McCann and partners

Consulting Engineers

Abingdon & Witney College

Heat Decarbonisation Plan

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1. Introduction

McCann & Partners have been appointed by Abingdon and Witney College to develop a Heat Decarbonisation Plan for the Abingdon Campus.

As part of our services on this project we have carried out a review of the available O&M information, a visual non-intrusive survey of the MEP plant room services and emitters, and a condition appraisal based on CIBSE Guide M. No tests, operation of equipment or detailed calculations were carried out in conjunction with the survey.

2. Site Overview

The Abingdon campus is situated on Wootton Road and comprises of ten different blocks built in phases, some of which have been refurbished.

McCann & Partners visited the Abingdon campus on the 14th March 2023 to undertake the visual survey of the plant rooms for each block.

3. Outline System Descriptions

This section of the report provides an overview of the systems based on the available O&M information and as surveyed on site.

3.1. Mechanical and Public Health

3.1.1. Block A

The mechanical services serving Block A – the motor vehicle workshop – were refurbished in 2013/2014. The main plant, plantroom pipework and radiators were replaced and existing distribution pipework retained.

Heating to the workshop is provided by gas fired air heaters. The IT workshop, office, store and toilets are served by Low Temperature Hot Water (LTHW) radiators fed from a 48kW gas fired boiler in the plantroom.

Refrigerant based fan coil units with external condensers provide cooling to the IT workshop.

Domestic hot water is provided locally to the cleaners store and workshop sink by electric hot water heaters.

3.1.2. Advanced Skills Centre

No O&M information was obtained for the Advanced Skills Centre. Based on the plant room survey, the services appear to have been installed in 2017.

Two gas fired boilers generate LTHW serving two circuits; a constant temperature circuit serving the hot water cylinder and a variable temperature circuit serving radiators throughout the building.

Four external condenser units serve cassette units providing cooling and/or heating within the building.

3.1.3. Block B

The mechanical services within Block B were refurbished in 2015/2016. The two 115kW gas fired boilers, a 309 litre hot water cylinder, radiators, air heaters, ventilation and VRV systems were replaced as part of these works.

The gas fired boilers provide LTHW to two variable temperature circuits serving radiators throughout the building and Engineering Workshop 01, and a constant temperature circuit serving the air heaters within Engineering Workshop 02. The LTHW circuit design temperatures are 80°C flow and 60°C return.

A gas fired hot water storage heater provides domestic hot water to the building.

There are two external condenser units providing heating and cooling to Block B. One external condenser unit serves cassette units within the IT classrooms and the second serves a wall mounted unit within the Comms Room to provide cooling only.

Block B has a DEC rating of C (66) and has estimated heating Energy Use Intensity (EUI) of 51kWh/m^2 and electrical EUI of 71kWh/m^2, with no contribution from renewable energy.

3.1.4. Block C

The main mechanical plant serving Block C was replaced in 2017 as part of the boiler replacement works. Three 96kW gas fired boilers generate LTHW to serve four circuits serving a 170l hot water cylinder and providing heating throughout the building.

Block C has a DEC rating of C (53) and has estimated heating Energy Use Intensity (EUI) of 51kWh/m^2 and electrical EUI of 71kWh/m^2, with no contribution from renewable energy.

3.1.5. Block D

The mechanical services within Block D were refurbished in 2014/2015. The heating system within the plantroom, including the pipework, was replaced as part of these works. The existing gas fired boiler was retained and an additional 350kW gas fired boiler added to supplement the system. The age of the existing boiler is unknown, however there is evidence of service history from 2012, suggesting the boiler is at least 12 years old.

The gas fired boilers generate LTHW to serve two heating circuits serving radiators throughout the building and domestic hot water heating coils.

A refrigerant heating and cooling system was installed as part of the 2015 refurbishment works. Five VRV systems serve cassette units and overdoor air curtains within the building and hydroboxes within the plantroom serving the domestic hot water system.

Domestic hot water is generated and stored by two 1000l indirect hot water cylinders. The cylinders have two heating coils fed from the LTHW system and the hydrobox system.

Block D has a DEC rating of C (53) and has estimated heating Energy Use Intensity (EUI) of 51kWh/m^2 and electrical EUI of 71kWh/m^2, with no contribution from renewable energy.

3.1.6. Block E

The main heating and hot water services plant serving Block E was replaced in 2021. Two 58kW gas fired boilers generate LTHW to provide heating throughout the building. A 375l direct gas fired domestic hot water cylinder provides domestic hot water, with a flow temperature or 62°C at the time of the survey.

Three external condenser units distribute refrigerant to Block E, providing cooling and/or heating to the building. The units appear to have been installed in 2008/2009.

