Annex A - EIR 202400410817 Response

1. Could you supply all briefings, analysis prepared for or by the Scottish Government, all minutes/notes from meetings, all correspondence sent and received by the government, including internally, about Scotland supplying hydrogen to Germany, from between November 1 2023 and the date of this FOI?

While our aim is to provide information whenever possible, under the exception at regulation 10(4)(b) of the EIRs, a public authority may refuse a request for information if it is 'manifestly unreasonable'. The Scottish Information Commissioners guidance on the regulation 10 (4) (b) exemption at: http://www.itspublicknowledge.info/Law/EIRs/EIRsExceptions.aspx says that there may "be instances where it is appropriate for the Commissioner to consider the proportionality of the burden on the public authority in terms of the costs and resources involved in dealing with a request when considering the application of this exception".

In this case, the costs and resources involved in complying with your request would be disproportionate due to the significant burden it would place upon officials to search for, compile, redact and quality control the requested information for release. Across the Scottish Government, the export of hydrogen to Europe, and specifically Germany, is a well-developed workstream that features across multiple policy areas. Because of the volume of records which would need to be searched for and reviewed, a 20 working days extension to the response deadline (under regulation 7 of the EIRs) would still not make the request manageable. For these reasons, we consider that your request is manifestly unreasonable and so we are refusing it under regulation 10(4)(b).

As the exception is conditional we have applied the 'public interest test'. This means we have, in all the circumstances of this case, considered if the public interest in disclosing information outweighs the public interest in applying the exception. We have found that, on balance, the public interest lies in favour of upholding the exception. While we recognise that there may be some public interest in information about hydrogen export policy via pipeline this is outweighed by the public interest in ensuring the efficient and effective use of public resources by not incurring excessive costs when complying with information requests.

You may however wish to consider reducing the scope of your request in order to make it manageable. There are a number of ways we can suggest you may do so. You could narrow the type of information, and/or the timescale you are interested in. Regarding the current request, all 'correspondence, including internally' relating to the topic amounts to a large number of items potentially in scope. Likewise, all material relating to the topic over a six month period also results in a large number of items in scope.

To note in relation to your ask the Scottish Government has commissioned a number of research projects relating to the export of Hydrogen to Europe, which will be published within the coming months. **Scenarios for Clean Hydrogen Demand in Europe** is a research study which will investigate North Western European demand

for low-carbon hydrogen imports up to 2050. **The Assessment of Low-Carbon Hydrogen Supply Chain Export Opportunities** study will deliver an assessment of the opportunities for Scotland to export supply chain capabilities to target markets across the clean hydrogen sector. Further the **North Sea Hydrogen Alliance** project will investigate pipeline infrastructure between Scotland and Germany; and matching Scottish hydrogen production to German hydrogen demand.

2. Could you supply any analysis undertaken of how many houseowners will be penalised for not having zero carbon heating systems, and any analysis/briefings about how they would be penalised for not having a zero carbon heating system by 2033?

In relation to your request for 'any analysis undertaken of how many houseowners will be penalised for not having zero carbon heating systems', Scottish Government has not commissioned any analysis on this topic and therefore, regulation 10(4)(a) applies here – information not held.

In relation to your query on 'analysis/briefings about how they would be penalised for not having a zero carbon heating system by 2033', some of the information that you have requested is available from Delivering net zero for Scotland's buildings - Heat in Buildings Bill: consultation - gov.scot (www.gov.scot). Please see Section 5. Monitoring and Enforcement, specially section 5.10 – 5.18. Under regulation 6(1)(b) of the EIRs, we do not have to give you information which is already publicly available and easily accessible to you in another form or format. If, however, you do not have internet access to obtain this information from the website(s) listed, then please contact me again and I will send you a paper copy.

3. How much has the Scottish Government spent on zero carbon heating systems, like heat pumps, in its own buildings in the last three years (2021-2024) with a breakdown of what this cash was spent on?

Details of zero carbon heating system projects within Scottish Government buildings are published here: Money spent to decarbonise Scottish Government buildings: EIR release - gov.scot (www.gov.scot) and in our Public Bodies Climate Change Reports on the SSN website Reports (sustainablescotlandnetwork.org). This previous EIR release covers all projects from 2021 – 2024.

Under Regulation 6(1)(b) of the EIRs (information already publicly available), we do not have to give you information which is already reasonably accessible to you. If, however, you do not have internet access to obtain this information from the website(s) listed, then please contact me again and I will send you a paper copy.

4. a) Could you supply all analysis undertaken on the cost of making all Scottish buildings net zero after the £33bn prediction in 2021, b) and what the cost is now?
c) Could you also supply all briefings prepared for or by the Scottish Government, all minutes/notes from meetings, all correspondence sent and

received by the government, including internally, about this, between November 1 2023 and the date of this FOI.

We have identified 37 items which are in scope of your request in relation to items a and c above. Please find these documents attached in Annex B.

While our aim is to provide information whenever possible, in this instance we are unable to provide some of the information you have requested because exceptions under regulations 10(4)(d) (material which is still in the course of completion, unfinished documents or incomplete data); 10(4)(e) (internal communications); and 11(2) (personal data of a third party) of the EIRs apply to that information. The reasons why those exceptions apply are explained below.

Regulation 10(4)(d) – material in course of completion, unfinished documents or incomplete data

An exception under regulation 10(4)(d) of the EIRs (unfinished or incomplete information) applies to some of the information you have requested because it is material which is still in the course of completion. Work around updating the £33 billion figure (the estimate used in the Heat in Buildings Strategy) as the cost of decarbonising Scotland's building stock has not concluded. The cost information we hold at this time may not be correct as the underlying assumptions, including on minimum energy efficiency and clean heat policy approach have yet to be verified. In addition, the model underpinning work to review costs has not yet been validated through an audit by an external body. We expect this work to be fully completed by late this year and for updated cost estimates to be published over the later autumn.

This exception is subject to the 'public interest test'. We have found that, on balance, the public interest lies in favour of upholding the exception. We recognise that there is some public interest in release as part of open, transparent and accountable government. However, this is outweighed by the public interest in ensuring that unfinished or incomplete information which is under active consideration is not disclosed when it might misinform the public.

Regulation 10(4)(e) – internal communications

An exception under regulation 10(4)(e) of the EIRs (internal communications) applies to some of the information you have requested because it is internal communication between Scottish Government officials about assumptions, scenarios and estimates relating to policy which is under development and discussion.

This exception is subject to the 'public interest test'. Therefore, taking account of all the circumstances of this case, we have considered if the public interest in disclosing the information outweighs the public interest in applying the exception. We have found that, on balance, the public interest lies in favour of upholding the exception. We recognise that there is some public interest in release as part of open, transparent and accountable government, and to inform public debate. However, there is a greater public interest in high quality policy and decision-making, and in the properly considered implementation and development of policies and decisions. This means that Ministers and officials need to be able to consider all

available options and to debate those rigorously, to fully understand their possible implications. Their candour in doing so will be affected by their assessment of whether the discussions on clean heat policy will be disclosed in the near future, when it may undermine or constrain the Government's view on that policy while it is still under discussion and development.

Regulation 11(2) of the EIRs (personal information)

This exception under regulation 11(2) of the EIRs (personal information) applies to some of the information requested because it is personal data of a third party and disclosing it would contravene the data protection principles in Article 5(1) of the General Data Protection Regulation and in section 34(1) of the Data Protection Act 2018. This exception is not subject to the 'public interest test', so we are not required to consider if the public interest in disclosing the information outweighs the public interest in applying the exception.

While items in scope of your request can be released in redacted form please note the answer to item 2. of your request (figure replacing the £33 billion estimate from 2021) will be withheld under regulation 10(4)(d) (material in course of completion, unfinished documents or incomplete data) for the reasons explained above. Regarding the list of items, please note that some emails reference certain attachments that, being merely draft documents, have not been released separately, rather only in their final or most up-to-date versions – Documents 1-6.

5. How many grants have been handed out for heat pumps so far in 2023 and 2024, and how many buildings still need to be upgraded?

After your clarification of 01 May, I have collated information on the number of heat pumps installed in 2023 and 2024 with grant funding from the Home Energy Scotland (HES) Grant and Loan Scheme and HES Loan and Cashback Scheme.

The HES Grant and Loan Scheme allows applicants to claim a grant, interest free loan or a combination of both for heat pumps. I have provided the number of heat pumps installed broken down into applications that claimed grant only, loan only and both grant and loan funding.

These figures include instances where an application was submitted prior to January 2023, but the full/final payment of funding for all measures listed on the application was paid during the requested timeframe.

Heat Pump Funding Type	**January 2023 – December 2023**	**January 2024 – March 2024**	**Total**
Grant Only	343	223	**566**
Loan Only	14	2	**16**

Grant and Loan	1,727	460	**2,187**
Total Heat Pumps Installed	**2084**	**685**	**2769**

In terms of how many buildings still need to be upgraded, as set out in the Heat in Buildings Strategy, we will need all homes and buildings to convert to 'clean' heating systems by 2045 in order to meet our net zero climate target. We define 'clean' heating systems as those that do not produce any greenhouse gas emissions at the point of use. Around 87% of all dwellings (2,227,000 total households) do not use clean heating systems (2022 SHCS data).

Under Regulation 6(1)(b) of the EIRs (information already publicly available), we do not have to give you information which is already reasonably accessible to you. If, however, you do not have internet access to obtain this information from the website(s) listed, then please contact me again and I will send you a paper copy.

Overview of ZDEH Decarbonisation costs

This brief note addresses an action relating to ZDEH and Energy Efficiency costs from the HiBs Cost and Affordability Steering Group meeting on 26/09/2023.

Decarbonisation costs of domestic buildings

A dataset provided by Element Energy, accompanying their report to Scottish Government in 2020 was used as the primary source for undertaking an initial estimate of the NZDEH decarbonisation cost for Scotland's domestic housing stock. The dataset has approx. 3,500 house archetypes, and for each archetype, what technology could be applied to the dwelling, alongside the associated decarbonisation cost. The steps to arriving at an average decarbonisation cost per dwelling as follows;

- Determine which technologies should be included excluded for comparison from the EE data set.
- Select lowest cost technology (either as upfront capital cost or by total life cost) applied across the 3,500 house archetypes.
- Create pivot chart that summarises the total cost and number of dwellings across each technology type.
- From this, a weighted average decarbonisation cost can be created and applied across the housing stock for each projected installation (work to be done). Assumes that the various technologies will be applied in similar proportions / profile over future years. An example is provided below.
- The base costs were adjusted or 'trued up' to reflect construction cost inflation[1] of 35% (applied to both the ZDEH technology as well as associated ancillary works) from the base date of 2017 used in the data (June 2017 – 113.7, to June 2023 – 105.1 a change of 31%).

The results are summarised below;

[redacted]

The average costs per dwelling range from **[redacted]** (these exclude DH connection as a technology).

The following tables provide further detail on the indicative total NZDEH capital costs applying various low cost technologies to the domestic housing stock. In this first table, the technology with the lowest total cost (ie upfront and operational) over the life of the technology was selected for each of the 3,500 build archetypes. **[redacted]**.

Total NZDEH capital investment costs by minimising total lowest whole life cost

[redacted]

The tables indicate a range of ZDEH costs from **[redacted]** (excluding EE improvements), at an average cost of **[redacted]** per dwelling (DH excluded). The average cost for installation of ASHP is in line with other data sources (at around £14k) but other technologies such as electric storage and electric boilers do lower the overall average.

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1 https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices

The following table adopted a similar approach, but looked to solely minimise th=e upfront capital cost for NZDEH installations, and it is noted that the total life costs across the technologies is in the region of **[redacted]**, compared to **[redacted]** where the total life cost has been minimised in the table above.

Total NZDEH capital investment costs by minimising upfront capital expenditure

[redacted]

The tables indicate a range of ZDEH costs from **[redacted]**, at an average cost of **[redacted]** per dwelling. This low average reflects the application of c.1,000,0000 direct electric heating as well as electric boilers.

Ongoing actions

The above provide initial indicative costs for domestic ZDEH deployment and it would be helpful to consider the appropriateness of the blend of technologies proposed, whether these are considered suitable and whether they should be modified to reflect an alternative profile of anticipated by policy colleagues. For instance, the number of direct electric, electric storage or electric boilers may be too high.

Energy Efficiency

c. 50% of domestic dwellings currently meet the EPC C banding, with c.1.2m potentially requiring improvement to facilitate application of various low temperature ZDEH technologies.

Current work by CAD, provides very early stage indicative costs for energy efficiency improvements in the region of **[redacted]** per property, which when applied to housing stock that require improvement, indicates a total EE cost to be **[redacted]**. An overview of the approach adopted is outlined below, alongside the initial results.

Estimating energy efficiency cost improvements by application of a list of measures to domestic stock

Initial estimates of the total and per home average cost of installing the following measures has been investigated, based on the following measures:

1. 270mm loft insulation
2. Cavity wall insulation
3. Draught proofing
4. Suspended floor insulation

The following data sources for costings have been considered.

- NHM
- Technical Feasibility report
- BRE work
- PEAT

Data sources for stock:

- Home Analytics (‘HA’)

Stock Summary

Home Analytics includes records for 2.76m dwellings (which compares to SHCS data of 2.5m). Of these, 1.43m fall below EPC C; 1.22m fall below EPC C and could install one of the measures above.

- 646k have less than 250mm loft insulation and could have loft insulation

- 426k could get cavity wall insulation
- 943k could get suspended floor insulation

HA does not include an indicator for draught proofing. The majority (590k) would get only one measure. 477k get two measures, and 157k get three.

Summary of Costings Data

Depending on the source and time period, estimates for the average cost for each measure are highly variable:

Measure	Data source	Estimated average cost
Loft insulation	NHM	£560
	Technical feasibility report	£300
	BRE work	£400 - £900
	PEAT	£430
Cavity wall insulation	NHM	£620
	Technical feasibility report	£410
	BRE work	£550 - £2,100
	PEAT	£1,200
Floor insulation	NHM	£750
	Technical feasibility report	£2,000
	BRE work	£2,900
	PEAT	£2,400
Draught proofing	NHM	£150
	Technical feasibility report	--
	BRE work	£140
	PEAT	--

NHM

The National Housing Model (NHM) project was done using 2017 prices and is therefore out of date with regards to costings. However, it provides a detailed analysis of the entire stock, specifically with the goal of reaching certain energy efficiency targets.

The NHM identifies 1.6m properties below EPC C. Of these:

- The majority (57%) need only one measure to reach EPC C. The most commonly required is floor insulation
- 35% need two measures; of these, the most common combination is loft and floor insulation
- 9% need three or four measures; the majority of these need cavity, loft and floor insulation

To install these measures in these properties, in 2017 prices:

- The estimated total cost is **[redacted]**
- The weighted average per home cost is **[redacted]**
- Per home costs are as low as **[redacted]** and as high as nearly **[redacted]**

35% of homes required only floor insulation, with an average per home cost of **[redacted]**. A further 22% of homes require combinations of measures with an average cost less than **[redacted]**. 30% of homes require combinations of measures with an average cost of around **[redacted]**. 7% of homes require combinations of measures with an average cost above **[redacted]**.

Element Energy undertook a report for Scottish Government that considered technical feasibility of low carbon heating in domestic buildings[2] and associated energy efficiency improvements. This report

[2] Technical Feasibility of Low Carbon Heating in Domestic Buildings : Report for Scottish Government's Directorate for Energy & Climate Change (www.gov.scot)

includes estimates of costings and proportions of the stock requiring each measure. This work is based on developing around 50,000 archetypes to represent the stock as a whole.

To simplify the stock to these archetypes, certain generalisations were made, particularly that all properties are assumed to have double or triple glazing. According to Home Analytics, less than 10% of the stock has single glazing, so this is considered to have a small impact. They use a combination of fixed and variable costs.

