FINAL REPORT
Energy Efficiency Upgrade
Heating Ventilation & Air Conditioning System
Raymond Terrace Community Care Centre
CEEP 1089

15 SEPTEMBER 2014

This project received funding from the Australian Government.
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The views expressed herein are not necessarily the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein.
1. Executive Summary

The Raymond Terrace Community Centre located at 57 Port Stephens Street, Raymond Terrace is owned and operated by Port Stephens Council; however the facility is wholly used for a wide range of community purposes. The facility houses numerous community organisations and their activities including: Hunter New England Local Health Network - Community Team & Mental Health, Port Stephens Community Care Inc., RSL Raymond Terrace Sub Branch, Multiple Sclerosis Society, Ageing Disability & Home Care, Port Stephens Home Modifications & Disability Services.

Port Stephens Council had approved $166,000 in funding from the Australian Government under the Community Energy Efficiency Program in June 2012 to design and construct a new Heating & Ventilation Cooling System and an overall Building Management System as part of the Community Energy Efficiency Program.

The existing Heating Ventilation & Air Conditioning system at the Raymond Terrace Community Care Centre was installed in 1993 when the building was converted to its existing use from its former use as the Council Administration Building. Whilst the mechanical plant is long lasting and has been well serviced and maintained, inefficient in terms of both its energy demand and its maintenance, service and repair requirements.

The replacement of the four (4) existing reverse cycle rooftop packaged units with new, modern energy efficient plant integrated with TREND Building Management System for optimal control and energy savings combined with additional energy saving strategies delivered a minimum reduction in electricity consumption of 45%.

This project also significantly reduced energy costs to Council, indirect greenhouse gas emissions, and increase comfort and safety to community service providers and clients and community members using the facility.
2. Project Objectives

The primary aim of the project was to significantly increase the energy efficiency of Raymond Terrace Community Care Centre as well as increase community awareness and knowledge of the financial and environmental benefits of energy efficiency to the wider community.

Objectives of the project include:

- Gross reduction in air conditioning energy usage, running costs, & greenhouse gas emissions.
- Improved reliability & service delivery
- Lower maintenance costs
- Increased outside air reticulation and improvement in indoor air quality
- Elimination of inconsistencies in temperature throughout the building
- Elimination of the use of R22 Refrigerant on site
- Increased community awareness of the numerous benefits of energy efficiency
- Implement new systems compliant with the latest BCA and Code requirements with significant reductions in energy consumption and carbon emissions.

3. Project Energy Efficiency Activities

The following energy efficiency improvement work was undertaken:

- Replacement of four (4) existing reverse cycle rooftop packaged units with new, energy efficient plant of the highest quality
- All plant use the latest R410 refrigerant (non-ozone depleting).
- All plant will use super-efficient ‘plug fans’ and electronic thermal expansion valves where available under 2012 MEPS.
- Inclusion of a new ‘Trend’ BMS (Building Management System) linked to the main system in the Council Administration Building.
- Control improvements, more sensors, averaging sensors.
- Sensors with digital readout of temperature and (limited) set point adjustment for staff.
- Improve air flows to areas as required (where deficient)
- Increase the potential fresh air flow by 100%, from the existing fixed system by adding ‘economy cycle’ whereby 100% outside air is introduced if ambient conditions are favourable for cooling (as required under BCA Section J)
- With this ‘free cooling’ arrangement energy savings are the result as it is not necessary to run the AC unit compressors.
Heating Ventilation & Cooling (HVAC)

- Prior to upgrade HVAC used 60% of total site electricity
- After installation electricity consumption down by 80% (note: Solar PV System and energy efficient T5 Lighting associated projects have also contributed to the reduction in electricity consumption)
- $30,000 reduction in electricity costs each year
- Reduced greenhouse gas emissions by 120 tonnes CO2e/yr
- Improved occupancy comfort
- Reduced maintenance costs

Project Energy Efficiency Improvement

Optimal Consulting Engineers prepared an Options Report for energy efficiency improvements to the existing HVAC system at the Raymond Terrace Community Care Centre in March 2012. Optimal Consulting Engineers estimate the efficiency improvement to HVAC system as a result of this project to be between 45 & 55%. Optimal Consulting Engineers consider this to be a minimum efficiency improvement calculated by way of a 30% improvement in energy efficiency of reverse cycle ducted units as per MEPS, a 50% improvement in the energy efficiency of supply fan consumption (due to the introduction of new 'plug' fans) compared to the traditional forward curved belt drive systems as presently installed, and a 12% saving in compressor consumption due to the introduction of electronic expansion valves.

