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LANCASTER CITY COUNCIL
Promoting City, Coast & Countryside

Lancaster City Council
Building Energy Decarbonisation Plan

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23 March 2022

Revision P04

Final Draft

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date	**23/03/22**

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1 Lancaster Decarbonisation Plan on a Page

Lancaster City Council have set a target to reduce the Council's direct emissions to net zero by 2030. In order to achieve this target, significant investment is required over the coming years.

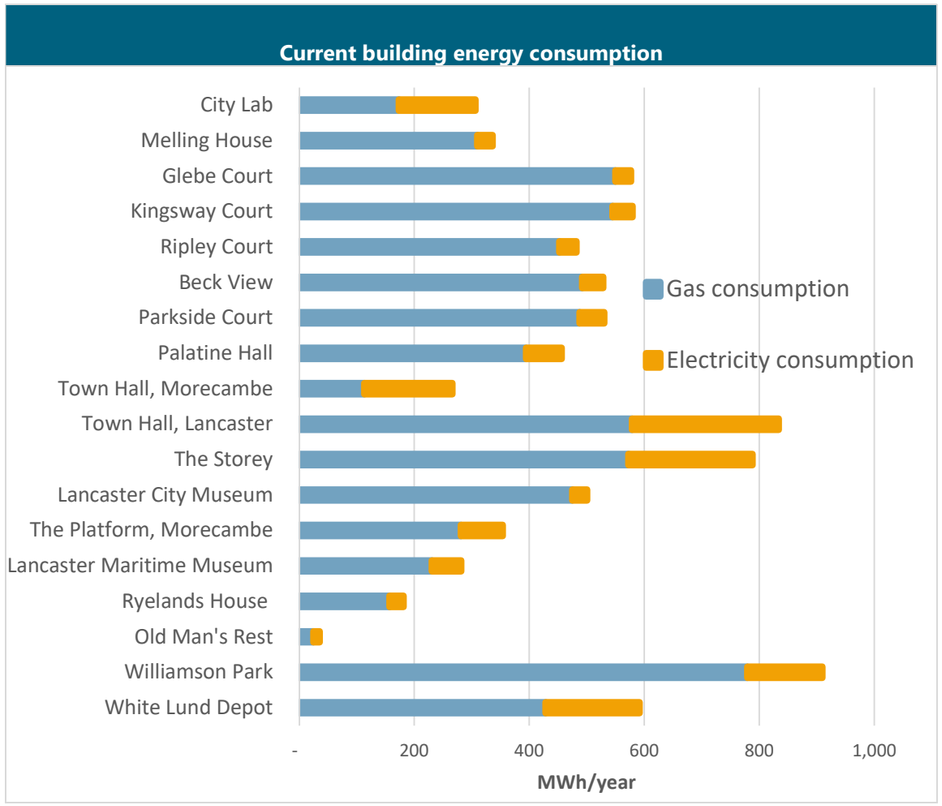
Achieving the target will require dedicated internal resource and significant long term planning. The decarbonisation of the building stock should be planned and budgeted. This report analyses 19 buildings within the LCC stock, and proposes a decarbonisation plan for these buildings.

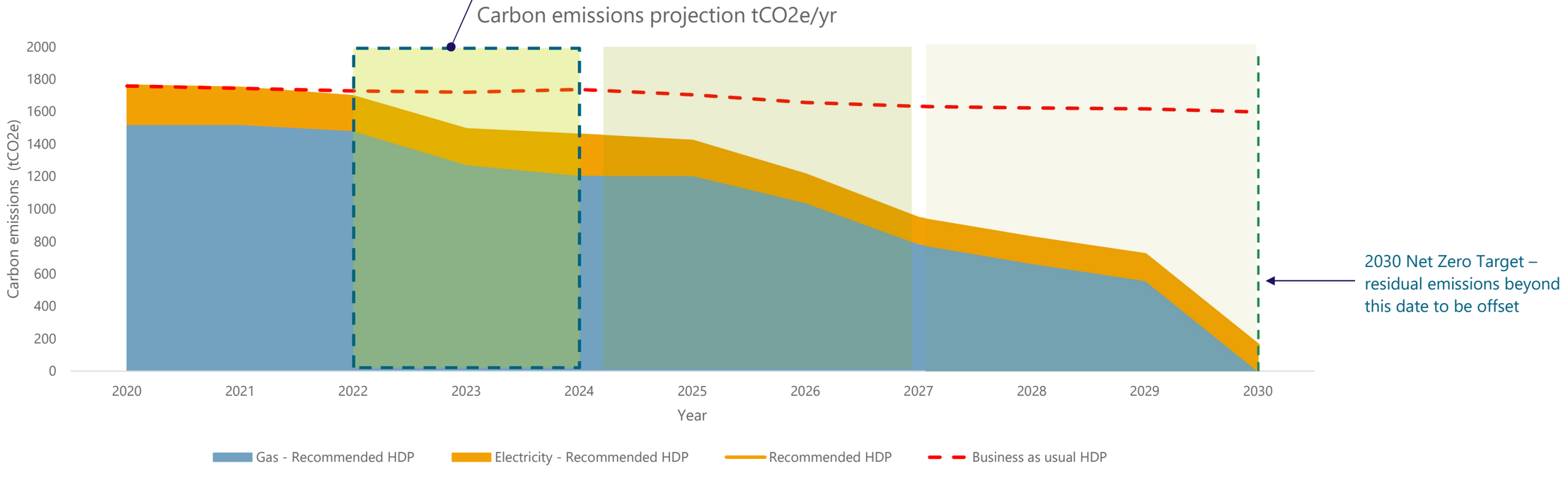
Summary of buildings within scope of this plan	
Number of buildings	18
Total annual energy consumption of existing buildings	8,539MWh
Total annual carbon emissions of existing buildings	1759 tCO2

Outcome of proposed decarbonisation projects within this plan	
Annual carbon emissions in 2030	46.193 tCO2
Annual carbon saving in 2030	1712.96 tCO2
% operational carbon vs existing by 2030	2.63 %
Total capital cost	£ 14.96 million

Short Term Action Plan

- Moving away from reliance on burning of fossil fuels is a key priority. Any boilers coming to their end of life should be prioritised for replacement in lieu of heat pumps.
- Where heating plant is replaced, smart controls should be installed to optimise performance and allow remote visibility of energy consumption.
- Replacement of non-LED lighting should be prioritised across the building stock.
- Regards improvement of fabric, priority should be on the buildings in particularly poor condition or with significant portions of single glazing.
- All priority interventions (i.e., prior to 2024) should be prepared for the next round of PSDS funding (phase 4)





2 Introduction

Purpose

The purpose of this plan is to set out the decarbonisation pathway for the 18 gas emitting buildings owned by Lancaster City Council (LCC). This plan will align the decarbonisation targets of the UK government, with local targets set out by LCC. This plan will be adopted by LCC as a framework for which to guide and structure future investment in their estate such that the carbon targets can be achieved. This plan targets 19 buildings within the Council's Estate, namely:

Building	Typology	DEC/EPC Rating	Listed Status
LCC Lancaster Town Hall	Civic	B	Yes
LCC Palatine Hall		C	Yes
LCC Morecambe Town Hall		B	Yes
Lancaster City Museum		C	Yes
Lancaster Maritime Museum		A	Yes
Ryelands House		D	Yes
Old Mans Rest		D	N/A
Williamson Park		N/A	Yes
The Platform	Commercial	B	Yes
The Storey		D	Yes
City Lab		C	N/A
White Lund Depot		D	N/A
Melling House	Residential	A-E	N/A
Beck View		B-D	N/A
Glebe Court		B-D	N/A
Ripley Court		B-D	N/A
Parkside Court		B-C	N/A
Kingsway Court		B-D	N/A

Figure 2-1 - Buildings within scope

All of the buildings set out in the table above have been subject to a detailed buildings survey, the reports of which can be seen in Appendix A.

