St. Alban's Church

Assessment of Energy Savings Opportunities

EMphasis3 CO_2 Reductions

2,000 tonne reduction in CO_2 emissions

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ENERGY **ENVIRONMENT** **TRAINING**

Contents

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This service is provided as part of the "EMphasis3 CO2 Reductions" project which is partially funded by the 'European Regional Development Fund'.

1 Executive Summary

Opportunities for reducing energy use have been investigated at St. Alban's Church as part of a wider Building Energy Audit program through the EMphasis3 project. The following table summarises the opportunities identified during the site energy audit.

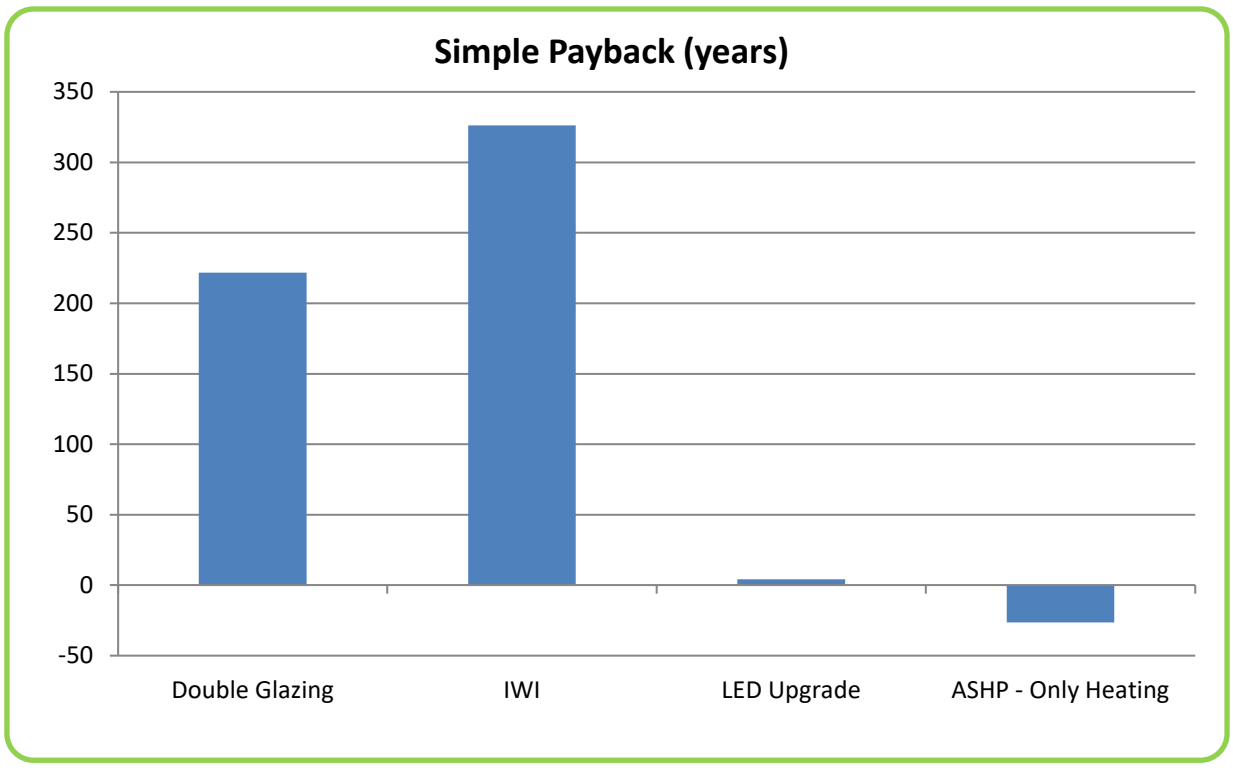
Project Name	Utility Saved	Annual Consumption saving	Units	Annual Total £ saving[1]	Annual tCO_2e saving	Capital Expenditure £	Simple Payback (years)	Lifetime tCO_2e savings
Double Glazing	Gas-Oil	3,203	kWh	220	0.8	48,758	221.7	23.0
IWI	Gas-Oil	1,676	kWh	115	0.4	37,536	326.3	12.9
LED Upgrade	Electricity	4,401	kWh	1,408	1.2	5,700	4.0	24.4
ASHP - Only Heating	Gas-Oil	9,815	kWh	-771	2.4	20,400	-26.5	26.3
Total		**19,095**		**972**	**4.9**	**112,394**	**115.7**	**86.6**