Block E has a DEC rating of B (45) and has estimated heating Energy Use Intensity (EUI) of 51kWh/m^2 and electrical EUI of 71kWh/m^2, with no contribution from renewable energy.

3.1.7. Block G

Block G is served by the systems within Block C.

Block G has a DEC rating of C (62) and has estimated heating Energy Use Intensity (EUI) of 51kWh/m^2 and electrical EUI of 71kWh/m^2, with no contribution from renewable energy.

3.1.8. Dance Studio

The dance studio is a prefabricated, modular building with minimal mechanical services. The building is naturally ventilated and heating is provided by electric panel heaters. Based on layouts available within the planning application, there are no WC or showering facilities within the dance studio and therefore not domestic water or drainage provision.

3.1.9. Green Construction Centre

The Green Construction Centre was built in 2021, therefore all building services systems are less than 2 years old.

Two 12kW Air Source Heat Pumps (ASHPs) generate LTHW with circuit temperatures of 45°C flow and 40°C return to serve underfloor heating throughout the building. Heating to the workshops is provided by electric radiant panels.

The ASHP system serves a 210l hot water cylinder to raise the stored water temperature to 55°C, from which an electric immersion element raises the temperature to 60°C.

3.1.10. The Development Centre

The Development Centre was built in 2015, therefore all building services systems are approximately 8 years old.

There are two ASHPs generating LTHW at 55°C flow and 45°C return temperatures to serve the underfloor heating system throughout the building.

The ASHP system does not serve a domestic hot water circuit, therefore domestic hot water is presumed to be generated by local direct electric water heaters.

4. Condition Appraisal

This condition survey details our findings and will be used to inform the low and zero carbon feasibility assessment for the Abingdon Campus.

The following timescale and condition definitions have been used in this report:

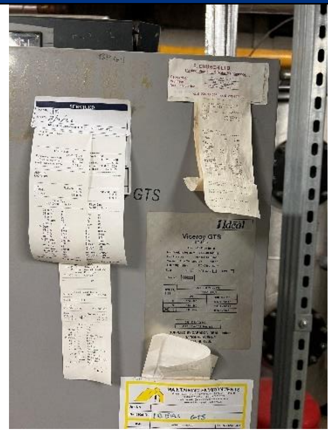
Timescale	Definition
Immediate	Requires attention as soon as practically possible
Short Term	One year
Medium Term	Two to five years
Long Term	Six to ten years
Condition	**Definition**
Good	In new condition with no wear or other defects
Satisfactory	Subject to general wear and tear but still serviceable and functioning adequately
Fair	Subject to several years wear but still serviceable with repair work necessary
Poor	In a dilapidated condition, subject to hard long-term wear, major repair/or replacement necessary.

This report is subject to our standard conditions and limitations, a copy of which is detailed within Section 11.

4.1. Mechanical and Public Health

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
Heat Source							
Block A	Gas-fired boiler	20	5.5.1.1.2.8	Boilers appear to have been serviced regularly and the system appears in good condition	Satisfa ctory	Long Term (10+ years)	
Advanced Skills Centre	Gas-fired boiler	20	5.5.1.1.2.8	Boilers appear to have been serviced regularly and the system appears in good condition	Good	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
Block B	Gas-fired boiler	20	5.5.1.1.2.8		Satisfa ctory	Long Term (10+ years)	
Block C	Gas-fired boiler	20	5.5.1.1.2.8	Boilers appear to have been serviced regularly and the system appears in good condition	Satisfa ctory	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block D	Gas-fired boiler	20	5.5.1.1.2.8	Boiler 01 – Age of boiler unknown. Appears to have regular service history from 2015. Evidence of service in 2012	Satisfactory	Medium Term (5 years)	
				Boiler 02 – Installed in 2014/2015 and appears to have been regularly serviced	Satisfactory	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block D	Hydrobox	15	5.6.4.1.1.2		Satisfactory	Long Term (7 years)	
Block E	Gas-fired boiler	20	5.5.1.1.2.8	Installed in 2021 and serviced in 2022	Good	Long Term (10+ years)	
Green Construction Centre	Air source heat pump	15	5.6.4.1.1.1	Not visible on inspection	-	Long Term (10+ Years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
The Development Centre	Air source heat pump	15	5.6.4.1.1.1	Units appear in satisfactory condition, however rubbish and debris is gathering behind unit and should be cleared.	Satisfa ctory	Long Term (7 years)	 
Domestic Hot Water							
Block A	Instantaneous electric water heater	12	5.4.4.1.1.2	Not visible on inspection	-	-	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Advanced Skills Centre	Hot water calorifier / cylinder	20	5.4.3.1.7.1		Good	Long Term (10+ years)	
Block B	Direct gas-fired water heater	15	5.4.4.1.1.1	Service history not recorded after 2018	Satisfactory	Long Term (7 years)	
Block C	Hot water calorifier / cylinder	20	5.4.3.1.7.1	Not visible on inspection	-	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block D	Hot water calorifier / cylinder	20	5.4.3.1.7.1		Satisfactory	Long Term (10+ years)	
Block E	Direct gas-fired water heater	15	5.4.4.1.1.1	Installed in 2021 and serviced in 2022	Good	Long Term (10+ years)	
Green Construction Centre	Hot water calorifier / cylinder	20	5.4.3.1.7.1		Good	Long Term (15+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
The Development Centre	Instantaneous electric water heater	12	5.4.4.1.1.2		-	Medium Term (2 – 5 years)	
External Condenser Unit (Cooling)							
Block A	VRV System	15	5.6.7.1.9.7		Satisfactory	Medium Term (5 years)	 