This building energy decarbonisation plan describes the state of LCC's energy use and its plans for reducing and/ or decarbonising it further. The plan outlines what LCC has already done, what it is currently doing, and what it plans to do in the future. The plan explains what actions are going to be taken, over what timescales, and the intended outcomes.

Context

The UK government targets are to achieve net zero carbon by 2050, with an interim target of achieving 78% reduction by 2035 (vs. 1990 baseline levels). Both of these targets are legally binding. However, Lancaster City Council has a more ambitious target of becoming net zero by 2030.

LCC have approved an action plan to achieve this goal. The scope of the targets include scope 1 and 2 emissions as well as travel directly linked to the council's activities (i.e. council owned fleet and staff travel). The carbon emissions were benchmarked at 2018/19.

The following image shows the breakdown of carbon emissions for the 2019/20 year. The total emissions were calculated at **4,263 tonnes CO2e.**

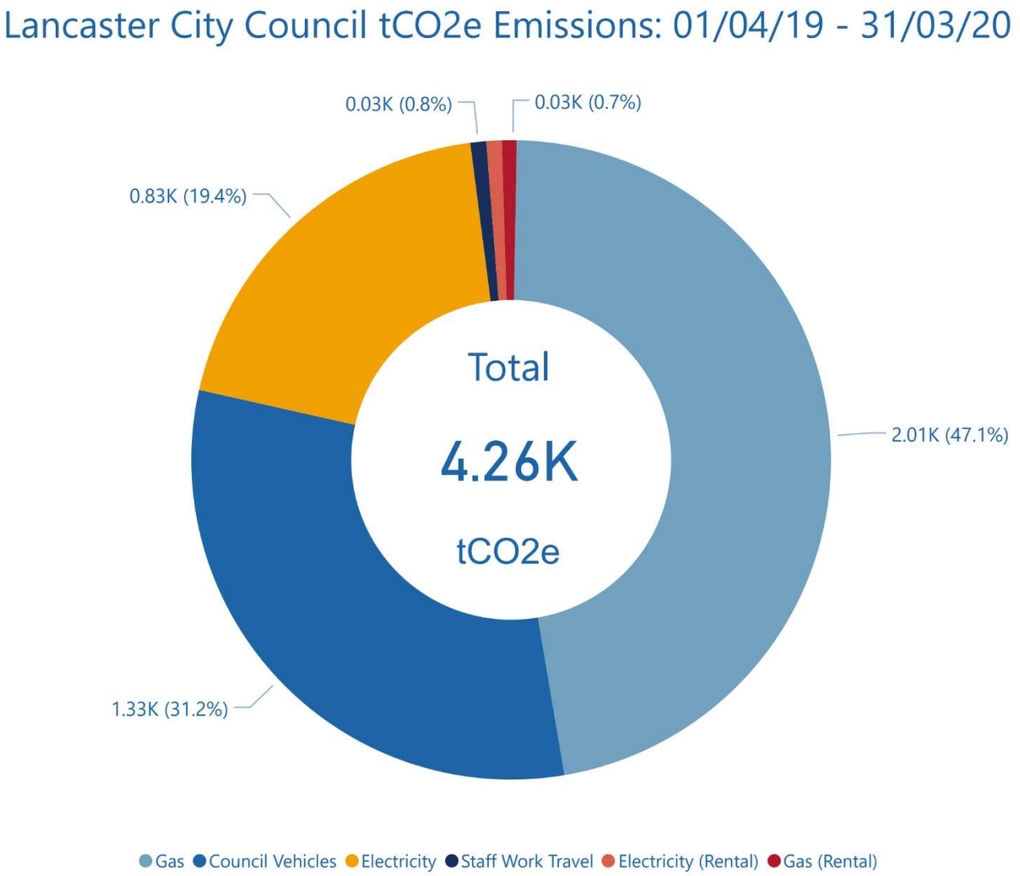


Figure 2-2 - Council CO2 emission 2018/19

The LCC already uses 4.2M KWh of independently audited 100% green energy. The following images show the gas and electricity consumption across the building stock. It can be seen that the Salt Ayre Leisure Centre is a significant outlier, however, LCC have already decarbonised the building in November 2021 and the gas fired plant is currently being replaced with heat pumps. Concurrently, a PV array has also been built on an adjacent landfill site and is expected to supply the facility, via a direct wire, with approximately 60% of its energy demand. The building has also been retrofitted with new double glazing and the external lighting replaced with LEDs which together will result in carbon savings for the estate.

