Assessment Of Energy Saving Opportunities For

Little Neston Methodist Church

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EXECUTIVE SUMMARY

The Carbon Trust is grant funded by the Department for Environment, Food and Rural Affairs, the Department for Business, Enterprise and Regulatory Reform, the Scottish Government, the Welsh Assembly Government and Invest Northern Ireland.

This report presents the results of a CMEE (Carbon Management Energy Efficiency) site survey of the Methodist Church in Little Neston carried out by Malcolm Hanna of AECOM. The agreed objectives of the wider CMEE project is to undertake audits of 12 churches to identify energy saving opportunities and to produce a short, site specific report. The 12 reports are to be used to prepare a 'How to Guide' which will be distributed to all Methodist Churches to help them prioritise energy saving actions at their sites using real case examples.

Site visits were to concentrate on lighting, space heating, hot water as well as opportunities for changing people's behaviour. If a site is entitled to apply for the Carbon Trust Loans to assist in paying for installation of the measures recommended within the report then this will be indicated within the Action Plan (overleaf). For more information on the Carbon Trust Loan scheme, see http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/business-loans/pages/loans.aspx

If all the prioritised measures at this site are implemented, the aggregated savings from the measures identified represent a 33% reduction in energy consumption and a 28% reduction in cost or £459 which translates into direct cost savings.

ACTION PLAN

The recommendations listed below are prioritised, according to payback, with energy management the first priority

Priority	Recommendations	Estimated annual savings			Estimated cost (£)	Payback period (years)	Timescale for implementation and by whom (to be completed by the client)	May be eligible for loan*
		(£)	CO_2 (tonnes)	(kWh)				
1	Improving management, monitoring and targeting of energy use – link to meter reading and bill checking	£82	0.5	2,097	0	Immediate		no
2	Replace old inefficient fluorescent lighting (5 ft T12 units) with more energy efficient T8 lamps	£3	0.02	44	£0	Immediate		no
3	Install a thermostat to control Hall boiler operation	£110	0.66	3,600	£300	2.7		Yes
4	Replace entrance lobby tungsten spot lamps with more energy efficient units	£3	0.02	40	£10	3.5		Yes
5	Insulate the external wall and rear of the Church Hall areas	£72	0.43	2,358	£400	5.6		Yes
6	Replace old boiler with new high efficiency unit.	£146	0.88	4,798	£3,500	24		Yes
7	Replace old inefficient fluorescent lighting (8 ft T12 units) in the church with more energy efficient lamps	£34	0.3	474	£1,600	47		Yes

Priority	Recommendations	Estimated annual savings			Estimated cost (£)	Payback period (years)	Timescale for implementation and by whom (to be completed by the client)	May be eligible for loan*
		(£)	CO_2 (tonnes)	(kWh)				
8	Install secondary glazing in Church	£9	0.056	308	£1554	Over 100 years		Yes
TOTAL		£459.00	2.866	13,719	£7,364.00	16		

* Please refer to the Site Survey Publication for eligibility details or visit www.carbontrust.co.uk/loans and www.eca.gov.uk/etl

1. INTRODUCTION

1.1. Site details

Buildings and site

Little Neston Methodist Church was constructed in 1872 with the Church Hall extended in the 1960s. The buildings have an internal floor area of approximately 2,615 ft^2**.** The buildings comprise of the following elements;

- Entrance Lobby
- Church
- Vestry
- Hall (old)
- Hall (new)
- WCs
- Store
- Meeting rooms (1 and 2)
- Kitchen

There are no building refurbishments planned in the near future as work has been undertaken recently, with a new disabled toilet and new windows installed in August 2009. The main church building is of solid sandstone, with the later additions of brick construction. It is understood that these newer brick wall areas are currently uninsulated.

Most of the windows are single glazed, however some of the hall windows have been recently double glazed.

The building has two gas meters, one for the Church and one for the Hall and kitchen. There are also two electricity meters on site.