The costings are drawn from PEAT data, based on inputting 71,000 archetypes to represent the stock to the level of detail required by the PEAT tool. A key limitation of these costings is that the prices are for 2017. Standard and “hard to treat” cavity wall insulation are treated separately, meaning that the cost for properties with hard to treat cavity wall insulation requirements is likely higher than the average shown in Table 1 below.

Table 1: Average per home cost of selected measures, Technical Feasibility report (Element Energy), 2017 prices

Measure	**Estimated per home cost**
Loft insulation	300
Cavity wall insulation	412
Floor insulation (suspended)	2,000

BRE work

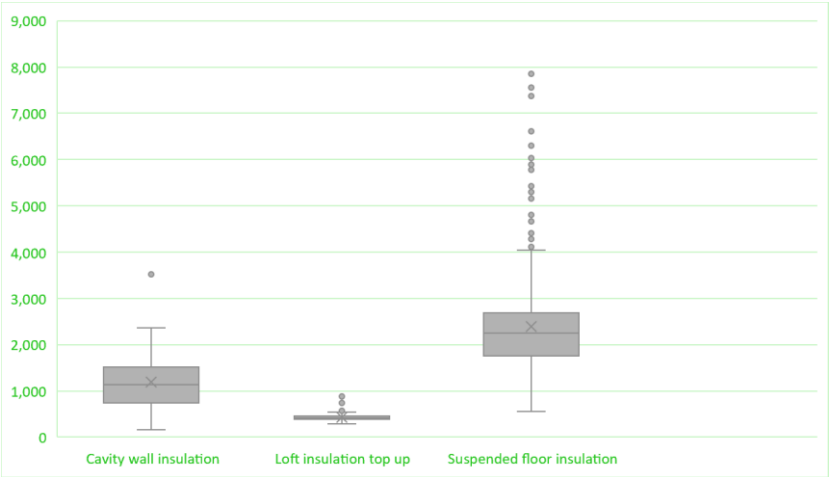
The BRE work gave the following estimates for the relevant measures:

Measures/ size	**Average cost**
Easy to treat cavities (Unfilled)*	571
Hard to treat cavities (Unfilled)*	2,168
Partially filled cavities	4,695
Loft insulation*	424
Loft insulation (HTT)*	924
Suspended timber floor insulation	2,921
Draught proofing (draught stripping)	143

PEAT

The PEAT tool allows input of data from Home Analytics to provide a household-level estimate of costs to improve household efficiency. However, due to the complexity of the scenario modelling, it would take significant time to run this analysis on the entire stock.

As a short term stop-gap, a data set of c.1,300 homes was entered into the tool. The results were wide ranging in terms of the costs of each measure per the chart below:



Methodology

1. Identifying dwellings. Downloaded HA dataset with specific columns (see appendix):
2. Filter dataset to return only properties with :
    - EPC below C
    - Loft insulation below 250mm
    - Wall construction not solid brick or stone, and uninsulated
    - Floor construction suspended, and uninsulated

It was assumed these dwellings will be regulated to install some form of measure, and are not restricted in doing so.

Results in 1.2m dwellings.

3. Identifying costs

A dataset was downloaded from HA for c.1,300 dwellings (about 0.1% of the relevant stock), and subsequently uploaded to PEAT. For the measures detailed above, the average costs and ranges for this limited sample were identified:

Measure name	# Dwellings	Av. cost	Min. cost	Max. cost
Loft insulation top-up	435	427	282	883
Suspended wooden floor insulation	904	2,390	555	7,848
Cavity wall insulation	128	1,194	154	3,551

4. Applying costs

Identified unit costs for each measure were indicated as follows:

Measure	Unit	Average £
Loft insulation (pre-measure 0-99mm)	per dwelling	436.78
Loft insulation (pre-measure 100-249mm)	per dwelling	424.91
Floor insulation	per m2	25.28
Cavity insulation	per dwelling	1,194.46

These unit costs were then applied to the 1.2m dwellings outlined above.

Results

The initial results indicated that **[redacted]**could be affected by the regs (below EPC C & could have one of the measures installed[3].

- **[redacted]** have less than 250mm loft insulation and could have loft insulation
- **[redacted]** could get cavity wall insulation
- **[redacted]** could get suspended floor insulation

The majority **[redacted]** would get only one measure. **[redacted]** get two measures, and **[redacted]** get three, at a total cost of **[redacted]**, with a mean of **[redacted]** per home, and median of **[redacted]**.

Across all combinations, a range of costs were identified, with 50% of dwellings seeing a cost between **[redacted]** and **[redacted]** per dwelling, with the lowest cost being **[redacted]**, and the highest i**[redacted]**.

Private Rental Sector net zero costs

There are approximately 362,000 private rental sector properties in Scotland, of which 50% are at EPC C or better. As an early estimate, applying average energy efficiency costs of **[redacted]** to these dwellings and an average NZDEH cost of **[redacted]** across all of the PRS stock, would indicate a total decarbonisation cost in the region of **[redacted]**.

The Communities and Analytics Division have a draft report (not published) that has considered various decarbonisation scenarios across the domestic stock, using data and assumptions from the National Housing Model. In the scenarios analysed, a particular Version 1 of the low carbon scenarios can be regarded as one way of modelling a full decarbonisation of the housing stock, based on the assumption that the electricity supply can be fully decarbonised.

Under this scenario, the decarbonisation cost for the PRS sector is estimated to be in the region of **[redacted]**, based on 2017 prices. Adjusting for construction price inflation of 35%, would indicate an adjusted cost for the PRS sector (at 2023 prices) to be in the region of **[redacted]**.

These two independent approaches to estimating the PRS decarbonisation cost are relatively close in value and so does provide a degree of comfort around the cost estimate.

Potential impact of cost caps

It is proposed that this is developed further during November, with input from policy colleagues. Further work would also allow a better and more up to date estimate to be provided.

[3] HA does not include an indicator for draught proofing.

APPENDIX

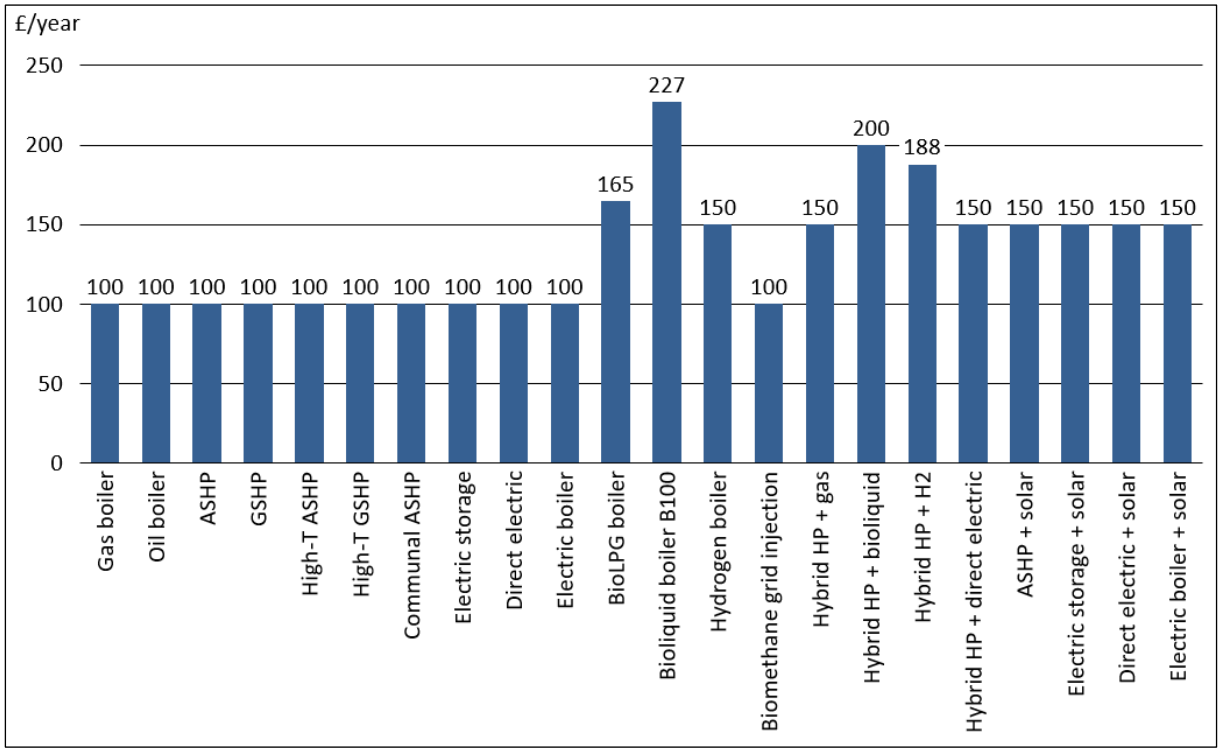
The analysis provided above utilised data provided by Element Energy in their reports 'Domestic Low Carbon Heating - Element Energy - Technical Feasibility costs v2, and 'Domestic Low Carbon Heating - Element Energy - Technical Feasibility - Appendix - Final Version' dated and March 2020 respectively.

Components of heating system base cost.

These are the costs provided in the original report, but have been inflated by construction RPI of c. 35% to obtain equivalent costs at a base date of 2023.

	Fixed CAPEX (£)	
	2020	2023
ASHP	4,804	6,485
GSHP	8,804	11,885
High-T ASHP	4,000	5,400
High-T GSHP	5,000	6,750
Communal ASHP	801	1,081
Electric storage heating	-	-
Direct electric heating	227	306
Electric boiler	700	945
Hybrid ASHP + gas boiler or hydrogen boiler	6,042	8,157
Hybrid ASHP + bioliquid boiler	6,546	8,837
Hybrid ASHP + direct electric heating	5,319	7,181
ASHP + solar	7,229	9,759
Electric storage + solar	2,425	3,274
Electric resistive + solar	2,652	3,580
Electric boiler + solar	3,121	4,213

Assumed annual maintenance cost by technology



Sources and assumptions on low-carbon heating technology costs

Technology	Sources	Assumptions
Gas boiler	As Fifth Carbon Budget, converted to 2020 prices.	
Oil boiler	As Fifth Carbon Budget, converted to 2020 prices.	
ASHP	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS	Reduction in cost of unit and installation of 20% between 2020 and 2040.
GSHP	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS	Reduction in cost of unit and installation of 20% between 2020 and 2040. Assuming ground loop shared between two properties.
High-T ASHP	2020 values from Evidence gathering - Domestic High Temperature Heat Pumps (2016), BEIS	Reduction in cost of unit and installation of 10% between 2020 and 2040.
High-T GSHP	2020 values from Evidence gathering - Domestic High Temperature Heat Pumps (2016), BEIS	Reduction in cost of unit and installation of 10% between 2020 and 2040. Assuming ground loop shared between two properties.
Communal ASHP	6 homes used as the size of the communal heating system based on the average terrace length from HCLG English Housing Survey 2017-2018	Assumes a communal HP serving 6 homes. Fixed and marginal capex and same as for individual ASHP and shared across the 6 homes.
Electric storage	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology.

Electric resistive	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology. Opex same as for electric storage.
Electric boiler	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology. Opex same as for gas boilers and electric storage
Solid biomass boiler	Capex from Fifth Carbon Budget dataset converted to 2020 prices. Opex from NERA 2009: The UK Supply Curve for Renewable Heat	
BioLPG boiler	Capex of unit and installation from ClimateXChange 2019, The potential contribution of bioenergy to Scotland's energy system. Additional opex for the delivery and storage of gas based on LPG Gas Central Heating Costs, Household Quotes 2018.	Opex same as for gas boiler with additional cost for the delivery and storage of bioLPG
Bioliquid boiler B100	ClimateXChange 2019, The potential contribution of bioenergy to Scotland's energy system. NNFCC 2019, Heating Options for Off-Gas Grid Consumers. BoilerGuide New Oil Boiler Replacement – Installation Costs (accessed 04/10/2019).	Dedicated bioliquid installation. Fixed opex assumed to be the same as for general boilers, plus oil tank costs. Oil tank can be rented or owned. Cost of tank rental or cost of own tank assumed to be equivalent and included in opex. Oil tank cost with installation £1,900 (over 15 yr)
Hydrogen boiler	Hydrogen supply chain evidence base (2018), Element Energy for BEIS	£153 added to cost of gas boiler to account for increased cost of Hydrogen boiler (Hydrogen-only boiler and Hyready boiler). Uplift of 50% in the opex compared to gas boiler due to the need to replace catalyst used to reduce NOx emissions (for both Hydrogen-only boiler and Hyready boiler).
Biomethane grid injection		Same appliance as gas boiler
Hybrid HP + gas	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS. Increase in capex for Hyready boiler and uplift in opex for catalyst replacement in line with Hydrogen supply chain evidence base (2018), Element Energy for BEIS	Hyready boiler in gas mode. Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system (£100 each) due to economies of scale.
Hybrid HP + bioliquid	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS. NNFCC 2019, Heating Options for Off-Gas Grid Consumers. BoilerGuide New Oil Boiler Replacement – Installation Costs (accessed 04/10/2019).	Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale. Additional OPEX £50 for small oil tank (£750 over 15 yr).
Hybrid HP + H2	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS Increase in capex for Hyready boiler and uplift in opex for catalyst	Hyready boiler in hydrogen mode. Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum

	replacement in line with Hydrogen supply chain evidence base (2018), Element Energy for BEIS	of the opex for the two components of the hybrid system due to economies of scale; uplift of 50% in the component of the opex associated with the hydrogen boiler due to replacement of the catalyst used to reduce NOx emissions when operating in hydrogen mode.
Hybrid HP + resistive		Capex derived by removing boiler component of hybrid heat pump and adding cost of resistive heating based on modelled kW. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale.
Combinations with solar thermal	Costs as Fifth Carbon Budget, converted to 2020 prices. Heat delivered assumption based on NERA 2009: The UK Supply Curve for Renewable Heat, table B.13	Heat delivered by solar collectors calculated assuming that solar thermal delivers no more than 60% of hot water demand or 643 kWh/kW, whichever is lower. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale.

Additional costs

Additional costs considered in the EE study included costs for the installation of additional components required by the new low-carbon heating system (e.g. hot water cylinder or low-temperature radiators) but also costs for the removal of components of the old heating system no longer required (e.g. boiler decommissioning) and costs for equipment not linked to the heating system (e.g. replacement of cooker/hob when moving to a non-gas based heating technology).

A list of the additional costs related to equipment and measures is reported in the table below. The applicability of these costs depends on the new heating technology that is being installed and on the counterfactual heating technology which is being decommissioned. Some of the additional components of the counterfactual heating system may be utilised for the new heating system.