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Advanced Skills Centre	VRV System	15	5.6.7.1.9.7		Satisfactory	Long Term (9 years)	
Block D	VRV System	15	5.6.7.1.9.7		Satisfactory	Medium Term (5 years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block E	VRV System	15	5.6.7.1.9.7	Installed in 2008/2009. Visible rust on all units.	Fair	Short / Medium Term (2 years)	 

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
Heat Emitters							
Block A	Gas fired unit heaters	15	5.6.2.1.1.7	Installed in 2013/2014	Satisfa ctory	Long Term (6 years)	
Block A	Radiators	20	5.6.1.1.3.8	Installed in 2013/2014 Plug in heaters appear to be used to supplement heating system	Satisfa ctory	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
Block A	Fan coil units	20	5.6.3.1.2		Not visible, within ceiling void	Long Term (10+ years)	
Advanced Skills Centre	Radiators	20	5.6.1.1.3.8		Good	Long Term (10+ years)	
Advanced Skills Centre	VRV System	15	5.6.7.1.9.7		Good	Long Term (10+ years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block B	Radiators	20	5.6.1.1.3.8	Insulation damaged and missing in areas	Good	Long Term (10+ years)	
Block B	Fan convectors	15	5.6.1.1.3.3		Satisfactory	Long Term (9 years)	

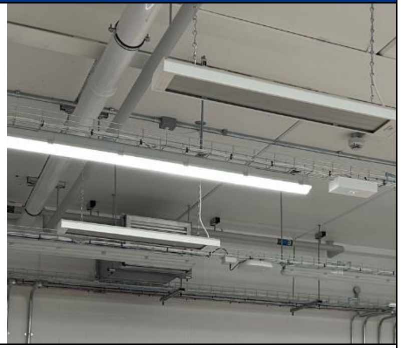
Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
							
Block C	Electric Radiant Panel	20	5.6.1.1.3.8	Not visible on inspection	-	-	
Block C	Radiators	20	5.6.1.1.3.8	Combination: Convector heater	Fair	Medium Term (2 years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
				Panel heater	Fair	Medium Term (2 years)	 
				Newer radiators in WC areas	Satisfa ctory	Long Term (10 years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block D	Fan coil units	20	5.6.3.1.2	Units appear in satisfactory condition, however stains on ceilings suggest potential pipework leaks or improper insulation ineffectively preventing condensation	Satisfactory	Long Term (12 years)	
Block D	Radiators	20	5.6.1.1.3.8	Insulation damaged and missing in areas	Satisfactory	Long Term (10 years)	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Condition	Approximate Timescale for Replacement	Photo
Block E	Radiators	20	5.6.1.1.3.8		Satisfactory	Long Term (6 years)	
Block G	Radiators	20	5.6.1.1.3.8	Age unknown Radiators and pipework subject to wear in creative spaces Plug in heaters appear to be used to supplement heating system	Satisfactory	Medium Term (5 years)	 

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
							
Dance Studio	Electric Panel Heater	15	5.6.8.1.1.2		Good	Long Term (10+ years)	
Green Construction Centre	Underfloor heating	25-30	5.6.1.1.4	Not visible	-	-	

Building Reference	Equipment	Reference Service Life – CIBSE GUIDE M (years)	RICS NRM 3Code	Comments	Conditi on	Approximate Timescale for Replacement	Photo
Green Construction Centre	Electric Radiant Panel	20	5.6.1.1.3.8		Good	Long Term (10+ years)	
The Development Centre	Underfloor heating	25-30	5.6.1.1.4	Not visible	-	-	

5. Low and Zero Carbon Technology Feasibility

A high level assessment of applicable low and zero carbon technologies has been carried out to determine suitable options for the decarbonisation strategy at the Abingdon campus of Abingdon and Witney College. Photovoltaics (PV), solar thermal and ASHPs have been analysed based on the building uses and suitability to retrofit to existing buildings. PV and solar thermal calculations are generally based on 60% of the roof area or less where there are obstructions on the roof.