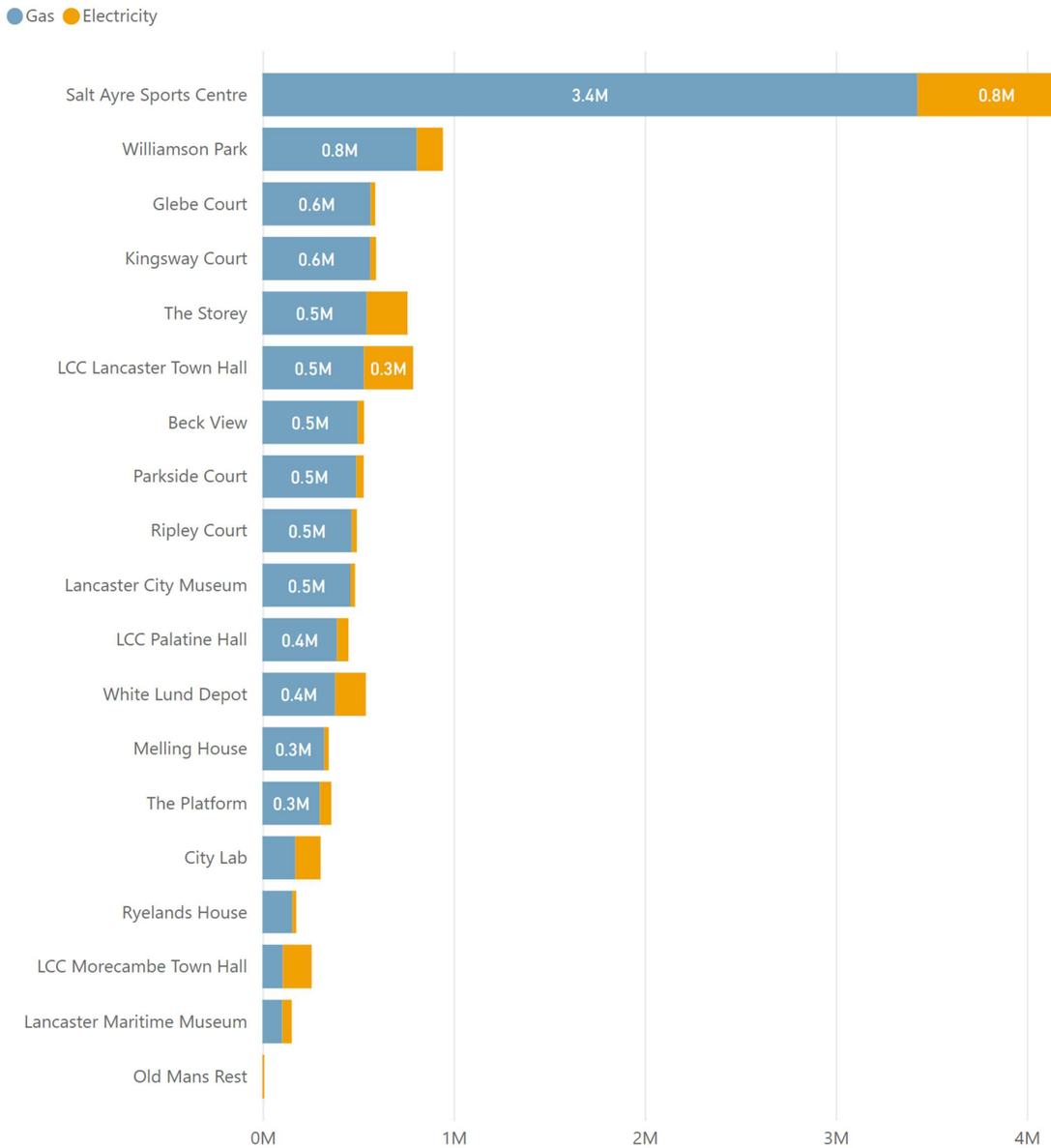


Figure 2-3 - Council gas and electrical energy consumption (buildings) 2018/19

The plan also sets out some key actions. Aside from the Salt Ayre Leisure Centre which is already underway, the building design related actions are as follows

Action	When	Additional Cost	Comments
Go off gas. The amount of renewable electricity being generated would provide the opportunity to convert to electric boilers or depending on the business case ground source heating, hydrogen etc There would of course be additional costs to this which would need further work to establish	2025-2030	TBC	Depends on heating system used Current cost of a 300KW fuel cell CHP system suitable for LTH would cost £1.75M- an external bid for this has been submitted as part of the joint hydrogen project with Lancaster Uni and EDF
Invest in energy management software in main buildings This will then help us develop carbon budgets for teams	2020/21	£50K	

Figure 2-4 - LCC building related carbon reduction actions

3 Your Decarbonisation Plan

The LCC decarbonisation plan provided consists of a Buildings Energy Decarbonisation Plan, which is the outcome of detailed building surveys on all of the buildings within scope. The purpose of this output is set out in Table 3-1.

Table 3-1 - BED Plan and Toolkit Summary

	Buildings Energy Decarbonisation **Plan**
Format	PDF Report (this report)
Purpose	To guide and structure future investment in the LCC estate such that the carbon targets can be achieved. This will set out an action plan *at the time of writing* and thus provide a point-in-time assessment. The plan provides a set of short, medium and long term actions. This will give direction as to the properties to prioritise, and the measures which can be introduced to do this.
How to Use	The plan is intended to allow LCC to plan investment going forward. A short, medium and long term strategy can be developed using this plan as a starting point.

Resourcing

LCC will be ultimately responsible for overseeing and delivering the decarbonisation plan. The question and answers listed below create the framework for internal resourcing and delivery of the plan.

What role is responsible for managing the energy consumption across the estate and who will be overseeing the delivery of the plan?
Lancaster City Council's Asset Manager has responsibility for managing energy consumption across the estate. The decarbonisation plan, funding and delivery of the measures sits with the council's Climate Emergency Project Team.
Are the individuals overseeing any project appropriately trained, or will additional training be required to deliver the HDP?
Officers overseeing the projects have extensive project management experience, however additional resources will be required to support the delivery of the measures. Projects will be reported on through the council's corporate reporting process
What is the existing resource for the identification, development, and delivery of the HDP?
Currently, the council has three dedicated officers the oversee the delivery of the climate emergency projects and pathway to net zero 2030 from direct emissions this includes the delivery of the heat decarbonisation plan.
What are the anticipated resource requirements for the delivery of HDP?
It is anticipated that a level of cross-service working with be required in order to deliver the HDP. Specifically the Climate Emergency Project Team and Property Services. The additional external resources will be required to support the detailed design, delivery, planning consultancy and contract administration.
Will this require additional human resource?
The additional internal resource will be required from Legal, Finance and Procurement to secure funding, review contracts and procure works.
Will it require additional financial resources?
Where possible, the council will be seeking external funding opportunities such as those offered by BEIS through PSDS, however it is anticipated that LCC will need to make some financial contributions to secure funding. As a minimum, it is expected this will be the equivalent gas boiler replacement costs. Officers will be updating capital programmes and seeking approval to establish new budgets and profile expenditure in line with the decarbonisation pathway outlined in this report.

Key Challenges

The key challenges for the delivery of the plan are expected to be:

- Allocation of resilient and consistent resources to manage the process
- Allocation of sufficient resources to plan and deliver required decarbonisation projects through design, procurement and delivery
- Availability of revenue for the required works, from feasibility studies, to design, procurement and installation
- Establishment of new capital budgets to contribute towards the costs of decarbonisation works
- Collection of accurate information regards the performance of existing buildings
- Generation of accurate information regards the prediction of post project building performance
- Pipeline management, bid management, project management all overlap for the allocated small team as different schemes/opportunities come through to be acted upon

Governance

The decarbonisation plan for the borough will need to pass through the governance procedures of LCC.

Internal governance process will ensure the proposed pathway:

- Aligns with to objectives in the Carbon Reduction Strategy and associated documents.
- Can be monitored using principles/framework given in ISO9001
- Represents decarbonisation pathway that does not incur excessive additional costs.

Funding and Finance Models

The decarbonisation of buildings requires significant investment. The required level of capital investment to achieve the carbon savings required are described within this report as well as in the toolkit, with the intention that this will inform planned investment and management of available funds going forward.

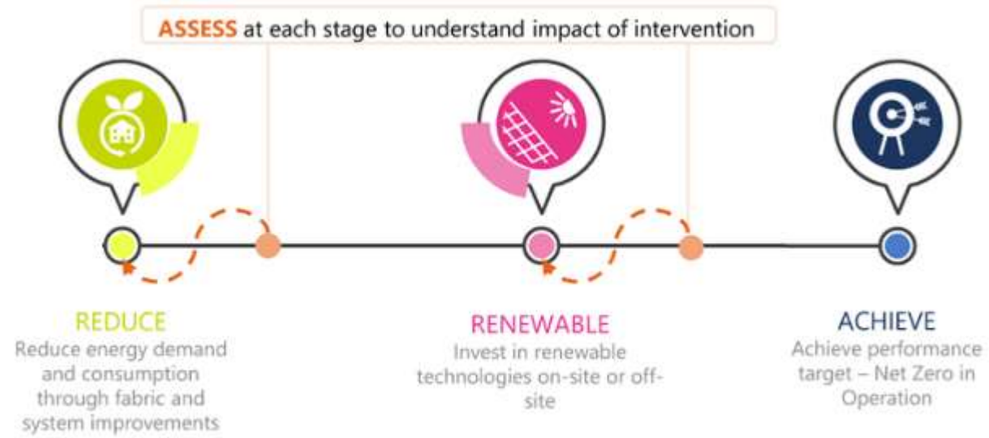
There are currently a number of different models for financing decarbonisation projects, which aim to remove some of the financial barriers to decarbonisation.

- Public Sector Decarbonisation Scheme (PSDS) - The PSDS scheme provides grants for public sector bodies to fund heat decarbonisation and energy efficiency measures. The scheme aims to support the public sector in taking a 'whole building' approach when decarbonising their estates. The next round of funding will be Phase 4, expected later this year (2022).
- Social Housing Decarbonisation Fund
- Innovation Loans
- Invest to Save
- Energy Performance Contracts
- As part of a larger project UK Shared Prosperity Fund could be utilised?