Additional cost components

Equipment / measure	Fixed capex (£)	Marginal capex	Source	Assumptions
Hot water cylinder	1,059	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	180L storage volume
Additional thermal store to allow some use of Off peak electricity	1,711	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Two 180L hot water cylinders with shared installation cost

Equipment / measure	Fixed capex (£)	Marginal capex	Source	Assumptions
Point-of-use hot water systems	2,060	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Typical installation of 3 electric taps and 1 electric shower per dwelling
Conversion to low T radiators	1,100 to 2,567	-	Hybrid Heat Pumps (2017), Element Energy for BEIS	Applied in dwellings with existing wet heating system. Depending on building size.
Replacement of cooker/hob	315	-	Analysis of Alternative UK Heat Decarbonisation Pathways (2018), Imperial College for CCC	Weighted average across gas households, based on cost of £500 (2017 prices), 23.9m gas households, with 14.8m gas hobs and 8.4m gas ovens.
Installation of wet distribution system	1,273	5 £/m^2	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Only applied in dwellings with electric system
Removal of wet heating system	204		Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Only applied in dwellings with non-electric system
Decommissioning of boiler	509		Analysis of Alternative UK Heat Decarbonisation Pathways (2018), Imperial College for CCC	Includes decommissioning of other non-cooking gas appliances
H_2 conversion costs - hydrogen boiler, hydrogen hybrid HP	560		Hydrogen supply chain evidence base (2018), Element Energy for BEIS	£509 for pipework and £51 added as labour cost for the switchover of the Hyready boiler from gas to H2.
Additional pipework for communal ASHP in flat	3,364	-	Element Energy modelling for private sector client (2018)	Excluding internal emitter replacement. Includes heat exchange unit and meter. 2.5m service pipe per flat, 10m lateral pipe and 3.1m heat riser per floor, pump, installation and labour.
Additional pipework for communal HP in terrace house	6,157	-	Element Energy modelling for private sector client (2018)	Excluding internal emitter replacement. Includes heat exchange unit and meter. 30m external pipeline per communal heating system and 2.5m service pipe per house.
Wiring for direct electric heating	89	135 £/kW	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Only applied in dwellings with non-electric heating when switching to electric heating
Wiring for storage heating	509	178 £/kW	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Applied in dwellings with non-storage heating when switching to storage heating

Sources and assumptions on the cost of fuels and grid electricity

Fuel type	Sources	Assumptions
Electricity (Standard, Off Peak, On Peak)	Projections from BEIS Green Book data tables, Long-run variable costs of energy supply (LRVCs): Electricity LRVC – Central, Domestic. Off peak cost = 60% on-peak cost from Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	"Electricity - Standard" composed of 70% on-peak and 30% off-peak
Heat from DH	Cost calculated from modelling results based on District heating and local approaches to heat decarbonisation (2015) Element Energy for CCC 2015	
LPG (bottled gas)	Costs based on ratio of annual retail cost of LPG compared to natural gas from Biopropane for the off-grid sector (2016) EUA	
BioLPG	Costs based on ratio of annual retail cost of biopropane to natural gas from Biopropane for the off-grid sector (2016) EUA	
Biomethane	Costs based on ratio of annual retail cost of biomethane to natural gas. For large scale production, cost of biomethane: USD 0.65/LGE = 7.36 $c/kWh (from IRENA, Biomethane), natural gas price of 4.3 $c/kWh (from Oxford Institute for Energy Studies 2017, Biogas: A significant contribution to decarbonising gas markets?). Cost assumed to remain constant over time (from IRENA 2013, New fuels for transport: the cost of renewable solutions).	Assuming large scale production of biomethane. Cost of biomethane assumed to be 70% higher than natural gas in 2018.
Bioliquid 100	Costs based on ratio of annual retail cost of bioliquid B100 to diesel. Proportion of cost of Bioliquid B100 and of diesel from DOA alternative fuel price report (from US DOA, Alternative Fuel Price Report).	Cost of Bioliquid B100 25% higher than for diesel in 2018. Cost assumed to remain constant over time from 2020.
Gas	Projections from BEIS Green Book data tables, Long-run variable costs of energy supply (LRVCs): Gas LRVC – Central, Domestic	
Oil	CCC's long-term targets analysis (2019)	

Download HA dataset with the following columns:

- "UPRN",
- "URBAN_RURAL_CLASSIFICATION",
- "PROPERTY_TYPE",
- "PROPERTY_TENURE",
- "MIXED_TENURE",
- "PROPERTY_AGE",
- "FLOOR_AREA_ESTIMATE",
- "LISTED_BUILDING_GRADE",

- "WALL_CONSTRUCTION",
- "WALL_INSULATION_PREDICTION",
- "PROBABILITY_WALL_UNINSULATED",
- "FLOOR_CONSTRUCTION",
- "FLOOR_INSULATION",
- "LOFT_INSULATION_PREDICTION",
- "LOFT_INSULATION_PROBABILITY_0_99",
- "LOFT_INSULATION_PROBABILITY_100_",
- "LOFT_INSULATION_PROBABILITY_250M",
- "LOFT_INSULATION_PROBABILITY_NO_L",
- "MAIN_FUEL_TYPE",
- "MAIN_HEATING_SYSTEM",
- "OFF_GAS_GRID",
- "SAP_RATING_BAND",
- "FUEL_POVERTY_QUARTILE"

HiBs Costs and affordability – initial cost estimates

Overview of ZDEH Decarbonisation costs

This note provides initial outputs from modelling work for the costs and affordability project. It offers upfront cost estimates for the transition to ZDEH across all domestic and non-domestic properties based on the lowest capital cost technologies for each property as well as the lowest lifetime cost technologies (which may involve a higher upfront capital cost). Energy efficiency costs are also estimated.

Summary outputs

A simple inflation-adjusted revision of the £33bn costs in the HiBS strategy[1], would suggest a total cost in 2023 prices of £45bn. The overall cost range for installing ZDEH systems and improving energy efficiency based on a more refined mix of technologies and under differing assumptions on the number of properties connected to a heat network places the range for total costs at **[redacted]**.

HiBS Strategy document – original cost profile

The original £33bn HiBs costs were based on a simple NZDEH cost of £10k being applied across 2.2m properties (effectively assuming every property would require a heat pump), with EE costs of £2k being applied to the entire 2.5m dwellings in Scotland. Applying construction inflation of c.35% to this shows this figure would be the equivalent of £45bn now.

[redacted]

Estimates based on blend of ZDEH technologies and specific EE measures

This project has looked to consider a more refined blend of applicable technologies (including variable numbers of district heating connections). This involved drawing on data from Element Energy research to identify a range of possible technologies that might be applied to a particular property, and in many instances the average cost for installing the technology is lower than that originally estimated based on heat pumps.

Taking this more refined approach has also enabled the cost to be compared depending on whether the aim is to minimise the upfront capital costs or minimise the lifetime costs of the system. This has resulted in a range for the costs being identified based on combinations of both the level of district heating connections that might be made, as well as a range of technologies that might be selected.[3]

This more refined approach produces a total cost range for installation of ZDEH and upgrades to energy efficiency of between **[redacted]** (in 2023 prices). This is the upfront capital cost to the property owner and does not factor in any infrastructure costs associated with the construction of heat networks.

[redacted]

[1] https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

Private Rental Sector (PRS)

There are approximately 362,000 private rental sector (PRS) properties in Scotland, of which 50% are at EPC C or better. Two approaches have been used to estimate the cost of decarbonisation for the PRS stock. The first uses a blended average cost for NZDEH deployment alongside a list of specific energy efficiency measures (both approaches developed as part of this HiBS cost and affordability work). The second uses previous work undertaken by the Communities and Analytics Division and is adjusted for recent construction cost inflation.

Initial findings indicate a net zero decarbonisation cost for PRS properties in the region of **[redacted]** based on the proportionate share of overall costs above, with c.14.5% of the housing sock relating to the PRS sector. However, a more nuanced analysis in the body of the report suggests that the costs are more likely to be at the lower end of the spectrum, and in the range of **[redacted]**.

Steering Committee guidance and actions

In considering the outputs presented in this note, it would be helpful for the Steering Committee to reflect on the appropriateness of the blend of technologies proposed, and whether any proportional increases or decreases should be assumed regarding the likely technology mix. For example, if the number of assumed direct electric, electric storage or electric boilers were capped at a lower level, the overall costs would change as the next most suitable technology would have to be selected once any cap on the number of properties able to utilise a given technology was reached.

Non- domestic energy costs

OCEA have undertaken an initial update and approach to the decarbonisation costs for the non-domestic buildings, within the limitations of data available. Initial calculations indicate that costs remain in the region of **[redacted]**, but it is recognised that these are likely to be materially understated, based on other information eg Local Authority net zero strategic plans. Further exploration of non-domestic costs, including identifying the public sector cost will be a key component of the next steps.

Next steps

As well as further exploring the non-domestic costs, work now needs to be undertaken to consider the phasing of the indicative costs, aligned with the timing and backstop dates proposed in upcoming HiBs Regs and Social Housing Net Zero Standard consultations. This will then allow the funding component of the project to estimate the potential SG funding requirements over time.

HiBs Costs and affordability – initial modelling outputs for updated costs

Original HiBS costs utilised in the HiBS Strategy

The original HiBs Strategy estimate for decarbonisation costs for domestic sector buildings was based on a simple ZDEH cost of £10k (assuming that ASHP would be the dominant NZ technology) being applied across 2.2m properties, with EE costs of £2k being applied to the entire 2.5m dwellings in Scotland. Calculations underpinning this and detailing the methodology are available.

Applying construction inflation of 35% to these costs give an ZDEH cost of £13,500 per dwelling, and an average energy efficient improvement cost of c.£2,700 per dwelling. This gives a total net zero heating installation cost for domestic properties in the region of £36bn (in 2023 prices).

Applying a technology mix to ZDEH costs for domestic buildings

A dataset provided by Element Energy, accompanying their report to Scottish Government in 2020 was used as the primary source for undertaking an initial estimate of the ZDEH decarbonisation costs for Scotland's domestic housing stock. The dataset has approx. 3,500 house archetypes, and for each archetype, what technology could be applied to the dwelling, alongside the associated decarbonisation cost is identified. The methodology used in this project was;

- Determine which technologies should be included excluded for comparison from the Element Energy data set.
- Select lowest cost technology (either as upfront capital cost or by total life cost) applied across the 3,500 house archetypes.
- Create pivot chart that summarises the total cost and number of dwellings across each technology type.
- From this, a weighted average decarbonisation cost can be created and applied across the housing stock for each projected installation (work to be done). Assumes that the various technologies will be applied in similar proportions / profile over future years. (See example below).
- The base costs were adjusted to reflect construction cost inflation[2] of 35% (applied to both the ZDEH technology as well as associated ancillary works) from the base date of 2017.

Heat Network

Various levels of District Heating (DH) deployment have been considered with 250,000, 500,000 and 750,000 homes connecting to a DH network, representing around 10%, 20% and 30% of the housing stock respectively. Where DH has not been selected as a technology, the next lowest cost alternative has been used. It should be noted that the Element Energy data reflects only the basic cost of connection and installation of a HIU unit (c. in the region of £1,000) to a network, and so does not reflect the wider system costs that are likely to be incurred by the heat network supplier

[2]https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices ((Index at June 2017 – 113.7, and June 2023 – 105.1 a change of 31%, so 35% provides a conservative estimate of increased costs)

and recovered via a standing charge to a customer over the life of the asset. The total cost for a heat network installation is in the region of **[redacted]** per home and so it should be noted that the overall clean heat costs, do not include an additional **[redacted]** to reflect capex costs that will be paid for over time, versus at the point of installation.

The below table shows an upfront capital cost for installing ZDEH in the range of **[redacted]** depending on the number of properties connected to DH and whether seeking to minimise upfront capital costs or minimise lifetime system costs, even if this means higher initial capital costs.

[redacted]

The following tables provide further detail on the indicative total ZDEH capital costs applying various low-cost technologies to the domestic housing stock. In this first table, the technology with the lowest total cost over the life of the technology was selected for each of the 3,500 build archetypes. (Note that total lifetime costs for each technology considers the upfront and operational costs, although only the upfront capital costs have been included in reaching the total cost estimates presented as the main outputs in this paper).

Total ZDEH capital investment costs by minimising total lowest whole life cost

[redacted]

The above tables indicate a range of ZDEH costs from **[redacted]** (excluding energy efficiency improvements). This provides an average cost of **[redacted]** per dwelling excluding DH connections or **[redacted]** if DH connections are included.

The average cost for installation of ASHP is in line with other data sources (at around **[redacted]**) but other technologies such as electric storage and electric boilers do lower the overall average. The operational costs included in the tables reflect the undiscounted cost of energy and maintenance for the technology over its useful economic life. This suggests a total lifetime cost in the range of **[redacted]**. To ensure a fair comparison of technologies with differing lifetimes, a levelized unit cost of energy ('LCOE') was used to rank technologies[3];

The following table summarises the outputs when using the same methodology, except focused on minimise the upfront capital cost for ZDEH installations. Here the total life costs across the technologies is in the region of **[redacted]**, (compared to **[redacted]** above), with total upfront capital costs in the range **[redacted]**. In these scenarios the average cost per dwelling is estimated as being in the range of **[redacted]** when excluding DH connection, or £6,500 to £7,600 when including DH.

Question for the Steering Group to consider

Are the technologies identified below those which we would wish to see installed in practice or might some be discouraged / capped at a certain level?

3

Modelling could be adjusted to cap the total level of any technology at a given proportion of total dwellings. This would impact the overall cost estimates as properties would have to adopt the second cheapest technology once the cap on numbers was reached for the lowest cost option.

Alternatively, it might be possible to allow a range of technologies to be installed as compliant conversion to ZDEH but seek to only provide SG funding for particular technologies. Further consideration would need to be given to how this approach might be modelled as part of the funding component of this project.

Total NZDEH capital investment costs by minimising upfront capital expenditure

[redacted]

Energy Efficiency

Around 50% of domestic dwellings currently meet the EPC C banding, with c.1.2m potentially requiring improvement to facilitate application of various low temperature ZDEH technologies.

Current work by CAD, provides very early stage indicative costs for energy efficiency improvements in the region of **[redacted]** per property, which when applied to housing

stock that require improvement, indicates a total energy efficiency cost in the range of **[redacted]**.

Estimating energy efficiency cost improvements by applying a list of measures

Drawing on data from NHM, Technical Feasibility Report, BRE work and PEAT, along with housing stock data from Home Analytics, initial estimates of the total and per home average cost has been estimated, based on the following measures:

1. 270mm loft insulation
2. Cavity wall insulation
3. Draught proofing
4. Suspended floor insulation

Stock Summary

Home Analytics includes records for 2.76m dwellings (which compares to SHCS data of 2.5m). Of these, 1.43m fall below EPC C; 1.22m fall below EPC C and could install one of the measures above. While Home Analytics does not include an indicator for draught proofing it suggests the majority (590k) would get only one measure. 477k get two measures, and 157k get three.

Summary of Costings Data

Depending on the source and time period, estimates for the average cost for each measure are highly variable:

[redacted]

NHM

The National Housing Model (NHM) project was done using 2017 prices. However, it provides a detailed analysis of the entire stock, specifically with the goal of reaching certain energy efficiency targets.

The NHM identifies 1.6m properties below EPC C. Of these:

- The majority (57%) need only one measure to reach EPC C. The most commonly required is floor insulation
- 35% need two measures; of these, the most common combination is loft and floor insulation
- 9% need three or four measures; the majority of these need cavity, loft and floor insulation

To install these measures in these properties, in 2017 prices:

- The estimated total cost is £1.5bn (2023 prices - £2.0bn)
- The weighted average per home cost is £970 (2023 prices - £1,261)
- Per home costs are as low as <£100 and as high as nearly £7,000

35% of homes required only floor insulation, with an average per home cost of c.£700. A further 22% of homes require combinations of measures with an average cost less than £1,000, while 30% of homes require combinations of measures with

an average cost of around £1,300. 7% of homes require combinations of measures with an average cost above £1,500.

Element Energy undertook a report for Scottish Government that considered technical feasibility of low carbon heating in domestic buildings[4] and associated energy efficiency improvements. This report includes estimates of costings and proportions of the stock requiring each measure. This work is based on developing around 50,000 archetypes to represent the stock as a whole.

To simplify the stock to these archetypes, certain generalisations were made, particularly that all properties are assumed to have double or triple glazing. According to Home Analytics, less than 10% of the stock has single glazing, so this is considered to have a small impact. They use a combination of fixed and variable costs.

The costings are drawn from PEAT data, based on inputting 71,000 archetypes to represent the stock to the level of detail required by the PEAT tool. A key limitation of these costings is that the prices are for 2017, but in the table below these have been uplifted to reflect construction price inflation to 2023. Standard and “hard to treat” cavity wall insulation are treated separately, meaning that the cost for properties with hard-to-treat cavity wall insulation requirements is likely higher than the average shown below.