A 45% (most conservative assessment) saving correlates to an actual reduction of 59,130 kWh/yr and an annual greenhouse gas emission reduction of approximately 62.6 tonnes of CO2e per year. Over the minimum expected useful life of the new HVAC equipment total savings in electricity consumption of 886,950 kWh can be expected, delivering a minimum reduction in GHG emissions of 939 tonne of CO2e over the minimum expected life of the equipment.
Baseline Energy Usage

Total electricity consumption for Raymond Terrace Community Care Centre in 2010/11 was 281,000 kWh. Average annual electricity consumption over the previous 5 years was 260,000 kWh, however this included a period of shutdown for 5 months in early 2009.

It is estimated that total electricity consumption from the former HVAC system was approximately 131,400 kWh/yr, or approximately 47% of total building electricity consumption. This is considered to be a conservative (i.e. minimum) estimate.

<table>
<thead>
<tr>
<th>PROJECT TITLE</th>
<th>Energy Efficiency Upgrade to the Heating &amp; Air Conditioning system</th>
<th>PROJECT ID</th>
<th>CEEP1089</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUNDING RECIPIENT</td>
<td>Port Stephens Council</td>
<td>DATE</td>
<td>15/9/14</td>
</tr>
</tbody>
</table>

Building, Facility or Site 1

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site 1</th>
<th>Raymond Terrace Community Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>57-59 Port Stephens street, Raymond Terrace</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Community Health Services</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Upgrade of HVAC system</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td>MEPS, NABERS, Online WebGraphs, Planet Footprint</td>
</tr>
</tbody>
</table>

Baseline Energy Usage

| Baseline Energy Efficiency          | 90 kWh/m2 |

Energy Efficiency Improvement

| Energy Efficiency Improvement       | Reduction 59,130 kWh per annum and greenhouse gas emission reduction of 62.6 tonnes of CO2e per annum |

Reporting Data (Measuring Energy Efficiency and Additional Data)

| Net lettable (air conditioned) area 1460m2 and 50-60 occupants |
| Daily hours of operation: 9am to 5pm |
| Building construction date 1964 |

Cost of Activity

| Cost of Activity | $301,159 |

Estimated Cost Savings

| Estimated Cost Savings | $29,595 per annum (@ 50c/kW) |

Baseline Energy Efficiency

The energy efficiency of the former HVAC system is approximately 90kWh/m2. With a total lettable area of 1460 m2 and total electricity consumption in 2010/11 of 281,000 kWh the building currently has a 4 star energy rating (NABERS). Note. This energy rating was obtained online through the NABERS website and has not been verified by an accredited assessor.
Method and Tools

Total baseline electricity consumption for Raymond Terrace Community Care Centre was supplied directly from Port Stephens Council's online electricity monitoring service, WebGraphs & verified against electricity invoices supplied by Council's electricity retailer. This data has also been verified through Council's online Environmental Scorekeeping service provider Planet Footprint. Planet Footprint also independently sources data directly from Council's electricity retailer.

An Options Report was prepared for Council by Optimal Consulting Engineers in March 2012 which provides an estimate of the total electricity consumption from existing HVAC system of 131,400 kWh/yr based on 90kWh/m² x 1460 m² of lettable air conditioned floor space. Optimal Consulting Engineers refer to the AIRAH Handbook 2010 (Australian Institute of Refrigeration Air Conditioning and Heating) of which the Director of Optimal Consulting Engineers is a member. 131,400 kWh represents approximately 47% of the total building electricity consumption. Port Stephens Council's Energy Saving Action Plan (June 2007) was prepared by Asset Technologies Pacific (ATP) which provides an Energy Balance Model for Consumption for the period 1/2/2005-1/2/2006. ATP estimate the annual electricity consumption at 124,700 kWh/yr, or 50.2% of the then total building consumption of 248,630 kWh. This is consistent with the more recent estimate provided by Optimal Consulting Engineers of approximately 50% of the total building consumption, and demonstrates a comprehensive approach to assessing the baseline energy consumption at the facility.