4 Approach to Decarbonising Your Buildings

The Process

It is important when considering decarbonisation of buildings, to ensure that efforts are made to reduce energy consumption of buildings prior to introducing active decarbonisation technologies such as heat pumps or photovoltaic panels, as shown in the following diagram.



REDUCE Operational Energy Use

Following initial operational energy assessment, where energy demand can be reduced, it should be. This can be done through a number of intervention measures such as:

- Improve fabric efficiencies, thereby reducing building loads. This could be done by, for example, applying insulated cladding to the walls or replacing single glazing with double glazing to reduce heating demands.
- Improve system efficiencies such as heat pump efficiency, utilising heat recovery in the ventilation system and increasing lighting efficiencies where possible. Any of these interventions will reduce the energy demands of the building.

Increase RENEWABLE Energy Supply

Once the building is functioning as leanly as possible carbon emissions can be further reduced through:

- Removing systems that directly utilise fossil fuels as a heat or electricity source (gas boilers, gas fired calorifiers) and replace with electrically lead systems.
- Connection to low carbon heat network (if available).
- On-site renewable technologies that directly feed the building thereby reducing the buildings metered consumption. Note PV generation could be implemented independently of “reduce” measures, but it is recommended to prioritise “reduce” measures where possible.
- Off-site renewable installations funded by the developer with a portion of their load ‘earmarked’ to offset emissions associated with the building.

Naturally all of these options have spatial impact and as such renewable technology implementation should be carefully coordinated.

ACHIEVE

In order to report on portfolio and building performance and ensure a building is operating as efficiently as it should be, it is important to ensure that the energy consumption and generation of a building is monitored. This requires a comprehensive monitoring and verification strategy with sufficient M&V software and hardware. This will include metering within the building services systems to allow monitoring of, as a minimum, the following performance criteria:

Type of data	Description
Contextual data	• Update of GIA (m^2), if necessary
Building energy use	• Grid electricity consumption (kWh) • Gas consumption (kWh) • Other fuels consumption (kWh) • District heating/cooling consumption(kWh) (if applicable)
Renewable energy	• Renewable electricity generation (gross) (kWh) • Solar thermal heat generation (kWh) • Renewable electricity exported (kWh) • Renewable electricity used on site (kWh)
Energy storage equipment	• Battery storage capacity (kWh) • Net electricity flow to EVs (kWh)
Plant parameters (Energy exported)	• District heating energy exported (kWh) • District cooling energy exported (kWh)

Decarbonisation Measures

For the purposes of this decarbonisation plan and associated toolkit, the decarbonisation measures have been categorised as shown in the table below.

Categorisation of measures		Example of measures	Challenges and constraints
 **Reduce**	**Fabric**	Addition of external insulated cladding, internal insulation, draught proofing, glazing replacement or upgrade are typical methods of fabric improvement.	Listed buildings prove a particular challenge, as any significant aesthetic change to the building (i.e. external cladding) will be rejected at planning. Older buildings typically benefit greatly from draught proofing and adding additional insulation where possible.
	Controls Upgrade	It is common for a building to either not have a central Building Management System, or for that system to be poorly commissioned. Thus it important that, prior to installation of new HVAC equipment, the systems operate at their maximum efficiency. This could be achieved by installation of smart controls, a BMS system or optimisation of an existing system.	Constraints can be upgrading or interfacing with an old or obsolete BMS system. Specification of a new or upgraded BMS system therefore important, and must be carried out by a controls specialist.
	Lighting	LED lighting is commonly installed as a quick and effective means of improving lighting efficiency when compared to traditional incandescent or compact fluorescent light bulbs.	LED drivers will be required to achieve required voltage, and lighting redesign may be required to ensure consistent and uniform light levels.
 **Renewable**	**Decarbonisation of Heat**	Typically this will involve the replacement of exiting gas fired boilers with heat pumps. This enables the shift away from direct combustion of fossil fuels in lieu of a decarbonising electrical grid. Heat pump systems are typically defined by the heat source, such as air source, ground source or water source.	Delivery temperature on conventional heat pumps is limited to around 60°C, although high temperature heat pumps are available. Space for heat extraction will be required, be it air, ground or water source. Constraints of existing electrical infrastructure capacity is also a typical constraint
	Photovoltaics	PV provides a scalable and cost effective means of generating renewable electricity on site which would displace consumption of grid electricity. It can be implemented independently of other measures.	Photovoltaics provide a mature and scalable technology option to generate renewable energy on site. Key constraints include the condition of the roof (if roof mounted) which must be assessed by a structural engineer during feasibility. The integration with the existing electrical LV system is also important
Infrastructure		An upgrade in electrical infrastructure may be required when heat supply is electrified. This is due to the increased demand on the building electrical supply when, for example, a gas boiler is switched out for a heat pump.	Infrastructure upgrades can be costly and take time. Early engagement with the DNO is recommended

5 Building Performance Summary

Overview of Buildings within Scope

The 18 buildings within scope consist of a wide range of typologies such as care homes, depots and civic buildings. Each one of the buildings was subject to a detailed decarbonisation survey, and the existing meter data for each has also been analysed. This allowed the production of an energy consumption and carbon emissions baseline for each building. The summary of the resulting baseline is shown on this page to allow visualisation of the energy performance of the existing buildings.

Following the site surveys, a suite of decarbonisation measures were proposed to each building, resulting in an energy and carbon saving against this baseline.

It should be noted that there the interventions described within this study do not assume the introduction of a heat network or mains hydrogen provision to the centre of Lancaster. If low carbon infrastructure were to be introduced to the city centre, the proposed interventions would need reviewing.

Summary of buildings within scope of this plan	
Number of buildings	18
Total annual energy consumption of buildings	8,539 MWh
Total annual carbon emissions of buildings	1,759 tCO_2

