funding to identify opportunities outside of the major refurbishment cycle, which may only happen once every 4-5 years.

Application Process

30. Application forms for Phases 1 and 2 will be developed. Accompanying guidance documents will be produced to outline how both applicants and assessors should undertake each process. We anticipate testing these documents with industry prior to publication.

31. We expect applications will be submitted via email or through an online portal, which would also host relevant guidance documents and information on how to get advice on the application process. Where appropriate, questions and resulting answers will be posted on the website alongside the guidance.

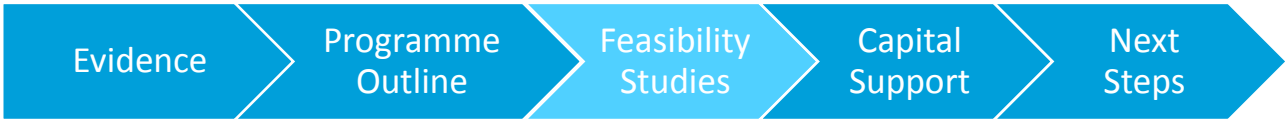
Consultation Questions

Consultation Question – Overall Programme Design

12	Do you think the approach set out above (providing grants to conduct feasibility studies

	and support capital investment) is sufficient to increase industry confidence in identifying and investing in opportunities for recovering heat from industrial processes? Do you think the current barriers would be better addressed by the feasibility studies (Phase 1) or capital investment (Phase 2)? Please provide details of any other concerns the Programme does not address.
13	Are there any situations where you think another form of support besides grants would be more appropriate? Please provide details and evidence to support your response.
14	Will the proposed scope of the Programme (companies in the manufacturing sectors) exclude any projects that could help meet our policy aim of increasing industry confidence in identifying and investing in recoverable heat opportunities? Please provide evidence to support your response.
15	What types of information might cause confidentiality concerns if asked for as part of the application process?

Phase 1 Design – Support for Feasibility Studies



32. This section sets out how we intend to run Phase 1 of the Programme, including the application process as well as the allocation and administration of funding. Consideration will be needed as to how funding is distributed and the criteria against which competing bids will be assessed. As part of this consultation we are keen to get a better understanding of how many companies would be interested in applying for feasibility study funding through the Programme.

33. A balance needs to be maintained between providing enough support to encourage greater investigation into recoverable heat opportunities, and not paying for feasibility studies which companies would have undertaken anyway. To ensure value for money, it is important that the Government's commitment is matched by that of industry.

34. There will be a limited pot of funding to be awarded to companies on a competitive basis. It is proposed that we offer a maximum of 50% match funding for delivery of onsite feasibility studies, rising to 60% for medium sized enterprises and 70% for small enterprises[17] and by 15 percentage points for investments located in assisted areas. This level of match funding is compliant with the EU State Aid General Block Exemption Regulation Article 25, which allows funding for feasibility studies[18].

35. There are various options for how funds should be allocated, such as being ring-fenced into specific pots for different sectors or different sized projects, but this approach may limit the benefits of open competition. It is therefore intended that funds will be allocated on the basis of a set of assessment criteria that can apply to all sectors with projects of varying size. This is explored further below.

[17] Definition of small and medium sized enterprises is set out at http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en

[18] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014R0651&from=EN

Application Windows

36. It is proposed that Phase 1 would have a series of between 1 and 4, 3-month application windows within the project period, and companies would be required to submit their application to allow sufficient time for the assessment to take place before the end of a particular window. We are keen to understand whether the time frames outlined for each window are suitable.

37. It is intended that this would provide time for companies to align their application with internal investment budgets, as well as enabling a comparison of quality / potential to be made across a portfolio of projects. It is intended that funding will be available across each of these windows. Applications will be assessed on a collective basis at the end of each 3-month window, according to the assessment criteria set out further below.

Eligibility Screening

38. As there may be a large number of applications for funding, it is intended that an initial eligibility screening process would take place before a full application is considered. Those that pass this process will go on to a full assessment, with feedback provided at each stage to allow resubmission of an application in the current or future windows.

39. It is intended that the initial set of eligibility criteria are:

- The application must be made by a **legal entity established in the UK**. This does not exclude partnership with legal entities not established in the UK. The project is compliant with the relevant **State Aid requirements**. Sources of match funding are clearly identified and are from non-public funding sources.
- The investment project must be located on a manufacturing site in England or Wales. Firms headquartered elsewhere will be eligible to apply for the Programme, provided it is to support an industrial heat recovery investment made on a manufacturing site in England or Wales.
- The Feasibility Study will be **delivered within 6 months of notification of intent to award a grant**. This will ensure only projects that are expected to be undertaken within a reasonable time will be supported.
- The application is consistent with the Programme's definition of 'industrial heat recovery' and the uses it supports, as laid out in the Policy Background Section of this document.

Assessment Criteria

40. For the full assessments, a set of criteria will be established against which individual applications will be assessed. Each criterion will be scored, with the resulting total used

to choose which applications should be funded where more applications are received than budget is available.

41. A recommended set of assessment criteria for Phase 1 is set out in Table 2 below, upon which funding decisions would be made. A weighting factor could be applied to key criteria, which are to be confirmed.

Table 2: Feasibility Study Assessment Criteria, where weightings are to be confirmed.

Category 1: Potential for results	Category 2: Deliverability	Category 3: Economic Case
A. Size of heat source and how this compares to the total volume of heat generated on site To identify how much waste heat it might be possible to recover and how significant this is.	**D. Experience of delivery team** Experience of project manager and team in delivery of related projects.	**H. Cost of the Feasibility Study** Expected costs of completing study.
B. Total on-site heat demand and proportion of this met by on-site heat generation To identify how much of the waste heat it might be possible to use on site, as the most efficient potential use of the recovered heat.	**E. Quality Assurance** Measures in place to ensure a good quality study is produced.	**I. Value for Money (VfM)** Assessment based on costs / benefits of the Programme. Including the reduction in energy bill savings due to increased efficiency.
C. Ability to increase industry confidence in investing in heat recovery A range of projects should be supported to capture as wide a range of industrial investors as possible. Learnings should be widely applicable to other projects.	**F. Project Plan** Clearly defined plan for project delivery in a timely manner.	
	G. Wider Environmental Impacts The heat recovery technology must not result in an increase in the emissions of key air pollutants e.g NO_x, SO_x, PM_{10} and $PM_{2.5}$. Measures will be put in place to ensure changes in air quality emissions can be assessed, whether through modelling or testing.	

42. In addition the following criteria each application will be required to prove its additionality, by providing evidence that it would not have gone ahead without the support of the Industrial Heat Recovery Support Programme. This will be a pass/fail test, with applications only progressing to full assessment if they are successful.

