Holy Trinity CE Primary School

Heat Decarbonisation Site Report

A site visit to Holy Trinity CE Primary School was conducted on 15th March 2022 by David Legge to review the opportunities that the building has to decarbonise it energy usage so that it can become Net Zero by the Governments target of 2050 or considerably sooner.
The visit also review what elements of this may be deliverable and fundable through the recent Public Sector Decarbonisation Scheme (PSDS) supported by the Low Carbon Skills Fund (LCSF).

Outline of Current Position

Holy Trinity primary school is a suburban school and was originally built in 1842 and has been extended several times since the mid-1900s including a major extension in 1998 and further extensions in the past 10 years. The school comprises eight classrooms, library, main hall, kitchen, staff room, offices, small learning rooms, cloakrooms, and WCs.

The lighting is mixed with predominantly LED fittings, with a significant number of retrofit tubes in existing diffusers as well as T5 and T8 fluorescent fittings remaining. The building has the usual array of computers, projectors, and other appliances but these were noted to be used efficiently and not left on. There is a main kitchen on site serving the buildings lunches.

The original school walls are of solid red brick construction whereas later extensions appear to be brick cavity with insulation having been retrofitted into them. There are mainly pitched, red clay tiled roofs, and a small number of flat felt roofs. There are typically uPVC double glazed windows throughout the school, but the original school still has some single glazed timber framed casement windows.

Every year Holy Trinity CE Primary School uses £21,234 of energy and emits 64.8 tonnes of CO2e into the atmosphere contributing to the current climate crisis. Our review has found that the energy usage could be reduced by 84.8% saving £10,540 and 43.16 tonnes of emissions per year. Many of the measures have quick paybacks and therefore saving energy and responding to the climate crisis is also good business.

The overall energy saving and decarbonisation opportunities at this building have been summarised on the following table:

Energy Savings Summary

Saving Recommendations	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	% Energy Reduction	Estimated Capital Cost	Simple Payback (years)	CO_2 saving (tonnes of CO_2e/year)
Remove water coolers	219	£31	0.11%	Nil	Immediate	0.1
Reduce set point of hot water to 60 deg C (kitchen)	898	£41	0.47%	Nil	Immediate	0.2
Optimise control system settings	13,839	£830	7.24%	Nil	Immediate	3.7
Consider installing Electric Vehicle Charging Points	0	N/A	N/A	£2,500	N/A	N/A
Fit flow regulators onto existing taps	2,245	£316	1.18%	£300	0.9	0.6
Install SavaWatt devices on fridges and freezers	1,900	£268	0.99%	£610	2.3	0.5
Fit timed fused spurs to hot water heaters	1,944	£274	1.02%	£1,080	3.9	0.5
Change existing lighting for low energy lamps/fittings	7,533	£1,061	3.94%	£5,905	5.6	1.9
Install PIR motion sensors on selected lighting circuits / Adjust settings on existing PIRs	1,540	£217	0.81%	£1,463	6.7	0.4
Install a Solar PV array to roof of building (assumed 100% of energy generated used in building)	16,619	£2,341	8.70%	£26,978	11.5	4.2
Replace single glazed windows and doors for double glazed units	19,083	£1,145	9.99%	£24,196	21.1	5.1
Install Cheetah kitchen hood extract controls	1,320	£186	0.69%	£4,000	21.5	0.3
Install an Air Source Heat Pump into the building to replace existing heating system	94,102	£3,744	49.25%	£147,200	39.3	25.5

From our review of this site there appear to be the following energy efficiency and decarbonisation measures that could be considered.

Lighting

The lighting across the site is mixed but is predominantly LED fittings, with a significant number of retrofit tubes in existing diffusers. However, there are also T5 and T8 fluorescent fittings remaining, so it is recommended that all this lighting be replaced with new LED units.

> **Recommendation: Change all the remaining fluorescent lighting to LED.**

Most of the lighting has no lighting control and is switched on and off using a simple light switch. There are several lights which currently remain on all the time in areas such as corridors, toilet areas, staff room, and the like. Some of these areas are only used occasionally and for a short amount of time and as such, the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows where artificial lighting is not required for much of the year during the day.