Average per home cost of selected measures

[redacted]

BRE work

The BRE work gave the following estimates for the relevant measures:

[redacted]

PEAT

The PEAT tool allows input of data from Home Analytics to provide a household-level estimate of costs to improve household efficiency. However, due to the complexity of the scenario modelling, it would take significant time to run this analysis on the entire stock.

As a short term stop-gap, a data set of c.1,300 homes were entered into the tool. The results were wide ranging in terms of the costs of each measure per the chart below:

[4] Technical Feasibility of Low Carbon Heating in Domestic Buildings : Report for Scottish Government’s Directorate for Energy & Climate Change (www.gov.scot)

[redacted]

Methodology

1. Identifying dwellings. Downloaded Home Analytics dataset with specific columns (see appendix):
2. Filter dataset to return only properties with:
    - EPC below C
    - Loft insulation below 250mm
    - Wall construction not solid brick or stone, and uninsulated
    - Floor construction suspended, and uninsulated

It was assumed these dwellings will be required by regulation to install some form of measure and are not restricted in doing so.

Results in 1.2m dwellings requiring some form of action.

3. Identifying costs

A dataset was downloaded from Home Analytics for c.1,300 dwellings (about 0.1% of the relevant stock), and subsequently uploaded to PEAT. For the measures detailed above, the average costs and ranges for this limited sample were identified:

[redacted]

4. Applying costs

Identified unit costs for each measure were indicated as follows:

[redacted]

These unit costs were then applied to the 1.2m dwellings outlined above.

Results

The initial results indicated that **[redacted]** could be affected by the regs (below EPC C & could have one of the measures installed[5].

- **[redacted]** have less than 250mm loft insulation and could have loft insulation
- **[redacted]** could get cavity wall insulation
- **[redacted]** could get suspended floor insulation

The majority (**[redacted]**) would get only one measure. **[redacted]** get two measures, and **[redacted]** get three, at a total cost of **[redacted]**, with a mean of **[redacted]** per home, and median of £2,540.

[5] HA does not include an indicator for draught proofing.

Across all combinations, a range of costs were identified, with 50% of dwellings seeing a cost between **[redacted]** per dwelling, with the lowest cost being **[redacted]**, and the highest is **[redacted]**.

Private Rental Sector net zero costs

The work outlined earlier in this report (based on differing blends of technologies, and minimising for either upfront capex costs or overall total life costs) indicated a cost of **[redacted]** for installation of ZDEH and improving energy efficiency, based on c.14.5% of housing being PRS. However, this range of costs can be narrowed by assuming that many PRS landlords are likely to install the cheapest upfront cost technology, which reduces the range of costs from above to be in the range of **[redacted]** (a per dwelling cost of **[redacted]** depending on whether you include DH connections in calculating the weighted average)

There are approximately 362,000 private rental sector properties in Scotland, of which 50% are at EPC C or better. As an early estimate, applying average energy efficiency costs of £2,550 to these dwellings and an average ZDEH cost in the range of **[redacted]** across all of the PRS stock, would indicate a total decarbonisation cost in a narrower range of **[redacted]**, and so at the lower end of the broad based estimate initial provided.

The Communities and Analytics Division have a draft report (not published) that has considered various decarbonisation scenarios across the domestic stock, using data and assumptions from the National Housing Model. A particular scenario (Version 1) within the various low carbon scenarios considered, was used to model a full decarbonisation of the housing stock assuming that the electricity supply can be fully decarbonised.

Under this scenario, the decarbonisation cost for the PRS sector was estimated to be in the region of **[redacted]**, based on 2017 prices. Adjusting for construction price inflation of 35%, would indicate an adjusted cost for the PRS sector (at 2023 prices) to be in the region of **[redacted]**.

These two independent approaches to estimating the PRS decarbonisation costs are relatively close in value and so does provide a degree of comfort around the cost estimate.

Air Source Heat Pump costs

A quick review of the current ASHP supply market was undertaken to validate some of the ASHP cost assumptions above etc. installation appears to be in the region of £13,000-£15,000 and the associated costs can be broadly allocated as follows;

Item Cost	range	Average cost	Percentage
Supply air source heat pump: Air-to-water (5kw - 17kw)	£5,000 - £9,000	£7,000	45%
Install air source heat pump: Air-to-water	£6,000 - £11,000	£8,000	55%
Total	£11,000-£20,000	£15,000	100%
Option - upgrade to larger radiators (assume 10 in property)	£2,000 - £5,000	£3,000	

Source: https://www.checkatrade.com/blog/cost-guides/air-source-heat-pump-cost

Reviews of current ASHP suppliers, indicate costs for the heat pump itself range **[redacted]** (including hot water cylinder) dependent on the power output ranging from 5kW to 16kW heat pump which would be used in larger homes. This indicates a minimum installation cost of **[redacted]** and a maximum installation cost of **[redacted]**.

APPENDIX

The analysis provided above utilised data provided by Element Energy in their reports 'Domestic Low Carbon Heating - Element Energy - Technical Feasibility costs v2, and 'Domestic Low Carbon Heating - Element Energy - Technical Feasibility - Appendix - Final Version' dated and March 2020 respectively.

Sources and assumptions on low-carbon heating technology costs

Technology	Sources	Assumptions
Gas boiler	As Fifth Carbon Budget, converted to 2020 prices.	
Oil boiler	As Fifth Carbon Budget, converted to 2020 prices.	
ASHP	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS	Reduction in cost of unit and installation of 20% between 2020 and 2040.
GSHP	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS	Reduction in cost of unit and installation of 20% between 2020 and 2040. Assuming ground loop shared between two properties.
High-T ASHP	2020 values from Evidence gathering - Domestic High Temperature Heat Pumps (2016), BEIS	Reduction in cost of unit and installation of 10% between 2020 and 2040.
High-T GSHP	2020 values from Evidence gathering - Domestic High Temperature Heat Pumps (2016), BEIS	Reduction in cost of unit and installation of 10% between 2020 and 2040. Assuming ground loop shared between two properties.
Communal ASHP	6 homes used as the size of the communal heating system based on the average terrace length from HCLG English Housing Survey 2017-2018	Assumes a communal HP serving 6 homes. Fixed and marginal capex and same as for individual ASHP and shared across the 6 homes.
Electric storage	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology.
Electric resistive	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology. Opex same as for electric storage.
Electric boiler	From Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Capex constant for all years, as established technology. Opex same as for gas boilers and electric storage
Solid biomass boiler	Capex from Fifth Carbon Budget dataset converted to 2020 prices. Opex from NERA 2009: The UK Supply Curve for Renewable Heat	
BioLPG boiler	Capex of unit and installation from ClimateXChange 2019, The potential contribution of bioenergy to Scotland's energy system. Additional opex for the delivery and storage of gas based on LPG Gas Central Heating Costs, Household Quotes 2018.	Opex same as for gas boiler with additional cost for the delivery and storage of bioLPG

Bioliquid boiler B100	ClimateXChange 2019, The potential contribution of bioenergy to Scotland's energy system. NNFCC 2019, Heating Options for Off-Gas Grid Consumers. BoilerGuide New Oil Boiler Replacement – Installation Costs (accessed 04/10/2019).	Dedicated bioliquid installation. Fixed opex assumed to be the same as for general boilers, plus oil tank costs. Oil tank can be rented or owned. Cost of tank rental or cost of own tank assumed to be equivalent and included in opex. Oil tank cost with installation £1,900 (over 15 yr)
Hydrogen boiler	Hydrogen supply chain evidence base (2018), Element Energy for BEIS	£153 added to cost of gas boiler to account for increased cost of Hydrogen boiler (Hydrogen-only boiler and Hyready boiler). Uplift of 50% in the opex compared to gas boiler due to the need to replace catalyst used to reduce NOx emissions (for both Hydrogen-only boiler and Hyready boiler).
Biomethane grid injection		Same appliance as gas boiler
Hybrid HP + gas	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS. Increase in capex for Hyready boiler and uplift in opex for catalyst replacement in line with Hydrogen supply chain evidence base (2018), Element Energy for BEIS	Hyready boiler in gas mode. Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system (£100 each) due to economies of scale.
Hybrid HP + bioliquid	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS. NNFCC 2019, Heating Options for Off-Gas Grid Consumers. BoilerGuide New Oil Boiler Replacement – Installation Costs (accessed 04/10/2019).	Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale. Additional OPEX £50 for small oil tank (£750 over 15 yr).
Hybrid HP + H2	2020 values from Hybrid Heat Pumps (2017), Element Energy for BEIS Increase in capex for Hyready boiler and uplift in opex for catalyst replacement in line with Hydrogen supply chain evidence base (2018), Element Energy for BEIS	Hyready boiler in hydrogen mode. Reduction in cost of heat pump unit of 20% between 2020 and 2040. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale; uplift of 50% in the component of the opex associated with the hydrogen boiler due to replacement of the catalyst used to reduce NOx emissions when operating in hydrogen mode.
Hybrid HP + resistive		Capex derived by removing boiler component of hybrid heat pump and adding cost of resistive heating based on modelled kW. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale.
Combinations with solar thermal	Costs as Fifth Carbon Budget, converted to 2020 prices. Heat delivered assumption based on	Heat delivered by solar collectors calculated assuming that solar thermal delivers no more than 60% of hot water demand or 643 kWh/kW, whichever is

	NERA 2009: The UK Supply Curve for Renewable Heat, table B.13	lower. Opex assumed to be £50 lower than the sum of the opex for the two components of the hybrid system due to economies of scale.

Additional costs

Additional costs considered in the EE study included costs for the installation of additional components required by the new low-carbon heating system (e.g. hot water cylinder or low-temperature radiators) but also costs for the removal of components of the old heating system no longer required (e.g. boiler decommissioning) and costs for equipment not linked to the heating system (e.g. replacement of cooker/hob when moving to a non-gas based heating technology).

A list of the additional costs related to equipment and measures is reported in the table below. The applicability of these costs depends on the new heating technology that is being installed and on the counterfactual heating technology which is being decommissioned. Some of the additional components of the counterfactual heating system may be utilised for the new heating system.

Additional cost components

Equipment / measure	Fixed capex (£)	Marginal capex	Source	Assumptions
Hot water cylinder	1,059	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	180L storage volume
Additional thermal store to allow some use of Off peak electricity	1,711	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Two 180L hot water cylinders with shared installation cost
Point-of-use hot water systems	2,060	-	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Typical installation of 3 electric taps and 1 electric shower per dwelling
Conversion to low T radiators	1,100 to 2,567	-	Hybrid Heat Pumps (2017), Element Energy for BEIS	Applied in dwellings with existing wet heating system. Depending on building size.
Replacement of cooker/hob	315	-	Analysis of Alternative UK Heat Decarbonisation Pathways (2018), Imperial College for CCC	Weighted average across gas households, based on cost of £500 (2017 prices), 23.9m gas households, with 14.8m gas hobs and 8.4m gas ovens.
Installation of wet distribution system	1,273	5 £/m^2	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Only applied in dwellings with electric system
Removal of wet heating system	204		Evidence gathering for electric heating options in	Only applied in dwellings with non-electric system

Equipment / measure	Fixed capex (£)	Marginal capex	Source	Assumptions
			off gas grid homes (2019), Element Energy for BEIS	
Decommissioning of boiler	509		Analysis of Alternative UK Heat Decarbonisation Pathways (2018), Imperial College for CCC	Includes decommissioning of other non-cooking gas appliances
H_2 conversion costs - hydrogen boiler, hydrogen hybrid HP	560		Hydrogen supply chain evidence base (2018), Element Energy for BEIS	£509 for pipework and £51 added as labour cost for the switchover of the Hyready boiler from gas to H2.
Additional pipework for communal ASHP in flat	3,364	-	Element Energy modelling for private sector client (2018)	Excluding internal emitter replacement. Includes heat exchange unit and meter. 2.5m service pipe per flat, 10m lateral pipe and 3.1m heat riser per floor, pump, installation and labour.
Additional pipework for communal HP in terrace house	6,157	-	Element Energy modelling for private sector client (2018)	Excluding internal emitter replacement. Includes heat exchange unit and meter. 30m external pipeline per communal heating system and 2.5m service pipe per house.
Wiring for direct electric heating	89	135 £/kW	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Only applied in dwellings with non-electric heating when switching to electric heating
Wiring for storage heating	509	178 £/kW	Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	Applied in dwellings with non-storage heating when switching to storage heating

Sources and assumptions on the cost of fuels and grid electricity

Fuel type	Sources	Assumptions
Electricity (Standard, Off Peak, On Peak)	Projections from BEIS Green Book data tables, Long-run variable costs of energy supply (LRVCs): Electricity LRVC – Central, Domestic. Off peak cost = 60% on-peak cost from Evidence gathering for electric heating options in off gas grid homes (2019), Element Energy for BEIS	"Electricity - Standard" composed of 70% on-peak and 30% off-peak
Heat from DH	Cost calculated from modelling results based on District heating and local approaches to heat decarbonisation (2015) Element Energy for CCC 2015	
LPG (bottled gas)	Costs based on ratio of annual retail cost of LPG compared to natural gas from Biopropane for the off-grid sector (2016) EUA	

BioLPG	Costs based on ratio of annual retail cost of biopropane to natural gas from Biopropane for the off-grid sector (2016) EUA	
Biomethane	Costs based on ratio of annual retail cost of biomethane to natural gas. For large scale production, cost of biomethane: USD 0.65/LGE = 7.36 $c/kWh (from IRENA, Biomethane), natural gas price of 4.3 $c/kWh (from Oxford Institute for Energy Studies 2017, Biogas: A significant contribution to decarbonising gas markets?). Cost assumed to remain constant over time (from IRENA 2013, New fuels for transport: the cost of renewable solutions).	Assuming large scale production of biomethane. Cost of biomethane assumed to be 70% higher than natural gas in 2018.
Bioliquid 100	Costs based on ratio of annual retail cost of bioliquid B100 to diesel. Proportion of cost of Bioliquid B100 and of diesel from DOA alternative fuel price report (from US DOA, Alternative Fuel Price Report).	Cost of Bioliquid B100 25% higher than for diesel in 2018. Cost assumed to remain constant over time from 2020.
Gas	Projections from BEIS Green Book data tables, Long-run variable costs of energy supply (LRVCs): Gas LRVC – Central, Domestic	
Oil	CCC's long-term targets analysis (2019)	

V0.1

Heat in Buildings Bill: Costs & Affordability

Main Messages

- **[redacted]**
- The Climate Change Act (Scotland) 2009 sets out the Just Transition Principles as reducing emissions in a way which tackles inequality and promotes fair work, at the heart of Scotland's approach to reaching net zero. In practical terms, a just transition is both the outcome; a fairer, greener future for all as well as the process to achieving this; a process which must be undertaken in partnership with those impacted the most. This will be achieved through co-design and collaboration to ensure that benefits of the transition are equally distributed. SG will publish guiding principles to underpin our commitment that no one is left behind in the heat transition which will include transitional support for those in fuel poverty. Further analysis is being undertaken to consider the distributional impacts of decarbonising our homes and buildings and how we can mitigate them.
- **[redacted]**
- **[redacted]**
- **[redacted]**

[redacted]

Interaction with cost cap

- **[redacted]**
- **[redacted]**

Scottish Government Schemes

The Warmer Homes Scotland programme run by Warmworks on behalf of the Scottish Government is the national fuel poverty scheme which fully funds and project manages the installation of energy efficiency improvements and zero emission heating systems. In 2022/23, Warmworks supported almost 5,500 homes and families, completing almost 12,000 individual heating and insulation upgrades. Since 2015 Warmer Homes Scotland has supported more than 35,000 homes and families across the country.[1]

There is no RDEL for Warmworks operations for WHS. Warmworks management fees are now an extra cost added onto the capital grant therefore, for example, if an install is £10K, a management fee will be added

[1] 107616-002_WW_Warmer_Homes_Scotland_Annual_Report_v5_AW_web.pdf (warmworks.co.uk)

to this figure and will then be paid through capital. Warmworks costs can be broken down as follows:

- **[redacted]**

- **HES grants and loans** allocated for current financial year is **[redacted]** in capital loans[2] and **[redacted]**in recycled financial transactions (which we do not keep). SG resource is **[redacted]** for contract costs (EST) and SG staff costs are approx. **[redacted]**.