43. The proposed customer journey is set out below.

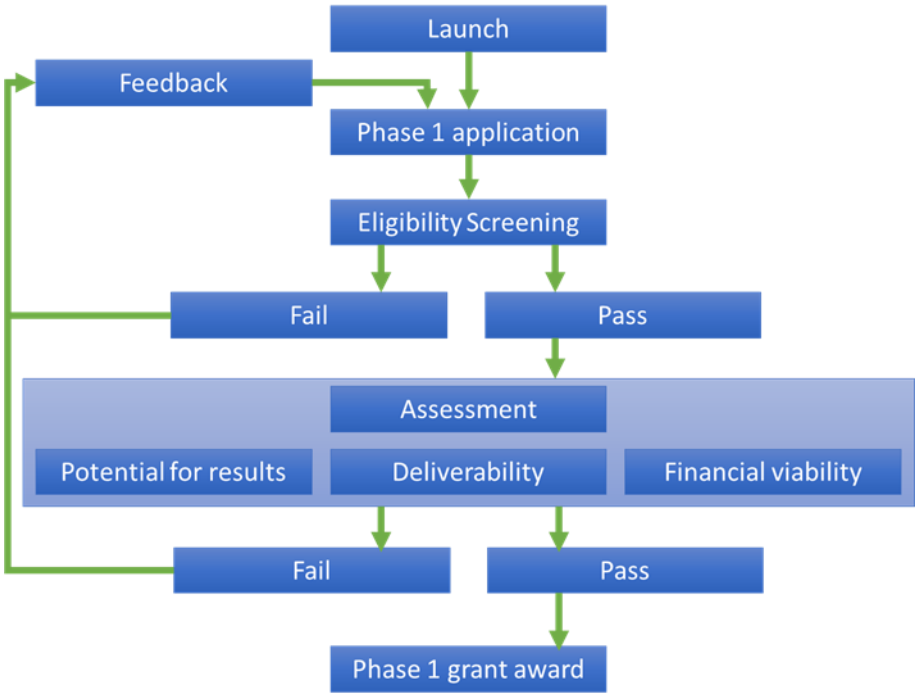


Figure 2: Application and Assessment Process – Phase 1

Grant Process

44. We propose that grant awards would be payable, on a milestone payment basis, once the feasibility study has been approved following the assessment process outlined above. We anticipate this will help ensure the work is completed in a timely manner and to a high level of quality. Applicants may wish to take this into consideration when entering into agreements with contractors responsible for delivering the feasibility study.

45. The assessment process will be carried out by a technical specialist with experience in heat recovery technologies, and the intention is that this process will ensure that the recommendations set out in the feasibility study are reasonable and appropriate for the site in question. It is proposed that the quality assessment be made on the basis of the criteria set out below, with a consideration of what constitutes pass / fail for each one.

- Reasonableness of costs: related to what can be estimated using indicative Capex and Opex guidelines

- Reasonableness of assessment of grade and quantity of waste heat available: related to what can be calculated from primary information supplied in application.
- Reasonableness of assumed efficiency of recovery and, therefore, quantity of waste heat recovered: related to what can be calculated from primary information supplied in application.
- Accuracy of rates of return calculated using standard financial feasibility assessment workbook: If no disagreement with assessor's calculation.

Delivery of Feasibility Studies

46. Specialist advice from experienced providers will be needed in order to complete a comprehensive site specific feasibility study, which identifies the different opportunities for how heat can be recovered and reused.

47. It is anticipated that there will be interest in the Programme from a wide range of companies, from large multi-nationals with dedicated energy managers to SMEs with, in some cases, scant resources. Some companies may have existing relationships or contracts with engineering consultancies, whereas others would benefit from advice in terms of who to turn to for specialist advice.

48. Consideration has been given to different ways in which companies could be engaged to undertake the feasibility studies, from the engagement of a single firm to deliver all studies, to allowing applicants to find and engage a firm of their choosing. It will be the responsibility of the applicant to contract an appropriate company to perform the feasibility study, and ensure quality of service. We aim to support this with a published list of suppliers, which we consider to be an appropriate and balanced approach. This list would be non-exhaustive, and serve as a signposting of services rather than an agreed limited list of suppliers – due diligence work will not have been undertaken on the suppliers so they should not be viewed as recommended.

49. If, as proposed, a variety of different contractors are undertaking the feasibility studies, it will be important to set out clear guidelines for what we expect these studies to cover. There will need to be a certain amount of consistency to maintain standards and enable a comparative assessment, including a consistent format for data collection. Rather than impose a rigid format, we propose to use an outline structure for all feasibility studies that has room to allow for individual variances whilst providing the appropriate type and level of information. This is set out in detail in Annex 2: Proposed structure of Feasibility Studies.

Consultation Questions

Consultation Question – Phase 1 Design

16	Would you be interested in applying for feasibility study funding? If not, is there a particular reason why (already have onsite heat recovery, no money for investment, do not see benefits in heat recovery etc.)?
17	Is the maximum level of Government match-funding for feasibility studies (50%, rising to 60% / 70% for SMEs, and by 15 percentage points for investments located in assisted areas) suitable to generate interest from your company? What would be the minimum level of match funding needed?
18	Do you have any comments on the duration of the application windows or delivery windows? Could any of the windows be shortened? Do you have an alternative suggestion? Please provide evidence to support your suggestion.
19	Are there sufficient industry technology specialists to deliver the feasibility studies within the timeframe of 6 months set above? We would particularly like to hear from those with a good overview of the market, including trade associations and service providers.
20	Do you have any comments on the proposed eligibility screening process or criteria?
21	Do you agree with our proposed approach to use an outline structure for feasibility studies? Do you have any comments on the content of the outline structure?
22	Do you foresee any problems in contracting a suitable company to undertake a feasibility study for your site? Would a signposting service to recommended service providers be helpful?
23	How would you recommend the Government goes about compiling a list of suitable services for providing feasibility studies?
24	Do you agree with the outline structure for feasibility studies provided in Annex 2? What areas do you think it's important for all feasibility studies to cover? Do you think the feasibility study stage should also highlight other energy efficiency opportunities beyond heat recovery?

Phase 2 Design– Support for Capital Funding

50. This section sets out how we intend to allocate and administer funding for Phase 2 of the Programme and invites views on design as well as submission of evidence on cost and performance of existing heat recovery projects.

General Approach

51. There will be a limited pot of funding (up to £12m in total), to be awarded to companies on a competitive basis. Government match funding of a maximum 30% will be offered for the implementation of recoverable heat technologies, rising to 40% for medium sized enterprises and 50% for small enterprises[19], and by 15 percentage points for investments located in assisted areas. This level of match funding is compliant with the State Aid General Block Exemption Regulation Article 38[20].

52. It is intended that the capital funding element of the Programme will be staggered to start around a year after Phase 1 opens. It is expected that some feasibility studies will result in projects that offer commercially viable rates of return, which companies may choose to implement without the need for additional capital support. Others might be economically viable but require additional capital support to make them commercially viable.

53. A decision on whether to award funding will be made on a competitive basis, according to a set of established criteria. Proposals must set out a clear need for financial support, showing that the project would not have gone ahead without the benefit of grant funding through the Programme. This is to ensure value for money for the tax payer, in that government is only paying for projects that would not otherwise go ahead.