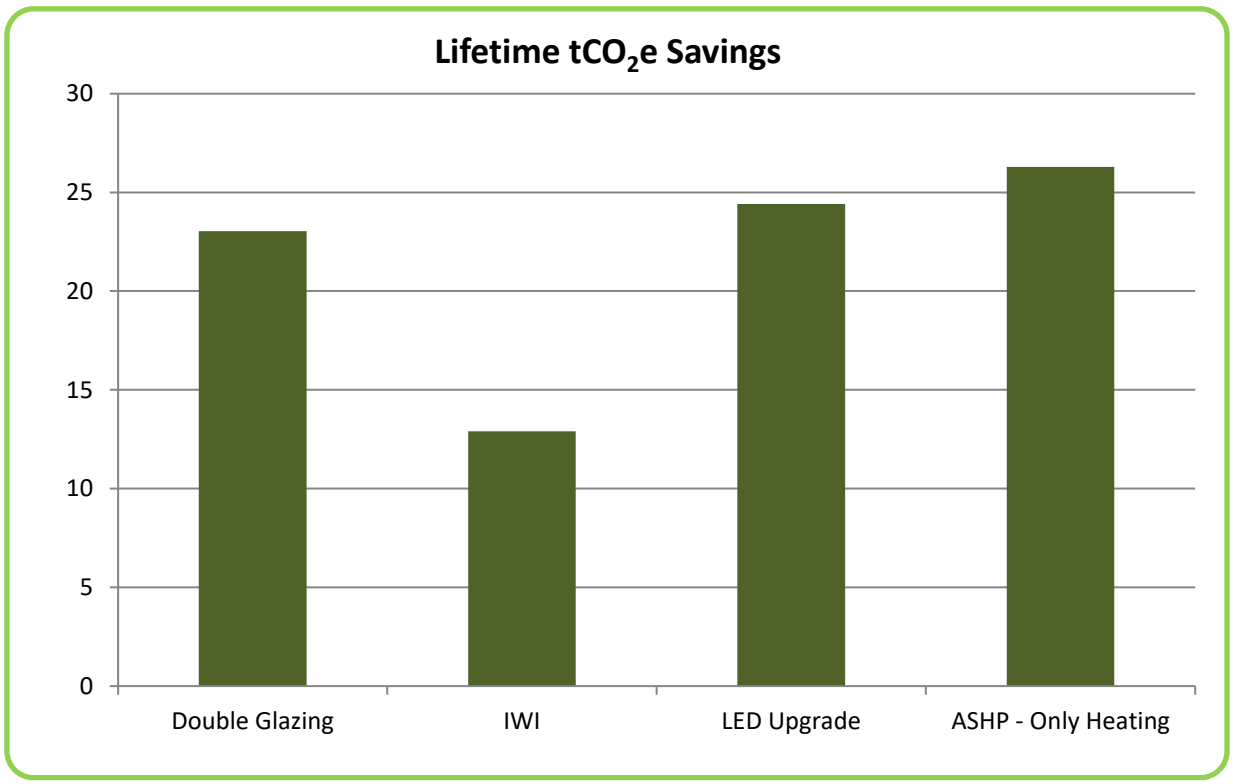
Note that the total Capital Expenditure may be reduced through an application to The EMphasis3 project which looks to part-fund SME energy efficiency projects through its grant scheme, up to an intervention rate of 36%.

The table below summarises the estimated CO_2e emissions before and after the implementation of the above projects:

Current Annual tCO2e	11.1
Estimated Annual tCO2e Savings	8.6
Estimated Future Annual tCO2e	2.5

Simple payback and Lifetime tonnes CO_2e savings for each project are represented in the following graphs:




Lifetime tCO2e Savings
30
25
20
15
10
5
0
Double Glazing
IWI
LED Upgrade
ASHP - Only Heating

2 Project Details

Consultant Name:	Isabel Romero
Email address:	IsabelR@gepenv.co.uk
Site Address:	St Alban's Church, West Leigh, Havant PO9 5TE
Site Visit Date:	26th January 2022

2.1 Site Description

Building work began in 1965 and the new church was dedicated in 1966. Originally constructed as a timber framed building, cedar clad, it became necessary to completely refurbish the church, Lady chapel and adjoining hall. This took place in two phases between the autumn of 1993 and the summer of 1994. The timber cladding was replaced with a composite resin material and the interior re-insulated and lined. However, the client confirmed that the wall insulation could be improved. There is no loft insulation. There is no asbestos in the building structure. The windows are all single gazed, except for the Small Hall and the kitchen next to it.