- **[redacted]**

UK Government Schemes

ECO and GBIS

The Great British Insulation Scheme (GBIS) supports eligible British homeowners to install wall, loft, roof and park home insulation if the property has an EPC certificate of D to G and is in council taxa bands A – E in Scotland. Eligibility criteria to benefit from full or partial funding includes qualifying benefits including Universal Credit, Child and Working Tax Credit and legacy benefits. Limited information has so far been published about take-up of the scheme but as of January we estimate that around 140 Scottish households have benefitted from the scheme (4%).

Energy Company Obligation (ECO4) grants in Scotland are available until March 2026 and obligate larger energy companies to put money aside for the scheme. Scottish homeowners and private tenants who are in fuel poverty can fully fund energy efficiency improvements and clean heat installations for their property. Properties must have a low energy rating (D and below) and high energy costs (as defined by Ofgem), typically those using electric heating or off-grid gas heating like oil and LPG boilers. Eligibility requirements are as for GBIS and works can include cavity and solid wall insulation, solar panels and heat pumps.

From October to December 2023 Scottish properties received 6,700 ECO financed energy efficiency measures or 8% of all GB measures. These benefitted around 1,600 Scottish households with more than 90% of ECO financed measures benefitting detached properties belonging to an owner occupier. Analysis of ECO4 delivery data suggests that many of these households were in off gas network areas and ECO Flex was a significant factor in establishing household eligibility.

Based upon share of measures, we estimate that c.£100 million has been spent on Scottish properties from March to December. This is an average delivery cost of £5,466.52 per ECO measure or £26,398.37 per household.

[2] £23 million covers all loans for EST including HES SME, WABS, PRS and Equity.

	Insulation	Gas boiler	Clean heat	Solar PV	Heating controls	Total (includes Windows & doors)	Households receiving ECO measure (Scotland)	Estimated ECO costs claimed (Scotland)
Oct-Dec 23	1,919	517	922	880	3,311	7,550	1604	TBC
Share of GB	7.1%	5.5%	17.8%	17.1%	6.7%	7.8%	8.2%	(7.8%)
Year to date	4,726	1,226	2,426	2,119	7,957	18,455	3,998	£62.5m
YTD share	7.5%	5.4%	23.0%	17.6%	6.8%	8.1%	8.9%	(8.1%)

ECO finance can no longer be blended with SG funding, so there is no longer the scope to leverage ECO finance as in previous years, however it is leveraged through HEEPS ABS and WHS, this is described as ECO Flex and Scotland has the second highest proportion of ECO Flex funded measures, worth perhaps £40 – 50 million last year.

- **[redacted]**
- **[redacted]**
- **[redacted]**
- **[redacted]**

Purpose

Provide an update, and further breakdown *by tenure*, of cost estimates for clean heat and achieving minimum energy efficiency standards, in accordance with the proposed Heat in Buildings Bill. This paper also sets out an estimate of the likely cost to government, although further analysis is required. Furthermore, it also provides an initial estimate of the costs of implementing and operating the proposed legislation.

Recommendation

You are invited to note the contents of this submission.

[ANY OTHER RECOMMENDATIONS?]

Context

The 2021 Heat in Buildings Strategy estimated the total capital cost of installing clean heat and upgrading energy efficiency across all Scotland's buildings at £33 billion. The £33 billion figure was based on a limited set of technologies, installation of heat pumps across all properties as well as applying an energy efficiency uplift.

Over the course of this Session of Parliament the Scottish Government has committed to allocating £1.8 billion to heat and energy efficiency. The Scottish Government continues to face questions on the extent to which public funding will be available to support the transition to clean heat and energy efficiency. It was raised

by XX% of consultation responses, who noted that grant, interest free loans and access to finance more widely, were seen as key enablers and barriers to acceptance.

We are already seeing rising demand across all support schemes, putting increasing pressure on budgets. In order for schemes to be sustainable over the even short term, changes will be required to limit demand or capital budgets will need to increase.

A detail financial memorandum is required alongside the Bill. It should set out the costs arising from the proposed measures and how these will fall on the Scottish Government, Local Government as well as other organisations, businesses and individuals.

Estimated Capital Cost

We have worked with SFT to develop a new model, which is now being utilised to estimate costs. This allows for a more detailed and granular breakdown of costs. This model is now being validated, and so the figures presented below should only be considered as initial estimates.

Based on revised modelling, which assumed a more mixed range balance of technologies, including XX% of the building stock connecting to heat networks (detailed at Annex A) the total estimated cost of meeting the 2033 Minimum Energy Efficiency Standard and the 2045 backstop for clean heating is **[redacted]**. This is broken down as follows per Table 1.

[redacted]

Assuming that activity is driven in line by the proposed legislative triggers the costs will not fall evenly over time. Capital spend will occur early driven by:

- The 2028 minimum energy efficiency standard for PRS homes
- The 2033 minimum energy efficiency standard for owner occupied homes
- The property sales trigger for clean heating (in all buildings)

Where there is no legal requirement for early action, for the purposes of the modelling it is assumed that spend occurs in the period 2040-2045. However, it reality it can be assumed that some of these capital costs will be accrued earlier as households and organisations choose to take early action to comply, for example as they replace expired heating systems.

Table 2 - Forecast cost profile in 5 year periods with introduction of HiBs Bill (£ billion in 2023 prices)

[redacted]

Public Sector costs over time

[redacted]

redacted]

[redacted]

Non-domestic costs over time

[redacted]

[redacted]

Heat network costs overtime

[redacted]

[redacted]

Public Affordability and Acceptability

People and organisations already spend on replacing heating systems. It is estimated that annually **[redacted]** is spent on replacing gas and oil boilers, based on assumption that a replacement boiler costs **[redacted]**.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

<u>Businesses</u>

[redacted]

[redacted]

The costs accruing to the Scottish public sector fall into three main categories:

i. CDEL costs of providing support for works to comply with standards, e.g. grants and loans.
ii. RDEL costs associated with managing capital programmes and providing advice services.

iii. RDEL costs associated with establishing and operating the proposed regulatory system.

CDEL: Cost of providing grants and loans

Scottish Government support schemes already provide significant and extensive, sector / tenure wide support. This is outline at Annex B. Continuing to offer the same level of funding out to 2045 based on two scenarios:

Regulatory only scenario ---

Regulation + some early action ---

Note will also want to include HN costs in here.

RDEL: costs associated with managing capital programmes and advice services

Will also want to include HN development costs in here.

RDEL: costs of establishing and maintain proposed regulatory system

Some sectors / tenures will be wholly, or significantly, reliant on public spending to meet the regulatory targets. These are:

- Public sector estate
- Social Housing (particularly local authority owned housing)

Implications for affordability

1. . Work is currently underway with the Scottish Futures Trust to refresh this figure and to provide a breakdown by tenure as well as an indicative profile over time for both energy efficiency upgrades and clean heat installation. This will enable us to assess cost profiles under a range of scenarios including with the introduction of the HIB Bill.

2. In updating this cost figure we are considering the technology mix which is likely to apply as the overall building stock converts to clean heat. As some technologies which would be compliant with a clean heat definition typically cost less than installation of a heat pump, the initial outputs of this modelling suggest that costs may not be hugely different, the total capital investment cost for end users being estimated at around **[redacted]** for domestic properties compared to the £27 billion currently in the public domain.

3. The below table summarises the overall estimated cost for meeting the energy efficiency backstop proposed in the HIB Bill consultation for Owner Occupiers

and Private Rented Sector (PRS) as well as for all those properties to convert to clean heat by 2045. Costs for social housing and for non-domestic properties are not included.

5 year cost estimates for meeting MEES and installing clean heat in OO and PRS
[redacted]

4. The table shows a total cost for owner occupiers and PRS of **[redacted]** with a cost of **[redacted]** for the five year period from 2025 to 2030 and similar costs for the subsequent two five year periods. The reason for the very high cost **[redacted]** for the final five year period to 2045 is because the model assumes a high number of conversations in 2045 so that all properties will have clean heating by the required backstop, although the profile of underlying installation rates combined with point of sale trigger conversations would not achieve this on their own. The estimate for the five years to 2045 is therefore unrealistic but is required for modelling purposes so that the total cost figure reflects the costs for conversion of the whole stock.

5. **[redacted]**

6. **[redacted]**

7. **[redacted]**

8. **[redacted]**

9. **[redacted]**

NON-DOMESTIC EMISSIONS ABATEMENT AND COSTS

Introduction

This note provides a summary of analysis relating to emissions abatement and estimated costs of decarbonising non-domestic buildings in Scotland, in line with proposed Heat in Buildings (HiB) regulations.

Due to the challenges in conducting analysis of the non-domestic building stock (more detail provided in the next section) simplifying assumptions have been made throughout. Therefore, all estimates should be viewed as indicative only and treated with caution.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

HiBs Cost & Affordability Steering Group

October meeting – summary note

Updates & presentations

1. The Future Finance team provided an update on work undertaken since the last meeting, briefly outlining progress made on assumptions and revisiting project timelines.

[redacted]

3. A colleague delivered a presentation on Cost Caps for consideration to include in this work.

Discussions

<u>Group which own converted properties but not fully complied in regard to energy efficiency (EE) measures.</u>

[redacted]

[redacted]

The steering group agreed to come back to this via correspondence (action).

[redacted]

[redacted]

[redacted]

[redacted]

A steering group member noted his disagreement with the above and named two issues with it:

[redacted]

<u>Metrics for identifying financially vulnerable in other countries</u>

A steering group member expressed asked for information on what other countries do in terms of specific schemes, eligibility criteria & categorisation of levels of support. The Future Finance team to look into it and circulate a paper on this (action).

Conclusions & actions

1. **[redacted]**

2. It was agreed that despite complete clarity on some details, modelling should begin.

3. **[redacted]**

4. **[redacted]**

5. Action: Future Finance team to look at various tax bands and other classifications of income to continue the work of identifying the most appropriate tier support system.

3. **[redacted]**

4. Action: Future Finance team to look at provisions in other countries to help the financially vulnerable - specific schemes, eligibility criteria & categorisation of levels of support.

Hi **[redacted]**,

Please find attached below my draft of the notes from Tuesday's steering group meeting.

Thanks,
[redacted]

[redacted]
Heat in Buildings Delivery Officer | Public Engagement, Behaviours and Communications & Future Finance | Futures Unit, Heat in Buildings Division | Directorate for Energy and Climate Change | 5 Atlantic Quay, 150 Broomielaw, Glasgow, G2 8LU

[redacted]

Hi all,

[redacted] and I met earlier today to discuss non-domestic cost estimates.

[redacted]

[redacted]

[redacted]

[redacted]

In the meantime, particularly with the next steering group for the affordability work coming up and questions likely to come in during the consultation period, I've suggested some lines below. Feel free to comment/amend however note I'll be on annual leave until January from around 5pm today. **[redacted]** and **[redacted]** will aim to pick up urgent questions in the meantime.

Thanks,
[redacted]

- We are continuing to refine our estimate of the cost of decarbonising non-domestic buildings in Scotland, including the public sector estate
- New data is due to become available in the coming months, which should help inform this
- The estimate of around £6 billion continues to be a reasonable estimate of the cost of installing clean heat, such as heat pumps and connections to heat networks. This will vary depending on the technology mix.
- However, the cost of energy efficiency improvements, which are not proposed to be legally mandated but are often a prerequisite to installing clean heat, will be additional and could be significant
- Other additional infrastructure costs could also be significant, such as the cost of constructing heat networks, which may fall on Local Authority balance sheets.

From: **[redacted]**
Sent: Wednesday, November 15, 2023 4:25 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello,

I can attend the first half of the meeting so hopefully we can cover off then?

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 3:13 PM
To: **[redacted]**

Subject: RE: Public sector buildings

Thanks **[redacted]**.

I was going to suggest we pick up at the meeting scheduled for 11 am next Wednesday, but aware you may not be able to make that. Is there another time that would suit better?

I'll be away for the remainder of the year after Wed.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 10:16 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello **[redacted]**,

Happy to share the data we have- might be helpful for us to have a discussion around the sort of things that would be helpful for us to inform some of the analysis as we likely have a lot more of it than we think. **[redacted]**

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:38 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Not at all – it's all helpful in building a picture of what we do and don't know and how we can fill the gaps.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:37 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, and sorry for the change of heart.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:35 AM

To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:16 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**,

That text looks good to me as a summary of **[redacted]** estimates (and thanks **[redacted]**!), with caveats we need around them.

[redacted]

[redacted]

Thanks again,

[redacted].

From: **[redacted]**
Sent: Tuesday, November 14, 2023 4:11 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

Of course, no problem. The sub is hopefully going up this week I believe.

Would something along the lines below be ok? (**[redacted]**– any thoughts on this?)

Thanks,

[redacted]

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 3:50 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Also sorry if this figure is to be used could you please share the doc with me so I can ensure it's appropriated communicated and caveated.

It is the cost of installing clean heat only and does not include any energy efficiency costs.

Thanks,
[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 1:54 PM
To: **[redacted]**
Subject: RE: Public sector buildings

No problem, and thanks.

When is the sub due to go up?

I have revised the **[redacted]** as part of my analysis, however as this figure is in the public domain and is quoted in the Partial BRIA accompanying the consultation, probably best to stick with it for now.

[redacted]

[redacted]

[redacted]

If you're aware of any other data which could be used, please do flag.

Happy to discuss.

[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:49 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:03 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

As you're aware I've been updating the analysis on non-domestic emissions and costs. **[redacted]**

[redacted]

I'll also set up a call to discuss.

Is there something you need this information for in particular/in the meantime?

[redacted]

From: **[redacted]**
Sent: Monday, November 13, 2023 6:01 PM
To: **[redacted]**

Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 13, 2023 12:57 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi Emaline,

Sorry for not coming back to you last week, if you could also copy in **[redacted]** and **[redacted]** as optional attendees, that would be really helpful.

Do we have an initial overall estimate for the cost for public sector buildings as part of the affordability work? (and sorry if I have asked before and forgotten the answer!)

Thanks

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 6, 2023 10:47 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, that's helpful.

[redacted]

[redacted]

Best wishes,
[redacted]

From: **[redacted]**
Sent: Wednesday, November 1, 2023 5:03 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Wednesday, November 1, 2023 9:18 AM
To: **[redacted]**
Subject: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

Thanks!
[redacted]

[redacted] (She/Her)
Economic Advisor | Heat in Buildings Economics
Office of the Chief Economic Advisor – OCEA | Scottish Government

My working days are Monday to Wednesday

Copying **[redacted]** in as the SRO for the costs and affordability piece of work. Some reflections / questions noted below. Thanks

[redacted] (he / him)
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

From: **[redacted]**
Sent: Wednesday, November 22, 2023 2:47 PM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Hi all,

[redacted] and I met earlier today to discuss non-domestic cost estimates.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

In the meantime, particularly with the next steering group for the affordability work coming up and questions likely to come in during the consultation period, I've suggested some lines below. Feel free to comment/amend however note I'll be on annual leave until January from around 5pm today. **[redacted]** and **[redacted]** will aim to pick up urgent questions in the meantime. **[redacted]**

Thanks,
[redacted]

- We are continuing to refine our estimate of the cost of decarbonising non-domestic buildings in Scotland, including the public sector estate

- New data is due to become available in the coming months, which should help inform this
- The estimate of around £6 billion continues to be a reasonable estimate of the cost of installing clean heat, such as heat pumps and connections to heat networks. This will vary depending on the technology mix.
- However, the cost of energy efficiency improvements, which are not proposed to be legally mandated but are often a prerequisite to installing clean heat, will be additional and could be significant
- Other additional infrastructure costs could also be significant, such as the cost of constructing heat networks, which may fall on Local Authority balance sheets.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 4:25 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello,

I can attend the first half of the meeting so hopefully we can cover off then?