Gas and electricity meter data has been shared by Abingdon and Witney College:

	Gas (kWh)	Electricity (kWh)			
	Meter data	Meter 1	Meter 2	Meter 3	Meter 4
January	66,852	34,833	14,922	4,951	12,068
February	43,789	28,413	15,159	3,085	11,253
March	47,669	31,770	16,961	3,316	12,725
April	33,467	23,964	11,257	3,982	10,647
May	10,665	28,008	11,942	1,967	9,917
June	3,032	27,338	11,130	1,297	9,064
July	1,184	25,233	6,702	1,237	6,963
August	1,504	28,520	5,999	1,301	7,390
September	1,660	28,569	9,564	1,726	8,737
October	3,948	28,590	11,135	1,867	8,781
November	34,620	31,242	13,664	2,731	10,923
December	42,304	25,981	13,865	3,293	9,749
Total (kWh)	290,694	342,461	142,300	30,753	118,217
Total (MWh)	291	634			

Three buildings on campus have existing PV on their roofs:

Building	Estimated PV System Rating (kWp)	Estimated PV Output (kWh)
Block A	8	6,510
Advanced Skills Centre	14	13,770
The Green Construction Centre	14	13,770

There appears to be additional available roof space on Block A and the Advanced Skills Centre to increase the amount of PV or add solar thermal. The Green Construction Centre appears to have maximised the available roof space and therefore additional PV or solar thermal is not considered.

The following table outlines potential CO_2 and energy savings and indicative costs of the considered technologies based on the metered data for the campus, averaged based on building floor area:

Technology	Block A	Advanced Skills Centre	Block B	Block C	Block D	Block E	Block G	Dance Studio	Green Construction Centre	The Development Centre
PV – Electrical Demand										
Energy Reduction	22%	28%	69%	69%	69%	69%	69%	69%	-	82%
CO_2 Reduction	35%	35%	63%	63%	63%	63%	63%	63%	-	82%
Capital Cost	£4,579	£16,858	£54,386	£36,824	£207,762	£92,532	£35,502	£8,498	-	£11,079
Anticipated Payback	<10	<10	<10	<10	<10	<10	<10	<10	-	<10
Recommended	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes
Solar Thermal										
Energy Reduction	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	-	-	5.6%
CO_2 Reduction	7.6%	7.3%	5.4%	5.4%	5.4%	5.4%	5.4%	-	-	5.6%
Capital Cost	£4,367	£ 12,341	£16,334	£11,060	£62,398	£27,791	£10,663	-	-	£3,327

Technology	Block A	Advanced Skills Centre	Block B	Block C	Block D	Block E	Block G	Dance Studio	Green Construction Centre	The Development Centre
Anticipated Payback	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	-	-	Does not pay back
Recommended	No	No	No	No	No	No	No	No	-	No
ASHP										
Energy Reduction	20.5%	20.6%	20.6%	20.6%	20.5%	20.6%	20.6%	21.0%	-	4.3%
CO_2 Reduction	44.1%	35.6%	26.3%	26.3%	24.9%	26.3%	26.3%	19.4%	-	4.3%
Capital Cost	£23,040	£28,397	£110,400	£138,240	£336,000	£55,680	£19,627	-	-	-
Anticipated Payback	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	Does not pay back	-	-
Recommended	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No – no plant space available	No - Existing Strategy	No - Existing Heating Strategy

Part of the UK Government's net zero strategy calls for the electrification of the majority of heat generation. This eliminates fossil fuels and will lead to the gradual reduction in carbon emissions as the electricity grid decarbonises by 2035, therefore ASHPs are proposed despite not offering a system payback.

As indicated in the table above, solar thermal panels offer the lowest energy and emissions savings of the three technologies. Additionally, when ASHPs are adopted for hot water generation, the relative contribution of solar thermal decreases and PV is favoured due to the approximate 3:1 ratio of hot water output to electrical energy input when ASHPs are used.