54. It is our intention that full application details for Phase 2 will be made available when Phase 1 is launched. We expect to gather information on the possible project pipeline through early applications to Phase 1, which may impact on possible targeting of some later rounds of capital funding.

[19] Definition of small and medium sized enterprises is set out at http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en

[20] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014R0651&from=EN

Application Windows

55. Similar to Phase 1, it is intended that Phase 2 of the Programme will be run with distinct rounds of funding. The funding pot will be provisionally split across 1 to 3, 3-month distinct application windows to encourage healthy competition between applicants. We also want to ensure that Phase 1 participants from the later windows are still able to apply for capital funding.

56. We are keen to support a range of projects in each application round and are therefore minded to maintain the flexibility to put a limit on the value of projects supported. The assessment criteria outlined below recognise the need for the Programme to support as wide a range of industrial investors as possible. Therefore if one or two applications look like they will take up all or most of the funding allocated for a particular application window, we will consider whether the money might be better spent on a greater number of smaller projects, depending on how well these meet the other assessment criteria.

57. Applications will be assessed on a collective basis at the end of each 3-month application window, according to the assessment criteria set out further below.

Pre-competition Qualification

58. Many Phase 2 applicants will have participated in Phase 1, but this will not be a requirement of entry to Phase 2. We do not want to rule out projects that have already undertaken feasibility studies independently of the Industrial Heat Recovery Support Programme.

59. By means of entry to Phase 2, it is proposed that a simple pre-qualification questionnaire (PQQ) will be used as a first step for all applications. This will allow applicants who passed through Phase 1 to easily test whether the outcome from their feasibility study would be compliant with Phase 2, and will allow applicants who have already (independently) completed feasibility studies to determine whether they have the necessary information in place to apply.

60. Suggested criteria for the pre-competition qualification are set out below (Table 3), and we would appreciate views on whether this would be an appropriate method of ensuring suitable proposals progress to the full application stage.

Table 3: Criteria for Pre-competition Qualification

Category 1: Investment	Category 2: Benefits	Category 3: Scale/Additionality
A. Minimum threshold for RoI Return on investment needed to gain capital investment approval. **B. Availability of match funding** Evidence of investment from non-public funding sources.	**C. CO_2 savings** Proof of carbon savings. **D. Cost per tonne CO_2 saved** Carbon savings related to cost of project. **E. Energy bill savings** Expected bill savings following a reduction in primary energy demand.	**F. Minimum threshold for MWth recovered** Scale of heat recovery. **G. Additionality** Evidence that project would not have gone ahead without support.

The proposed customer journey is set out in Figure 3 below.

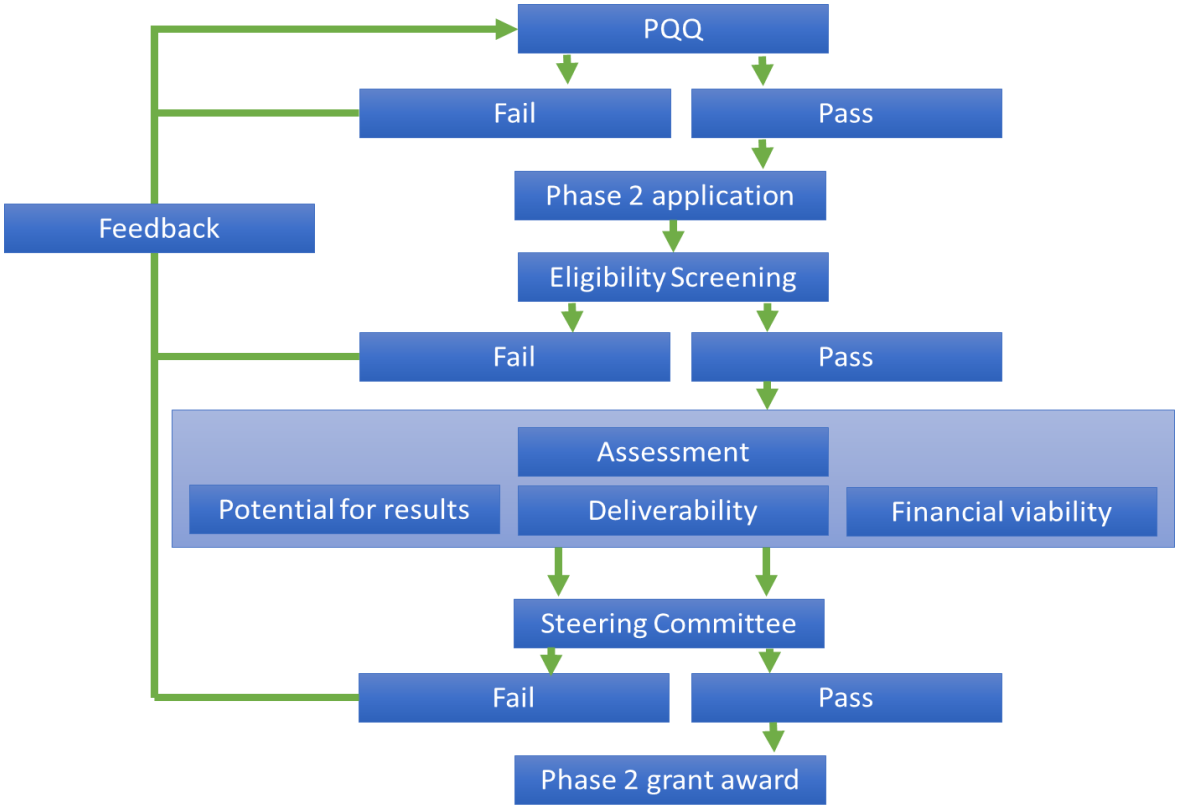


Figure 3: Application and Assessment Process – Phase 2

Assessment Criteria

61. A set of assessment criteria will be established, against which individual applications will be assessed. Each criterion will be scored, with the resulting total used to choose which applications should be funded where more applications are received than budget is available. This set of criteria builds on the details set out in the PQQ, outlined above.

62. A recommended set of assessment criteria for Phase 2 is set out in Table 4 below, upon which funding decisions would be made. A weighting factor could be applied to key criteria such as potential MWh of heat for recovery and value for money

63. In addition in the following criteria each application will be required to prove its additionality, by providing evidence that it would not have gone ahead without the support of the Industrial Heat Recovery Support Programme. This will be a pass/fail test, with applications only progressing to full assessment if they are successful.

64. A proposed Additionality Assessment table is set out in Annex 4: Additionality Assessment, for completion by applicants. We would perform independent verification on applications, such as requiring applicants to participate in a project audit.