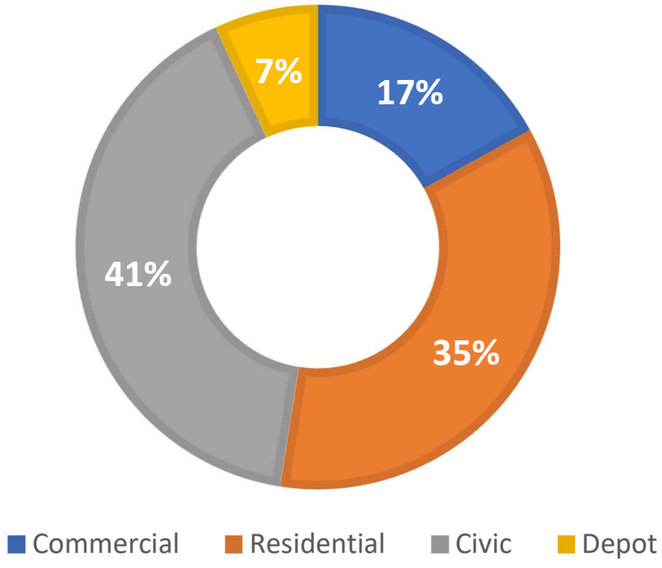
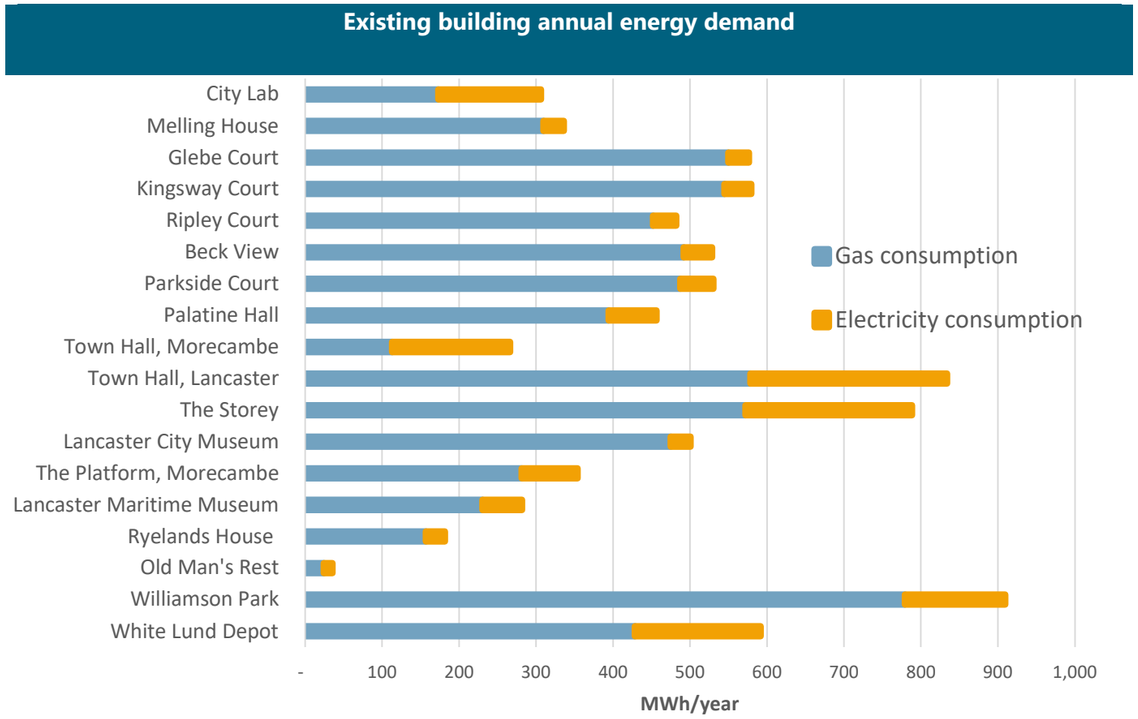
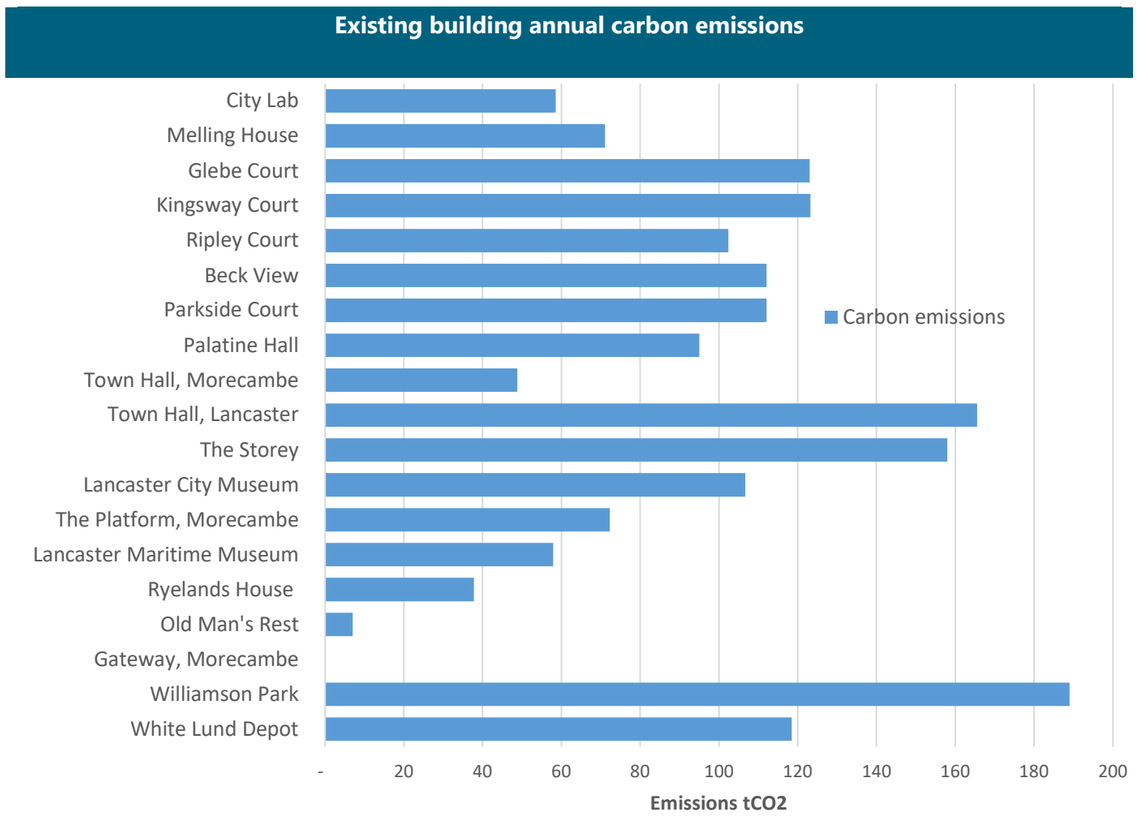


Figure 5-1 - Existing portfolio annual energy consumption by Typology (MWh)





Proposed Decarbonisation Activity

The buildings listed below show the proposed decarbonisation projects. The "low" capital costs shown are exclusive of project contingency with the "high" figures inclusive (which are typically quoted in this report).