The heating is provided by an oil boiler (Grant 160 ~ 200 Multi Pass Oil Boiler with a seasonal efficiency of 85.6%). The boiler is more than 20 years old and is approaching end of its serviceable life. A temperature control is in the main hall of the church. According to the client, there are 2 or 3 oil deliveries per year (500L per delivery approx.). The heat emitters are mainly radiators with 1 or 2 panels and with flow/return pipes. There are also 2 air blowers that are fed by the oil boiler (main hall). In the Lady Chapel and the Small Hall there are 2 electric heaters (each).

The domestic hot water (DHW) system is provided via point of use (PoU) electric water heaters of different capacities, but they are all around 3kW. There is no mechanical ventilation.

Lighting system in St. Alban's Church is a mix of Compact Fluorescent (CFL), halogen spotlight, tubular fluorescent T8 and GLS bulbs (General Lighting Service). Only one of the toilets had motion sensor. All the lighting is controlled manually.

There is no renewable energy technology currently installed on-site.

For the recommendations in this report the following factors have been used:

Electricity Cost #	31.98 p/kWh
Electricity Carbon Factor*	0.27730 $kgCO_2e/kWh$
Gas Oil Cost +	6.86 p/kWh
Gas Oil Carbon Factor*	0.25676 $kgCO_2e/kWh$

*Based on 2019 DBEIS carbon factors.
Based on latest available bill.
+ Based on annual consumption and total cost, provided by the client.

For the avoidance of doubt, energy prices include CCL where appropriate but exclude delivery charges, VAT and other fixed elements.

3 Energy Audit Methodology

Energy consumption data has been sourced for the 12-month period from January to December 2019. Both, electricity and gas-oil annual consumption, has been provided by the client via email. There is no monthly consumption available. Gas-Oil consumption has been given in volume (L) and then converted into kWh using 2019 BEIS Conversion Factors.

4 Analysis of Current Energy Consumption

The energy consumption at St. Alban's Church was for the 12-month period between January and December 2019 is summarised below:

Month	Electricity (kWh)	Gas-Oil (kWh)	Total Energy (kWh)
Total	4,244	19,250	**23,494**

5 Action Plan

The following table provides a summary of the measures identified. A detailed analysis of each measure is shown in section 6.

Project Name	Utility Saved	Annual Consumption saving	Units	Annual Total £ saving[1]	Annual tCO_2e saving	Capital Expenditure £	Simple Payback (years)	Lifetime tCO_2e savings
Double Glazing	Gas-Oil	3,203	kWh	220	0.8	48,758	221.7	23.0
IWI	Gas-Oil	1,676	kWh	115	0.4	37,536	326.3	12.9
LED Upgrade	Electricity	4,401	kWh	1,408	1.2	5,700	4.0	24.4
ASHP - Only Heating	Gas-Oil	9,815	kWh	-771	2.4	20,400	-26.5	26.3
Total		**19,095**		**972**	**4.9**	**112,394**	**115.7**	**86.6**

[1]The total cost saving includes all cost savings (energy, renewable income) and is adjusted for any additional annual costs (e.g. maintenance, staff costs).

Note that the total Capital Expenditure may be reduced through an application to The EMphasis3 project which looks to part-fund SME energy efficiency projects through its grant scheme, up to an intervention rate of 36%.

6 Detailed Recommendations

Recommendation 1:

Description	Double Glazing
Technology Type	Insulation - Building fabric: Double glazing with metal or plastic frames
Project Description	Most of the windows are single glazed. The windows are old and opening sections no longer close correctly, leaving gaps which allow uncontrolled heat loss. Single Glazing:

	Height (m)	Width (m)	Number of windows
Church Hall	8	1	1
Church Hall	4.5	2.7	1
Church Hall	2.9	0.7	1
Small Hall	4.3	1	5
Small Hall	0.7	5.92	1
Entrance	2.2	5.14	1
Entrance	2.2	1.28	1
Entrance	2.2	2.55	1
Entrance	2.2	1.28	1
Entrance	2.2	4.95	1

Replacing them with modern double glazing will reduce the energy consumed to heat the inhabited spaced.