Table 4: Capital Grant Funding Assessment Criteria

Category 1: Potential for results	Category 2: Deliverability	Category 3: Economic Case
A. Potential amount of heat (MWh) that could be recovered How much waste heat is set to be recovered. **B. Potential carbon dioxide reduction (tCO_2e)** Reduction in carbon emissions due to increased efficiency. **C. Potential energy bill savings** Reduction in energy bill savings due to increased efficiency. **D. Ability to increase industry confidence in investing in heat recovery** A range of projects should be supported to capture as wide a range of industrial investors as possible. Learnings should be	**E. Detailed work plan** Clearly defined plan for project delivery in a timely manner. **F. Company financial standing** Application is from a company that is a going concern. **G. Experience of delivery team** Experience of project manager and team in related projects. **H. Risk management** Identification of risks with mitigation measures in place.	**K. Appropriateness of cost breakdown** Reasonable and detailed costs for project completion. **L. Value for Money (VfM)** Assessment based on costs / benefits of the Programme.

widely applicable to other projects.	**I. Quality Assurance** Measures in place to ensure a good quality project is delivered, and robust reporting processes to evaluate the performance. **J. Wider Environmental Impacts** The heat recovery technology must not result in an increase in the emissions of key air pollutants e.g NO_x, SO_x, PM_{10} and $PM_{2.5}$. Measures will be put in place to ensure changes in air quality emissions can be assessed, whether through modelling or testing.	

Grant Process

65. For Phase 2 of the Programme, where projects are likely to involve considerable amounts of investment, it is essential that companies are fully committed to implementation. Based on the evidence collected to date, we also consider that many projects can be made commercially viable with only a small amount of capital support from government.

66. It is therefore intended that up to a maximum of 50% grant funding (depending on company size and grant requirement) will be provided for capital investments in heat recovery equipment. A limited pot of funding will be available (up to £12m) to be split equally between the delivery windows, with applications being assessed on a competitive basis. We are keen to support a range of projects through the Programme, and may limit individual grants at £1m per project.

67. We propose that payment of grant awards be made on the basis of three milestones: on confirmation of grant award; commencement of the installation; and completion of the project (heat recovery equipment is operational). This ‘payment by results’ approach ensures that funds are being issued not only when spend has been completed, but also when technical progress has been achieved.

68. We anticipate that eligible project costs, as a general outline, could include:

    - Capital costs for heat recovery equipment

- Pipework, monitoring & control equipment (within the site boundary)
- Any building works necessary to complete the installation of the heat recovery equipment
- Installation and commissioning costs
- Internal staff costs, without profit mark-up, for development or delivery of the project (e.g. – as part of company's contribution to match funding)

69. Commercialisation-phase[21] costs may also be included in the above, where these are incorporated as capital costs.

70. We would not anticipate covering costs related to disruption of processes or plant downtime, as we would anticipate installation to be timed around periods of least disruption or mitigations put in place to compensate for this.

71. For projects that involve feeding waste heat into an existing heat network, we propose that only the cost of pipework, pumps and controls to the boundary of the applicant's site is eligible.

72. work outside of the site, as well as any back-up boilers or other ancillary items involved in relation to the heat network, would be out of scope and funding should be sought, if needed, through the Heat Networks Investment Project. Proposals that involve provision of waste heat into a new heat network are also out of scope, and funding should be sought through the Heat Networks Investment Project.

73. For projects that involve heat customers not connected to a heat network (e.g. providing the heat over the fence to a neighbouring site) it is our intention that the cost of pipework, pumps and controls to the point of connection would be eligible.

Delivery of Capital Projects

74. We anticipate between 1 to 3 delivery windows of 1 to 2 years based on the availability of capital.

75. Delivery of capital projects will be accompanied by an appropriate ongoing monitoring and evaluation process; an important element of any effective Programme. For delivery of Phase 2 of the project, it will be important to ensure that construction and

[21] The commercialisation phase is the development stage in which the project sponsor contractually secures investment and future revenues, procures and appoints a delivery partner (where required), obtains relevant permissions and permits, and makes any technical changes required as an outcome of the interplay between the financial and contractual negotiations set out above.

commissioning are proceeding to time and budget and that post commissioning performance is as anticipated, robust data will be available over an extended period, and the impact of the project can be properly evaluated.

76. It is therefore likely that there will be some level of ongoing reporting / monitoring requirement to track grant progress, confirm any amendments to project plans, and review milestone dates. We would also want to gather data on costs / performance of particular technologies in different situations. This could be through monthly updates, quarterly reports (using standard templates), site visits or other similar methods.

Consultation Questions

Consultation Question – Phase 2 Design

25	Would you be interested in applying for capital funding, and what level of capital expenditure would be required for your project (if known)? If not, is there a particular reason why (already have onsite heat recovery, no money for investment, do not see benefits in heat recovery etc.)?
26	Is the level of support for capital funding (maximum 30%, rising to 40% / 50% for SMEs, and by 15 percentage points for investments located in assisted areas) suitable to generate investment from your company? What would be the minimum level of match funding needed?
27	Do you have any comments on the duration of the application windows?
28	Do you have any comments on the optimal duration of the delivery window, particularly regarding any difficulties your company may have in completing projects within a 1 to 2 year delivery timeframe or coordinating with your internal investment cycles?
29	Would you find it helpful to have a pre-competition qualification stage for Phase 2? Do you have any comments on proposed pre-competition qualification questionnaire?
30	Do you have any comments on the proposed assessment criteria for Phase 2?
31	Do you have any comments on the proposed additionality assessment table?
32	Do you agree with our proposed outline of eligible costs? Please provide evidence to justify any alternative or additional suggestions.
33	Do you have any confidentiality concerns over the ongoing provision of data to support the Programme's monitoring and evaluation process?

Next Steps

Confirmation of Policy

77. Responses from this consultation will be considered and the Programme design further developed as appropriate. A Government Response to this consultation will be published in due course, setting out our consideration of stakeholder feedback and confirming the Programme rules and timings.

78. It is our intention to set out the full Programme requirements when Phase 1 is launched. This will enable potential applicants to appreciate not only what will be required to access feasibility study funding, but also the expected requirements to access capital grant funding as well, for when Phase 2 comes on line a year later.

79. This would involve development of detailed Programme guidance, which we expect to test with stakeholders in due course. We would welcome approaches from those individuals or organisations interested in providing feedback on this guidance, and are keen to ensure that stakeholders from all parts of the customer journey (consultants, suppliers, industry and academia) have the opportunity to participate in this process.

