Implementing and promoting energy efficiency solutions in heritage buildings through retrofiting the 1880's Southern Midlands Town Hall

CEEP 1011

30 June 2014
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1.0 Introduction

Southern Midlands Council received funding of $25,646 from the Australian Government under the Community Energy Efficiency Program in September 2012 to implement and promote effective measures to improve energy efficiency in older or heritage listed buildings.

A key objective of the Project was to provide an example of how energy efficiency in a heritage building can be implemented without compromising the heritage features of the building. The centerpiece of the Project is the Town Hall at Oatlands, a Georgian building constructed in the 1880s which now houses the administration and works services offices of Southern Midlands Council – located in the rural heart of Tasmania’s midlands.

The ‘Centre for Heritage at Oatlands - Heritage Education and Skills Centre’, a partner in the Project, was tasked with the role of promoting the retrofitted Town Hall as a case study in a course entitled ‘Energy Efficiency and Comfort in Heritage Buildings’. The aim of the course is to stimulate transference and adoption of the techniques used in the Project. The Project site is well situated to achieve this as surrounding Oatlands there is a large local, regional and statewide representation of colonial sandstone buildings, a building type notorious for poor energy efficiency.

2.0 Project Background

The Town Hall at Oatlands was constructed at a time (1880) when there was little awareness or need for energy efficiency. Heritage buildings often leak significant amounts of heat due to lack of insulation, chimney drafts, poorly sealed windows and doors, numerous vents and high ceilings. Absence of insulation and high thermal mass also means that many heritage buildings actively transfer warmth from the core to the outside necessitating high energy use during winter months to maintain an adequate level of internal comfort.

Energy efficiency was not a consideration at the time of construction of buildings such as the Town Hall. This was primarily due to the abundant locally available cheap sources of firewood – fireplaces are a feature in every room of such buildings. Also, thoughts of energy constraint and efficiency planning were not yet in the general consciousness. Following ‘hydro-industrialisation’ in Tasmania, during the period 1970-2000, electricity was relatively cheap in Tasmania and as a primarily renewable energy state there was less momentum in the community to begin to address energy consumption.

With growing awareness of climate change and energy use constraints driving price increases, Southern Midlands Council developed a climate change and energy efficiency
program in 2008. Part of the approach was to closely monitor energy use and to explore options for energy efficiency at both a corporate and community level. Detailed energy efficiency audits were undertaken at several of Council’s office buildings, including the Town Hall at Oatlands. This work provided the perfect platform on which to build the energy efficiency project part funded under the CEEP grant.

### 3.0 Project Detail

The Project was undertaken between September 2012 and June 2014. Key components of the project were:

- undertake an initial baseline energy consumption audit;
- identification of activities appropriate to reducing energy consumption at the Town Hall, together with forecast energy savings of each activity;
- implementation - retrofitting the Town Hall at Oatlands with the identified activities;
- development of the course curriculum for ‘Energy Efficiency and Comfort in Heritage Buildings’;
- promotion of ‘Energy Efficiency and Comfort in Heritage Buildings’ and conduct course(s) – dependent upon enrolments;
- promote Project activities through a range of options including an interpretations panel and web site; and
- undertake an energy audit of the Town Hall on completion of the Project activities to guage the success of the Project against the anticipated benefits.

#### 3.1 Baseline Energy Audit

Prior to the implementation of the CEEP funded Project a baseline energy audit of the Town Hall at Oatlands was commissioned and undertaken by Dr John Todd of Eco Energy Solutions. Key points from the audit were:

- the Town Hall has a floor area of 380 m2 (downstairs where all the offices are located) housing 11 staff.
- In 2010/11 activities in the building consumed 64,800 kWh of electricity
- Annual electricity use in the Town Hall over the prior 6 years was relatively constant.
- Electricity usage per staff member was 5,890 kWh for the period prior to energy efficiency measures being implemented. Figures for typical office energy use per Australian government employee are 3,000 kWh per employee per year. This is almost half the Town Hall figure (5,890 kWh/staff/year).
• Energy usage in relation to floor area of the Town Hall offices is 170 kWh/m²/yr. The annual electricity use for commercial office buildings in Hobart is about 195 to 240 kWh/m²/yr. The target for new buildings is 100 to 125 kWh/m²/yr (Building Operators and Managers Association recommendation for Hobart office buildings). It is likely that the reason for the relatively low energy use per square metre of floor area is because the building has a large floor area per staff member, with the large entrance hallway, large staircase, and intermittently used Council Chambers.