Costs	Capital Costs:	£48,758
	Additional Annual Operating Costs:	£0
Annual Savings	Energy (kWh)	3,203
	Running Costs:	£220
	Greenhouse Gas (GHG) Emissions (tonnes CO2 equivalent)	0.8
	Other Cost savings:	£0
	Potential RHI / FiT Income:	£0
	Total £ Savings:	£220
	Simple Payback (years)	221.7
Lifetime Emissions savings	Lifetime GHG emission savings (tCO2e)	23.0

Calculations and assumptions

Refer to Appendix 1 of this report for savings calculations.
Costs associated with issues due to the presence of asbestos have been excluded.
Pricing is aligned to domestic windows (£600/m^2); commercial or safety aspects that are required will increase costs.
The cost of redecoration following the installation of the windows has been excluded.
Approximate dimensions were taken for window location to allow for estimation and financial modelling. Quoting suppliers should take their own measurements to ensure units are manufactured at the correct size for the install work.
Smaller windows should be inspected and included within an upgrade project as required.

Risks and Issues:

The installation would require the area immediately surrounding each window to be emptied.
Working at height from ladders/platforms will be invasive and put staff and site visitors at risk - it is likely that when work is in progress then it will affect the usability of the office spaces and factory.
Full RAMS will be required when quotations are submitted.

Implementation of Energy Saving Opportunities:

Determine what is permitted under the planning regulations applicable to this building.

Survey the windows to determine the optimal design for each replacement window.

Invite suppliers to quote for supply and fit with accompanying RAMS.

Schedule the installation with the agreement of the site manager.

Monitor for and make any changes to the heating system as the need for heat will reduce.

Recommendation 2:		
Description	Internal Wall Insulation	
Technology Type	Insulation - Building fabric: Dry wall lining	
Project Description	The church has external pre-cast concrete panels that provides some insulation. However, during the survey, the client explained that they have issues with the timber structure that is behind the concrete panels, as part of the timber is rotten. This recommendation has not accounted for any work on the existing timber structure. However, it is suggested to improve the insulation levels by adding internal wall insulation. Adding 100mm of insulated plaster board would improve the U-value from 1.7W/m^{2}K to 0.22W/m^{2}K and will also significantly decrease the heat transferred to the walls.	
Costs	Capital Costs:	£37,536
	Additional Annual Operating Costs:	£0
Annual Savings	Energy (kWh)	1,676
	Running Costs:	£115
	Greenhouse Gas (GHG) Emissions (tonnes CO2 equivalent)	0.4
	Other Cost savings:	£0
	Potential RHI / FiT Income:	£0
	Total £ Savings:	£115
	Simple Payback (years)	326.3
Lifetime Emissions Savings	Lifetime GHG emission savings (tCO2e)	12.9

Calculations and assumptions

Insulated plasterboard with an 100mm insulation layer provides the improved 0.22W/m^{2}K U-value.

Costs have been based on similar projects at an average cost of £130/m^2 including approximately 20% project contingency. This can vary significantly building by building and wall by wall dependant on internal fixtures, sealing around windows, adaption of plugs / telecoms sockets etc. Redecoration costs have been excluded.

Risks and Issues:

Applying the insulated plasterboard to internal walls will involve significant disruption the building users during installation.

Installing the insulated plasterboard to the internal walls will marginally decrease the floor area of rooms.

Implementation of Energy Saving Opportunities:

Create a specification for the insulation and a scope of works for the wall insulation, including in particular the specification of the insulating plasterboard.

Obtain contractor quotations for supply and fit including for any M&E type works, including references of previous IWI experience and RAMS.

Select the most suitable quotation and schedule the installation with agreement of the Building and Department Managers.

<table>
<tr><th colspan="3">Recommendation 3:</th></tr>
<tr><td>Description</td><td colspan="2">LED Upgrade</td></tr>
<tr><td>Technology Type</td><td colspan="2">LED Lighting –T8 and CFL to LED including new fitting.</td></tr>
<tr><td>Project Description</td><td colspan="2">The site has predominantly tubular fluorescent T8 and CFL luminaires. All of them are manually controlled.

Upgrading all the luminaires to new LED luminaires will reduce the energy consumed by lighting and help free up electrical capacity for heat pumps.

Replacing the existing luminaires for new LED luminaires will not only reduce the energy consumed by these lamps but also reduce, in the short term, lamp replacement costs as LED lamps have a longer life expectancy.