Annex

Annex 1: Detailed assessment criteria for Phase 1

Criteria	Comments
Category 1: Potential for results	
A. Size of heat source and how it compares to the total volume of heat generated on site	• Assessed via existing company information on the waste heat source of interest and total heat generation.
B. Total on-site heat demand and proportion of this met by on-site heat generation	• Assessed via the amount of heat generated in the existing process. • Applicants should demonstrate that the existing process generating waste heat is operating efficiently and, therefore, an investment in upstream efficiency could not be expected to generate better returns. This requirement is consistent with best practice. Potentially difficult to assess this criterion without imposing unreasonable information supply requirements on applicants.
C. Ability to increase industry confidence in investing in heat recovery	• Assessed against two criteria: 1. High replication of small-scale incremental projects. 2. Low-medium replication of large scale projects via dissemination of lessons learned. • Projects supported by the fund should represent the widest possible range of industrial sectors and heat recovery technologies.
Category 2: Deliverability	
D. Experience of Project Manager and delivery team	• Assessed via seniority and experience of the bidder's named staff who will have responsibility for managing and contributing to the study (i.e. how many qualified engineers). The criteria should also include the capabilities of any proposed consultants/contractors that the bidder is proposing to be involved in the work. • The application will need to provide information against the feasibility study scope of works topics to give the assessors confidence that the scope of works is likely be satisfied. BEIS have already considered 3 options for the delivery of the Feasibility Studies, and we have explored each option further in Annex 5: Technical Annex – Industrial Heat Recovery Support Programme of this report. • The finally selected option would have an impact on the scope of the assessment criteria.
E. Quality Assurance	• How does the applicant plan to QA their Phase 1 Feasibility Study? • Have they planned a peer review process? • Has the consultant detailed their QA process, and how they will address any issues in quality?
F. Project Plan	• Evidence for application: Gantt chart

	• What timescale will the Feasibility Study be carried out over? There needs to be sufficient time between the end of Phase 1 and the application window for Phase 2 to allow for a full application to be written.
G. Wider environmental impacts	• Heat recovery technology must not result in an increase in the emissions of key air pollutants e.g NO_x, SO_x, PM10 and PM 2.5. Are appropriate measures in place to ensure that changes in air quality emissions can be assessed, whether through modelling or testing. Are other wider environmental impacts considered and assessed if appropriate?
Category 3: Economic Case	
H. Cost of the Feasibility Study	• Are the costs quoted by consultants commensurate to the scope and scale of work being proposed?
I. Additionality	• Assessed through applicant response to demonstrate that the project would not have happened without this Programme. At Phase 1 it should also be noted where sites have a thermal input of 20 MWth or more, as these sites will have to carry out a review of potential heat recovery options under Article 14 (5) of the Energy Efficiency Directive, thus potentially lowering the additionality of this funding.
J. Value for Money (VfM)	• Assessed via calculation of: - Grant % for Phase 1 - £ total - £ grant per MWth that could be recovered

Annex 2: Proposed structure of Feasibility Studies

Section	Title	Notes on content guidance
1	**Summary of the main on-site processes**	Description of main heat generating and consumption processes carried out on site. Brief description of intermediate and final products produced. For installations covered by EU ETS, a list of the following: • Number and type of sub-installations defined for the installation for the purposes of EU ETS allowance allocation. • For each sub-installation: (1) The activity level (e.g. product output, measurable heat generated) (2) Fuel consumed (3) Type of fuel consumed (4) Associated CO_2 emissions – for the three most recent years or, where not available, for the baseline years used for Phase III allocation. (N.B. This is to get an approximate feel for the current thermal and carbon efficiency of the existing processes in order to make a judgement on whether these processes have the potential to improve efficiency without the implementation of heat recovery, which might be a more cost effective strategy.) • Processes to include: (1) Type of fuel used to generate heat (2) Thermal input capacity of heat generation process (3) Annual quantity of fuel consumed in heat generation (4) Medium (i.e. steam, hot water, hot air) used to carry heat to process (5) Approximate conditions of medium carrying heat to process (temperature, pressure and composition) (6) Medium carrying heat away from heat consuming process which is currently not utilised (wasted) (7) Approximate conditions of medium carrying heat away from process (temperature, pressure and composition). This information is best accompanied by a simple Sankey diagram illustrating the relationships between the processes and the fuel and heat flows within the site.
2	**Description of Waste Heat Recovery Potential**	For each heat generating process identified above, a statement of the following: (1) Medium carrying heat away for heat consuming process which is currently not utilised (wasted) (2) Approximate conditions of medium carrying heat away from process (temperature, pressure and composition).
3	**Analysis of available on-site waste heat**	For each heat generating unit listed above: (i) Medium carrying heat away for heat consuming process which is currently not utilised (wasted) (ii) Approximate conditions of medium carrying heat away from process (temperature, pressure and composition). (iii) Approximate rate of heat flow away from heat generating process (MWth) This information is best accompanied by a simple Sankey diagram illustrating the flows of energy into and from the heat generating units.
4	**Description of potential uses**	There may be a number of potential uses of the waste heat itemised above, each with different characteristic environmental benefits and financial performance. Each of these should be identified and then discounted or considered in more detail in the

	for heat	options appraisal below. A consideration should be given to the following potential uses of waste heat: • Recovery and consumption on-site to satisfy existing heat demand (including cooling demand via an absorption chiller), thereby displacing the use of primary fuel inputs or electricity consumption. • Recovery and conversion on-site to power (electrical or mechanical) for consumption on-site (electricity or mechanical work), or export for consumption elsewhere (electricity), thereby displacing electricity consumption. • Recovery and export via a heat carrying medium (e.g. steam, hot water) for consumption off-site, thereby displacing the use of primary fuel inputs or electricity consumption. Recipients of such heat may be nearby industrial installations or existing (planned) district heating networks. Evidence should be required that a methodical approach was adopted to identify the potential uses of the waste heat. For example, in the case of waste heat export, evidence that heat maps of local heat loads have been consulted. Options may be discounted at this stage, without more detailed options appraisal, if clear justification is given that the project would not be viable. For example, technical issues such as quantity of waste heat not being large enough or heat sink too far away may be cited with justification.
5	**Description of suitable heat recovery technologies**	In respect of each flow of heat away from the heat generating unit which is not utilised (listed above), nomination and brief description of the recovery and transformation/upgrade technology available.
6	**Appraisal of Financial and Environmental performance of option projects**	For each waste heat recovery option carried forward from 4 and 5, Options appraisal should be carried out. The applicant can use their own calculation spreadsheets, so long as the following parameters are utilised in the analysis and results are returned (on the basis that bids are clear what assumptions are used for calculations): **Parameters to Utilise** • Capex • Opex • Revenues • Cost savings • Lifetime of technology **Results to Return** Amount of heat recovered (annual and lifetime) in MWh

		CO_2 saved (annual and lifetime) – should be based on fossil fuel displaced - use reference figures (latest Defra table of carbon intensities) Internal Rate of Return, expressed from perspective of site operator and Government Cost of CO_2 avoided, expressed as Net Present Value (NPV) over lifetime of the project divided by CO_2 savings over lifetime of the project, expressed from the perspective of the site operator and Government. This should use a Discount Rate of 3.5%. Analysis of sensitivity of the value of the IRR and NPV/CO_2 avoided to the key parameters of: Capex, maintenance cost, cost of energy displaced, revenue from heat/power sold. These results may be best presented as 'Tornado Diagrams'.
7	**Appraisal of other benefits of the options**	Business growth potential, employment benefits and competitiveness. Estimation of replication potential resulting from each Option.
8	**Summary of options and presentation of results**	**Fixed template** For each Option appraised, a summary of financial and environmental performance characteristics should be provided. These should include: • Capex (£m) • Opex (£m/yr) (to include maintenance over and above that associated with the current process). • IRR (%) • CO_2 saved, annual and lifetime • Cost of CO_2 avoided (£NPV/tCO_2 (lifetime) • MWh of heat recovered and utilised • Cost avoided by MWh heat utilised (£/MWh) These headline characteristics of each option should be presented in a fixed template used by all applicants.