6. Fabric Performance Analysis

Limited fabric information is available for the buildings on campus, therefore fabric parameters have been assumed based on the version of Building Regulations Approved Document Part L at the time of construction. It is likely the U-values of newer buildings will improve on all or some of these figures, therefore the savings outlined may vary. The improved U-values assumed in this analysis are based on the Climate Emergency Design guide published by LETI:

Element	Baseline U-value (W/m^2K)	Improved U-value (W/m^2K)
Floor	0.25	0.15
Roof	0.25	0.12
External Walls	0.35	0.15
Glazing	2.2	1.2
Doors	2.2	1.2

Based on the above U-values, high level calculations indicate the potential energy and CO_2 emissions reductions outlined in the table below:

Fabric Improvements	Block A	Advanced Skills Centre	Block B	Block C	Block D	Block E	Block G	Dance Studio	Green Construction Centre	The Development Centre
Roof										
Energy Reduction	9%	3%	3%	1%	2%	2%	2%	3%	1%	1%
CO_2 Reduction	4%	2%	2%	1%	1%	2%	1%	2%	1%	1%
Walls										
Energy Reduction	3%	2%	2%	3%	1%	3%	3%	4%	1%	1%
CO_2 Reduction	5%	4%	2%	4%	1%	3%	3%	3%	3%	1%
Floor										
Energy Reduction	1%	0%	1%	1%	0%	3%	2%	5%	0%	1%
CO_2 Reduction	3%	0%	1%	1%	0%	3%	2%	5%	1%	1%
Windows										
Energy Reduction	1%	2%	2%	3%	1%	1%	3%	3%	1%	1%

CO_2 Reduction	2%	2%	2%	3%	1%	1%	3%	2%	1%	1%
Combined										
Energy Reduction	7%	6%	7%	8%	3%	7%	9%	13%	3%	4%
CO_2 Reduction	15%	9%	8%	9%	4%	9%	10%	12%	6%	4%

Implementing all of the fabric improvements outlined about could reduce building energy consumption by an average of 8% and CO_2 emissions by an average of 11%. As existing in-use buildings, it may be difficult to upgrade the performance of the ground floor and external walls. Therefore, window and roof upgrades are recommended.

The extent of fabric improvements should be considered further with detailed consideration to ease of installation and cost. As part of moving to an ASHP heat generation strategy, minimising heat losses reduces the electrical demand and mitigates the potential increased size of emitters.

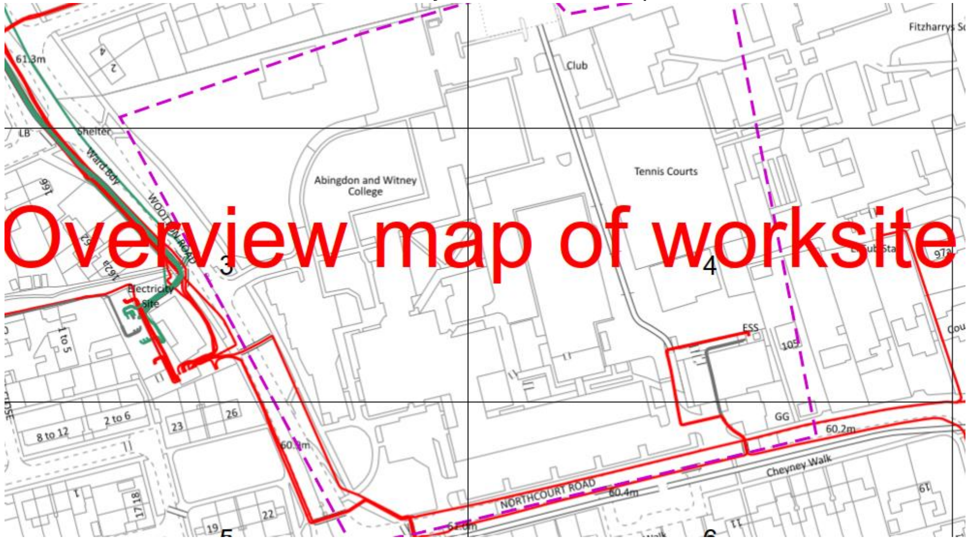
During design development, the output of emitters in good condition could be evaluated for suitability of reuse based on the reduced heat losses associated with the fabric upgrades. Historically, boilers generate low temperature hot water at 80°C flow and 60°C return temperatures, and therefore a temperature differential of 20K. ASHPs typically operate with a temperature differential of 5K, requiring four times the water flow rate to deliver the same energy as boilers. It is unlikely fabric improvements will reduce heat losses to the same scale, therefore the distribution pipework would need to be replaced as part of the heat decarbonisation works. The Green Construction Centre and The Development Centre are served by ASHPs, therefore no internal retrofit of pipework and emitters is required.

7. Capacity of electrical infrastructure

A high level visual review/inspection of the existing Electrical Installation has been carried out for the purpose of this report, to provide an overview on the condition and suitability of the existing systems to serve any potential upgrades to the supply, which may be required to serve the new additional mechanical equipment.

Based on the record plan from Scottish & Southern Electricity Networks, there were 2 nos. Of 11kV supply to the campus site. However, the supply rating to site is unknown.