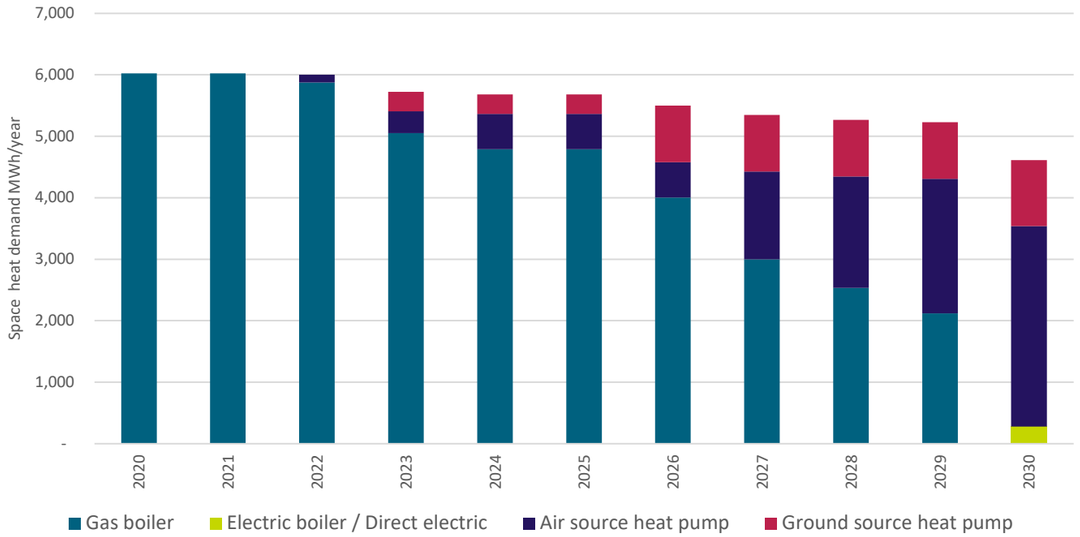
Building	Year of Implementation of Measure						Annual Energy Saving if measures are implemented before 2030		Total Carbon Saving	Capital Cost	
	Reduce			Renewable			Electricity	Gas			
	Fabric	BMS	Lighting	PV	Heat Decarb.	Heat Decarb. Technology	MWh/yr	MWh/yr	tCO_2 until 2030	Low (£)	High (£)
LCC Lancaster Town Hall	2027	2027	2027	2027	2027	Air source heat pump	-74.471	578.504	480.39	1,288,000	2,057,193
LCC Palatine Hall	2023	2023	2023	2023	2023	Air source heat pump	-79.915	394.476	621.48	589,000	940,751
LCC Morecambe Town Hall	2027	2027	2027	2027	2027	Air source heat pump	45.809	113.099	109.67	762,000	1,217,066
Lancaster City Museum	2030	2030	2030	2030	2030	Air source heat pump	- 84.663	475.022	98.20	448,500	716,344
Lancaster Maritime Museum	2030	2030	2030	2030	2030	Air source heat pump	21.545	230.512	50.91	508,400	812,016
Ryelands House	2030	2030	2030	2030	2030	Ground source heat pump	15.156	156.802	34.66	489,000	781,031
Old Mans Rest	2030	2030	2030	2030	2030	Ground source heat pump	8.457	24.416	5.71	215,000	343,398
Williamson Park	-	2026	2026	-	2026	Ground source heat pump	-160.209	779.18	785.12	541,000	864,085
The Platform	2030	2030	2030	-	2030	Electric radiant heating	-187.936	281.243	50.98	223,000	356,176
The Storey	2023	2023	2023	2023	2023	Ground source heat pump	-33.766	572.313	963.53	1,081,000	1,726,573
City Lab	2022	2022	2022	2022	2022	Air source heat pump	0.457	0.172	336.65	443,385	708,175
White Lund Depot	2030	2030	2030	2030	2030	Ground source heat pump + Electric radiant heating	-52.296	428.423	89.82	601,000	959,917
Melling House	2024	2024	2024	-	2024	Air source heat pump	- 95.9	309.705	408.76	247,000	394,508
Beck View	2027	2027	2027	-	2027	Air source heat pump	-190.622	492.036	375.37	422,100	674,178
Glebe Court	2030	2030	2030	-	2030	Air source heat pump	-209.594	549.87	107.87	299,700	478,681
Ripley Court	2030	2030	2030	-	2030	Air source heat pump	-150.820	452.191	89.83	355,032	567,057
Parkside Court	2029	2029	2029	2029	2029	Air source heat pump	-162.278	487.55	191.64	500,700	799,718
Kingsway Court	2028	2028	2028	-	2028	Air source heat pump	-192.717	544.931	317.27	355,600	567,964
							- 1,583 GWh	**7,043 GWh**	**5,117 tCO_2**	**£9.369 million**	**£14.96 million**

6 Buildings Pathway to Net Zero Carbon & Key Priorities

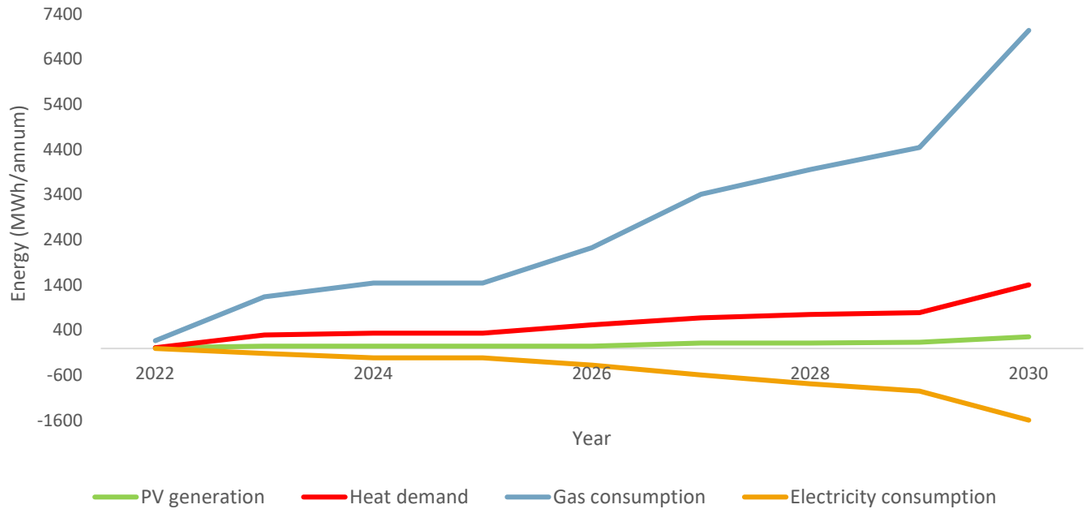
Pathway Through a Lens

The following charts show the transition of technologies over the term, and the resulting impact on energy and fuel consumption.

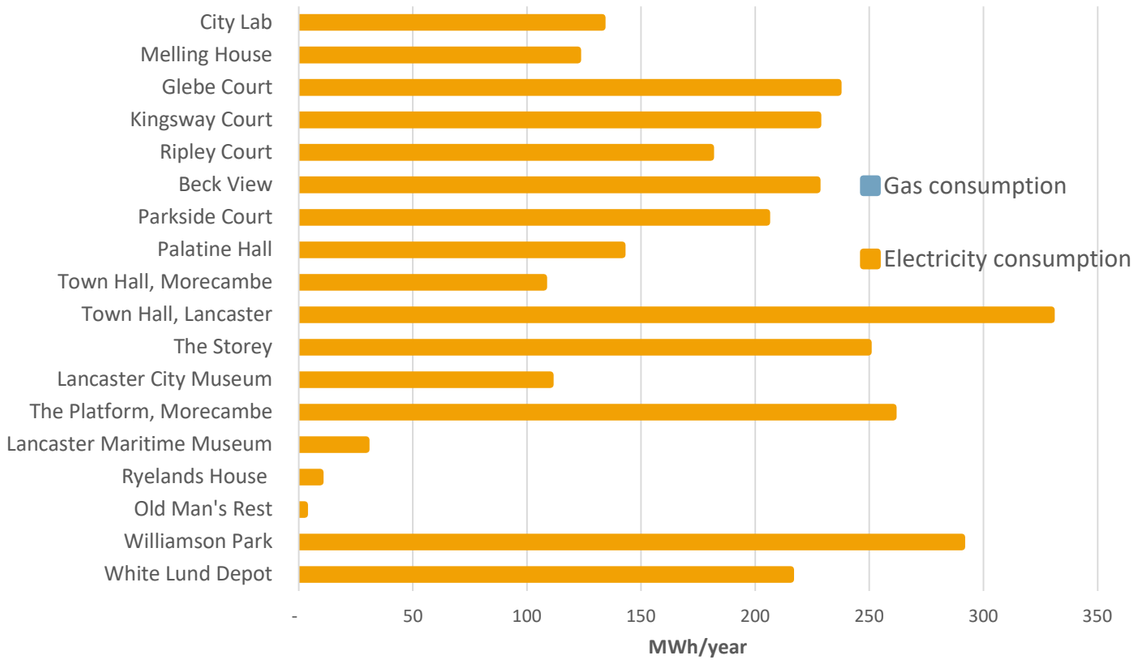
BUILDING LEVEL SPACE HEATING TECHNOLOGIES