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 3:13 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**.

[redacted]

[redacted]

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 10:16 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello **[redacted]**,

[redacted]

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:38 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Not at all – it's all helpful in building a picture of what we do and don't know and how we can fill the gaps.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:37 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, and sorry for the change of heart.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:35 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:16 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**,

That text looks good to me as a summary of **[redacted]** estimates (and thanks **[redacted]**!), with caveats we need around them.

[redacted]

[redacted]

Thanks again,

[redacted].

From: **[redacted]**
Sent: Tuesday, November 14, 2023 4:11 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

Of course, no problem. The sub is hopefully going up this week I believe.

Would something along the lines below be ok? (**[redacted]**– any thoughts on this?)

Thanks,

Eleanor

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 3:50 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Also sorry if this figure is to be used could you please share the doc with me so I can ensure it's appropriated communicated and caveated.

It is the cost of installing clean heat only and does not include any energy efficiency costs.

Thanks,

[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 1:54 PM
To: **[redacted]**
Subject: RE: Public sector buildings

No problem, and thanks.

When is the sub due to go up?

I have revised the **[redacted]** as part of my analysis, however as this figure is in the public domain and is quoted in the Partial BRIA accompanying the consultation, probably best to stick with it for now.

[redacted]

[redacted]

[redacted]

If you're aware of any other data which could be used, please do flag.

Happy to discuss.

[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:49 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:03 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

As you're aware I've been updating the analysis on non-domestic emissions and costs. **[redacted]**

[redacted]

I'll also set up a call to discuss.

Is there something you need this information for in particular/in the meantime?

[redacted]

From: **[redacted]**
Sent: Monday, November 13, 2023 6:01 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 13, 2023 12:57 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

Sorry for not coming back to you last week, if you could also copy in **[redacted]** and **[redacted]** as optional attendees, that would be really helpful.

Do we have an initial overall estimate for the cost for public sector buildings as part of the affordability work? (and sorry if I have asked before and forgotten the answer!)

Thanks

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 6, 2023 10:47 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, that's helpful.

[redacted]

[redacted]

Best wishes,
[redacted]

From: **[redacted]**
Sent: Wednesday, November 1, 2023 5:03 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Wednesday, November 1, 2023 9:18 AM
To: **[redacted]**
Subject: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

Thanks!
[redacted]

[redacted] (She/Her)
Economic Advisor | Heat in Buildings Economics
Office of the Chief Economic Advisor – OCEA | Scottish Government

My working days are Monday to Wednesday

Thanks **[redacted]**. Have responded in orange below. **[redacted]**

It might be worth picking up with **[redacted]** and co as to what was agreed on how to present the figures.

Thanks,
[redacted]

From: **[redacted]**
Sent: Wednesday, November 22, 2023 3:58 PM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Copying **[redacted]** in as the SRO for the costs and affordability piece of work. Some reflections / questions noted below. Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

From: **[redacted]**
Sent: Wednesday, November 22, 2023 2:47 PM
To: **[redacted]**

Cc: **[redacted]**

Subject: RE: Public sector buildings

Hi all,

[redacted] and I met earlier today to discuss non-domestic cost estimates.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

In the meantime, particularly with the next steering group for the affordability work coming up and questions likely to come in during the consultation period, I've suggested some lines below. Feel free to comment/amend however note I'll be on annual leave until January from around 5pm today. **[redacted]** and **[redacted]** will aim to pick up urgent questions in the meantime. The steering group has been moved back to 11 December given the flurry of activity happening over the next few weeks. There are likely to be other aspects of the work which the Steering Group will focus on at its next meeting but I think we will need to come back to this further, probably with more offline discussion with **[redacted]**, **[redacted]**and **[redacted]** over the period up to Christmas.

Thanks,
[redacted]

- We are continuing to refine our estimate of the cost of decarbonising non-domestic buildings in Scotland, including the public sector estate
- New data is due to become available in the coming months, which should help inform this
- The estimate of around £6 billion continues to be a reasonable estimate of the cost of installing clean heat, such as heat pumps and connections to heat networks. This will vary depending on the technology mix.
- However, the cost of energy efficiency improvements, which are not proposed to be legally mandated but are often a prerequisite to installing clean heat, will be additional and could be significant
- Other additional infrastructure costs could also be significant, such as the cost of constructing heat networks, which may fall on Local Authority balance sheets.

[redacted]

Hi all,

[redacted] and I met earlier today to discuss non-domestic cost estimates.

[redacted]

[redacted]

[redacted]

[redacted]

In the meantime, particularly with the next steering group for the affordability work coming up and questions likely to come in during the consultation period, I've suggested some lines below. Feel free to comment/amend however note I'll be on annual leave until January from around 5pm today. **[redacted]** and **[redacted]** will aim to pick up urgent questions in the meantime.

Thanks,
[redacted]

- We are continuing to refine our estimate of the cost of decarbonising non-domestic buildings in Scotland, including the public sector estate
- New data is due to become available in the coming months, which should help inform this
- The estimate of around £6 billion continues to be a reasonable estimate of the cost of installing clean heat, such as heat pumps and connections to heat networks. This will vary depending on the technology mix.
- However, the cost of energy efficiency improvements, which are not proposed to be legally mandated but are often a prerequisite to installing clean heat, will be additional and could be significant
- Other additional infrastructure costs could also be significant, such as the cost of constructing heat networks, which may fall on Local Authority balance sheets.

From: **[redacted]**
Sent: Wednesday, November 15, 2023 4:25 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello,

I can attend the first half of the meeting so hopefully we can cover off then?

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 3:13 PM
To: **[redacted]**

Subject: RE: Public sector buildings

Thanks **[redacted]**.

[redacted]

[redacted]

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 10:16 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hello **[redacted]**,

[redacted]

Thanks,

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:38 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Not at all – it's all helpful in building a picture of what we do and don't know and how we can fill the gaps.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:37 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, and sorry for the change of heart.

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:35 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

From: **[redacted]**
Sent: Wednesday, November 15, 2023 9:16 AM
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**,

That text looks good to me as a summary of **[redacted]** estimates (and thanks **[redacted]**!), with caveats we need around them.

[redacted]

[redacted]

Thanks again,

[redacted].

From: **[redacted]**
Sent: Tuesday, November 14, 2023 4:11 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

Of course, no problem. The sub is hopefully going up this week I believe.

Would something along the lines below be ok? (**[redacted]** – any thoughts on this?)

Thanks,

[redacted]

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 3:50 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Also sorry if this figure is to be used could you please share the doc with me so I can ensure it's appropriated communicated and caveated.

It is the cost of installing clean heat only and does not include any energy efficiency costs.

Thanks,
[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 1:54 PM
To: **[redacted]**
Subject: RE: Public sector buildings

No problem, and thanks.

When is the sub due to go up?

I have revised the **[redacted]** as part of my analysis, however as this figure is in the public domain and is quoted in the Partial BRIA accompanying the consultation, probably best to stick with it for now.

[redacted]

[redacted]

[redacted]

If you're aware of any other data which could be used, please do flag.

Happy to discuss.

[redacted]

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:49 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Tuesday, November 14, 2023 11:03 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

As you're aware I've been updating the analysis on non-domestic emissions and costs. **[redacted]**.

[redacted]

I'll also set up a call to discuss.

Is there something you need this information for in particular/in the meantime?

[redacted]

From: **[redacted]**
Sent: Monday, November 13, 2023 6:01 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 13, 2023 12:57 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

Sorry for not coming back to you last week, if you could also copy in **[redacted]** and **[redacted]** as optional attendees, that would be really helpful.

Do we have an initial overall estimate for the cost for public sector buildings as part of the affordability work? (and sorry if I have asked before and forgotten the answer!)

Thanks

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Monday, November 6, 2023 10:47 AM
To: **[redacted]**
Subject: RE: Public sector buildings

Thanks **[redacted]**, that's helpful.

[redacted]

[redacted]

Best wishes,
[redacted]

From: **[redacted]**
Sent: Wednesday, November 1, 2023 5:03 PM
To: **[redacted]**
Subject: RE: Public sector buildings

Hi **[redacted]**,

[redacted]

Thanks,

[redacted]

[redacted]
(She/her)

Head of Non-Domestic Heat in Buildings Regulations | Heat Networks and Non-Domestic Regulations Unit | Heat in Buildings Policy and Regulations Division
Directorate for Energy and Climate Change
Scottish Government

[redacted]
3F South, Victoria Quay, Edinburgh, EH6 6QQ

From: **[redacted]**
Sent: Wednesday, November 1, 2023 9:18 AM
To: **[redacted]**
Subject: Public sector buildings

Hi both,

[redacted]

[redacted]

[redacted]

[redacted]

Thanks!
[redacted]

[redacted] (She/Her)
Economic Advisor | Heat in Buildings Economics
Office of the Chief Economic Advisor – OCEA | Scottish Government

My working days are Monday to Wednesday

Hello all,

Please find below the agenda for the above meeting (subject to **[redacted]** attendance owing to possible Jury Duty):

The purpose of this meeting is to understand where we have got to, the structure of underlying modelling options and how to approach the next steps.

Agenda

- Summary of the EE and NZDEH costs paper, including treatment of District Heating (attached to this email)
- Next steps:

[redacted]
[redacted]
[redacted]
If you have anything to add, please let me know.

Regards

[redacted]

** Please note I now work from home and the office and will be available on Microsoft teams and email **
[redacted] | Senior Policy Officer | Future Finance Team | Heat in Buildings Future Delivery Unit | Heat & Energy Efficiency Scotland
The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415

Hi **[redacted]**,

Apologies for taking so long in getting back to you!

The £33 billion figure – as the footnote on P81 of the strategy says - it might vary over time depending on the actual path to decarbonising. It was a cost which was estimated internally for inclusion in that Strategy and is still the cost we use to provide an indicative overall cost. We acknowledge the current cost may be higher or lower than this figure, depending on the assumptions you apply.

Internally we are interested in getting a more detailed understanding of the costs across different types of properties and for the deployment of different types of technology. **[redacted]**

Regards

[redacted]

From: **[redacted]**
Sent: Tuesday, November 28, 2023 3:48 PM
To: **[redacted]**
Cc: **[redacted]**
Subject: FW: LHEES Review - Update

Hi **[redacted]**,

We have had the below query from Fife regarding the £33 Billion figure. Do you know if we have any background analysis that we can share on where this comes from?

Thanks,

[redacted]

From: **[redacted]**
Sent: 24 November 2023 11:44
To: **[redacted]**
Cc: **[redacted]**
Subject: RE: LHEES Review - Update

Good morning **[redacted]**,

I'm reading through the green heat task force report at the moment. Like the Heat in Buildings Strategy, it references the £33 billion estimated cost of decarbonising heat/energy efficiency. I was wondering if there is a public report/paper showing a breakdown of this calculation including method? If so, can this be shared?

Would be interesting to see, and also something to consider when estimating total cost for Fife (we have PEAT for domestic, but nothing similar for non-domestic)

Thanks
[redacted]

From: **[redacted]**
Sent: Thursday, November 23, 2023 2:30 PM
Cc: **[redacted]**
Subject: LHEES Review - Update

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi All,

I hope this finds you well.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Regards,

[redacted]

Heat in Buildings Division| Directorate of Energy and Climate Change | Scottish Government
[redacted]

Hi **[redacted]**,

Just about to head to office, so here is a copy of the updated report that hopefully reflects the points raised by **[redacted]**and **[redacted]**.

Feel free to make any other amends before sending onwards.

Speak soon,

[redacted]

[redacted]
Positive Impacts
Following the most recent COVID-19 advice from the UK and Scottish Government, SFT has closed its office. All staff will be working from home for the foreseeable future. I have access to business systems and can be reached on my usual contact details above.

[redacted]

Afternoon,

In advance of the Costs and Affordability Steering Group meeting on Monday afternoon, please find attached a summary slide pack and a paper on updated cost estimates from the initial modelling.

The meeting will provide an opportunity to update the group on work since the last meeting, including around how we are progressing against the planned timeline. The aim is to focus the meeting on two substantive areas of discussion. Firstly is the updated costs which are summarised in the slide pack and set out in more detail in the attached paper. Secondly there is a revised proposal for modelling the funding costs of tiered support levels in future based around income levels. The slides summarise the proposed approach and I can talk through it further at the meeting. The final few slides look to illustrate some of the complexity and challenges which we will be working through over the next period as we look to go from having overall cost estimates to have profiled estimates over time

Hope everyone has a good weekend when it comes and I look forward to discussing this all further on Monday.

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

Afternoon,

We will look to schedule monthly meetings of this group through early 2023 and use January as an opportunity to discuss some of the items which had been scheduled for today.

There were 2 documents circulated for today's meeting – a slide pack providing an overview of progress and a refined proposal for providing tiered support in future based around household income, as well as a paper setting out the initial modelling outputs for overall costs. It would still be really helpful to get feedback from the Steering Group around the costs paper so we would appreciate it if you can respond with comments on it before finishing up for Christmas leave. This will allow the project group to take stock and refine future work in advance of bringing updates back to the January meeting of the group.

In particular, with regards the costs paper, we would appreciate that you:
[redacted]

Comments on the above and any other general feedback on the paper would be appreciated because it is the outputs reported in the paper which we will start to use in subsequent strands of the work.

If you have any comments on **[redacted]**, then I am happy you feed those back too. However, I would look to use the next meeting of the group as an opportunity to discuss **[redacted]** in more detail and ensure we all have a common understanding. We can therefore hold it until January as there are strands of work we can progress in the meantime (based on outputs reported in the paper).

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

From: **[redacted]**
Sent: Monday, December 11, 2023 1:09 PM
To: **[redacted]** Sue Kearns <Sue.Kearns@gov.scot>; **[redacted]** Catherine Williams <Catherine.Williams@gov.scot>; **[redacted]**
Cc: **[redacted]**
Subject: RE: HiBS Costs and Affordability Project Steering Group - November

Hi all,

Due to a number of pressures today we are having to cancel this meeting today. Unfortunately we can't delete from diaries so please delete. We will look to rearrange for early new year. **[redacted]** will be in touch separately re: seeking comments on papers.

Thanks,
[redacted]

-----Original Appointment-----
From: **[redacted]**
Sent: Wednesday, July 26, 2023 1:59 PM
To: **[redacted]** Sue Kearns; **[redacted]** Catherine Williams; **[redacted]**
Cc: **[redacted]**
Subject: HiBS Costs and Affordability Project Steering Group - November
When: 11 December 2023 14:30-16:00 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Microsoft Teams Meeting

Dear Colleagues,

Changing the date as the original slot clashed with HiBs document publication and members may be needed elsewhere.

Thanks,
[redacted]

Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 398 269 378 664
Passcode: 9XApmx
Download Teams | Join on the web
Or call in (audio only)
+44 131 376 2847,,913764527# United Kingdom, Edinburgh
Phone Conference ID: 913 764 527#
Find a local number | Reset PIN
SCOTS Connect - Please note - You must have the explicit permission of the organiser to record this meeting and its attendees, using any technology.
Learn more | Help | Meeting options

Hi **[redacted]** and team,

Thanks for this. Noted points to note below – thank you.