Overview map of campus site extracted from Scottish & Southern Electricity Network record plan:



7.1. Block A

7.1.1. Capacity of Incoming Power for new ASHP

For the proposed decarbonisation scheme, a new ASHP system is considered and the estimated additional electrical loading of ASHP at Block A would be 24kW with a total maximum operating current 56amps TPN.

In absence of an ‘As Installed’ Main LV Distribution schematic and metering of outgoing way of Block A, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The circuit breaker and power cable of Block A may require upgrade to facilitate the decarbonisation scheme.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.1.2. **PV Installation**

There was an existing PV system installed at the building roof and current spare spaces for PV system extension as mentioned in Section 5. For a new PV system apply in the existing building, there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

7.2. Block B

7.2.1. Capacity of Incoming Power for new ASHP

Refurbishment work was carried out in Block B in 2015/16, and the latest LV schematic only indicates the affected areas but does not consider unchanged areas such as the incoming main switch. The "Existing Main Switch" on Drawing E-4001 under Job No. C3997 dated 05-10-15 was not indicated with any ratings of the switch.

For the proposed decarbonisation scheme, a new ASHP system is considered and the estimated additional electrical loading of ASHP at Block B would be 126kW with a total maximum operating current 216amps TPN.

In absence of an 'As Installed' Main LV Distribution schematic and metering of outgoing way of Block B, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The circuit breaker and power cable of Block B may require upgrade to facilitate the decarbonisation scheme.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.2.2. **PV Installation**

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

The current condition of plant room was full of installed equipment and space constrained. It may be hard to find sufficient space for the new equipment.

7.3. Block C

7.3.1. Capacity of Incoming Power for new ASHP

A 630A TPN incoming LV supply from DNO was feeding into the LV distribution panel which served for Block C & Block D.

From the LV distribution panel, a dedicated LV supply serves the Block D via an underground LV cable to the buildings fused isolator located in the ground floor plant room. The cable size could not be determined from the visual inspection carried out at the time of the site.

For the proposed decarbonisation scheme, a new ASHP system is be considered and the additional electrical loading of ASHP at Block C would be 144kW with a total maximum operating current 268amps TPN.

In absence of an ‘As Installed’ Main LV Distribution schematic and metering of outgoing way of Block C, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The main circuit breaker and incoming power cable of Block C and Block D would be required for upgrade to facilitate the decarbonisation scheme. The total electrical loading of new ASHP for Block C & Block D sums to 766amps TPN, which exceeds the current building supply of 630A TPN.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.3.2. PV Installation

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

7.4. Block D

7.4.1. Capacity of Incoming Power for new ASHP

A 630A TPN incoming LV supply from DNO feeds the LV distribution panel which served for Block C & Block D.

From the LV distribution panel, a dedicated LV supply serves the Block D via an underground LV cable to the buildings fused isolator located in the ground floor plant room. The cable size could not be determined from the visual inspection carried out at the time of the site.

For the proposed decarbonisation scheme, a new ASHP system is considered and the additional electrical loading of ASHP at Block D would be 315kW with a total maximum operating current 498amps TPN.

In absence of an 'As Installed' Main LV Distribution schematic and metering of outgoing way of Block D, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The main circuit breaker and incoming power cable of Block C and Block D would be required for upgrade to facilitate the decarbonisation scheme. The total electrical loading of new ASHP for Block C & Block D sums to 766amps TPN, which exceeds the current building supply of 630A TPN.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.4.2. PV Installation

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

7.5. Block E

7.5.1. Capacity of Incoming Power for new ASHP

The main switch of LV distribution panel is 630A TPN and set at 250A TPN for Block E.

From the LV distribution panel, a dedicated LV supply serves the Block E via an underground LV cable to the buildings fused isolator located in the ground floor plant room. The cable size could not be determined from the visual inspection carried out at the time of the site.

For the proposed decarbonisation scheme, a new ASHP system is considered and the additional electrical loading of ASHP at Block E would be 63kW with a total maximum operating current 108amps TPN.

In absence of an 'As Installed' Main LV Distribution schematic and metering of outgoing way of Block E, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The circuit breaker and power cable of Block E maybe required for upgrade to facilitate the decarbonisation scheme.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.5.2. PV Installation

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

The current condition of plant room was full of installed equipment and it may be hard to find sufficient space for the new equipment. Also, there was a water tank installed at the middle of electrical plant room which is generally recognised as not good practice. environment for electrical installation.

7.6. Block G

7.6.1. Capacity of Incoming Power for new ASHP

For the proposed decarbonisation scheme, a new ASHP system is considered and the additional electrical loading of ASHP at Block G would be 25kW with a total maximum operating current 41amps TPN.