Space Heating
Space heating is provided by gas boilers, a Vaillant VCW GB 28OH (35.4kW), which supplies the hall areas. This is due to be replaced in summer 2010, due to maintenance issues with the existing 20 year old unit. A Worchester 15sBi (16.7 kW) which heats the Church. In addition there are 4 pairs of electric tubular heaters (10 feet long) providing additional heating for the Church. There are also 2 fan heaters fed off the main boiler plant.

A review of the operating schedules against occupancy profile of the church hall areas indicated a reasonably close match. This is an area that should be checked regularly as incorrect schedules are a key area of energy waste.

Domestic Hot Water
DHWS is provided from the Vailant gas fuelled combination boiler. An electric hot water dispenser is located in the kitchen, which provides water for hot drinks.

Lighting
The majority of internal lighting is fluorescent. This is a combination of old T12 type units and more modern T8 types. All lighting is manually switched. There are also 2 100W tungsten spot lamps in the Entrance Lobby.

Energy and Environmental Management

Energy is purchased by the Treasurer who also reads the meters quarterly and pays the bills. There is no monitoring or targeting of energy use explicitly carried out at present. However there is a budgetary comparison year on year.

Maintenance
Maintenance arrangements are made locally. The local heating contractor deals with most of the Cheshire Churches.

Procurement
Procurement is generally dealt with locally at church level.

2. ENERGY USAGE PROFILE

2.1. Site Energy Consumption and Spend

The site consumes approximately 41,931 kWh of energy per annum (based on 2009 figures), costing a total of £1,631. All energy values are in terms of delivered energy.

This comprises

Utility	Energy Consumption		Cost		CO_2 Emissions
	kWh/year	%	£/year	%	tCO_2
Electricity (if used)	8,513	20	610	37	4.6
Gas (if used)	33,419	80	1,021	63	6.1
Total Energy	41,931		1,631		10.7

The unit costs for electricity and gas used in calculating savings are 7.17 and 3.054 p/kWh respectively (excluding VAT and standing charges where the data provided allows for this). These values have been used from previous audit data as for gas use only an annual cost was provided. For electricity use some unit information was provided in addition to annual cost, however the unit rate was equivalent to over 20p/kWh which would be extremely unusual, hence the price assumption.
Carbon conversion factors used – Grid electricity (0.544 $kgCO_2/kWh$), Natural gas (0.184 $kgCO_2/kWh$)

3. CARBON REDUCTION OPPORTUNITIES

Priority no. 1	**Improving management, monitoring and targeting of energy use – link to meter reading and bill checking**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£82	0.5	2,097	0	immediate
Detail	General good housekeeping approaches to managing energy can deliver energy savings of up to 15%. These should be underpinned by monitoring of energy use by a monthly review of actual (not estimated) use based on meter readings. Comparison with previous monthly use and eventually with historic data (same month last year) can provide insights into any exceptional use or progress made. An annual energy report could be provided to the Finance Committee to highlight progress made and future actions needed. The programme of good housekeeping could include; • Lights to be switched off when areas unoccupied or when daylighting permits • Regularly checking timers on boilers and heaters, checking of any lighting controls • Switching off of any other equipment such as catering equipment when not being used • Tighter control of heating systems – switching off of radiant heaters when not needed It is appreciated that the buildings are already quite tightly controlled by a relatively small group of people and therefore potential further savings are limited. However in general there should still be scope to improve, particularly as at present energy use is not monitored at all. A conservative view has been taken that savings of 5% should be achievable.			
Risks to business continuity	There are no significant risks but care should be taken when asking other building users to participate in a Good Housekeeping energy saving actions. Make sure that any sensitive equipment is carefully marked so that others do not tamper with settings. Also information should be circulated to ensure that people understand controls.			