Annex 3: Detailed assessment criteria for Phase 2

Criteria	Comments
Category 1: Potential for results	
A. Potential amount of heat (MWh) that could be recovered	• Assessed via the amount of heat generated in the existing process (noting potential changes over time). • Applicants should demonstrate that the existing process generating waste heat is operating efficiently and, therefore, an investment in upstream efficiency could not be expected to generate better returns. This requirement is consistent with best practice. Potentially difficult to assess this criterion without imposing unreasonable information supply requirements on applicants so this criteria should be discussed further. • BEIS could require detailed designs to be in place prior to a Phase 2 application, or at least be in a good state of readiness.
B. Potential CO_2 reduction (tCO_2e)	• Scored on the basis of ranges for reduction, given that the application has passed the minimum threshold for GHG savings in the Phase 2 PQQ. • Assessed via the reference fossil fuel for the heat that would need to be produced if waste heat was not recovered.
C. Potential energy bill savings (£)	• Scored on the basis of ranges for energy bill reduction.
D. Ability to increase industry confidence in investing in heat recovery	• Assessed via: - High replication of small-scale incremental projects - Low-medium replication of large scale projects via dissemination of lessons learned - Dissemination and communication plans • Projects supported by the fund should represent the widest possible range of industrial sectors and heat recovery technologies.
Category 2: Deliverability	
E. Detailed work plan	• Work Plan including tasks, milestones and allocation of resources • Detail of procurement plan or supply contracts (if available) • Plan must include arrangements for monitoring and evaluation
F. Company financial standing	• Assessed via audited accounts for the previous 3 years, which could be supplemented by a Dun & Bradstreet report if there are any concerns.
G. Experience of delivery team	• Seniority and experience of the bidder's named staff that will have responsibility for managing and contributing to the study (i.e. how many qualified engineers). The criteria should also include the capabilities of any proposed

	consultants/contractors that the bidder is proposing to be involved in the work. • Details of technology providers and construction partners, track record in comparable projects and previous experience
H. Risk management	• Risk assessment and mitigation actions • Risk identification and escalation process
I. Quality Assurance	• Has the consultant detailed their QA process, and how they will address any issues in quality?
J. Wider environmental impacts	• Heat recovery technology must not result in an increase in the emissions of key air pollutants e.g NO_x, SO_x, PM10 and PM 2.5. Are appropriate measures in place to ensure that changes in air quality emissions can be assessed, whether through modelling or testing? • Are other wider environmental impacts considered and assessed if appropriate?
Category 3: Financial viability	
K. Appropriateness of cost breakdown	• Are all costs eligible under Article 38 for Energy Efficiency measures, and the published Programme Guidance? • Tendering approach. The applicant should obtain at least three quotes for high value items (over £10,000) • Are the costs commensurate to the scope and scale of work being proposed?
L. Value for Money (VfM)	• This criteria would be assessed against a number of sub-criteria: - Grant % for Phase 2, e.g. assuming the maximum grant is 30%, anything lower would score higher marks - £ total - £ grant per MWth (thermal) of Recoverable Heat - £ grant per tonne CO_2 equivalent reduction
M. Additionality	• Assessed through applicant response to demonstrate that the project would not have happened without this Programme. • Score for additionality for sites larger than 20MWth input would cover total thermal input and refurbishment schedule (would require a question in the application form referencing Article 14(5) of the Energy Efficiency Directive)

Annex 4: Additionality Assessment

Proposed form to be completed by Phase 2 applicants.

<table>
<tr><th>Additionality component</th><th>Description / considerations</th><th>Declaration</th></tr>
<tr><td>Intervention options</td><td>What other efficiency measures has the company considered?
Feasibility study to identify waste heat options.
Company may have considered other more general efficiency measures</td><td rowspan="2">Qualitative Assessment<table><tr><td>Would not have undertaken the activity</td><td>Would have undertaken the activity but at a later date</td><td>Would have undertaken the activity but on a reduced scale and at a later date</td><td>Most of the impact would have occurred anyway</td><td>Approx. half the impact would have occurred anyway</td><td>A relatively small amount of the impact would have occurred anyway</td><td>Would have undertaken the activity anyway</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>Rationale for Assessment (250 words max)</td></tr>
<tr><td>Reference case (do nothing scenario)</td><td>What efficiency improvements would you undertake under BAU?
Feasibility study to identify ROI of project
Business case / indication from board on necessary ROI to undertake project without need of further support
Statement from applicant specifying if tried to instigate such a project before and why was it not approved</td></tr>
<tr><td>Gross direct effects</td><td>Impact of project
Costs / RoI
MW heat reused
CO_2 savings
Reduction in primary energy demand
Bill savings</td><td>Quantitative Estimate<table><tr><td>Cost</td><td>Match funding</td><td>RoI threshold</td><td>Waste heat reused</td><td>Reduction in primary energy demand</td><td>CO_2 savings</td><td>Bill savings</td></tr></table></td></tr>
</table>

		£	%	Months	MWh	MWh	CO_2e	%
Leakage effects	Does the project have any positive / negative impacts outside of site? • Project infrastructure can be used by neighbouring companies • Installation provides work to local firms • Possible provision of low cost energy to other users (through heat network or conversion to power)	**Qualitative Assessment** • •						
Displacement	Are any of the project benefits caused by reduced outputs elsewhere? • Other factors are contributing to savings, such as other efficiency measures, reduction in energy costs, cuts in production etc.	**Qualitative Assessment** • •						
Substitution effects	Are any benefits directly offset by negative impacts elsewhere? • Additional energy needed to recover / convert waste heat • Impact on production	**Qualitative Assessment** • •						
Multiplier effects	Are there any indirect benefits from the project?	**Qualitative Assessment** •						

	• Sharing of case studies with other EIIs (required) • Increased evidence base for government and industry • Development of supply chain and reduced costs of heat recovery equipment	•

Annex 5: Technical Annex – Industrial Heat Recovery Support Programme

The analysis presented in this technical annex is based on a techno-economic model by Element Energy which is populated using literature sources, expert review, site visits and discussions with individual companies. As a result the analytical outputs are indicative of the potential benefits of industrial heat recovery and not wholly reflective of the Industrial Heat Recovery Support Programme.

Importantly, the proposed scope of the Programme is also wider than the 8 Energy Intensive Industries (EIIs) considered by Element Energy study. We will look to update and refine the analysis post-consultation, after improving our evidence base on the types of industrial heat recovery projects likely to come forward across the manufacturing industry. Further detail of the risks and limitations of the analysis are detailed in Section 7 of this annex.