<table>
<tr><th>Zone</th><th>Lamp Type</th><th>No.</th><th>Hours</th></tr>
<tr><td rowspan="4">St Alban's Church</td><td>GLS 100W</td><td>18</td><td>1,500</td></tr>
<tr><td>2D CFL 21W</td><td>11</td><td>1,500</td></tr>
<tr><td>GLS halogen 42W</td><td>22</td><td>1,500</td></tr>
<tr><td>T8 5' single lamp</td><td>12</td><td>1,500</td></tr>
</table>
</td></tr>
<tr><td>Costs</td><td>Capital Costs:
Additional Annual Operating Costs:</td><td>£5,700
£0</td></tr>
<tr><td>Annual Savings</td><td>Energy (kWh)
Running Costs:
Greenhouse Gas (GHG) Emissions (tonnes CO2 equivalent)
Other Cost savings:
Potential RHI / FiT Income:
Total £ Savings:
Simple Payback (years)</td><td>4,401
£1,408
1.2
£0
£0
£1,408
4.0</td></tr>
<tr><td>Lifetime Emissions Savings</td><td>Lifetime GHG emission savings (tCO2e)</td><td>24.4</td></tr>
<tr><td colspan="3">Calculations and assumptions
Refer to Appendix 1 of this report for savings calculations.
No motion or daylight sensors have been accounted for in this recommendation.
Operational hours are assumed to be between 1,200 and 1,300 hours.
This is a ‘like for like’ replacement without reduction of luminaire numbers. Careful lighting design may help reduce installation cost and increase savings while also improving lighting conditions over a straight ‘like for like’ replacement. Replacement emergency lights are not included in the cost assessment.
The capital expenditure includes supply and install of new fittings.
A labour rate of £50 per hour has been used with typically one hour per fitting budgeted for.
Additional costs for any evening working are not included.
The unit price for electricity is 31.98p/kWh.</td></tr>
</table>

Risks and Issues:
For the project to succeed the current requirements of each space must be fully defined before determining suitable replacement lamps and luminaires.
The replacement works may have to be carried out outside of the service hours of the site to protect building's users and staff. No account has been made for any additional costs that result from this.
A survey of the existing wiring of lighting should be undertaken to ensure suitability prior to committing to the upgrade. No costs have been included for remedial electrical works should the wiring be found to require upgrade.

Implementation of Energy Saving Opportunities:
Re-audit the existing lighting within the spaces identified for upgrade at the point of commencing a procurement process to ensure that all recent changes or upgrades etc have been logged prior to developing a scope of works.

Specialist lighting contractors should be engaged to determine the feasibility of upgrading to LED.

Provide a scope of works alongside a general electrical engineering, control & luminance requirement specification (inc. any emergency lighting requirements) and commence a supply and install procurement process. GEP can assist in verification of the proposals received.

Obtain contractor proposals including control capability and RAMS.

Select the most suitable quotation and schedule the installation.

Recommendation 4:		
Description	ASHP – Only Heating	
Technology Type	Heating - Heat Pump (Air source)	
Project Description	It is recommended to upgrade the gas boiler system to a High Temperature Air Source Heat Pump (ASHP) air-to-water system. This will provide controlled and energy-efficient heating to the building. Substitution of oil-fired heating boiler for electric heat pumps will invariably result in an increase in operating cost to the building occupier. This is primarily due to the low cost of oil in relation to electricity in a ratio of nearly 4:1. The efficiency of the heat pump in comparison to the gas boiler is around 3:1. The Domestic How Water (DHW) system is already served via Point of Use (PoU) electric water heaters. Therefore, the ASHP would only need to provide heating. The 15kW ASHP capacity will significantly reduce the consumption of gas at the site and has been modelled using an average seasonal Coefficient of Performance (COP) of up to 270%. It is believed that there is adequate external space for the equipment. However, the existing boiler might need to be removed (not included in cost).	
Costs	Capital Costs:	£20,400
	Additional Annual Operating Costs:	£300
Annual Savings	Energy (kWh)	9,815
	Running Costs:	-£471
	Greenhouse Gas (GHG) Emissions (tonnes CO2 equivalent)	2.4
	Other Cost savings:	£0
	Potential RHI / FiT Income:	£0
	Total £ Savings:	-£771
	Simple Payback (years)	-26.5
Lifetime Emissions Savings	Lifetime GHG emission savings (tCO2e)	26.3

Calculations and assumptions

Refer to Appendix 1 of this report for savings calculations.
The CAPEX includes equipment (£1,000 per kW) and installation cost (20% of equipment costs).
Servicing is to be based upon OEM requirements but is assumed to be equivalent to current boilers (~£300/year).
Financial calculations have assumed that all electricity used by the ASHP has been sourced from the National Grid rather than any local renewable generation. Based on preliminary modelling consent to increase supply capacity may be required.