Optimal Consulting Engineers and Port Stephens Council are of the view that the actual electricity consumption from the former HVAC system was likely to be much higher than 50% of the total building consumption. This is for two reasons: Firstly, since the 2007 ATP report was prepared there have been a number of efficiency improvements implemented throughout the building (T5 lighting, Solar HW, & PLCs in particular) and therefore HVAC consumption will likely represent an increasing proportion of the total consumption. Secondly, both the age of the equipment and the recurrent failures of equipment suggest that the existing HVAC system is likely to be operating well below expected efficiency for its age. Despite this, an estimation of total electricity consumption for the existing HVAC system of 131,400 kWh (or approximately 47% of 2010/11 total building consumption) has been used for the purposes of this funding application and project proposal. Port Stephens Council is now able to demonstrate reductions in annual electricity consumption at the site of greater than 131,400 kWh and corresponding GHG emissions.

To verify the above consumption figures during the project through the temporary installation of sub-metering to determine actual electricity consumption of a short period of time. From this actual data it is intended to extrapolate a more accurate estimation of existing consumption, which again is likely to be greater than 50% of total building consumption. This data will be able to be directly compared with actual consumption data post installation of the new energy efficiency HVAC equipment.

Greenhouse Gas emissions were calculated by Optimal Consulting Engineers using an emissions factor of 1.06 tCO2e/MWh.
**Professional Assistance**

Richard Walsh, Director of Optimal Consulting Engineers provided professional assistance through the preparation of an Options Report in March 2012, as well as calculations on baseline energy consumption, baseline energy efficiency, and projected energy efficiency improvement.

Port Stephens Council's subscription to the Planet Footprint Environmental Scorekeeping Service was utilised to verify baseline energy consumption. Over 200 local government organisations subscribe to Planet Footprint's service. Electricity data is sourced directly from Council's electricity retailer and verified by Planet Footprint in line with their quality assurance checks, as set out in Planet Footprint's guidance documents.

Asset Technology Pacific prepared Port Stephens Council's 2007 Energy Saving Action Plan. This Plan was used to verify the baseline energy use of the existing HVAC equipment to ensure the veracity of the estimates provided by Optimal Consulting Engineers in March 2012. This verification gave Port Stephens Council confidence in the electricity consumption estimates provided in their application, and the assumptions inherent within the estimates.

Port Stephens Council subscribes to the online electricity monitoring service, WebGraphs which is delivered through AusGrid's meter reading section. All electricity consumption data relating to the whole site was obtained in the first instance through WebGraphs prior to verification through other sources.

**Fig 1.**
Fig 2.

Electricity Costs ($)
HACC Community Care Centre 2007/08 - 2013/14
4. Project Demonstration and Communication Activities

This project is uniquely placed with its high level of exposure to such a wide cross section of the Port Stephens & Hunter Community as a central community hub for a range of service providers. Clear signage illustrating the energy efficiency works undertaken were erected around the perimeter of the facility. In addition an electronic smart screen has been installed in the foyer demonstrating current energy consumption/savings, all energy saving equipment including energy saving tips and information.

Promotional Signage

Energy Efficiency Presentation – Electronic Smart Screen
This project forms part of Port Stephens Council's ongoing commitment to energy efficiency throughout Council's numerous facilities, and with the wider Port Stephens community. Port Stephens Council clearly demonstrates the direct financial benefits of driving energy efficiency improvements and this project will be utilised as a key focus for the 12 months to promote the benefits of energy efficiency more widely.

5. Outcomes and Benefits of the Project

The ongoing provision of a diverse and essential range of community services from the Raymond Terrace Community Care Centre will be a legacy of this project. The current comfort levels within the facility were poor as a result of often intermittent and inefficient HVAC services. Providing a comfortable, safe, and efficient facility for the provision of a range of community health and support services is a valuable and ongoing contribution the Australian Government could make to the Port Stephens Community.

The direct financial savings to Port Stephens Council, and by extention the rate payers of Port Stephens, through reduced energy, maintenance, and repair costs is a significant boost to the community. These savings will help to ensure that Port Stephens Council is able to continue to deliver services to the community sustainably into the future.

Port Stephens Council will use it's extensive links with Hunter media outlets to promote the project as a demonstration of the benefits of energy efficiency to the environment, the Council, rate payers and the wider economy.

The Raymond Terrace Community Care Centre has recently been featured in local media as a result of a successful upgrade and replacement of old inefficient Electric Storage HWS with 3 x Evacuated Tube Solar HWS. The facility is well placed within the community to achieve a high level of public and media exposure through this project and builds on recent successes in energy efficiency.

Port Stephens Council can clearly demonstrate the direct financial benefits of driving energy efficiency improvements and this project will be utilised as a key focus to promote the benefits of energy efficiency more widely. As an example of Council's commitment to energy efficiency, across the top 12 electricity consuming sites owned & operated by Port Stephens Council, electricity consumption has been reduced by 21% or 1.18 MWh/yr.