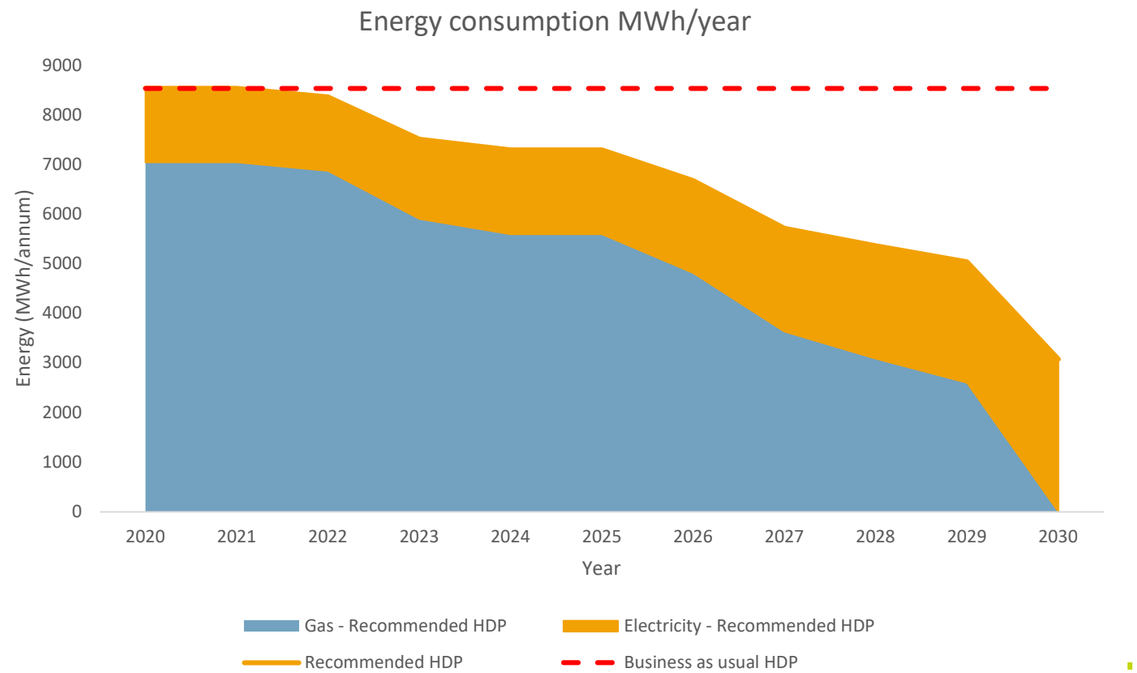
RETROFIT SAVINGS



OVERVIEW OF HIGHEST ENERGY CONSUMING ASSETS (MWH/ANNUM) - 2030 YEAR



ELECTRICITY AND GAS CONSUMPTION



7 Decarbonisation Action Plan

Short Term [£4.17 mill]

2022-2024

- Allocation of internal resource to manage and ensure implementation of the proposed pathway
- PSDS phase 2 or 3 and other known decarbonisation projects to be completed
- Identify viable PSDS phase 4 projects and apply for funding
- Carry out detailed decarbonisation studies on identified priority buildings

Medium Term [£4.63 mill]

2024-2027

- Review portfolio to determine priority opportunities and proceed with decarbonisation activity
- Where energy reduction measures have been implemented, begin replacement of gas fired boilers where at end-of-life
- Survey and develop decarbonisation plan for all other remaining buildings

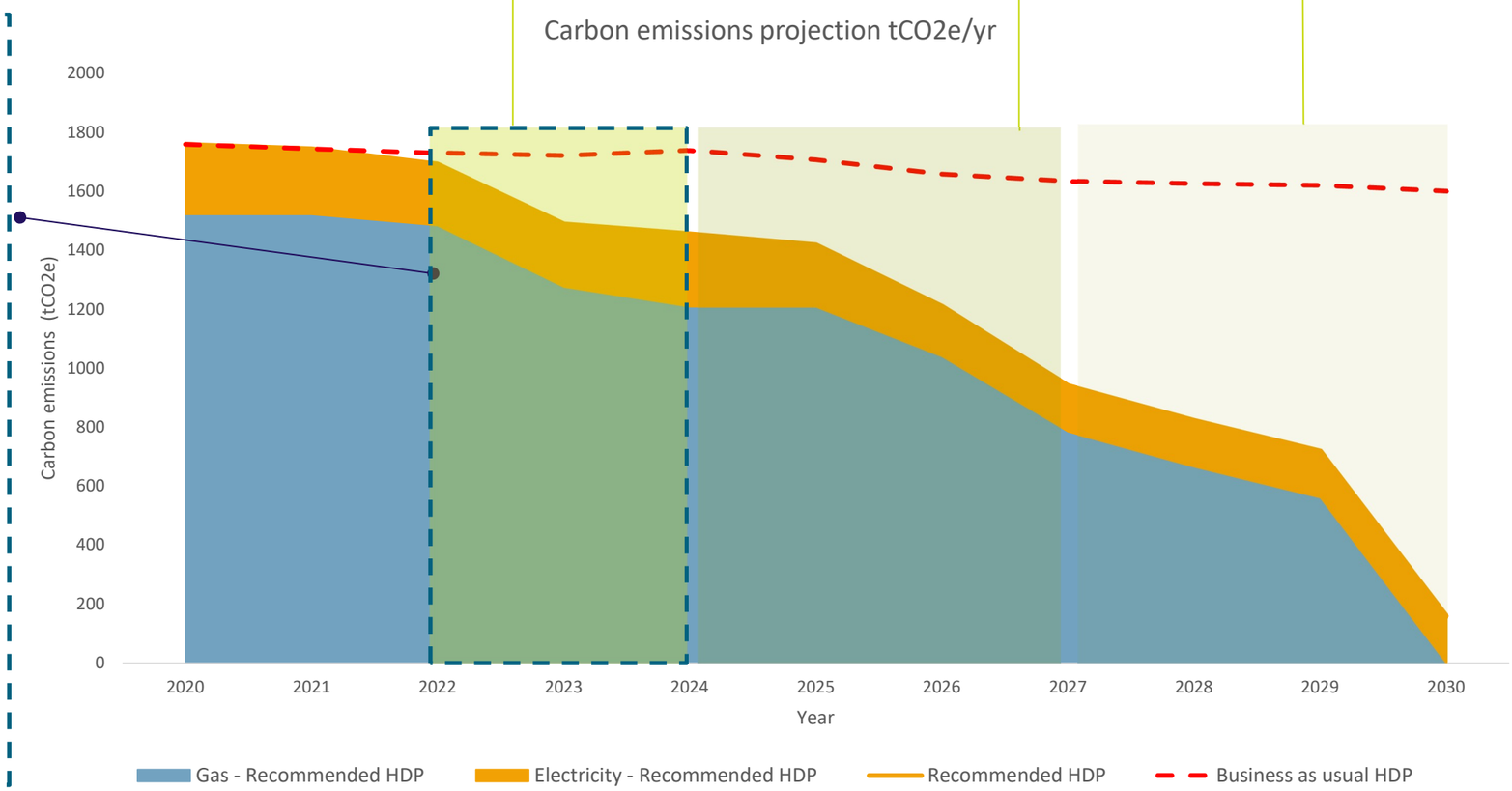
Long Term [£6.15 mill]

2027-2030

- Heat decarbonisation carried out on remaining buildings where existing gas fired plant comes to end of life
- All remaining measures implemented across estate

Detailed Short Term Action Plan

- Moving away from reliance on burning of fossil fuels is a key priority. Any boilers coming to their end of life should be prioritised for replacement in lieu of heat pumps.
- Where heating plant is replaced, smart controls should be installed to optimise performance and allow remote visibility of energy consumption.
- Replacement of non-LED lighting should be prioritised across the building stock.
- Regards improvement of fabric, priority should be on the buildings in particularly poor condition or with significant portions of single glazing.
- All priority interventions (i.e. prior to 2024) should be prepared for the next round of PSDS funding (phase 4)