Priority no. 2	**Replace old inefficient fluorescent lighting (5 ft T12 units) with more energy efficient T8 lamps**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£3	0.02	44	£0	immediate
Detail	In a number of areas of the building old inefficient T12 fluorescent lights were found. • Hall - 3 x 5ft T12			

	• Table tennis store - 3 x 5ft T12 • Store area – 1 x 5ft T12 These units should be replaced by T8 lamps, which in most cases can be fitted directly into the existing lamp holders. The T8 units offer an 8% energy reduction compared with the T12 units, whilst providing at least the same lighting performance. If this is carried out on lamp failure there is effectively no additional capital cost. An alternative to list no cost approach would be to replace the entire light fitting with a more energy efficient unit. The most efficient approach would be to install high frequency T5 fittings. However this approach would incur significant capital investment as highlighted in the opportunity dealing with replacement of the church lighting.
Risks to business continuity	No risks

Priority no. 3	**Install a thermostat to control Hall boiler operation**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£110	0.66	3,600	£300	2.7
Detail	At present the hall space heating system is controlled by the boiler return temperature, it does not have any thermostatic control sensors located in the heated space. It is recommended that thermostatic control is installed in order to control the heating system. Without this there is significant scope for over heating and energy waste. A well-controlled system will ensure that the boiler or heater does not operate unless there is a demand. Upgrading controls on older heating systems can deliver savings of 15% - 35%. In this case the lowest level estimate 15% has been used. In terms of thermostat location, they should not be influenced by draughts or heat sources such as sunlight, radiators. These factors create a 'false local temperature' and may result in heating systems over- and underheating a building.Thermostats should be placed in a north-facing room, Approximately half way up the wall if possible. This helps to provide a more representative temperature.			
Risks to business continuity	No risks			

Priority no. 4	**Replace entrance lobby tungsten spot lamps with more energy efficient units**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£3	0.02	40	£10	3.5

Detail	During the survey 2 spot lamps were found in the entrance lobby. It is recommended that these are replaced with more energy efficient alternatives, suggest compact fluorescent lamps. These lamps will typically reduce the energy used by 75% and should last between 6 and 15 times longer than the existing lamps.
Risks to business continuity	No risk. The cost to purchase these lamps is based upon an additional cost to the church of £5 per lamp (above cost of existing lamps) and an average use of 4 hours per week.

Priority no.5	**Insulate the external wall and rear of the Church Hall areas**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£72	0.43	2,358	£400	5.6
Detail	 The external walls of the Northern extension of the building are uninsulated cavity walls. This part of the building was constructed in the 1960s. It is recommended that these wall areas to the side of the hall, meeting room, kitchen and meeting room 2 to the rear of the building to an approximate perimeter length of 55m are insulated with insulating beads or granules blown into the wall cavity in order to reduce heat loss from this heated area. The Carbon Trust guide CTL062, How to implement cavity wall insulation indicates that Typically 10-30% of the heat lost from a building shell is lost through its wall and that the application of insulation to un-insulated walls can reduce this loss by this loss by around two-third.			
Risks to business continuity	The filling of cavity walls can potentially cause damp and water penetration problems to the external walls inner leaf and could aggravate existing thermal bridging problems. Therefore careful external and internal inspection of the existing structure and it's current condition is required to determine the suitability of this opportunity. Remedial work such as re-pointing the brickwork may have to be incorporated into the scope of this opportunity.			

Priority no. 6	**Replace old boiler with new high efficiency unit.**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£146	0.88	4,798	£3,500	24

Detail

The existing hall area boiler is 20 years old and requires replacement. It is intended that this unit will be replaced in summer 2010. The above calculation has been provided in order to indicate the potential savings associated with a boiler change. Typically we could expect efficiency improvements for modern boilers compare with 20 year old units of around 20%.

As the replacement unit will hopefully be in operation for the next twenty years and is likely to be responsible for around 70% of the gas used on site over that period, this represents probably the biggest opportunity to improve site energy efficiency and reduce carbon emissions.

