Final Report in relation to
Community Energy Efficiency Program Funding Agreement
for Mingara Cogeneration Project

Name: Andy Lord
Title of the project: Mingara Recreation Club Cogeneration Project.

This activity received funding from the Australian Government.

Australian Government
Department of Industry

This Final Report has been prepared by Mingara Recreation Club (ABN 81001662648) in accordance with the Final Report Guidance Material for Recipients. This report was submitted to the Department on the 22nd October 2014.
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1. Executive Summary

Mingara commenced discussions about the implementation of a cogeneration system in 2011 in the light of dramatic increases in electricity costs. The proposed system would provide electricity for the Club, and heating for the Club’s domestic hot water requirements and swimming pools. The Club’s objectives included reduction of electricity costs, reduction of gas heating costs, reduction carbon emissions and improved energy efficiency.

In April 2012, prompted by other Clubs’ cogeneration installations (in particular another CEEP Recipient Castle Hill RSL) and the availability of co-funding for the project, Simons Green Energy prepared a feasibility study in relation to the proposed cogeneration system. In January 2013, Mingara submitted a CEEP grant application with a binding quotation from Simons Green Energy for their scope in relation to the project. The anticipated project cost was $1,637,744 for the supply and installation of plant, construction of a new plant room and post implementation marketing and communications. In May 2013, the Club was notified that its application was successful and that a grant of $818,872 had been recommended subject to approval of a detailed project plan and execution of a Funding Agreement. The Club subsequently commenced preparation of additional material required by the former Department of Climate Change and Energy Efficiency to execute the CEEP Funding Agreement. After submitting documentation to satisfy the Department in relation to activities, costs and project plan timeframes, the Funding Agreement was executed in July 2013 and the Project Plan was accepted in October 2013.

The Cogeneration System was designed, specified and ordered in the period leading up to the end of 2013. The system was installed during the ensuing seven months and was handed over and formally accepted in September 2014, in line with the date scheduled in the Funding Agreement.

The project’s objective to reduce Mingara’s electricity expenditure and consumption were met and the project was delivered within budget and anticipated timeframe. Based on the current operating parameters and forecast energy prices, the Club expects to save approximately $326,000 in the first year of operation (and $350,000 per year on average over the following five years) in energy costs while reducing carbon emissions by 1500 tonnes per annum (or 30,000 tonnes in total over the life of the system) and increasing the efficiency with which it uses energy by 15.91% from an estimated 4,418 MJ / m2 / annum to 3,715 MJ / m2 / annum.

The success of the cogeneration installation has prompted the Club to review a range of other energy efficiency practices and investments. In particular, the sub-monitoring of the Club’s many air-conditioning units, its refrigeration compressors and pumps will inform management about the opportunities for further improvements. Such improvements include revised operational practices, more targeted equipment maintenance, upgrades to the HVAC system and installation of variable speed drive controllers to pumps. In addition, the Club’s cogeneration experience has been shared with other local clubs and local councils. At least one such Council (Gosford) have consequently, commenced investigating a range of energy efficiency options with their local aquatic centres.

Please note that 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.
2. Project Objectives.

The Club’s objectives in undertaking this project included:

- Reducing Mingara’s electricity expenditure;
- Utilising the waste heat from the cogeneration units for pool heating and hot water heating, thereby avoiding gas expenditure;
- Providing a successful business case for other club’s interested in cogeneration technologies; and
- Reducing the carbon dioxide emissions of the club which supports the Club’s environmental and sustainability objectives, as well as being perceived positively by the community.

These objectives complemented the program’s objectives of supporting “community organisations to increase the energy efficiency ... particularly where this would benefit low socio-economic and other disadvantaged communities “ and demonstrating and encouraging “the adoption of improved energy management practices within councils, organisations and the broader community”.

The Club has realised the benefits anticipated by the Program including better services and improved amenity for members and minimising energy consumption and costs. The Club’s reduced carbon support the national objective to reduce greenhouse gas emissions while the engagement of local construction trades and energy services companies has helped develop skills and capabilities.