In absence of an 'As Installed' Main LV Distribution schematic and metering of outgoing way of Block G, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The circuit breaker and power cable of Block G maybe required for upgrade to facilitate the decarbonisation scheme.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.6.2. PV Installation

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

7.7. Advanced Skills Centre

7.7.1. Capacity of Incoming Power for new ASHP

The main incoming switch of LV distribution panel for Advanced Skills Centre is 400A TPN and served by existing SSE transformer.

For the proposed decarbonization scheme, a new ASHP system is considered and the additional electrical loading of ASHP at Advanced Skills Centre would be 24kW with a total maximum operating current 56amps TPN.

In absence of an 'As Installed' Main LV Distribution schematic and metering of outgoing way of Advanced Skills Centre, it was not possible to review the complete LV Sub-Main Distribution System to determine the full extent of the existing installation and the peak electrical loading. The circuit breaker and power cable of Advanced Skills Centre maybe required for upgrade to facilitate the decarbonisation scheme.

It would appear that the cable and main isolator are in a fair condition, however, if an upgrade of the supply is required to serve the new mechanical systems, we would recommend that the main isolator is replaced with the main incoming cable to prolong the life of the main incoming supply service and devices.

7.7.2. **PV Installation**

There is an existing PV system installed at the building roof and current spare spaces for PV system extension as mentioned in Section 5. Any additional PV added to the building will need to consider the additional structural loading of PV panels as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

7.8. **Dance Studio**

7.8.1. **Capacity of Incoming Power for new ASHP**

An ASHP system is not proposed for the dance studio.

7.8.2. **PV Installation**

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

7.9. **Green Construction Centre**

7.9.1. **Capacity of Incoming Power for new ASHP**

The existing heat generation strategy for the Green Construction Centre is ASHPs, therefore no electrical upgrades are required.

7.9.2. **PV Installation**

There is an existing PV system installed at the building roof which maxmises the available roof spac. Therefore, there is no upgrade of the existing PV system under the high-level assessment.

7.10. The Development Centre

7.10.1. Capacity of Incoming Power for new ASHP

The existing heat generation strategy for the Development Centre is ASHPs, therefore no electrical upgrades are required.

7.10.2. PV Installation

A new PV system would be proposed under the decarbonisation scheme and there are few areas that would need to be considered such as the additional structural loading of PV panel as well as the spatial requirement of new equipment such as DC isolator, inverter, AC isolator and meter.

The additional structural loading created by the new PV panels would need to be taken into account when placing PV panels onto the roof.

8. Heat Network Feasibility

A campus heat network solution can simplify the implementation of ASHPs with regards to electrical infrastructure upgrades and locating plant. ASHPs could be located in a central energy centre, distributing LTHW in below ground pipework and rising within building plantrooms to substations to serve the building LTHW system.

Dedicated ASHPs per building would require external plant space at ground level or a structural assessment of whether the roofs can support ASHPs. This would reduce the available roof area for installing PV. With a campus energy centre, the ASHPs could be located externally at ground level.

Initial assessments indicate there is sufficient area to house an energy centre adjacent to the Development Centre:

The campus layout enables a clear route to distribute low temperature hot water pipework to the individual building plant rooms, where substations could be located. Installing substations within each building creates hydronic separation between the buildings and the heat network, enabling ease of phased building connection and isolation for maintenance.

A single energy centre could be located close to the site boundary, avoiding the requirement to increase the power supply to each individual building. Pending receipt of further information regarding the incoming supplies to the Abingdon Campus and individual buildings, and based on the information available at the time of writing, it is likely power supply upgrades will be required to accommodate ASHPs. On this basis, a heat network with a central energy centre in close proximity to the site boundary reduces the extent of upgrades to the campus.

9. Phasing

Building	Year of Install	Remaining Heat Generation Plant Life (Years)	Remaining Heat Emitter Life (Years)
Block A	2014	Boiler 10+ years	Gas fired heater 6 years Radiators 10+ years
Advanced Skills Centre	2017	Boiler 10+ years Hot Water Cylinder 10+ years	Radiators 10+ years
Block B	2016	Boiler 10+ years	Radiators 10+ years
Block C	2017	Boiler 10+ years	Radiators 10+ years
Block D	2015	Boiler 01 5 years Boiler 02 10+ years	Radiators 10+ years
Block E	2021	Boiler 15+ years	Radiators 6 years
Block G	Unknown	-	Radiators 10+ years
Dance Studio	2019	-	Radiators 10+ years
Green Construction Centre	2021	ASHPs 15+ years	Underfloor heating 20+ years
The Development Centre	2015	ASHPs 7 years	Underfloor heating 15+ years