1. What is the problem under consideration?

Industrial heat recovery (also referred to as recoverable heat) is a process by which heat generated by an industrial process, that otherwise would be wasted, is recovered and reused. Evidence from an Element Energy report[22] estimates 48 TWh per annum of energy is lost as heat in industrial processes, 7 TWh/yr of which has economic potential[23]. This 7 TWh/yr is equivalent to around 2% of the overall UK industrial heat energy use[24]. This wasted heat can be re-used to reduce the energy demands of firms. By reducing energy demand, recoverable heat has a range of benefits in particular the potential to deliver cost savings or additional revenue for firms and lower carbon emissions for wider society. The Government is intending to support industry to implement recoverable heat technologies to help realise this potential through the Industrial Heat Recovery Support Programme.

2. Rationale for intervention

Existing economic and non-economic barriers currently prevent the full benefits of waste heat recovery from being realised[25]. These barriers include insufficient information and expertise on identifying and appraising industrial heat recovery opportunities, investments not meeting company hurdle rates and a lack of capital funds to implement recoverable heat technologies. The Programme seeks to overcome these **barriers,** described in more detail below:

[22] Element Energy (2014) The potential for recovering and using surplus heat from industry
[23] Economic potential is defined as the total waste heat recovery investment from industry which has a positive Net Present Value.
[24] According to Element Energy report using Digest of UK Energy Consumption (2011)
[25] As identified by Element Energy, consistent with wider literature e.g. Cagno et al. (2012)

2.1 Information Barriers

From discussions with industry, the Element Energy report cites uncertainty around waste heat recovery potential as a significant barrier. This includes the insufficient information industrial companies have regarding both the technologies available to conduct waste heat recovery and their energy savings potential. Without this information industry may forego commercially viable waste heat recovery. Increasing awareness of the benefits of waste heat recovery can increase the priority of such investment projects within an organisation, and lead to the development of more compelling business cases. The Element Energy report estimates the commercially viable amount of wasted heat to be 5 TWh per annum.

The provision of match-funded feasibility studies as part of the Programme seeks to overcome this informational barrier by incentivising firms to acquire information on the waste heat recovery potential and the associated energy savings. Combined with capital funding, the Government is supporting industry in utilising waste heat previously rejected to the environment.

2.2 Investments Not Meeting Company Hurdle Rates

The payback periods for energy efficiency measures in industry tend to be relatively short, generally less than 2 years[26]. Firms therefore prefer investments which can generate returns quickly often due to pressure for short-term profit. This combined with the competition from other investment projects in an organisation with shorter payback periods mean firms are less likely to support industrial heat recovery investments even though they are cost-effective. The quantitative analysis by Element Energy identifies a total of 5 TWh per year of waste heat recovery which is commercially viable. This leaves 2 TWh/yr of potential that is economically but not commercially viable.

The capital funding phase of the Programme intends to unlock the economically viable proportion of waste heat which is not within the typical two year payback period. By providing up to 30% of the capital expenditure firms' initial expenditure on recoverable heat technologies will be lower. This reduces the time period in which they can recoup their initial investment and generate returns. By reducing payback periods the Programme will be able to incentivise a higher rate of uptake of waste heat recovery.

2.3 Lack of Capital Funds

Awareness of energy savings may not be sufficient if there is no capital available for industrial waste heat recovery investments. Funds may not exist because of a lack of liquidity, an inability to access external funding due to a firm's perceived credit risk, or because external capital is unaffordable due to the level of project risk.

This barrier has been highlighted by the 2050 Industrial Decarbonisation and Energy Efficiency Roadmaps project[27] and can result in foregone waste heat recovery. The Programme

[26] Element Energy states industry projects require a payback time of less than 2 years – these are 'commercially viable'

addresses these issues by providing capital funding, allocated through a competitive bidding process. This allows firms to finance waste heat recovery technologies and allows Government to ensure only projects which would not have occurred irrespective of government support are funded.

3. Policy objective

The policy objectives of the Programme are:

- To increase UK industry confidence in making investment decisions relating to the identification and implementation of recoverable heat technologies.
- To increase the deployment of industrial heat recovery technologies, by helping to overcome the barriers to this.

This will allow industry to re-use heat on-site or sell it to a third party, leading to the more efficient and productive use of energy, lower fuel bills or a new revenue stream for industry, and a reduction in carbon emissions.

The Programme will meet these aims by (1) supplying up to 70% of the cost to industry from feasibility studies to support industry in gathering information to identify where and how energy savings can be made from waste heat recovery; and (2) providing up to 30% capital support to firms to unlock economically viable waste heat that would otherwise not have been undertaken.

4. Description of policy options

4.1 Business-as-usual (BAU)

The BAU approach is the ‘do-nothing’ approach which means no funding is given to firms to overcome economic and non-economic barriers. The foregone benefit of not implementing the Programme is up to 7 TWh per annum of waste heat that could be recovered and reused. There are no associated costs or benefits of BAU.

4.2 Feasibility funding and competition funds (IHRS)

The first phase of this policy option is to provide up to 50 of the cost of feasibility study funds to applicants, to incentivise firms to collect information on the potential for waste heat recovery in their industrial processes. The second phase of the Programme is to provide funds, through a competitive bidding process, for up to 30% of firms’ capital expenditure on waste heat recovery technology.

[27] See footnote above.

5. Monetised and Non-monetised costs and benefits of the Programme

Monetised Costs	Description
Programme cost to Government	The total cost to Government includes matched feasibility studies funding, competition funds and admin costs.
Private capital expenditure	The total private expenditure on the initial investment costs of waste heat recovery technologies and techniques such as recovery technology, conversion technology and storage or distribution.
Private operational expenditure	The total private operational expenditure of waste heat recovery technologies.
Private feasibility funding	The private cost to firms of feasibility studies.

Monetised Benefits	Description
Carbon emissions savings	The value of carbon emissions savings as a result of lower energy use. These are monetised using the Government's Green Book Appraisal guidance[28]
Air quality savings	The value of improved air quality as a result of lower energy use. These are monetised using the Government's Green Book Appraisal guidance
Social fuel savings	The value of the net reduction in energy use. Calculated using the long-run variable costs of fuel by the amount of fuel which has been displaced.[29]
Rebound effect	This is the welfare gain to companies from the savings due to lower energy costs, which they in turn spend on energy. This 'rebound' energy is valued at the retail price of energy as per the Government's Valuation of Energy Use and GHG Emissions for Appraisal Guidance in Section 3.39.
Private benefit of government funding	Industry bidders who acquire funding benefit from the provision of government feasibility and competition funding.