3. Project Energy Efficiency Activities

The Cogeneration project involved the installation of two ENERG 229kW(e) Cogeneration units, appropriate heat exchangers, waste heat radiators, electrical switchgear and all site-works and electrical/hydraulic connections. The units are located in a newly constructed plant room. The system operates 15 hours a day, 7 days a week and generates over 50% of the electricity required to power the Club, reducing its reliance on grid supplied power.

These units provide heating to the Club’s 50m indoor Olympic pool, hydrotherapy pool and kid’s aqua-play area as well as domestic water for showers. The heat is directed to the existing gas hot water boiler circuit to “pre-heat” the pool water (via a plate heat exchanger) and thereby minimise the use of the gas hot water boilers. The waste heat brings the adult swimming pools up to 27°C and kids’ pool to 29°C all year around. Utilisation of the Cogeneration unit’s waste heat offsets the use of a substantial amount of gas previously used by boilers and enables more economic operation of the aquatic centre.

The cogeneration system utilises two, efficient ENER.G 230, 12 cylinder MTU 230kW reciprocating gas-fuelled engine operating continuously at 1500 rpm tied to a synchronous electrical generator. Heat recovery is via a fully closed primary water circuit incorporating an exhaust gas heat exchanger and suitable waste heat radiators. In addition, the project involved the installation of all electrical switchgear, all site-works and electrical/hydraulic connections.
The prime contractor for the project was Simons Green Energy, based in Sydney, while local sub-contractors, MACs Plumbing Services, were engaged for the mechanical and plumbing works. Lakewood Electrical undertook the electrical. Civil works were subcontracted to local contractors.

The project formally commenced in October 2013, with site preparation commencing in January 2014, equipment installation during April-May 2014 and commissioning in July 2014.

Key project activities included:

1. Establishing the project team, including roles and representatives of parties involved in the project
2. Planning the project (timescales, milestones and budgets)
3. Reviewing site data and preparing detailed scopes of works for sub-contractors
4. Appointing preferred system supplier
5. Completing preliminary system design (to enable system orders to be placed)
6. Ordering long lead time equipment
7. Completing detailed design including system design engineering, drawings, plant room design and specification, detailed civil works design and drawing, development application approval, gas arrangement design, electrical arrangement design, hydraulic design
8. Commencing applications for gas connection approval, electrical connection approval
9. Undertaking plant room construction and civil works
10. Completing pre-installation work including gas supply, hydraulic connection and electrical connections
11. Placing major system components and local assembly where required
12. Completing installation of cogeneration unit
13. Remediating site
14. Gaining approvals from regulatory bodies and electrical and gas authorities
15. Commissioning the installation
16. Tuning and balancing of systems
17. Training of Club staff and obtaining manuals
18. Analysing system performance

The technology and its implementation proceeded according to plan and the system has been operating in line with expectations. There were no particular issues, site specific or technology problems experienced during the implementation or subsequent operation. The key installation challenges involved running over 260 metres (each way) of thermal pipework over the roof of the aquatic centre and integration with Club’s existing heating system.

4. Project Demonstration and Communications Activities
The Club undertook a number of activities intended to demonstrate and communicate the energy efficiency activities and their effectiveness to Club members, staff and Board members as well as local businesses and councils. The most relevant stakeholders for the Club are its members, in particular those who use its swimming and club facilities. The Club has over 28,000 members from a local population of around 194,000 within 15km. As part
of the Mingara Recreation Group (operating other Clubs in Sydney and Port Macquarie),
total membership is over 56,500 and the Group is one of the largest employers in the region.
The Club therefore has substantial access to the local community via its membership and
related local businesses and has aggressively sought to inform the community about the
merits of the energy efficiency benefits associated with the Cogeneration project. In
particular, the Club has undertaken a number of activities including;

- Conducting a public launch including dignitaries Karen McNamara (Member for
  Dobell) and Doug Eaton (Mayor Wyong Shire Council) and approximately 50 guests;
- Producing and publishing a Case Study available on the Mingara’s Webpage;
- Producing an educational and promotional video available on YouTube;
- Conducting education seminars including at the Wyong Shire Road Show and
  planned seminars to local schools;
- Hosting site visits for Engineers Australia and Australian Leisure Facilities
  Association; and
- Providing PR and editorial in both internal and external media including
  "Sustainability Matters"; "Alfa Leisure"; "Pool and Spa Review"; "Cogeneration and
  On Site Power Production" and "Mingara Life Magazine".