It is understood that the Church will use local contractors to help with the selection of the boiler equipment. It is also recommended that the central property group (Manchester) should be consulted to see if there is further support available. The Energy Technology List contains details of the boilers which qualify for Enhanced Capital Allowances (ECA). Although Methodist Churches do not qualify for ECAs, the Energy Technology List is still a useful reference. In order to be included on this list the units have to meet key performance criteria e.g. net thermal efficiency must be >=95% at 100% of it's rated power. This can be used to help compare energy performance of equipment.

In general a high efficiency condensing boiler should be installed. Efficiencies of different units should be compared before selection. Ideally the lifetime or at least the energy costs over the next 10 years should be factored into the decision making process.

It is recommended that the boiler is linked to time control, including an optimiser, which will vary the time of switch on according to outside temperature. Temperature control of the system is also required to ensure that overheating and energy waste is avoided.

The size rating of the new boiler should also be considered on replacement. Over 20 years the building requirements may well have changed and as a result a like for like replacement may not be appropriate. A calculation of the

	sizing should be carried out based upon updated operations.
Risks to business continuity	No significant risks

Priority no. 7	**Replace old inefficient fluorescent lighting (8 ft T12 units) in the church with more energy efficient lamps**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£34	0.3	474	£1,600	47

Detail

There are currently 16no 8ft T12 fluorescent lamps illuminating the Church. These units are old and inefficient. From an energy efficiency perspective it is recommended that these units are replaced with more efficient alternatives. However it can be seen above that this opportunity represents an extremely long payback on investment. This is due to the fact that the church is used for such short periods of time. For this calculation we have estimated an average across the year of around 4-5 hours per week.

In reality this opportunity would probably be taken when the lights require replacement due to age or condition. In order to replace these units the whole fitting will need to be changed and if this is to be carried it is recommended that high frequency T5 fittings should be specified. There is an additional option of incorporating occupancy and daylight (Lux) control at this point, however due to the relatively short operating hours of the lights and as we understand it, the tight control for the specific service times these additional controls may not be provide sufficient benefit. This point should be further considered if this element is implemented, particularly around lighting control, as the church has good sources of natural daylight.

It is suggested that these T12 fittings would be replaced by twin 28W T5 units, 16 fittings in all. This would need to be confirmed by a lighting designer. The energy savings relate to the reduced control gear loses of the fittings, for the existing T12 units these are around 40%, for new high frequency units these are around 5-10%. The new fittings also provide the opportunity to reduce the rating of the installed units, from the existing 125W per fitting to 56W per fitting. Finally the inclusion of integrated controls for occupancy and daylight dimming control could add a further saving.

Risks to business continuity	No risks, long payback due to relatively short operating hours of lighting.

Priority no. 8	**Install secondary glazing in Church**			
Cost Saving £/yr or £k/yr	**CO_2 Savings tonnes/yr**	**Energy Savings kWh/year**	**Cost £ or £k**	**Payback Years**
£9	0.056	308	£1554	Over 100 years

Detail

During the survey interest in secondary or double glazing of the high level Church windows was expressed.

Visits to other churches highlighted a potential solution, which involves secondary glazing units fitted into the window reveal (as illustrated in the image below, taken at Claremount Church). This approach could be applied at Little Neston.

As can be seen from the calculation above, this measure offers a very long return on investment. For low level windows it can offer the added benefit of reducing draughts and improving comfort, however this benefit is not as clear for high level windows. The fact that the church is only heated for around 10 hours per week has a big impact upon the potential energy savings and hence the payback.

Risks to business continuity	The introduction of secondary units to the existing church windows could potentially cause some condensation problems between the two components and the allowance for trickle ventilators within the secondary units are to be considered to overcome this problem. The installation of secondary units will

	reduce the amount of reveal the windows currently have internally and therefore reducing the cill depth.