It is assumed that existing radiators will be retained and a High Temperature Heat Pump System be installed.

Risks and Issues:
Savings and benefit from heating systems are difficult to accurately predict as both staff behaviour and weather have to be estimated.
Install costs will increase if the system install encounters any unforeseen complexities within the building.
Installation work will be intrusive and require clearance of areas where heat pump plant is to be installed and access to route pipework and electric cabling. This may require works to be carried out during non-operational hours.
The sizing of the ASHP systems is critical if correct operating regimes are to be achieved. A more granular analysis of the building's heating profile should be undertaken as a feed into both the physical and financial modelling of the ASHP system.
External elements of the ASHPs might be at risk from vandalism. Where simple protection cages are installed to protect the external parts of the heat pump system, they must not restrict the airflow around the heat collection equipment.
Protective fencing may be required around the external heat collectors to prevent damage. This should not restrict air flow around the equipment.
Noise tests may lead to the requirement of additional attenuation depending on final location.
Planning consents and DNO / Capacity upgrades are as yet unknown.

Implementation of Energy Saving Opportunities:
Progress the project with a strong focus on detailed system design to ensure the overall system will deliver sufficient heat for the building taking account of any planned building fabric upgrades etc.

Build a business case for the project based on carbon savings, and life cycle costs against other decarbonisation options.

Analyse gas and heat demand data for the site at a half-hourly (HH) resolution, then build a heat profile for the site and extend this to 12 months. A project using heat meters on space heating flow and return (between Autumn and Spring) and DHW should be considered.

Model the ASHP system performance against the building thermal model heat profile (adjusted for planned building fabric measures) to determine the optimal install specification.

Develop an ASHP system specification, bill of materials and general engineering / M&E specifications.

Procure a turn-key solution with design, supply and install undertaken (and O&M optional) by a contractor.

7 About GEP Environmental

Our Service Offering

GEP Environmental are leading providers of environmental and energy consultancy services to clients across the United Kingdom & Ireland. We support organisations to identify, implement and maintain environmental, energy and training solutions. Our highly qualified project teams consist of environmental consultants, energy engineers and trainers with expertise in carbon management, ISO management systems, sustainable resource and waste management, energy efficiency, building surveying, low carbon building design and renewables.

Further information is available from http://www.gepenv.co.uk/

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- ISO 14001 Environmental Management Systems, ISO 50001 Energy Management Systems and ISO 9001 Quality Management Systems;
- Legislation & Compliance Services (Energy, Waste, Pollution Control, Buildings Operations, Permitting);
- Sustainability Reporting (FTSE4Good, CDP, GRESB, EPRA, CRC, ESOS, SECR);
- Waste Management Auditing and Compliance Support;
- IEMA Certified Training (IEMA Approved and IEMA Certified Training Courses);
- Feasibility Studies and Energy Efficiency Auditing;
- Implementation support including design, specification, evaluation and project management;
- Measurement and Verification (M&V);
- Programme Management and Technical Advisory.

Our teams maintain membership with professional bodies including the Institute of Environmental Management and Assessment (IEMA), the Institute of Environmental Sciences (IES) and the Energy Institute (EI).

Our Certifications

We are committed to service excellence and developing first class client relationships. Our quality and environmental standards are underpinned by our ISO 9001:2015 (QMS) and ISO 14001:2015 (EMS) certification.

8 About "EMphasis3 CO_2 Reductions" Project

EMphasis3 CO_2 Reductions (known as EMphasis3) is a European Regional Development Fund (ERDF) funded SME support project, led by the University of Portsmouth and delivered through the cleantech cluster Greentech South (GTS) based at the University of Portsmouth, in partnership with the University of Winchester.

EMphasis3 CO_2 Reductions aims to support the shift towards a low carbon economy in the Enterprise M3 (EM3) region and beyond, by promoting energy efficiency and renewable energy use in SMEs and promoting research and innovation in, and adoption of, low carbon technologies.

EMphasis3 will enable SMEs to reduce CO_2 emissions by using four funded interventions:

- Energy Efficiency Audits
- Energy Efficiency Grants (EEG) to part-fund energy saving/efficiency equipment or implement the recommendations of the audit
- Innovation Audits
- Innovation (Research and Development) Grants to enable SMEs to take low carbon innovations closer to commercialisation

The EMphasis3 project will run from 1st July 2019 - 30th June 2022 and will part-fund SME energy efficiency projects through its grant scheme, up to an intervention rate of 36%.