Space heating accounted for about two thirds of the electricity use at the Town Hall; with lighting also significant. The high proportion of electricity used for space heating and lighting is not surprising given the design of the building and the cool climate in Oatlands. The building has relatively small window areas and all occupied sections of the building the lighting is quite inefficient (e.g. the chandeliers), although factors other than energy efficiency (i.e. historical style) may make the on-going use of these lights appropriate.

The high space heating component also reflects the historical building construction. The high thermal mass (thick sandstone walls) and lack of insulation means the whole building structure cools down overnight and so the radiant temperature of all internal surfaces is cold most mornings; this means air temperatures must be higher to achieve suitable comfort levels.

3.1.1 Carbon Footprint

In the 2010/11 financial year, activities at the Town Hall consumed 64,800 kWh of electricity. The greenhouse gas intensity for Tasmania is 0.30 kg of CO₂ (equivalent) per kWh (based on the published figures from the Australian Department of Climate Change and Energy Efficiency in 2011). This gives a carbon dioxide (equivalent) emission of 19,440 kg for the year. Note: this estimate of CO₂ (equivalent) emissions for electricity is based on the official government emission factors for Tasmania. In practice, when electricity is saved in Tasmania it does not lead to a reduction in hydroelectric electricity generation, it means less electricity imported into the state via the Basslink cable. The actual reduction in CO₂ emissions associated with improved efficiency is better linked to the average carbon intensity of the Eastern Australian grid. Thus, an electricity saving of 1 kWh reduces greenhouse gas emissions by 1.07 kg CO₂ (equivalent) rather than 0.3 kg CO₂ (equivalent).
3.1.2 Projected energy savings for the CEEP Project

The audit of the Town Hall undertaken by Eco Energy Solutions provided a forecast of energy savings in relation to the energy efficiency activities planned under the CEEP Project. Detail of these forecasts is summarised below:

Key measures

<table>
<thead>
<tr>
<th>Action</th>
<th>Electricity Savings (kWh / year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrofit sash windows throughout Town Hall with Perspex inlays (retro-double glazing).</td>
<td>4,540</td>
</tr>
<tr>
<td>Install ceiling insulation and sarking - Works and Services Section.</td>
<td>3,050</td>
</tr>
<tr>
<td>Install perspex double glazing under dorma ceiling and skylights in the Works and Services Section.</td>
<td>2,010</td>
</tr>
<tr>
<td>Improve fireplace and chimney seals throughout (draught proofing).</td>
<td>730</td>
</tr>
<tr>
<td>Refurbish main entrance off High St. – draft seal, re-glaze and insulate above.</td>
<td>1,790</td>
</tr>
<tr>
<td>Refurbish Stutzer St. entry with an air lock (draught proofing).</td>
<td>480</td>
</tr>
<tr>
<td>Replace portable fan &amp; oil heaters with 240W under-desk thermo-film panels.</td>
<td>3,200</td>
</tr>
<tr>
<td>Improve efficiency of lighting – install sensors in toilets and kitchen.</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Project target energy savings

A total projected saving of 22,274 kWh annually - equivalent to a 35% saving as compared to the baseline.
3.2 Town Hall energy efficiency activities

Energy efficiency activities at the Town Hall were undertaken by Heritage Building Solutions.