Port Stephens Council quarterly newsletter YourPort provides an excellent opportunity to highlight this project as a great example of improved energy management practices within Port Stephens Council and will be utilised to increase the exposure of the project. The work and property will also be profiled and made available to the public via Planet Footprint’s online profiles feature.
6. Budget

The project proceeded on a competitive Tender process to ensure that both Port Stephens Council and the Commonwealth Government achieve value for money with this project. Port Stephens Council's Procurement Guidelines for Tendering were followed to ensure value for money.

Optimal Consulting Engineers prepared an Options Report for Port Stephens Council in March 2012, from which the most cost effective option for upgrading the existing HVAC system to optimise energy efficiency was selected as the preferred project delivering an immediate 29% saving on the project budget when compared to the next available upgrade option.

The project was delivered within budget with a total cost of $301,159 excluding GST. The project budget was $332,078 excluding GST. Final Grant amount $150,579.50.

The table below outlines the actual costs versus the budgeted costs in the funding application. Final grant amount

Table 1 – Project’s budget and actual costs

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>BUDGETED COSTS</th>
<th>ACTUAL COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Audit</td>
<td>1.1.1 Provide consultant’s report including current condition feasibility study and energy saving goals.</td>
<td>$3,000</td>
<td>$3,230</td>
</tr>
<tr>
<td></td>
<td>1.1.2 Completion of design, drawings and specifications required for the work.</td>
<td>$9,500</td>
<td>$8,360</td>
</tr>
<tr>
<td></td>
<td>1.1.3 Advertising &amp; Tendering process</td>
<td>-</td>
<td>$558</td>
</tr>
<tr>
<td>HVAC and BMS Works</td>
<td>1.2.1 Remove existing plant and rooftop ductwork and reclaim all available 'R22' refrigerant.</td>
<td>$12,250</td>
<td>$12,250</td>
</tr>
<tr>
<td></td>
<td>1.2.2 Replacement of four reverse cycle rooftop packaged systems.</td>
<td>$129,458</td>
<td>$127,750</td>
</tr>
<tr>
<td></td>
<td>1.2.3 New rooftop ductwork with 100mm internal insulation and FA economy cycle installed.</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td></td>
<td>1.2.4 Implement BMS with data logging, energy management, additional sub metering.</td>
<td>$45,000</td>
<td>$39,490</td>
</tr>
<tr>
<td></td>
<td>1.2.5 Replacement and upgrade of local wiring and heater (Price inclusive of 1.2.4)</td>
<td>$18,000</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>VARIATION Auditorium 1 variation of ducting design</td>
<td>-</td>
<td>$3,670</td>
</tr>
<tr>
<td></td>
<td>1.2.6 Building works – roof membrane sealing</td>
<td>$5,000</td>
<td>$1,190</td>
</tr>
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<td></td>
<td>1.2.7 Commissioning of new HVAC &amp; BMS - manuals, drawings, warranty</td>
<td>$5,000</td>
<td>$7,500</td>
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<td></td>
<td>1.2.8 Project coordination and management, supervision, management, commissioning and administration</td>
<td>$32,320</td>
<td>$30,442</td>
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<tr>
<td>Communications</td>
<td>1.3.1 Erect promotional signage</td>
<td>$3,000</td>
<td>$515</td>
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<td></td>
<td>1.3.2 Radio Equipment Relocation (new air conditioning duct in signal path)- Variation</td>
<td>-</td>
<td>$356</td>
</tr>
<tr>
<td></td>
<td>1.3.3 Produce and distribute promotional material &amp; issue media releases</td>
<td>$5,000</td>
<td>$5,648</td>
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<tr>
<td>Project Review &amp; Final Audit</td>
<td>1.4.1 Project Review and Final Audit (Price inclusive of 1.1.1)</td>
<td>$4,550</td>
<td>-</td>
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<tr>
<td>Final &amp; Financial Report</td>
<td>1.5.1 Final Report</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1.5.2 Financial Report</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

TOTAL: $332,078 $301,159

While the overall project was delivered within budget, there were minor variations within certain budget lines as outlined above.

An audited financial statement has been prepared for the project and will be submitted to the Department of Industry with the Final Report submission.
7. Project Operation, Mechanisms and Processes

A complete energy audit was undertaken by Optimal Consulting and including current condition, feasibility study and energy saving goals. As well as a detailed project delivery plan was developed including scheduled site meetings with consultant and contractor.