Appendix 1 – Savings Calculations

Recommendation 1:

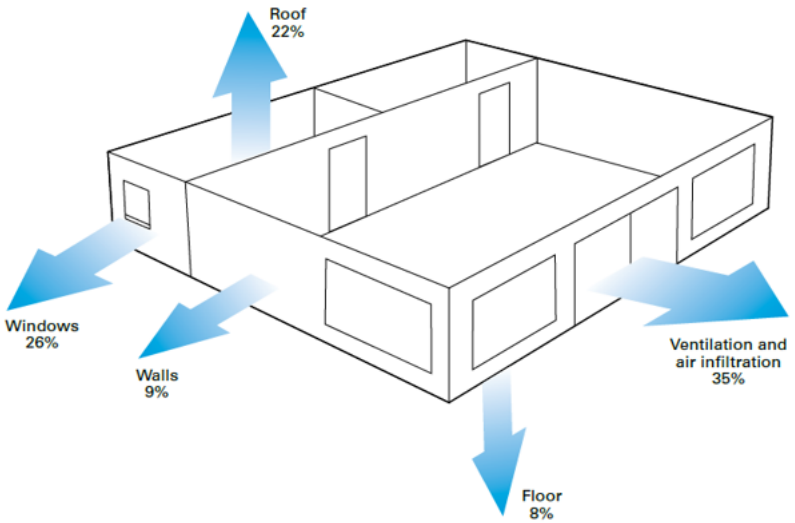
Description	Technology Type	Capital Cost	Additional Annual Operating Costs	Other Costs (e.g. staff)	Utility Saved	Consumption Saving	Units	£ Saving	tCO2e Saving	Other Cost Savings	Potential RHI/ FiT Income	Simple Payback
Double Glazing	Insulation - Building fabric: Double glazing with metal or plastic frames	48,758			Gas-Oil	3,203	kWh	219.89	0.82			221.74

Temperature Differential	12	° C
Heating system efficiency	86%	

Type		Height (m)	Width (m)	Number of windows	Area m^2	Old U-Value (W/m^2K)	New U-Value (W/m^2K)	Saving kW
1	Church Hall	8	1	1	8.00	5	1.8	0.3
2	Church Hall	4.5	2.7	1	12.15	5	1.8	0.5
3	Church Hall	2.9	0.7	1	2.03	5	1.8	0.1
4	Small Hall	4.3	1	5	21.50	5	1.8	0.8
5	Small Hall	0.7	5.92	1	4.14	5	1.8	0.2
6	Entrance	2.2	5.14	1	11.31	5	1.8	0.4
7	Entrance	2.2	1.28	1	2.82	5	1.8	0.1
8	Entrance	2.2	2.55	1	5.61	5	1.8	0.2
9	Entrance	2.2	1.28	1	2.82	5	1.8	0.1
10	Entrance	2.2	4.95	1	10.89	5	1.8	0.4
			Total	14	81.26			3.1

Replacement Windows			
ALTERNATIVE approximate way to build a rec:			
Space Heating kWh	19,250		
Proportion of Heat Loss	26%		
Window Heat Loss kWh	5,005		
Heat Loss Saving kWh	**3,203**	Actual Heat los:	17%
Window Area m2	81		
Unit Cost £/m2	£600		
Capital cost £	£48,758		
	£600 for Bespoke Alu Windows but mass-production (for a Commercial/Education Establishment)		
	£300 for typical UPVC Double		
	COSTS MAY NOT INCLUDE Bespoke elements or Considerable Scaffold Costs		

Figure 5 Heat loss from a commercial building



Recommendation 2:

Description	Technology Type	Capital Cost	Additional Annual Operating Costs	Other Costs (e.g. staff)	Utility Saved	Consumption Saving	Units	£ Saving	tCO2e Saving	Other Cost Savings	Potential RHI/ FiT Income	Simple Payback
IWI	Insulation - Building fabric: Dry wall lining	37,536			Gas-Oil	1,676	kWh	115.04	0.43			326.27

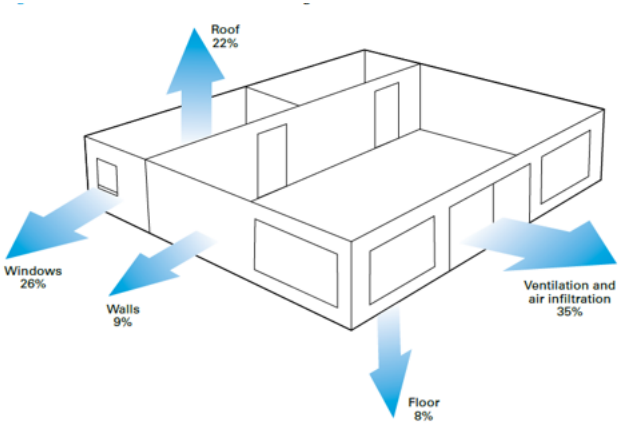
Temperature Differential	12	° C
Heating system efficiency	86%	