It is recommended that a motion sensor is installed on these specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two to five minutes after the last movement has been detected (note that the duration of the time lag after which the light goes off needs to be considered alongside the type of light that is fitted. LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors (commonly called PIRs) also have light sensors integrated into them so they can be used to make sure that the light does not come on if there is already sufficient daylight in the space.

> **Recommendation: Install PIR motion sensors on selected lighting circuits / Adjust settings on existing PIRs.**

SavaWatt

Across the site there are various refrigeration units such as fridges within staff breakout areas for storage of milk and staff food. These units run 24/7 and contribute to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that they are all fitted with a SavaControl unit. These units work by automatically detecting the load of the compressor and turning down the power when it is not in full load. This reduces the energy consumption of the refrigeration unit by around 18% while maintaining the cooling of the appliance. It does this by reducing the voltage delivered to the unit when it is idling but allowing the full energy to the unit when it is required. The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

> **Recommendation: Install SavaWatt SavaControl units on to all refrigeration devices.**

Replacement Windows

A small number of the original school building windows (as listed in Appendix 2) were found to be single glazed with a timber casement and as such they are very poor in terms of thermal quality. The introduction of new double-glazed units would reduce the heat loss from the building and improve thermal comfort.

It is therefore recommended to replace these windows with new double-glazed windows with a uPVC casement set into the existing surround to match other windows on site. It is suggested that any window installation is undertaken by a FENSA Approved Installer [www.fensa.org.uk.](http://www.fensa.org.uk)

Recommendation: Replace single glazed windows and doors for double glazed units.

Water

There are a number of electric point of use water heaters to provide hot water for hand washing. This only needs to heat the water to the required temperature when the building is in occupation but at the moment this heater is directly wired in without any form of time control and therefore maintains its set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7-day timeclock to replace the fused spur switch. An example of such a unit would be a TimeGuard FST77. They should be set up with times to match the times that the building is occupied. This will prevent the standing losses from the unit wasting energy during periods when the building is not occupied. Such units can be purchased at any electrical wholesaler and fitted by your existing electrician, or any NICEIC registered electrical contractor.

Recommendation: Fit timed fused spurs to hot water heaters.

The stored hot water to the kitchen currently has a set point of 62°C. This is above the recommended levels for water hygiene. HSE Guidance (HSG271 Part 2, Para 2.6) states that "Hot water should be stored at least at 60°C and distributed so that it reaches a temperature of 50°C (55°C in healthcare premises) within one minute at the outlets." It further states (para 2.25) that for indirect heating such as the arrangement in this building "The boiler plant (or other calorifier heat source) should be heating while the shunt pump is active to ensure a temperature of at least 60°C is achieved throughout the vessel for at least one continuous hour a day. It is therefore advised that the set point should be set to 60°C and the hot water system run for at least one hour each day. This is a relatively simple adjustment which can be made by those on site or the h eating engineer during their next service visit.

Recommendation: Reduce set point of hot water to 60 degrees C (kitchen).

The taps to the wash hand basins within the building have been checked as part of the audit and the average flow rate within these has been measured to be 7l/min. The recommended flow rate for hand washing is 4.8l/min and therefore the taps are providing more water than is necessary.

The over provision of water for hand washing is not only a source of excessive water use, but in the case of hot water, it is also a source of wasted energy in the heating that has to go into providing the hot water.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water. These regulators can be self-installed or by any good facilities staff.

Recommendation: Fit flow regulators to existing taps.

During the audit, it was noted that the building has a number of water coolers within it. These have typically been installed in kitchen areas to provide filtered / chilled water to the staff. These water coolers consume energy due to their refrigeration element and tend to be left on 24/7.

The water quality within the cold tap is extremely high and often UK tap water is of superior quality to bottled water which has been subject to varying temperatures and light as well as been contaminated by the plastic bottle itself.