A couple of questions and some thoughts:

Questions
[redacted]

Thoughts on your points below and generally:
[redacted]

[redacted]

[redacted]

[redacted]

Thanks
Catherine

From: **[redacted]**
Sent: Monday, December 11, 2023 2:59 PM
To: **[redacted]** Sue Kearns <Sue.Kearns@gov.scot>; **[redacted]** Catherine Williams <Catherine.Williams@gov.scot>; **[redacted]**
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[redacted]

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If you have any comments on **[redacted]**, then I am happy you feed those back too. However, I would look to use the next meeting of the group as an opportunity to discuss **[redacted]** in more detail and ensure we all have a common understanding. We can therefore hold it until January as there are strands of work we can progress in the meantime (based on outputs reported in the paper).

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

From: **[redacted]**
Sent: Monday, December 11, 2023 1:09 PM
To: **[redacted]** Sue Kearns <Sue.Kearns@gov.scot>; **[redacted]** Catherine Williams <Catherine.Williams@gov.scot>; **[redacted]**
Cc: **[redacted]**
Subject: RE: HiBS Costs and Affordability Project Steering Group - November

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Thanks,
[redacted]

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From: **[redacted]**
Sent: Wednesday, July 26, 2023 1:59 PM
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Subject: HiBS Costs and Affordability Project Steering Group - November
When: 11 December 2023 14:30-16:00 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Microsoft Teams Meeting

Dear Colleagues,

Changing the date as the original slot clashed with HiBs document publication and members may be needed elsewhere.

Thanks,
[redacted]

Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting
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Passcode: 9XApmx
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Phone Conference ID: 913 764 527#
Find a local number | Reset PIN
SCOTS Connect - Please note - You must have the explicit permission of the organiser to record this meeting and its attendees, using any technology.
Learn more | Help | Meeting options

Hi **[redacted]** / **[redacted]**,

[redacted]

[redacted]

Speak tomorrow,

[redacted]

[redacted]
Positive Impacts
Following the most recent COVID-19 advice from the UK and Scottish Government, SFT has closed its office. All staff will be working from home for the foreseeable future. I have access to business systems and can be reached on my usual contact details above.

[redacted]

From: **[redacted]**
Sent: 18 January 2024 14:38
To: **[redacted]**
Subject: RE: Budget coverage for Tier 1-3 households

OK, much appreciated. I can look at on trains tomorrow morning and **[redacted]** can maybe then circulate material before our planning session in SAH. Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
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From: **[redacted]**
Sent: Thursday, January 18, 2024 2:35 PM
To: **[redacted]**
Subject: Re: Budget coverage for Tier 1-3 households

Hi **[redacted]**,

I will get the slides updated, but realistically it will be late this afternoon / evening for being available first thing tomorrow morning as I am in meetings till 4.30pm.

Will work on it asap as a priority though.

[redacted]

[redacted]
Positive Impacts
Following the most recent COVID-19 advice from the UK and Scottish Government, SFT has closed its office. All staff will be working from home for the foreseeable future. I have access to business systems and can be reached on my usual contact details above.

[redacted]

From: **[redacted]**

Sent: 18 January 2024 13:19
To: **[redacted]**
Subject: RE: Budget coverage for Tier 1-3 households

Will do

From: **[redacted]**
Sent: Thursday, January 18, 2024 1:07 PM
To: **[redacted]**
Subject: RE: Budget coverage for Tier 1-3 households

[redacted],

Are you able to update the slide pack for costs work to add in the slide on this and incorporate any other tweaks to reflect conversations there?

I can then have a quick look over and we can get materials out to the steering group later today or first thing tomorrow. (I would prioritise this one over the social housing presentation as costs steering group is earlier in the week).

[redacted] – I am currently looking at the international comparisons paper and will come back on that today. I will think about whether it is best to circulate it for information along with the paper or to commit to circulating it after the meeting (as conscious people might not now have time to read it along with other material before the meeting). Can you put together a slide which summarises key points so we can incorporate that into the slide pack so that it is flagged at the meeting either way and people are therefore aware.

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
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[redacted]

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From: **[redacted]**
Sent: Thursday, January 18, 2024 9:31 AM
To: **[redacted]**
Subject: Budget coverage for Tier 1-3 households

Hi both,

Apologies as I should have got this to you sooner, but it has been slightly hectic on the social housing front.

[redacted]

[redacted]

[redacted]

Would be great to get your thoughts, but one thing I like is that on the face of it, it appears quite positive.

I am in back to back meetings all this morning so won't be able to speak before our catch-up - apologies.

Speak later

[redacted]

[redacted]
Positive Impacts
Following the most recent COVID-19 advice from the UK and Scottish Government, SFT has closed its office. All staff will be working from home for the foreseeable future. I have access to business systems and can be reached on my usual contact details above.

[redacted]

****
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Communications with the Scottish Government may be monitored or recorded in order to secure the effective operation of the system and for other lawful purposes.
The views or opinions contained within this e-mail may not necessarily reflect those of the Scottish Government.
****

[redacted],

Attached is a link to the updated slide pack to circulate to Steering Group members this morning. (hard copy attached for **[redacted]** benefit).

The one thing to check / update is the row descriptions in the new table **[redacted]** added yesterday and referred to in my previous email. Otherwise I think it all looks good and we should circulate the slides along with **[redacted]** cost paper this morning. Please include the agenda in the covering email with the papers – it will be in the chat from our call with **[redacted]** yesterday.

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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Dear All,

In preparation for the Steering Group meeting on Monday, please find attached the following:

- updated slides for the meeting here,
- the costs report here, and
- the paper on international schemes for the financially vulnerable here (for your information only, as we won't have time to discuss it at this meeting).

The agenda for the meeting will be as follows:
1) Project update and timelines (including deliverables)
2) Initial Costs Paper
3) **[redacted]**
4) **[redacted]**
5) AoB

Have a lovely weekend.

Kind regards,

[redacted]

From: **[redacted]**
Sent: Friday, December 8, 2023 4:14 PM
To: **[redacted]** Sue Kearns <Sue.Kearns@gov.scot>; **[redacted]** Catherine Williams <Catherine.Williams@gov.scot>; **[redacted]**
Cc: **[redacted]**
Subject: Papers - costs and affordability steering group - Monday 11 Dec

Afternoon,

In advance of the Costs and Affordability Steering Group meeting on Monday afternoon, please find attached a summary slide pack and a paper on updated cost estimates from the initial modelling.

The meeting will provide an opportunity to update the group on work since the last meeting, including around how we are progressing against the planned timeline. The aim is to focus the meeting on two substantive areas of discussion. Firstly is the updated costs which are summarised in the slide pack and set out in more detail in the attached paper. Secondly there is a revised proposal for modelling the funding costs of **[redacted]**. The slides summarise the proposed approach and I can talk through it further at the meeting. The final few slides look to illustrate some of the complexity and challenges which we will be working through over the next period as we look to go from having overall cost estimates to have profiled estimates over time

Hope everyone has a good weekend when it comes and I look forward to discussing this all further on Monday.

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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Morning,

Apologies as the slide pack circulated on Friday was not the most up to date version. Please replace it with the attached version which we will go through this afternoon.

The version circulated on Friday was the December version of the slides. They are largely unchanged. However, slides 2 and 3 have been updated while an additional slide has been included (slide 11) to provide an overview of the type of affordability modelling we will be able to undertake. The rest of the pack is the same.

Look forward to speaking this afternoon.

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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[redacted]

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Sent: Friday, December 8, 2023 4:14 PM
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Hope everyone has a good weekend when it comes and I look forward to discussing this all further on Monday.

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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FYI team,

The note sent out below, had the Dec presentation attached (I've attached the updated presentation in this email), so did not include the slide updates for new date of meeting, timeline, and additional slide I put in (corrected now for clean heat vs EE costs mislablelling). The eRDM link might well be going to the correct presentation but I could only see the files attached to the email. Thought I would let you know in case people download the file from their email rather than go through the eRDM link.

Speak later,

[redacted]

[redacted]
Positive Impacts
Following the most recent COVID-19 advice from the UK and Scottish Government, SFT has closed its office. All staff will be working from home for the foreseeable future. I have access to business systems and can be reached on my usual contact details above.

[redacted]
Address: Fourth Floor, 91 Haymarket Terrace, Edinburgh EH12 5HE

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[redacted]

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Hope everyone has a good weekend when it comes and I look forward to discussing this all further on Monday.

[redacted]

[redacted]

Thanks

[redacted]

Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
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[redacted],

[redacted]

Currently we are assuming a cost of **[redacted]** per domestic connection. **[redacted]** has suggested to me that this cost is perhaps nearer **[redacted]**.

Are you please able to pick this up and address as appropriate please. **[redacted]** are you able to share the evidence for **[redacted]**? **[redacted]** / **[redacted]**– can we dig out and set out the basis we landed on **[redacted]** originally.

[redacted] – to reassure you, model will be re-run so scope to update the figure if incorrect.

[redacted]
Head of Heat in Buildings Future Delivery Unit
Heat in Buildings Delivery Divsion
[redacted]

Hi all,

[redacted] forwarded this on to me.

[redacted]

[redacted]

[redacted]

[redacted]

Thanks,
[redacted]

From: **[redacted]**
Sent: Thursday, February 15, 2024 3:19 PM
To: **[redacted]**
Subject: Costs & Affordability - Heat Network Costs

[redacted],

[redacted]

Currently we are assuming a cost of **[redacted]** per domestic connection. **[redacted]** has suggested to me that this cost is perhaps nearer **[redacted].**

Are you please able to pick this up and address as appropriate please. **[redacted]** are you able to share the evidence for **[redacted]**? **[redacted]** / **[redacted]** – can we dig out and set out the basis we landed on **[redacted]** originally.

[redacted] – to reassure you, model will be re-run so scope to update the figure if incorrect.

[redacted]
Head of Heat in Buildings Future Delivery Unit
Heat in Buildings Delivery Divsion
[redacted]

Hi **[redacted]** / **[redacted]** (as well as **[redacted]**, **[redacted]**, **[redacted]** and **[redacted]** for interest)

I was looking for some DH information to convert some of the heat network targets eg 6TWh/yr by 2030 and what this means in terms of building / customer connections (combined domestic and non-domestic) to reflect that heat demand.

[redacted]

I found the following link to published heat network data by DESNZ that seem to be regularly updated - this version was for Dec 2022. It includes the following tables in relation to number of buildings connected to heat networks as well as number of customers

https://www.gov.uk/government/statistics/heat-networks-registered-under-the-heat-network-metering-and-billing-regulations-statistics-december-2022

I think for residential, the difference between building and customer connections will reflect the connection to tenements (as a single building) and this seems to reflect that the reverse trend is observed for the public sector, where the number of buildings connected is larger than the number of customers. Helpfully, there is also a table that reflects the annual output of these networks below.

As such, there is a way to connect the annual heat output with associated numbers of buildings and in turn the target requirements outlined above.

[redacted]

[redacted]

[redacted]

I've copied in **[redacted]**, **[redacted]**, **[redacted]** and **[redacted]** as it might be helpful to discuss these numbers etc above as they may have seen these and would be good to share thoughts on the potential of being able to link these numbers albeit with caveats etc.

Speak soon,

[redacted]

[redacted]

Hi **[redacted]**, **[redacted]**,

On the call with IPPR just now **[redacted]** reference their own modelled costs for the social housing sector, which I think they put at around £250-300m per annum. They also referenced estimated costs from the regulator between £650 – 1,300m per annum.

I think it would be useful if we could do a quick desk based review of the various cost estimates that have been done for the sector, given the very wide ranging estimates. **[redacted]** and **[redacted]** in the Social Housing Decarbonisation Policy Team may have an idea of who has done estimates, as will **[redacted]** and **[redacted]** in the Investment Unit. I think key sources likely to be:

- Scottish Housing Regulator
- SFHA
- ALACHO

[redacted]

Thanks,

[redacted]
Head of Heat in Buildings Future Delivery Unit
Heat in Buildings Delivery Divsion
[redacted]

Hi folks

The numbers in the table below were developed for the “Heat Network Delivery Models” work SG/SFT are undertaking and are the best estimates we have at the moment.

[redacted]

[redacted]

From: [redacted]
Sent: Thursday, April 11, 2024 10:29 AM
To: [redacted]
Cc: [redacted]
Subject: RE: HiBS installation profiles

Hello,

[redacted]

[redacted]

[redacted]

[redacted]

From: [redacted]
Sent: Friday, March 22, 2024 4:56 PM
To: [redacted]
Cc: [redacted]
Subject: Re: HiBS installation profiles

Hi **[redacted]/ [redacted]**,

I just tried to call to chat through the workings of the attached model. Here are some key bullets for you when looking at the model.

[redacted]

[redacted]

Although I am on holiday next week, I am coming into the SFT office on Thursday to catch up with **[redacted]** before he finishes up so you can get me on that day for any quick questions.

Best regards

[redacted]

[redacted]

From: [redacted]
Sent: 22 March 2024 12:31
To: [redacted]
Cc: [redacted]
Subject: RE: HiBS installation profiles

[redacted],

Just to confirm this all looks good to me and should give a range of outputs which we can work with.

[redacted]

Let me know if you want to catch-up later this afternoon.

Thanks

[redacted]

Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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From: [redacted]
Sent: Friday, March 22, 2024 9:43 AM
To: [redacted]
Cc: [redacted]
Subject: Re: HiBS installation profiles

Thanks **[redacted]**,

I have been working through the modelling on this basis and am sure will catch up with **[redacted]** later today.

Speak soon

[redacted]

[redacted]

From: [redacted]
Sent: 22 March 2024 09:38
To: [redacted]
Cc: [redacted]
Subject: RE: HiBS installation profiles

Hi **[redacted]**, these look a good starting point for me. **[redacted]** just back in and will take a look too.

[redacted]

From: [redacted]
Sent: Thursday, March 21, 2024 9:02 AM
To: [redacted]
Cc: [redacted]
Subject: HiBS installation profiles

Hi **[redacted]**/ **[redacted]**,

Following up on the conversation we had **[redacted]** (post **[redacted]**having to leave for the train) and as suggested here is a bulleted list of proposed profiles that can be included in the cost profiling for OO and PRS, and a confirmation of SH.

OO and PRS clean heat

[redacted]

[redacted]

[redacted] - hopefully you can follow my description, but I showed **[redacted]** how this can easily be done within the model and we actually sketched these profiles out in numbers to show how it would work.

[redacted]

[redacted]

[redacted]

[redacted]

Hopefully this give a starting base profiling of costs to look at that can then be explored further.

Let me know if there are other amends / thoughts you may have.

I have copied in **[redacted]** as he may be able to assist if needed when I am away next week.

Speak soon,

[redacted]

[redacted]

****
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[redacted],

See attached for an offline version of the paper outline from **[redacted]** which I have added some thoughts into around how to flesh it out and the modelling / analysis we will need to incorporate. I have not got the whole way through but have offered thoughts for much of it.

Can you look at and pick up some of the highlighted sections today? I don't expect you will get through all the points I highlighted in blue today but hopefully they make sense and we can work on it over the next few days. Various points are about liaising with **[redacted]** as they require outputs from modelling. You might just want to share this with **[redacted]** and we could all catch-up tomorrow but if you are speaking to him today then it will hopefully be helpful in clarifying what we need from him and what we can work on.

Thank s

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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Hi both,

Sending now so **[redacted]** can potentially add to it and circulate again prior to our meeting.

I still have the JT requirement to do – but all else you requested of me is either out to others where necessary or completed.

Will input further into other areas which can be allocated to me at the meeting tomorrow.

Thanks

[redacted]

From: [redacted]
Sent: Thursday, April 18, 2024 11:02 AM
To: [redacted]
Subject: costs paper thoughts

[redacted],

See attached for an offline version of the paper outline from **[redacted]** which I have added some thoughts into around how to flesh it out and the modelling / analysis we will need to incorporate. I have not got the whole way through but have offered thoughts for much of it.

Can you look at and pick up some of the highlighted sections today? I don't expect you will get through all the points I highlighted in blue today but hopefully they make sense and we can work on it over the next few days. Various points are about liaising with **[redacted]** as they require outputs from modelling. You might just want to share this with **[redacted]** and we could all catch-up tomorrow but if you are speaking to him today then it will hopefully be helpful in clarifying what we need from him and what we can work on.