Project Management Plan

Initiation

- Complete energy audit and obtain consultant's report including current condition, feasibility study and energy saving goals
- Appoint project review team

Duration: 1/3/12 - 26/3/12

Planning:

- Prepare tender documents
- Develop detail project delivery plan including scheduled site meetings and hold & witness points
- Access tender applications
- Engage successful tenderer
- Complete project management plan with user groups

Duration: 1/12/12 – 30/4/13

Execution:

- Complete site inductions before commencement of work
- Remove existing equipment and install new
- Implement energy management systems in BMS
- Site meeting as per delivery plan
- Supply as installed drawings
- Commissioning of new HVAC & BMS
- Erect signage, produce and display promotion material

Duration: 1/6/13 – 30/3/14

Completion:

- Review project to ensure performance and energy saving goals are achieved
- Audit to identify if further efficiencies or savings can be made
- Final report

Duration: 1/6/14 -5/09/14
Scope of Works

- Replace the four (4) existing reverse cycle rooftop packaged units with new, energy efficient plant of the highest quality.
- All plant will use the latest R410 refrigerant (non-ozone depleting).
- All plant will use super-efficient ‘plug fans’ and electronic thermal expansion valves where available under 2012 MEPS.
- Inclusion of a new ‘Trend’ BMS (Building Management System) linked to the main system in the Council Administration Building.
- Control improvements, more sensors, averaging sensors.
- Sensors with digital readout of temperature and (limited) set point adjustment for staff.
- Improve air flows to areas as required (where deficient)
- Increase the potential fresh air flow by 100%, from the existing fixed system by adding ‘economy cycle’ whereby 100% outside air is introduced if ambient conditions are favourable for cooling (as required under BCA Section J)
- With this ‘free cooling’ arrangement energy savings are the result as it is not necessary to run the AC unit compressors.
- Review project to ensure performance and energy saving goals are achieved
- Audit to identify if further efficiencies or savings can be made
8. Conclusion

It had become evident that an 'engineering solution' was required rather than a 'service solution'. This engineered solution proved to be the most cost-effective long term approach to good management of the valuable Council asset – the building and occupants.

The high level of exposure of the Raymond Terrace Community Care Centre to a wide range of community service providers will ensure that both the Australian Government and Port Stephens Council will receive value for money in terms of the public awareness raised about the project. This high level of exposure within the community will lead to further improvements in energy management with an increased capacity and understanding of energy efficiency.

Furthermore, the expenditure of Australian Government funds on this particular facility provides numerous additional benefits to the community. In particular, providing for a comfortable and safe environment from which numerous community organisations can deliver essential health and support services to the community clearly demonstrates how this project delivers value for money beyond the immediate improvements to the facility's energy efficiency and truly represents a sustainable project worth funding on environmental, economic and social grounds.

Beyond the wider awareness raising throughout the community of the benefits and opportunities of energy efficiency, this project provides Port Stephens Council staff and management with a perfect case study from which to learn from in designing future energy efficiency, and in particular HVAC, projects in the future. The direct project experience in undertaking such a large scale energy efficiency upgrade enhances Council’s ability to deliver energy efficient HVAC upgrades to many other Council facilities currently in need of attention.
9. Declaration

DECLARATION

The Authorised Officer of the organisation makes the following declarations:

☒ I declare that I am authorised to submit this Final Report (including any attachments) on behalf of Port Stephens Council .......................................................... (Name of organisation)

☒ I declare that the information provided in this Final Report is true and accurate.

☒ I understand, and acknowledge that giving false or misleading information in this Final Report is an offence under the Criminal Code Act 1995.

☒ I understand that final payment will only be made in accordance with the Funding Agreement including on satisfactory completion of Milestones.

Authorised Officer Signature: .................................................. Date: 5/9/14

Name: Kathryn Lister

Position: Projects Officer 

Organisation: Port Stephens Council

Witness Signature: .................................................. Date: 5/9/2014

Name: Sharon Christensen

Position: Administration Officer 

Organisation: Port Stephens Council

The use and disclosure of information provided in this Final Report is regulated by the relevant provisions and penalties of the Public Service Act 1999, the Privacy Act 1988, the Freedom of Information Act 1962, the Crimes Act 1014 and the general laws of the Commonwealth of Australia.

Information contained in the Final Report may be disclosed by the Department for purposes such as promoting the program and reporting on its operation and policy development. This information may also be used in answering questions in Parliament and its committees. In addition, the selected project information will be made publicly available. Public announcements may include the name of the grant recipient and of any project partners; title and description of the project and its outcomes; and amount of funding awarded.