3.2.1 Heating and Lighting upgrades

Activity 1.2.2 – heating upgrade

Most staff at the Town Hall employed supplementary heating additional to the space heating supplied by heat pumps in the building. These heaters were all inefficient fan heaters or oil column heaters consuming up to 2000 w each. These heaters were all disposed of and staff provided with either 160w or 240w ‘thermo-film’ under-desk personal heaters. After a short period of adjustment staff were content with the replacement heaters and found that they provided adequate localised warmth.

| Replace portable fan & oil heaters with 160W or 240W under-desk thermo-film panels | Cost $960 | Projected saving: 3,200 kWh/yr |

Activity 1.2.3 – lighting efficiency improvement

Lighting in infrequently used spaces at the Town Hall was often left on for the whole day resulting in unnecessary energy consumption. Sensor operated lighting was installed in toilets & kitchen to address this situation. These spaces are now only lit on-demand.
3.2.2 Draft proofing of entrances

Activity 1.3.1 – refurbishment of the High Street entry to the Town Hall

The High Street entrance to the Town Hall was very poorly sealed and insulated. The foyer essentially offered no resistance to the entry of wind and cold air into the Town Hall. Under this activity the following measures were adopted to rectify the situation:

<table>
<thead>
<tr>
<th>Improve lighting efficiency – install sensors in toilets and kitchen</th>
<th>Cost</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$1340</td>
<td>1,500 kWh/yr</td>
</tr>
</tbody>
</table>

Cost $1340

Projected saving: 1,500 kWh/yr
- replace 3mm glass with comfort plus laminate glass;
- draft seal the double doors; and
- insulate and seal the ceiling area with R 4.1 polyester insulation bats.

| Activity 1.3.4 - refurbishment of the Stutzer Street entry to the Town Hall |
|---|---|---|
| Refurbish High Street entrance to the Town Hall – draft proof, re-glaze and insulate. | Cost | Projected saving: |
| | $3950 | 1,790 kWh/yr |

Activity 1.3.4 - refurbishment of the Stutzer Street entry to the Town Hall

The Stutzer Street entry to the Town Hall was a similar scenario to the High Street entry in that it offered little resistance to the ingress of cold air to the building. The ‘closer’ on the door to the outside was ineffective, often resulting in the door being left ajar. This entrance was completely rebuilt to create an air lock compartment. The existing door to the outside of the building was draft-sealed and fitted with an effective ‘closer’.

<table>
<thead>
<tr>
<th>Refurbish Stutzer Street entry with air lock (draught proofing)</th>
<th>Cost</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$5900</td>
<td>480 kWh/yr</td>
</tr>
</tbody>
</table>
3.2.3 Addressing heat loss into high ceiling spaces

Activity 1.3.2 – seal ceiling space

The Works and Technical Services Section of the Town Hall has a particularly high ceiling – typical of older buildings. This situation previously offered no resistance to the loss of heated air into the ceiling cavity and then out through the poorly insulated roof. To rectify this situation a double glazed ‘false-ceiling’ unit was installed into the ceiling space to provide an effective barrier to heat loss. A ceiling fan was also installed to circulate warmed air throughout the office.

The Works and Technical Services Section also had no ceiling insulation. The roofing iron was removed, insulation and sarking installed and the iron replaced - refer to Section 3.2.6.

Activity 1.2.1 – install double-glaze skylight

In a similar measure, a double glazed unit was installed in the ‘print room’ replacing an old skylight that offered no barrier to the flow of warm air.
3.2.4 Retro double glazing of windows

**Activity 1.6.1 – retro double-glazing and window sealing**

The sash windows of the Town Hall were poorly sealed and hence drafty. All windows were refurbished and fitted with 5 mm poly-glass units to create a double-glazed effect and an effective insulating layer of air between the outside of the building and the office spaces. Each poly-glass unit was framed, backed with foam to provide a snug seal, and clipped into place enabling ease of removal if necessary.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressing heat loss into ceiling spaces</td>
<td>2,010 kWh/yr</td>
</tr>
<tr>
<td>Cost</td>
<td>$5650 (activities 1.2.1 &amp; 1.3.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade sash windows throughout the Town Hall offices (renovate windows &amp; install poly-glass inlays for double glaze effect)</td>
<td>4,540 kWh/yr</td>
</tr>
<tr>
<td>Cost</td>
<td>$5140</td>
</tr>
</tbody>
</table>
3.2.5 Sealing old fireplaces