100mm of IWI
Maximum 0.3, but ideally less

Type		Height (m)	Width (m)	Number of windows	Area m^2	Old U-Value (W/m^2K)	New U-Value (W/m^2K)	Saving kW
1					288.74	1.7	0.22	5.1
			Total	0	288.74			5.1

Replacement Windows			
ALTERNATIVE approximate way to build a rec:			
Space Heating kWh	19,250		
Proportion of Heat Loss	10%		
Wall Heat Loss kWh	1,925		
Heat Loss Saving kWh	**1,676**	Actual Heat loss	9%
Wall Area m2	289		
Unit Cost £/m2	£130		
Capital cost £	£37,536		

Suggested Costs:		
	CWI	£15
	IWI	£130
	EWI	£130
	Loft Insul (Rockwool)	£12
	Encapsulated pads above ceiling tiles	£50



Wall area	
100	m2
38	m2
52	m2
30	m2
7	m2
60	m2
50	m2
20	m2
357	m2

Recommendation 3:

	Description	Technology Type	Capital Cost	Additional Annual Operating Costs	Other Costs (e.g. staff)	Utility Saved	Consumption Saving	Units	£ Saving	tCO2e Saving	Other Cost Savings	Potential RHI/ FiT Income	Simple Payback
	LED Upgrade	Lighting Upgrades - Compact fluorescent including new fitting	£ 5,699.88			Electricity	4,401	kWh	1,407.53	1.22			4.05

Copy and paste Summary Schedule report from Light Touch Calculator and adjust sum ranges in above table.

Zone	Existing				Replacement				Capital Cost	Saving			Payback (yrs)
	Lamp Type	No.	Hours	Controls Reduction	Lamp Type	No.	Hours	Controls Reduction		kWh	£	CO2	
St Alban's Church	GLS 100W	18	1,500		LED bulb style 16.5W	18	1,500		£1,542	2,255	£721	625	2.1
St Alban's Church	2D CFL 21W	11	1,500		New LED 2D fitting 11W	11	1,500		£1,052	215	£69	59	15.3
St Alban's Church	GLS halogen 42W	22	1,500		LED bulb style 8W	22	1,500		£1,379	1,122	£359	311	3.8
St Alban's Church	T8 5' single lamp	12	1,500		New 5' LED fitting (LED tubes in new fittings) (single lamp)	12	1,500		£1,728	810	£259	225	6.7

Recommendation 4:

Boiler fuel replacement

Description	Technology Type	Capital Cost	Additional Annual Operating Costs	Other Costs (e.g. staff)	Utility Saved	Consumption Saving	Units	£ Saving	tCO2e Saving	Other Cost Savings	Potential RHI/ FiT Income	Simple Payback
ASHP - Only Heating	Heating - Fossil Fuel to Heat Pump (Air source)	£20,400	£300		Gas-Oil	9,815	kWh	-£471	2.43		£0	-26.47

					Hours per day	ays per wee	Shoulders	Winter	Uplift
Existing boiler efficiency	86%								
Heat Requirement	12,302	kWh		**Annual Heating Hc**	5	6	18	18	1
Present Fuel Usage	14,371	kWh	Includes fabric measures	1296					
% replaced by new ASHP	100%								
New ASHP Capacity	15	kW							
Heat generated by new ASHP	12,302	kWh							
New ASHP efficiency	270%		Accounts for DG and IWI						
New electricity requirement	4,556	kWh							
New electricity cost	£1,457								
New electricity emissions	1,263	kgCO2e							
Residual boiler fuel usage	0	kWh							
Residual boiler fuel cost	£0								
Residual boiler emissions	0	kgCO2e							
Present fuel cost	£987								
Present fuel emissions	3,690	kgCO2e							
Emissions Saving	2,427	kgCO2e							
RHI annual income									

Cost at £1,000 per kWp	£15,000	£1,000	per kWp
Thermal Buffer Tank	£2,000		
No alteration too Radiators	£0		
Install Cost	£3,400	20%	% of capital cost
TOTAL COST	**£20,400**		

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