Based on the condition survey, the majority of plant are not estimated to reach their end of life within the next 10 years. This creates flexibility in phasing the heat decarbonisation project. The following major steps have been identified:

1. Fabric upgrades: Stage fabric improvement works across all buildings
2. Upgrade incoming power: upgrade incoming cable and provide new power supply to energy centre location
3. Construct energy centre and install distribution pipework: Install main distribution pipework, with capped connection points to each building
4. Phased replacement of internal distribution and energy centre connection: Gradual replacement of building LTHW networks to suit ASHP operating temperatures and connection to heat network in order of years of remaining plant life
    a. Block A
    b. Block D
    c. The Development Centre
    d. Block B
    e. Block C
    f. Advanced Skills Centre
    g. Green Construction Centre

10. Conclusion

Of the energy reduction measures considered within this analysis, upgrades to the windows and roof can offer a reduction in energy demand, ASHPs can reduce energy consumption and PV reduces demand on the grid. The potential savings associated with these measures are outlined in the table below:

Decarbonisation Measures	Block A	Advanced Skills Centre	Block B	Block C	Block D	Block E	Block G	Dance Studio	Green Construction Centre	The Development Centre
Window and Roof Upgrades										
Energy Reduction	3%	3%	3%	3%	2%	3%	3%	3%	1%	1%
CO_2 Reduction	6%	4%	4%	3%	2%	3%	4%	4%	3%	2%
ASHP										
Energy Reduction	22%	22%	22%	22%	22%	22%	22%	17%	6%	7%
CO_2 Reduction	50%	38%	28%	28%	28%	28%	28%	24%	14%	7%
Combined – Fabric, ASHP, PV										
Energy Reduction	100%	47%	100%	100%	100%	100%	100%	100%	14%	100%
CO_2 Reduction	100%	73%	100%	100%	100%	100%	100%	100%	14%	100%

Based on the metered data available, it may be possible to decarbonise the Abingdon campus through these measures. By generating heat through ASHPs, the campus building services would not use fossil fuels. In conjunction with this, maximising PV panels could generate up to the equivalent annual energy consumption of the buildings on campus. While peak energy supply from PV panels and demand from the site may not always be aligned, there is potential to export electricity generated from the PV panels back to the grid.

The campus is well suited to an heat network strategy, which could facilitate decarbonisation by simplifying the installation of ASHPs and upgrading the electrical infrastructure and reducing downtime of buildings.

11. Limitations of Report

1. The survey was conducted in line with the brief to visually inspect and comment on the condition and the quality of the installation relating to normal good standards in the building services industry as dictated by CIBSE, IET and BSRIA current recommendations and standards.
2. The Inspection did not include Engineering Services which were built in, covered up, or otherwise made inaccessible in a normal course of construction, alteration, or fitting out.
3. No calculations were undertaken to determine the capacity of the plant items, nor were performance tests carried out on any of the systems or plant items. Design analysis of the systems was undertaken using generally accepted design criteria both past and present, primarily to establish the principle of design.
4. We specifically excluded tests relating to the performance of any heating, air conditioning or ventilation systems, pipe pressure tests, electrical or drainage tests. The omission of such tests might give rise to the fact that certain problems could exist which are not reflected in this Report.
5. We did not carry out a detailed inspection of the underground services and rainwater disposal system.
6. The report and survey excludes any investigation into structural engineering design, compliance with legislation relating to buildings, or the unsuitable use of high alumina cement or calcium chloride, calcium silicate brickwork, alkalisilicate reaction in concrete, cavity wall tie failure, radon gas seepage, woodwool slab permanent shuttering, asbestos or PCB or other materials considered as deleterious in construction, except in so far as such matters came to knowledge in the normal course of inspecting the materials and state or repair.
7. The report and survey did not include an inspection of the white goods, catering and vending equipment, telecommunication or data systems found within the building.
8. Any costs indicated within this Report are based on an assessment of the situation and the work involved at current prices and should not be taken as firm costs for the work details. To provide more accurate costs an investigation will be required in greater detail for individual items of the plant and systems, and may involve the employment of specialists where appropriate. In addition, please note that the costs do not include contract preliminaries, builders work, VAT or professional fees.
9. In accordance with our standard practice, we confirm that this Report is for the attention and purposes of the Addressee only and consequently McCann and Partners Ltd cannot accept any third party liability for the whole or any part hereof. Neither may the whole, nor any part of this report, nor any reference thereto, be published in any way nor included in any published document, circular nor statement without our prior written approval of the form and content in which it may appear.
10. We confirm we have not carried out an inspection of any pollution or contamination issues as part of this Report.

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