*Activity 1.3.5 – draft sealing fireplaces*

Every room in the Town Hall has a fireplace. The fireplaces offer an efficient conduit for air exchange into the building meaning loss of warm air and creating drafts. Seven fireplaces were sealed in two ways: poly-foam insulation inserts installed into the base of chimneys; and facades facing to the offices sealed with plywood.

<table>
<thead>
<tr>
<th>Improve fireplace and chimney seals (draught proofing)</th>
<th>Cost</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$700</td>
<td>730 kWh/yr</td>
</tr>
</tbody>
</table>

3.2.6 Upgrade of insulation

*Activity 1.3.3 – insulation*

Heritage buildings were not insulated on construction. As mentioned previously this was largely due to the absence of energy efficiency concerns at the time and an abundant energy source – firewood. The roof of Works and Technical Services Section was chosen as the most pressing location at the Town Hall requiring insulation and sealing. Staff often mentioned the drafty nature of the office and ingress of dust through the ceiling. The roofing iron was lifted from the offices, R4.1 polyester insulation bats installed, sarking installed, and roofing iron replaced.
Ceiling insulation and sarking installed - Works and Services Section

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Projected saving:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$14,200</td>
<td>3,050 kWh/yr</td>
</tr>
</tbody>
</table>
3.3 Communications Activities

3.3.1 Energy Efficiency & Comfort in Heritage Buildings

Activity 1.1.4 – development of course material

The curriculum for the course ‘Energy Efficiency & Comfort in Heritage Buildings’ was developed by a consultant engaged through the Centre for Heritage at Oatlands. Refer to Appendix 1.

Activity 1.8.1 – promotion of energy efficiency courses

The course ‘Energy Efficiency and Comfort in Heritage Buildings’ was advertised through the Centre for Heritage at Oatlands - Heritage Education and Skills Centre through their web site and brochures – see below:
To date the course has not been run as insufficient numbers enrolled to make running the course viable. The course will continue to be promoted in the foreseeable future.

### 3.3.2 Interpretation

**Activity 1.7.1 – interpretation panel**

A digital display highlighting Project aims, activities and outcomes was produced and installed in a prominent location at the reception desk of Southern Midlands Council.
The interpretations display clearly highlights project activities and the benefits they deliver in energy savings. The objective of the display is to promote the Government’s and Councils joint commitment to and leadership in the field of energy efficiency, and to inspire uptake of further energy efficiency activities within the local community.

### 3.3.3 Other communications activities

The Project was well publicised in the following ways:

*Newsletter articles*

Project information was submitted on a regular basis to the quarterly Southern Midlands Council ratepayer’s newsletter and the monthly community newsletter ‘Southern Midlands News’.

*Forums*

Southern Midlands Council has a representative on Tasmania’s southern region local government climate change forum – the Regional Climate Change Initiative. This forum meets on a quarterly basis and involves representatives from local government, state government and regional authorities. CEEP Project updates were provided at these meetings.

*Web sites*


Course promotion was undertaken on the Heritage Education and Skills Centre web site [www.centreforheritage.com.au](http://www.centreforheritage.com.au)
4.0 Project Outcomes

4.1 Energy efficiency outcomes

4.1.1 Baseline, projected and achieved energy efficiency

**Project baseline** during the baseline period (2010/11 – 12 months) activities at the Town Hall Oatlands consumed **64,800 kWh** of electricity.

**Project target** a total projected saving of **22,274 kWh annually** (equivalent to 35% less than baseline energy usage).

**Achieved to date** a total achieved saving of **21,954 kWh annually** (equivalent to 34% less than baseline energy usage).

Refer to Attachment 1 for further information on the energy efficiency outcomes of the Project.