The Club’s communication about the project and its energy efficiency benefits were
focussed towards the end of the project, however several announcements and press
releases gained attention during the project’s implementation.

5. Outcomes and benefits of the Project

The project has been extremely successful and the Club anticipates that its objectives will be
achieved over time. The planning, implementation and handover of the system took place
within the expected timeframe, within the anticipated budget and without any major
adverse surprises, site issues, accidents or incidents, interruptions to the business operations
of the Club, adverse media or reactions from local residents, or any other notable negative
issues.

Early operations of the system have not revealed any installation issues or potential
problems and a post implementation review indicates that the system is performing to
specification. Monitoring data is being collected and will be analysed to demonstrate the
financial and environmental benefits of the system and the data obtained from such analysis
compared with the feasibility analysis undertaken at the commencement of the project.

The declared objectives and outcomes of the project were as follows:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Reduce electricity costs</td>
<td>$555,000 reduction in grid electricity costs per annum</td>
</tr>
<tr>
<td>2 Reduce gas consumption and costs</td>
<td>Reduces gas consumption for heating the pools by $177,000 per annum (however increases overall gas consumption to operate cogeneration units)</td>
</tr>
<tr>
<td>3 Reduce CO2 emissions through the use of lower emitting fuel (gas vs predominately thermal coal) and greater efficiency of the installed equipment</td>
<td>Whilst ever the system is operating (in line with its planned operating times) it is delivering electricity and thermal energy to the club while emitting around half the CO2 of grid-based electricity</td>
</tr>
</tbody>
</table>
In addition, the installation has encouraged more generalised improved energy management within the Club with additional attention now paid to energy efficiency and sourcing other means of improving efficiency of the Club (such as sub-monitoring of electricity use). The Public launch of the Cogeneration system has highlighted the potential for energy demand reductions and energy efficiency improvements, alongside compelling investment outcomes. The local council has a vested interest, as a co-operator of the aquatic centre, in promoting these savings among local businesses and within its own sphere of operations and in the community (both businesses and individuals).

The Club has acted to educate the local community (business and citizen) about the benefits of energy efficiency in general and cogeneration in specifically. Several public events (attended by media), local PR and promotion, focus seminars and seminars directed at local community schools have raised and will continue to increase awareness about the benefits of cogeneration and energy efficiency.

The project is anticipated to generate substantial investment returns and financial performance will be evaluated on an ongoing basis. The integration of a monitoring system with the Club’s tariffs will enable ready calculation of savings and investment performance.

This project has been a good example of a successful project delivered under the CEEP. The prior success of other club’s energy efficiency projects (funded by CEEP) provided an incentive to consider implementing a cogeneration system and Mingara would not have investigated this significant project in the absence of CEEP co-funding. The Club’s objectives have been met, the project has gained awareness among the local community, many of whom are members of the Club and the energy saving potential has resulted in the Club investigating other similar energy efficiency projects at its other sites.

Ancillary benefits of this project include the ability to redirect savings in operating expenditure resulting from the lower energy costs into community activities and club capital improvements. Further, Club members have commented on the improved amenity of the Club’s swimming pools as a result of the higher pool temperatures.

The project involved substantial contracting by local sub-contract trades including mechanical, civil and electrical. Hence there were local industry supplements as a result of this project.

Mingara serves the local community on the central coast, of whom a large proportion are elderly (retirees), and low- middle income families. As such, the Club’s membership comprises a significant number of socio-economically disadvantaged constituents. Further, there is a relatively high level of unemployment in the region. These factors suggest that the cost savings and increased comfort resulting from the greater availability of thermal energy for heating the pools will provide a particular benefit to these members of the community. In addition, the cost savings projected will be applied to capital improvements of the facility and disbursements to local community groups, further benefiting these groups.