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Morning folks,

I have added comments to the report and most 'asks' are ok. May just need to clarify / confirm approach before getting to updated numbers etc. One bit to think about is approach to heat network costs in total as these are quite big numbers (based in demand profile and HN cost).

Speak later

[redacted]

[redacted]

From: [redacted]
Sent: 18 April 2024 16:30
To: [redacted]
Cc: [redacted]
Subject: RE: costs paper thoughts

Hi both,

Sending now so **[redacted]** can potentially add to it and circulate again prior to our meeting.

I still have the JT requirement to do – but all else you requested of me is either out to others where necessary or completed.

Will input further into other areas which can be allocated to me at the meeting tomorrow.

Thanks

[redacted]

[redacted],

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[redacted],

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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From: [redacted]
Sent: Friday, April 19, 2024 4:06 PM
To: [redacted]
Cc: [redacted]
Subject: Re: Heat network costs for costs and affordability modelling

Hi **[redacted]**,

Hopefully the following might help give a little more detail of what we are looking at - happy to discuss if that might be easier.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

From: [redacted]
Sent: 19 April 2024 12:38
To: [redacted]
Cc: [redacted]
Subject: RE: Heat network costs for costs and affordability modelling

Hi **[redacted]**,

Could you offer more detail as to what is it you are modelling and what the assumptions of your scenarios are? We can then advise on what would be the most appropriate (high level) estimate.

Thanks,
[redacted]

From: [redacted]
Sent: Friday, April 19, 2024 12:30 PM
To: [redacted]
Cc: [redacted]
Subject: Heat network costs for costs and affordability modelling
Importance: High

Dear All,

Quick query on DH capital spend costs – please see below table:

[redacted]

There are 4 potential figures for DH costs by 2045 – **[redacted]** – please let us know which one should be in our core scenario for modelling purposes?

Thanks!

[redacted]

** Please note I now work from home and the office and will be available on Microsoft teams and email **

[redacted] | Senior Policy Officer | Future Finance Team | Heat in Buildings Future Delivery Unit | Heat & Energy Efficiency Scotland

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Scottish Government
Riaghaltas na h-Alba
gov.scot

All,
So I don’t really have the background to this, which would be useful. Iniital thoughts based on reading **[redacted]** top email and skiming the others…

See detailed comments below…. But happy to discuss and/or provide further with wider context.

Kind regards
[redacted]
==========

From: [redacted]
Sent: Tuesday, April 23, 2024 12:08 PM
To: [redacted]
Cc: [redacted]
Subject: RE: Heat network costs for costs and affordability modelling - SENSITIVE

Hi **[redacted]**, **[redacted]**,

Thanks for sharing the detail below – useful to understand a bit better the approach you are taking.

I think the question below is ultimately a policy issue so copying in **[redacted]** and **[redacted]** who can provide a clear steer given their past work on targets and data. Following are a few points of concern vis-a-vis the assumptions you are making and the potential associated risks:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Happy to discuss.

Cheers,
[redacted]

From: [redacted]
Sent: Friday, April 19, 2024 6:03 PM
To: [redacted]

Cc: [redacted]
Subject: RE: Heat network costs for costs and affordability modelling

[redacted],

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

The Green Heat Finance Taskforce Part 1 Report is out now:
Here is the link: https://www.gov.scot/isbn/9781835216415
[Please note: I'm sending this email at a time convenient for me. Even if I've emailed you at an odd time, I don't expect a response outside of your working hours; when you are caring for others; on a non-work day or at the weekend]

From: [redacted]
Sent: Friday, April 19, 2024 4:06 PM
To: [redacted]
Cc: [redacted]
Subject: Re: Heat network costs for costs and affordability modelling

Hi **[redacted]**,

Hopefully the following might help give a little more detail of what we are looking at - happy to discuss if that might be easier.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

From: [redacted]
Sent: 19 April 2024 12:38
To: [redacted]
Cc: [redacted]
Subject: RE: Heat network costs for costs and affordability modelling

Hi **[redacted]**,

Could you offer more detail as to what is it you are modelling and what the assumptions of your scenarios are? We can then advise on what would be the most appropriate (high level) estimate.

Thanks,
[redacted]

From: [redacted]
Sent: Friday, April 19, 2024 12:30 PM
To: [redacted]
Cc: [redacted]
Subject: Heat network costs for costs and affordability modelling
Importance: High

Dear All,

Quick query on DH capital spend costs – please see below table:

[redacted]

There are 4 potential figures for DH costs by 2045 – **[redacted]** – please let us know which one should be in our core scenario for modelling purposes?

Thanks!

[redacted]

** Please note I now work from home and the office and will be available on Microsoft teams and email **

[redacted] | Senior Policy Officer | Future Finance Team | Heat in Buildings Future Delivery Unit | Heat & Energy Efficiency Scotland

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Hi,

As discussed yesterday, the estimated cost of installing clean heating in the approx. **[redacted]** non-domestic buildings currently using polluting heating (Biomass/Solid, LPG, Mains Gas, Oil or Other fuels) is around **[redacted]**. This includes the cost of preparatory works, installation, completion and sundries but does not include the cost of upgrading fabric or any other energy efficiency measures. The estimated public sector share is **[redacted]**.

[redacted]

[redacted]

I'm happy to discuss any of this further. What are the timescales for the paper you're preparing? I'd like to run through my approach once more with **[redacted]** and **[redacted]**, but happy for you to include the figures above for now.

[redacted]

Hi – **[redacted]**

Thanks
Catherine

From: Catherine Williams
Sent: Monday, February 12, 2024 3:43 PM
To: Jon Rathjen <Jon.Rathjen@gov.scot>; Sue Kearns <Sue.Kearns@gov.scot>; **[redacted]** Kersti Berge <Kersti.Berge@gov.scot>; **[redacted]**
Cc: [redacted]
Subject: Future HIBS funding requirements - capital spending review commission

Hi

We have received a capital spending review commission – this is looking out at period to 2035. I wanted to set out how we have addressed this for HIBS:

[redacted]

[redacted]

[redacted]

[redacted]

Please let me know if you have any questions.
Kind regards
Catherine

Catherine Williams
Deputy Director - Heat In Buildings Delivery
Scottish Government | Directorate for Energy and Climate Change

[redacted]
catherine.williams@gov.scot

Hi **[redacted]**,

You're welcome. Apologies for the delay in getting back to you, as I've been on leave.

I think at the meeting we discussed that there is an ongoing workstream to update the £33bn figure, but that this hasn't concluded and we are not in a position to share the outputs. This includes the consideration of inflation as well as other assumptions. We were always a little more conservative in terms of predicted cost reductions, which is why they were not included in the £33bn calculation.

Thanks,
[redacted]

From: [redacted]
Sent: Tuesday, April 2, 2024 12:56 PM
To: [redacted]
Cc: [redacted]
Subject: RE: Discussion with SWECO on heat

Hi **[redacted]**

Thank you for sending this information. Do you have plans to update the figures in the near term. I know there have been inflationary pressures on ASHP and associated insulation costs since 2021. I am also aware that the DESNEZ cost reductions on ASHP through scale effects have not transpired as forecast.

If not, I will take the £33bn figure as quoted.

Kind regards,
[redacted]

[redacted]
SWECO

From: [redacted]
Sent: Monday, March 25, 2024 10:19 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Discussion with SWECO on heat

Hi **[redacted]**,

As discussed, sharing the link to the EIR release which includes the breakdown of the £33bn figure: Heat in building strategy modelling: EIR release - gov.scot (www.gov.scot)

You may also find the Heat in Buildings Bill Consultation BRIA helpful, for a more recent discussion on costs: Scope - Heat in Buildings Bill consultation: business and regulatory impact assessment (partial) - gov.scot (www.gov.scot)

Let me know if there are further questions on this.

Thanks,
[redacted]

-----Original Appointment-----
From: [redacted]
Sent: Tuesday, March 19, 2024 1:40 PM
To: [redacted]
Cc: [redacted]
Subject: Discussion with SWECO on heat
When: 20 March 2024 11:00-11:30 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Microsoft Teams Meeting

Hello all,

On the back of the emails from SWECO with comments/queries on heat, I am setting up this call to discuss the comments raised.

Please forward onto anyone else you think may be of value joining.

If there are any issues with the time please let me know.

Thanks
[redacted]

Microsoft Teams meeting
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SCOTS Connect - Please note - You must have the explicit permission of the organiser to record this meeting and its attendees, using any technology.
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Hi **[redacted]**,

I had a very brief conversation with Catherine at my weekly 1 to 1 about the costs and affordability piece. **[redacted]**.

I suggested that you meet with Catherine whilst I'm on leave to chat through the work **[redacted]**.

[redacted]

[redacted]

[redacted]

From that we can then run the modelling and write a paper. I think this would then bring this work to a close and we can think about what comes next.

Hope that makes sense and happy to speak.

[redacted]

[redacted]
Head of Heat in Buildings Future Delivery Unit
Heat in Buildings Delivery Divsion
[redacted]

Hi **[redacted]**,

Had a quick looks at slides. They look good and think good to circulate. I think we should also circulate the longer costs paper as well. Happy for you to just put them out this afternoon.

Are you able to give me a short agenda for the session to keep me right on Monday.

[redacted]

From: [redacted]
Sent: Friday, December 8, 2023 1:39 PM
To: [redacted]
Subject: cost and affordability steering group slides

[redacted],

Here is the link to the proposed slide pack for the costs and affordability steering group on Monday.

It provides the update of work done, work planned, risks and issues requiring a steer / decision. It then has the timeline slide, which **[redacted]** is further updating, followed by a summary of key points from the costs paper and then some slides around **[redacted]**.

It would also be good to circulate the costs report which has been updated to reflect the discussion last week at SFT offices as it will provide much more detail than the slide pack for anyone who wants to delve into it.

[redacted] has been off sick much of this week so we do not have the international comparisons paper to circulate but can do so fairly soon after the meeting.

[redacted]

[redacted]

Thanks

[redacted]
Heat in Buildings Future Finance Team Leader
Heat in Buildings Futures Unit
Heat & Energy Efficient Scotland
[redacted]

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Hi **[redacted]**

Thanks for sharing, and sorry it's taken me a while to get to this.

Overall it makes sense to me and seems in line with what we discussed when we went through your spreadsheet. I've added a couple of small comments.

My main thought is that there's a lot of numbers and (to me at least) it's not always clear what the different numbers represent and whether they should or can be compared – maybe a quick summary at the top with "headline" figures attached would help? I'm particularly thinking of your newer estimates – **[redacted]**.

Thanks

[redacted]
Economic Advisor
Energy and Heat Analysis
OCEA

From: [redacted]
Sent: Thursday, November 9, 2023 3:32 PM
To: [redacted]
Cc: [redacted]
Subject: HiBS steering committee report update

Hi **[redacted]/ [redacted]**,

You may have had a notification as I have put an updated copy of the draft HiBS steering committee paper on the eRDM Connect platform under 'Analyst working group drafts', but I have attached a word copy for your good selves and **[redacted]** for reference.

[redacted] is currently reviewing at the moment, and please feel free to come back to us with any comments or thoughts you may have.

Speak soon,

[redacted]

[redacted]
Please note from 23 October we have changed our address and are now based at Thistle House, Fourth Floor, 91 Haymarket Terrace, Edinburgh EH12 5HE with our landline telephone number remaining unchanged.

SFT Outcomes
Demonstrating progress
with impact

Costs and Affordability Steering Group

22nd January 2024

Project overview and timelines

[REDACTED]

[REDACTED]

Initial costs modelling outputs

[REDACTED]

International approaches to funding support

Support Schemes for the Financially Vulnerable in Other Countries

15 European country schemes reviewed

- 4 countries have retrofit schemes for the financially vulnerable
- 6 countries have tier funding schemes with greater funding available for low-income households
- 2 countries have fixed subsidies based upon specific measures
- 3 countries have/ had tax incentives

Key criteria for vulnerable household awards

- Low income, low home efficiency ratings, in receipt of social welfare payments, off gas homes

Key characteristics of European Schemes

- Draws on EU funding (at least for some funding streams)
- Use of multiple schemes to fulfil multiple aims
- Unique mix of conditions per country impacting levels of funding needed

Conclusion: England and Ireland conditions closest to Scotland:

- Income threshold cap and/or
- Qualifying welfare payments

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Complexity and challenges to bear in mind

[REDACTED]

[REDACTED]

DATA & INPUTS

Floor area of non-domestic buildings (m2)

Total	**[redacted]**
of which polluting	**[redacted]**

Public sector building data

Number of buildings	**[redacted]**
Floor area	**[redacted]**

Source: e-PIMS however note data likely incomplete

[redacted]

Floor area of non-domestic buildings within heat network zones by FNA scenario (m2)

	Baseline
Total	**[redacted]**
of which polluting	**[redacted]**
	[redacted]

Public sector share of total cost

Based on no. of buildings	**[redacted]**
Based on floor area	**[redacted]**
Enhanced	**[redacted]**

Average heating load (kW/m2)

0.1

Technology cost - £ per kW installed capacity

Technology	Capex, £/kW (exclusive of VAT)
Ground source heat pump	**[redacted]**
Biomass boiler	**[redacted]**
Air-to-water heat pump	**[redacted]**
High temperature air-to-water heat	**[redacted]**
Air-to-air heat pump	**[redacted]**
Air-to-water heat pump/Gas Boiler H	**[redacted]**
District heating	**[redacted]**
BAU renewal, average all technologi	240-290
Electric resistive	**[redacted]**

Technology breakdown

	[redacted]
Scenario 1	**[redacted]**
Scenario 2	**[redacted]**
Scenario 3	**[redacted]**

CALCULATIONS

Weighted average cost (£/kW)

Scenario 1	**[redacted]**
Scenario 2	**[redacted]**
Scenario 3	**[redacted]**

Total cost £m

Scenario 1	**[redacted]**
Scenario 2	**[redacted]**
Scenario 3	**[redacted]**

Public sector cost £m

Based on no. of buildings

Scenario 1	**[redacted]**
Scenario 2	**[redacted]**
Scenario 3	**[redacted]**

[redacted]

Stringent 1	Stringent 2	
[redacted]	**[redacted]**	
[redacted]	**[redacted]**	
[redacted]	**[redacted]**	
[redacted]		
[redacted]	**[redacted]**	
[redacted]	**[redacted]**	**[redacted]**
[redacted]	**[redacted]**	
[redacted]	**[redacted]**	

Sensitivies

Weighted a
Scenario 1
Scenario 2
Scenario 3

				Total cost
				Scenario 1
				Scenario 2
				Scenario 3
				Public sect
Based on floor area		Enhanced		
	[redacted]		**[redacted]**	Scenario 1
	[redacted]		**[redacted]**	Scenario 2
	[redacted]		**[redacted]**	Scenario 3

- varying heating load by +/-10%

average cost (£/kW)	Weighted average cost (£/kW)	
[redacted]	Scenario 1	**[redacted]**
[redacted]	Scenario 2	**[redacted]**
[redacted]	Scenario 3	**[redacted]**

£m

	[redacted]
	[redacted]
	[redacted]

or cost £m

	Based on no. of	Based on f	Enhanced
	[redacted]	**[redacted]**	**[redacted]**
	[redacted]	**[redacted]**	**[redacted]**
	[redacted]	**[redacted]**	**[redacted]**

Total cost £m

Scenario 1	**[redacted]**
Scenario 2	**[redacted]**
Scenario 3	**[redacted]**

Public sector cost £m

	Based on no.	Based on flo	Enhanced
Scenario 1	**[redacted]**	**[redacted]**	**[redacted]**
Scenario 2	**[redacted]**	**[redacted]**	**[redacted]**
Scenario 3	**[redacted]**	**[redacted]**	**[redacted]**