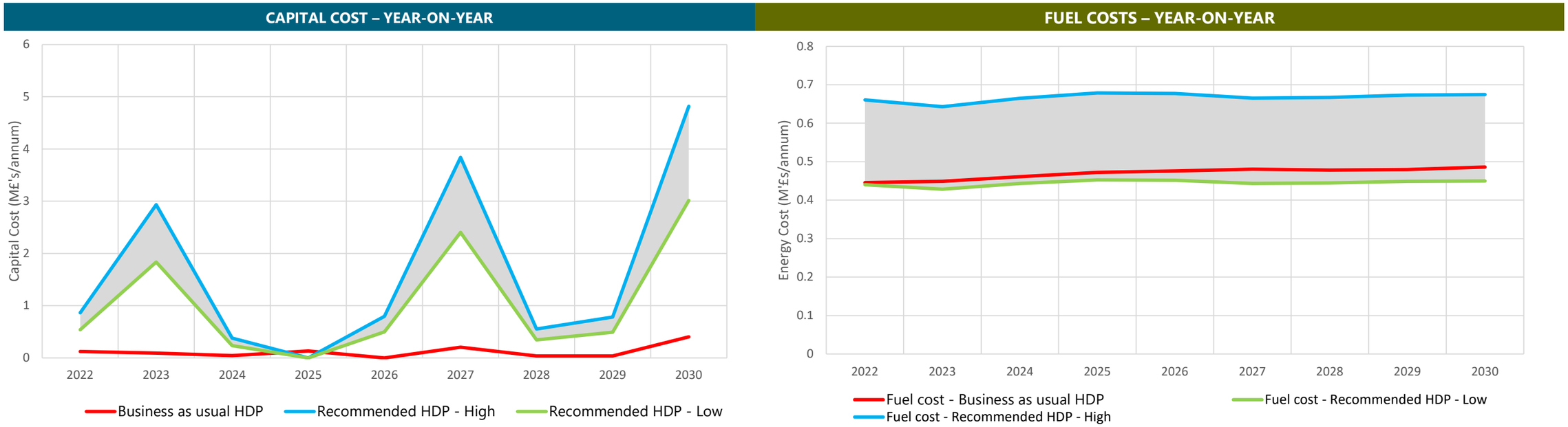


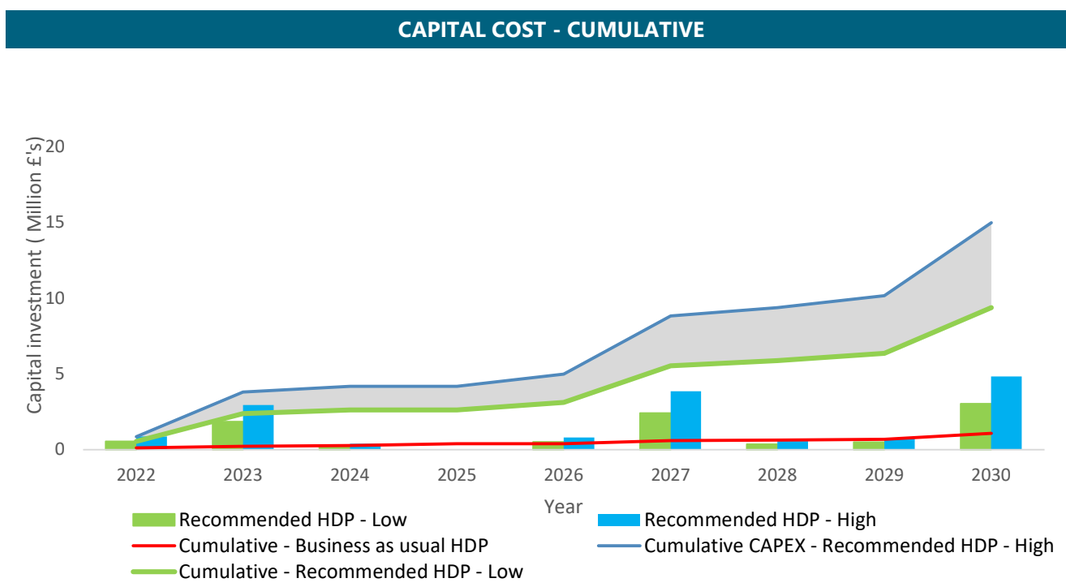
Capital and operational costs

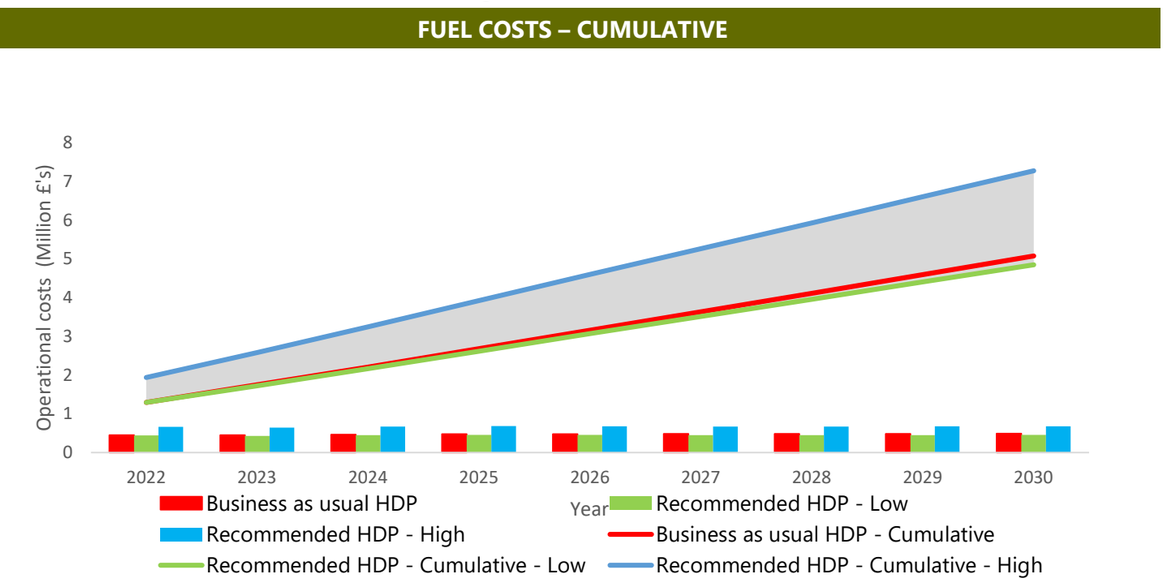
An estimation of the likely capital investment required to deliver the Decarbonisation Plan has been identified. The green line indicates the funding and capital expenditure currently that have been committed on projects. This mostly represents the 2021 PSDS round 1/2/3 funding. The "low" capital costs are derived from removing project contingency from the "high" figures which are quoted in this report above.

The impact on operational costs for the purchase of energy and the cost of offsetting any remaining carbon from 2030 has been identified. Potential additional costs associated with the purchase of REGO and PPA electricity from 2025 has not been included. The significant increase in operating costs in 2030 that occurs if no further investment in decarbonisation and energy efficiency projects beyond those currently detailed could be significant. The "low" energy forecast costs are taken from BEIS Green Book projections. The "high" costs include 50% increase to account for the current global energy crisis and resultant potential future energy price increases.

Figure 7: 1-4 – Below figures show the high – low contingency in capital and fuel costs







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