Given the proximity of high-quality drinking water in the cold tap it is recommended that the water coolers are removed. This will save energy as well as maintenance/leasing costs of the units.

Recommendation: Remove water coolers.

Kitchen

Within the commercial catering kitchen, there is a large extraction unit over the main cooking area. This is required for gas safety and to extract all the steam and odours from the cooking processes. Currently the extract fan runs at a fixed speed regardless of how much cooking is going on at the time.

It is recommended that a control system is added to the existing extract fan arrangement whereby temperature and humidity sensors are installed into the extract canopy which control the fan speed. This reduces the fan speed when there is less cooking going on and high levels of extract are not needed and increases it when it is required. It maintains a level of background extraction required for gas safety. Up to 80% savings on the power used by the extract fan can be achieved.

The supply and installation of such a kitchen extract control system can be undertaken by using the Cheetah system https://www.quintex.co.uk/cheetah/.

Recommendation: Install Cheetah kitchen hood extract controls.

Controls

The buildings main heating plant is controlled by a centralised controller. This is a domestic style Drayton LP711 located in the boiler room.

A high-level review of the settings within this control system highlighted a number of areas where the way in which it operates the building can be optimised to both reduce energy consumption and improve comfort. For example, the hot water is set to run continuously (24/7/365) and the heating is set manually on a daily basis despite the fact there is a time clock that correctly used, would allow good control of the heating system.

Recommendation: Utilise and optimise control system settings.

Existing Electrical Capacity available for Decarbonised Heat Provision

The site currently has one main electricity incomer which is a 100amp 3 phase supply located in the mains electrical intake cupboard in the corner of the main hall.

A 100A 3 phase supply has a maximum capacity of 69kVA.

Therefore, any future heat decarbonisation measures will need to be supported by an increase in the existing electrical capacity. Increases in supply capacity can be reviewed and quoted for by the local electricity District Network Operator (DNO) in the area. The DNO in your area is thought to be SSE Power Distribution - www.ssepd.co.uk; 0800 0483516 (North Scotland and Southern England).

Heat and Hot Water Decarbonisation

The building is currently provided with hot water from electric point of use water heaters to the WC wash hand basins and to the kitchenette sinks (with the exception of the kitchen stored hot water set up). As such these units are very energy efficient and it only ever heats the hot water that is required. It has additional advantages that it is 'always on' so does not require to have timings reset for ad hoc uses and as it does not have any stored water element it represents the lowest possible legionella risk profile.

The kitchen is currently provided with hot water from a large hot water tank located in the kitchen. This is heated from an associated dedicated gas boiler within the kitchen. As such the hot water is being heated by the gas boilers for long period during the week when there is little demand for hot water.

Given the nature of the number of hot water outlets and requirement for showers, the distribution and the hot water usage, it is recommended that a centralised approach to the hot water generation is continued but with the hot water tank being replaced for a packaged air source heat pump tank with an electric immersion such as the Dimplex Edel unit https://www.dimplex.co.uk/product/edel-hot-water-heat-pump.

Recommendation: Move kitchen hot water to ASHP direct water heater.

The building is currently heated from an oil boiler which provides hot water into the heating system. The use of fossil fuels for heating means that it will not be possible for the building to become zero carbon without changing the heating system. A boiler also has heat and other efficiency losses within it, which means that the efficiency of a boiler in converting the oil into the heat is typically around 80 to 95% (depending on the age and type of boiler). Air source heat pumps use electricity to power the heat pump which takes heat from the air and puts this into water which can then go into the heating system. An air to water heat pump can create around 3 units of heat for every one unit of electricity whereas an air-to-air heat pump can provide higher efficiencies, creating around 5 units of heat for every one unit of electrical input.

Boilers	Main boiler	Kitchen
		DHW boiler
Fuel	Oil	Gas
Make	Remeha	Worcester
Model	B23	Greenstar 15CDi
Type	Atmospheric	Condensing
Year of install	1996	2015
Expected life cycle / condition	End of life	12 years
Number of Boilers	1	1
Output (kW)	184	15

The existing boiler has passed the end of their serviceable life and it is therefore recommended that the replacement of the existing boilers for air source heat pumps are considered.