As can be seen from the revised energy efficiency table below, there was a reduction in overall energy intensity of the Club between the application date and calendar year 2013
due to increased operational attention on energy efficiency (turning lights off, revising AC run times) and as a consequence of an LED lighting upgrade. The baseline energy efficiency for the period January to December 2013 was 4,418 MJ / m2 / annum. Based on the September electricity and gas bills and consumption, we project an improved energy intensity, due to the operation of the cogeneration systems of 3,715 MJ/ m2/annum (a reduction by 703 MJ/ m2/annum). This represents a 15.91% improvement which is greater than estimated in our application. Further, based on the September accounts, we project a year 1 saving of $326,000 versus a projected $269,300.
# Project Energy Efficiency Improvement Template

<table>
<thead>
<tr>
<th><strong>PROJECT TITLE</strong></th>
<th>Mingara Recreation Club Cogeneration Project</th>
<th><strong>PROJECT ID</strong></th>
<th>CEEP2118</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNDING RECIPIENT</strong></td>
<td>Mingara Recreation Club</td>
<td><strong>DATE</strong></td>
<td>23 Nov 2014</td>
</tr>
</tbody>
</table>

**Building, Facility or Site 1**

<table>
<thead>
<tr>
<th><strong>Name of Building, Facility or Site 1</strong></th>
<th>Main Facilities building at Mingara Recreation Club</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location (address)</strong></td>
<td>Mingara Dr, Tumbi Umbi NSW 2261</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>The Club building houses 7 restaurants, entertainment facilities and an aquatic centre and gym.</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Installation of Cogeneration system. The proposed measure of efficiency is MJ/m²/year</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td>New baseline electricity is January 2013 – December 2013. The new baseline was determined by assessing relevant electricity and gas bills for the Club prior to the operation of the new embedded energy system.</td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>76,159,783 MJ / annum. The reduction in total energy usage is due to increased attention to energy efficiency operational measures and an LED lighting upgrade.</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>4,418 MJ / m² / annum</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction by 703 MJ/m²/annum to 3,715 MJ/m²/annum or 15.91% which is greater than estimated</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$1,637,000 (ex GST)</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$326,000 in year 1 which is greater than originally estimated. This estimate is based on the most recent energy prices experienced by the Club which are $10.07 per MJ for gas; a peak electricity charge of 18.87c/kWh and a shoulder charge of 14.32 c/kWh; and a KVA charge of $10.15 per KVA.</td>
</tr>
</tbody>
</table>
## Comparison between Original Project Plan and Post Implementation Energy Efficiency Improvement Tables

<table>
<thead>
<tr>
<th></th>
<th>Original Project Plan</th>
<th>Post Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building</strong></td>
<td>Main Facilities building at Mingara Recreation Club</td>
<td>Per Project Plan</td>
</tr>
<tr>
<td><strong>Type of Building, Facility or Site</strong></td>
<td>The Club building houses 7 restaurants, entertainment facilities and an aquatic centre and gym. The Club spends $1.2m on electricity annually and $132,000 on natural gas (primarily to heat the aquatic centre)</td>
<td>From January 2013 – December 2013 Electricity costs were $1.318m for an average monthly cost of $109,909 with September being a particularly low month at $99,586. This compares with the reference figure in the CEEP application of $1,200,519 per annum. From January 2013 – December 2013 gas costs were $177,582 for an average monthly cost of $14,798. This compares with a reference figure in the CEEP application of $132,000 per annum. In September 2014 (the first full month of cogen operation), the monthly electricity bill was $63,659.51 or $46,250 less than the monthly average for the most recent period. Assuming this outcome is representative, the annual savings will be approximately $555,000. In September 2014 (the first full month of cogen operation), the monthly gas bill was $33,888. Assuming this outcome is representative, the annual additional gas cost will be $229,000. The net reduction in costs will be approximately $326,000 per annum.</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Installation of Cogeneration system. The proposed measure of efficiency is MJ/m²/year</td>
<td>Per project plan</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td>Baseline energy usage and efficiency is measured broadly in accordance with a Level 1 assessment according to AS/NZS3598. We have used over 12 months of energy usage data to identify the existing baseline energy use. The baseline period evaluated was 1/9/2011 – 3/8/2012. This baseline energy use reflects normal operating conditions and incorporates data that existed prior to the implementation of the aquatic centre’s cogeneration system. Other anomalies have been taken into account. When a revised</td>
<td>New baseline electricity is January 2013 – December 2013.</td>
</tr>
</tbody>
</table>
### Energy Efficiency Analysis

Energy efficiency analysis is produced the latest available 12-month data will be used. The baseline energy use data includes energy imported to the site, specifically electricity and natural gas and energy (natural gas, LPG, diesel) that is consumed by stationary equipment on site (but not by mobile equipment).