### 4.2 Communications activities outcomes

The communications activities outcomes for the Project were as follows:

- four articles submitted to the Southern Midlands ratepayer newsletter;
- one article published in the ‘Southern Midlands News’;
- development of the curriculum for the course ‘Energy Efficiency & Comfort in Heritage Buildings’;
- development and installation of an electronic interpretations panel at the front reception desk of Southern Midlands Council – located in the Town Hall at Oatlands; and
- five quarterly updates provided through the Regional Climate Change Initiative forum.

To date, the outcomes of the communications activities are more difficult to quantify than the energy efficiency outcomes of the Project as there is always some uncertainty as to the level of engagement in the community despite best efforts to cover a range of promotional methods.

The course ‘Energy Efficiency in Heritage Buildings’ although not successfully run during the timeframe of the Project, will continue to be promoted. Enrolment numbers and course feedback will provide a more concrete measure of the communications outcomes of the Project.
6.0 Conclusion

The CEEP 1011 Project was a great success. The Project was implemented according to plan and aligned closely to the allocated budget.

The Project activities resulted in the forecast energy savings at the Town Hall being met. The Town Hall is now a considerably more energy efficient building (34% improvement) with greatly improved comfort levels for staff and visitors.

The Project has improved awareness amongst staff, and all associated with usage of the Town Hall, of the considerable environmental and financial benefits of undertaking a carefully planned energy efficiency upgrade. The project has also demonstrated that the unique features of heritage buildings do not need to be compromised when making upgrades for energy efficiency.

The benefits of the Project will continue to be realised indefinitely for Southern Midlands Council, and also more broadly as the foundation has been laid for ongoing promotion of energy efficiency in older/heritage buildings - the Town Hall at Oatlands provides a fine example of what can be achieved.
**Attachment 1: Project Energy Efficiency Improvement**

<table>
<thead>
<tr>
<th>PROJECT TITLE</th>
<th>Implementing &amp; Promoting Energy Efficiency Solutions in Heritage Buildings Through Retrofitting the 1880s Southern Midlands Town Hall</th>
<th>PROJECT ID</th>
<th>CEEP 1011</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUNDING RECIPIENT</td>
<td>Southern Midlands Council</td>
<td>DATE</td>
<td>2nd June 2014</td>
</tr>
</tbody>
</table>

### Building, Facility or Site 1

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site 1</th>
<th>Town Hall Oatlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>71 High Street, Oatlands, TAS 7120</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Council Administration Works and Services Office</td>
</tr>
</tbody>
</table>

**Activity Type and Measure**
- Energy efficiency retrofit including – double glazing, airlock entries, insulation, draft proofing, sensor lights and heating upgrade.

**Energy Efficiency Estimate Method**
The simulation used to provide the estimates is based on the 2012 Building Code of Australia from JV3.

**Baseline Energy Usage**
- Baseline period – 12 months (1 July 2010 to 30 June 2011)
- 64,800 kWh per annum

**Baseline Energy Efficiency**
- 64,800 kWh / 380 m² x 3.6 = 614 MJ per m² per annum
- 64,800 kWh / 11 x 3.6 = 21,207 MJ per FTE per annum

**Energy Efficiency Improvement**
- 21,954 kWh reduction – equivalent to:
  - 21,954 kWh / 380 m² x 3.6 = 208 MJ per m² per annum
  - 21,954 kWh / 11 x 3.6 = 7,185 MJ per FTE per annum

**Reporting Data (Measuring Energy Efficiency and Additional Data)**
- A total area of 380 m² and 11 FTE occupants
- 80% average operational occupancy level
- Daily hours of operation 8 am to 5 pm
- Building construction date 1880

**Cost of Activity**
- $40,300

**Estimated Cost Savings (based on current data)**
- $6,147 per annum.
  - Cost savings based upon the current cost of electricity for the Site of $0.28 per kWh (March 2014)
Appendix 1: Energy efficiency - Future proofing your heritage home - course notes

Supplied as a separate document