A new air to air source heat pump for the main building it could be located in the existing boiler room and vicinity; the removal of the oil tank would provide an external; space for the ASHP units. An air-to-air system would require a new internal fan units to be installed but this would be considered to be easier and more robust than upgrading the wet heating system and also provides the capability to be used for cooling in summer. 3 phase electrical power will also be required to power the units, which may require some upgrade in capacity.

Good local renewable companies can be contacted for further detailed assessment of heat pumps and quotes. To enable a high-quality funding application for such measures some design development work should be considered to be undertaken to work up an accurate heat loss model for the building, size and specify the internal and external units and to make initial contact with the DNO and planners over any requirements for additional power and/or planning permission.

There are currently government incentives available for installing air to water heat pumps, but these are subject to future change and adaption so should be reviewed at the time of implementation.

Recommendations:

Remove the gas fired hot water system and replace with an air source heat pump for hot water production for the kitchen.

Consider replacing the existing boilers with an Air-to-Air Source Heat Pump with new internal fan units.

Renewable Energy Generation

There is the potential for a PV array on several roofs of the building, including the various flat roof areas, as can be seen on the satellite photo below. The economics of installing panels mean that is it best considered when almost all of the electricity would be used on site. There is a constant base load for electricity which could be met in part by solar PV panels so an installation would be viable and would typically pay back in 8 to 12 years. The roof appears sound and in good condition and capable of taking panels with no shading issues.

Recommendation: Install PV panels on to various flat and pitched roofs.

Electric Vehicle Charging

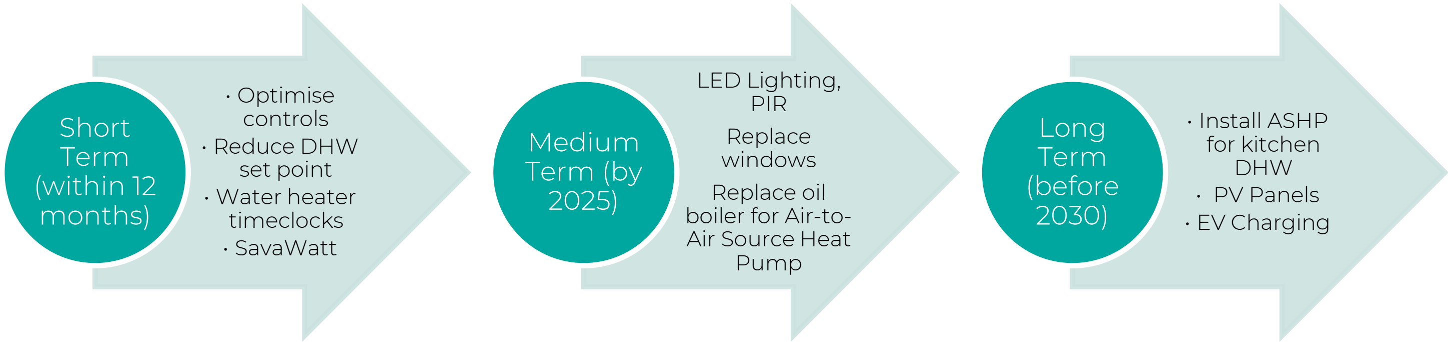
There is a parking area located to the front of the building. In order to facilitate sustainable transport choices, it is recommended that an electric vehicle charging point is fitted. This would enable any staff and visitors that have an electric car to be able to charge while at the building and it would also facilitate staff and other visitors to transition to electric vehicles over time.

Installing a unit such as a Rolec Securi-Charge would allow the organisation control over who is allowed to use the unit with simple mobile phone operated system. Or given the type of use of the building and control over the usage of the car park as a whole a simple 32-amp type 2 wall pod type charger without the need for a key may be most suitable. These are widely available through many suppliers such as http://www.rolecserv.com/ev-charging/product/EV-Charging-Points-For-The-Home.