<table>
<thead>
<tr>
<th>Baseline Energy Usage</th>
<th>97,863,248 MJ / annum</th>
<th>76,159,783 MJ / annum. The reduction in total energy usage is due to increased attention to energy efficiency operational measures and an LED lighting upgrade.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Energy Efficiency</td>
<td>4,774 MJ / m² / annum</td>
<td>4,418 MJ / m² / annum</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction by 703 MJ/m²/annum to 4,071 MJ/m²/annum or 14.7%</td>
<td>Reduction by 703 MJ/m²/annum to 3,715 MJ/m²/annum or 15.91% which is greater than estimated</td>
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<tr>
<td>Cost of Activity</td>
<td>$1,637,000</td>
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<td>Estimated Cost Savings</td>
<td>$269,300 in year 1.</td>
<td>$326,000 in year 1 which is greater than estimated</td>
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</table>

### Budget

The project budget in accordance with the Funding Agreement was $1,637,744 with CEEP providing $818,872 and the Club committing the remaining funds. The project was delivered on budget.

The project is expected to deliver a return on investment of approximately 45% per annum on the Club’s expenditure and a payback period of approximately 2.5 years is anticipated.

### Project Operation, Mechanisms and Processes

In order to execute the project, the following processes and methodologies were applied:

- **Up front analysis** was conducted early in the project to determine the project's financial feasibility.
- **Well prior to committing either CEEP or Club funds, a detailed technical quotation and specification** was obtained with binding prices for specified equipment.
- **Contractual documentation** (CEEP Funding Agreement, Simons Sales Contract, Civil works specifications and contracts) was prepared, reviewed and committed prior to expenditure of funds.
- **A project plan** was created (using MS Project) early in the project and progress against the plan was tracked by the Club and the nominated principal vendor, Simons Green Energy. Progress was reported frequently by email, telephone and face to face meetings.
• **Detailed design work** was undertaken **early** in the project to enable subsequent activities such engagement of mechanical and electrical contracts, civil works, and procurement of equipment to proceed without ambiguity.

• Civil works were specified and the Club’s requirements put to **competitive tender**. Tender selection was based on price as well as quality and reputation of the selected tenderer.

• A **risk analysis** was conducted prior to the commencement of the project and identified risks were identified and mitigated.

• **Expert staff** were committed by the vendors to the project. These included design, project and commissioning engineers.

• **Training and familiarisation** was conducted prior to commissioning.

• A plan for **marketing** and local community communication activities was prepared.

The project was managed by Simons Green Energy on a turn-key basis. Project management was successful and efficient and we would expect to manage similar projects in the same way again.

There were sufficient internal resources available to successfully implement the project with the bulk of the project activities undertaken by the principal contractor and its sub-contractors. There were sufficient external resources allocated to the project to ensure that it was completed according to plan. No particular difficulties were experienced and no technology or site specific issues were identified.

A key lesson learned, at this **early stage of the project**, is that the magnitude of savings derived from switching from grid supplied electricity to embedded generation is substantial and that the project returns are attractive. While this outcome had been anticipated, uncertainty over future energy prices, competing priorities for capital and management attention and potential project risks had deterred the Club from undertaking the project until the CEEP incentive appeared. A secondary learning as a result of focussing on energy efficiency is that other meaningful opportunities to reduce cost and carbon emissions do exist but require management attention and investment.

**8. Conclusion**

Mingara is pleased with the installation of its Cogeneration systems. The projected savings are greater than anticipated based on initial electricity and gas bills for the month of September. The projected return on investment is attractive and this project has provided an incentive for the Club to consider further energy efficiency initiatives in order to reduced costs and carbon emissions. The reduction in carbon emissions and improvement in energy efficiency assist the Club in promoting its positive image within the community and the industry.

The project was delivered on time and within budget with no negative impacts on the Club being experienced.
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 MINYARA RECLUB. (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: 9/12/14.

Name: Andy Hard


Witness Signature: .................................................. Date: 9/12/14.

Name: Michelle\n

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 1982, the Crimes Act 1900 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.