28 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/483278/Valuation_of_energy_use_and_greenhouse_gas_emissions_for_appraisal.pdf

29 These are monetised using the Government's Green Book Appraisal guidance

6. 'Best Estimate' Outputs

Table 5: Net Present Value Calculations

Monetised Benefits	Description
Total Programme Cost to Government[30]	£ 10 m
Costs	
Total private capital costs	£ 35 m
Total private feasibility costs	£ 5 m
Total private operating costs	£ 77 m
Total Costs	**£ 117 m**
Benefits	
Carbon savings	£ 239 m
Private Fuel savings gain (rebound effect)	£ 131 m
Net social gain from direct effect	£ 433 m
Air quality savings	£ 10 m
Total Benefits	**£ 812 m**
Net Present Value (£m in 2016 prices)[31]	**£ 695 m**
Benefit-Cost Ratio	**6.93**

Table 6: Carbon Savings

	Carbon Saving (Mt CO_2e)
Carbon Budget 4 (2023-27) savings	2.06 Mt
Carbon Budget 5 (2028-32) savings	2.00 Mt
Annual Carbon Savings*	0.38 Mt
Lifetime Carbon Savings	6.18 Mt (4.32 traded, 1.85 non-traded split)

*in the first 15 years of the Programme

30 This is not included in the NPV as it is a transfer between the Government and private sector. As matched feasibility and/or competition funds from Government are a cost to the Government but a benefit to the private sector they cancel each other out in the NPV.

31 Where base price is also 2016 i.e. 2016=100

7. Risks and Limitations

There are numerous risks and limitations in the analysis. The key ones identified are:

7.1 **Data:** the Cost-Benefit analysis presented here draws from evidence collected from the Element Energy report referenced above. The evidence was created through a series of literature reviews and further refined using site visits, interviews with experts, trade associations and individual companies. Given this evidence approach, the estimates using this analysis should be considered indicative of the relative magnitude of potential.

7.2 **Demand for waste heat recovery:** While the Element Energy report identifies 7 TWh/yr of economically viable waste heat, the amount of uptake incentivised by the Programme is uncertain and will not be known until bids are received by the Government.

Using the most conservative estimate of relatively low level of uptake of 1 TWh/yr the analysis still generates a Net Present Value of £254m. The 'best' estimate uptake in the analysis is 2.2 TWh/yr, this is split between waste heat recovery projects which become commercially viable with competition funds and the uptake realised due to feasibility studies. The uptake incentivised from feasibility studies is uncertain however, because there is a lack of empirical evidence on the relationship between information provision and uptake of industrial heat recovery.

7.3 **Total Programme Cost estimate**: the 'best estimate' of the analysis based on the Element Energy report estimates that total programme cost will be around £10m. However, as noted above, the data to compile this estimate is uncertain. The Government has budgeted for £18m towards the Programme which suggests sufficient funding at this stage.

8. Sensitivity Analysis

Variable	Current value in 'best estimate' scenario	Description of flexed assumptions (varying one input at a time from central case)	Range of NPV. (Best estimate = £695m)	Range of BCR. (Best estimate = 6.38)
Commercial Uptake[32]	25% or 1.2 TWh/yr	The proportion of commercial uptake which is assumed to be a direct result of the feasibility funding i.e. would not have occurred without the IHRS. This is varied from the most conservative estimate of 0% to a high estimate of 50%. Each 1% increase in commercial uptake results in a £15.1m increase in the NPV.	£295m - £1095m	4.93-7.88 (2.95 range)
Additional Uptake	1 TWh/yr	This is the amount of uptake incentivised through competition funding by reducing the payback period of waste heat recovery projects to a commercially viable time period. This is tested between 0 TWh and the full 2 TWh potential.	£360m - £1028m	5.39-7.76 (2.36 range)
Total Uptake	2.2 TWh/yr	This is commercial and additional uptake combined. Changing the total incentivised uptake between 1 and 4 TWh/yr. As the TWh/yr figure increases so does both NPV and the BCR.	£294m - £1295m	4.92-8.19 (3.27 range)
Rebound Effect	20%	The proportion of energy savings that firms use to consume more energy due to the savings made from waste heat recovery. This is varied between 0 to 20 % of energy 'rebounded'. The NPV falls as rebound effect increases due to the reduction in carbon savings exceeding the private gain to firms.	£695m - £735m	6.93-7.27 (1.01 range)
Support Rate	£4/MWh	Varying support rate from £2/MWh to £6/MWh. NPV rises and BCR falls with the support rate	£434m - £823m	6.41-7.46 (1.05)
Discount Rate	3.5%	The social discount rate 3.5% is used in the 'best estimate' for comparison, a private discount rate of 10% yields £354m.	£384m - £695m	5.73-6.93 (1.20 range)

[32] This is the amount of the 5 TWh/yr of commercially viable waste heat which is incentivised by the IHRS, through feasibility funding (to help overcome information barriers on waste heat recovery).

9. Consultation Questions: Evidence required

The Consultation Document asks respondents to provide responses, some of which are regarding evidence. The consultations questions are referenced below with the specific evidence required. We would greatly welcome evidence from respondents on these questions, to improve the analysis in this area.

Question 4: Do you have any further evidence on the potential for heat recovery from different industry sectors? This could include evidence gathered from academic or research institutions or through the experience of industrial companies.

- Evidence of potential for heat recovery in different industry sectors in TWh/yr

Question 7: Which of the barriers and enablers identified are the main ones you experience? Are financial (commercial) or non-financial (corporate / practical & technical) barriers greater?

- Costs of feasibility studies
- Information gathered e.g. costs and technologies for industrial heat recovery from feasibility studies

Question 9: Have you already investigated funding for a heat recovery project, or approached an Energy Services / Savings Company? Why did you decide to go ahead with / not go ahead with the project? What reasons were given for your success / lack of success in securing funding?

- Information from current industrial heat recovery projects
- Details on technology, performance and cost data of existing industrial heat recovery projects
- Capital expenditure and operating costs

Question 10: Can you provide examples of current heat recovery projects? We would particularly welcome details on technology, performance and cost data (capital expenditure and operating costs where possible). Case studies are welcomed from trade associations, industrial companies, technology providers, academics or other groups.

- Potential projects that could be brought forwards following the provision of financial support
- Details of the technology used in industrial heat recovery
- Expected use of recovered heat and fuel(s) displaced
- Size of project
- Details of the level of financial support you think will be required
- What is the payback period required for waste heat recovery projects?

Question 16: Would you be interested in applying for feasibility study funding? If not, is there a particular reason why (already have onsite heat recovery, no money for investment, do not see benefits in heat recovery etc.)?

- Demand for feasibility studies

Question 17: Is the maximum level of Government match-funding for feasibility studies (50%, rising to 60% / 70% for SMEs, and by 15 percentage points for investments located in assisted areas) suitable to generate interest from your company? What would be the minimum level of match funding needed?

- Is maximum level of Government match-funding for feasibility studies (50%, rising to 60% / 70% for SMEs) suitable to generate interest from your company?
- Minimum level of match funding needed

Question 25: Would you be interested in applying for capital funding, and what level of capital expenditure would be required for your project (if known)? If not, is there a particular reason why (already have onsite heat recovery, no money for investment, do not see benefits in heat recovery etc.)?

- Level of capital expenditure required for your project (if known), if interested in applying for capital funding

Question 26: Is the level of support for capital funding (maximum 30%, rising to 40% / 50% for SMEs, and by 15 percentage points for investments located in assisted areas) suitable to generate investment from your company? What would be the minimum level of match funding needed?

- Is the maximum level of support for capital funding (30%) suitable to generate investment from your company?
- Minimum level of match funding needed

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