As the building is a place of work installation grants are available through the work place charging scheme https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers which will fund 75% of the installation cost up to £500.

Recommendation: Consider installing EV Charging points.

The decarbonisation plan for this building therefore comprises:



Next Steps

In order to be able to present the best possible project for future potential funding rounds it is recommended full market supply and installation quotations are obtained for:

An electrical package combining LED Lighting, PIR, SavaWatt, timeclocks, EV Chargers, and Solar PV.
Replacement windows and doors.

The design of a potential air source heat solution should also be developed to include creating an accurate heat loss model for the building, sizing, and specifying the internal and external units and making relevant contact with the DNO and planners.

Appendix 1 – Lighting Replacement Schedule

Rooms / Location	Existing Fitting Type	No of fittings	Recommended Upgrade	Saving (£)	Total Cost	Payback (years)
Medical room	T8 5ft	2	600 x 600 23W Standard Panel (AG)	£62	£162	2.63
Store	2D	1	2D LED 10W	£6	£62	10.06
WCs	2D	6	2D LED 10W	£37	£373	10.06
Staff room	T8 6ft	4	5ft Single College LED	£54	£448	8.33
Y3/4 Group room	T5 5ft	2	5ft Single College LED	£27	£224	8.33
WCs	2D	6	2D LED 10W	£37	£373	10.06
WCs	T8 5ft	2	5ft Single Batten LED	£62	£171	2.79
Main hall	T8 5ft	3	5ft Single Batten LED	£36	£257	7.06
Main hall	T8 6ft	18	5ft Double College LED	£601	£2,066	3.44
Kitchen	T8 5ft	12	5ft Single Vapour LED	£139	£829	5.97

Appendix 2 – Window Replacement Schedule

Ref / Loc	Height (m)	Width (m)	Number	Area
Y3 class & Staff room	2.3	2.77	2	12.74
Y3 corridor	1.3	2.77	1	3.60
Y3 corridor	1.3	1.52	2	3.95
Main hall	4.68	2.15	2	20.12
Main hall	2.59	0.69	2	3.57
Main hall	2.19	1.05	1	2.30

NB: Window replacement costs have been priced on an average installed cost of £550/m²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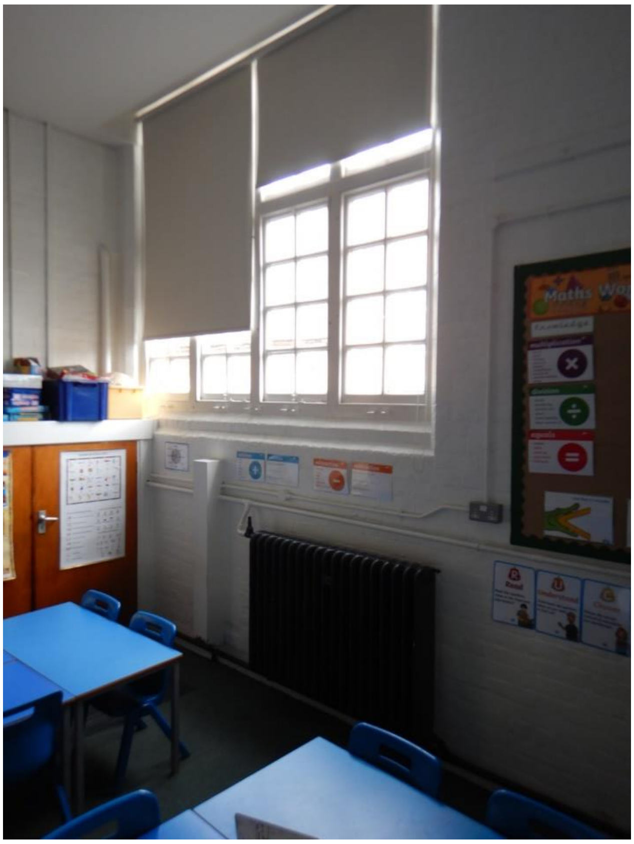


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