Maitland City Bowls, Sports and Recreation Club

TriGeneration and Electric Duct Heating Retrofit

CEEP1099

Final Report

September 2013
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Overview
Maitland City Bowls, Sports and Recreation Club’s TriGeneration and Electric Duct Heating Retrofit project under the Community Energy Efficiency Program is now complete. The project was made up of three core components:

1. Civil Works
2. Retrofit of Electric Duct Heating
3. TriGeneration installation and commissioning

All components were completed on or close to scheduled timeframes, with the only variances occurring due to installation timing of components versus the CEEP approved contract obligations.

The project represents a significant saving in baseline energy use and significant reduction in our carbon footprint. The entire system will represent substantial savings into the future and allow the Club to reinvest these savings back into the community through services and facilities.

Although the project does achieve the projected results, further investigation by industry and governments could substantially increase the CO² reduction opportunities of this and like systems through the offering of feed in tariffs and or rebates on Natural Gas costs. CO² reduction would be achieved through generating at the point of use thus reducing the line loss. Natural Gas also produces less CO² than coal fired generators, another area of reduction.
3.2a Details of Activities performed to achieve Objectives

The project was based around three core components:

4. Civil Works  
5. Retrofit of Electric Duct Heating  
6. TriGeneration installation and commissioning

Civil Works  
These civil works involved removing existing structures and designing, tendering and building the new structure which would house the majority of system components. These civil works weren't allowed for in the initial application mainly due to a change in suitable location, and represented an increase in costs of approximately $150,000.

Additionally the Club’s two natural gas metres had to be relocated with one of these upgraded to 35Kpa to allow for the increased use of natural gas and the future expansion of the Club. The Club now has one gas metre at 1.38Kpa and one at 35Kpa. The TriGeneration system is sub-metred to allow for accurate evaluation and ongoing measurement removing the need for specialist monitoring equipment. This expense was not part of the original CEEP application.

This work was completed by Cants Building and Constructions, with in-house construction management by Dick Pilgrim.

Civil Works Construction early April 2013
Retrofit of Electric Duct Heating

Retrofitting the Club's heating system was vital to the efficiency of the project. The Club has an existing cold water cooling air conditioning system, yet was still reliant on electricity to provide the heating capacity. This type of heating is very inefficient and expensive to run. The change to use waste heat increases the efficiency substantially and reduces electricity costs and ultimately CO₂ emissions.

As programmed, the majority of electric heating coils were removed and replaced with hot water coils. All these hot water coils are connected to a recirculating hot water circuit (the same as cold water) and to a new Innotech air conditioning control system.

Now airflow passing these coils is heated by water rather than by electricity. This heating capacity is effectively free from the waste heat collected off the Cogeneration Unit.

This work was completed by East Coast Air Conditioning.

New Hot Water Coil and associated duct work installed. Photo mid May 2013.

One of the Removed Electric Heating Coils and Ducts. Photo early May 2013
TriGeneration Installation and Commissioning
At this point in the project, our civil works had been completed and our Electric Duct Heating had been retrofitted and was operating from boiler capacity (the boiler provides heat should the TriGeneration System not be operational). We were now waiting for the large components to arrive and be installed. The ENER-G Cogeneration unit, manufactured in England had been on a ship to Australia for some time, along with the Shuangliang Absorption Chiller. Both arrived at Botany in late May 2013.

After passing customs all units and components were transported to site and craned into position ready for Commissioning.

Commissioning began in July, and continued for many weeks up to the launch date of August 15, 2013. Huge amounts of electrical installation, copper plumbing works and associated insulation had to be completed before the unit could be turned on. Eventually the unit was installed over a period of 5 days from Monday 5th of August 2013. An ENER-G installation technician from England spent approximately 5 days tuning the unit and consulting with Simons Green Energy and AusGrid to ensure that the unit complied with the appropriate regulations and supply into the Club’s main electrical system.

The Cogeneration unit arrives and is hoisted into position, early June 2013.

The Adiabatic Cooler (component for Absorption Chiller) is hoisted into position, early June 2013
Achievement of CEEP Objectives

The Project Objectives
The original application called for objectives and outcomes to be explained in section 6 of the document. Here, the following objectives were stated;

1. The retrofit of Electric Duct Heating to Hot water heating, including all associated duct work and controls.
   a. As described under the heading “Retrofit of Electric Duct Heating”, all required electric duct heaters where decommissioned and removed. In their place, new water coil heaters were installed. The associated hot water piping was connected with controls. The final result being the ability to heat those areas of the Club using waste hot water instead of electricity. The objective has been achieved. 

2. The installation of a 142Kw CoGeneration plant to reduce the reliance on the grid and to supply hot water.
   a. The CoGeneration/TriGeneration installation and commissioning process is described under the heading TriGeneration Installation and Commissioning. A change of generator supplier from the original application meant that the unit being installed was a 150Kw system, and also included a full acoustic enclosure. This added no increase in price, but an increase in capacity and a decrease in environmental acoustic emissions.
   At the same time as the CoGeneration arrived, the absorption chiller was also installed. Although both units where commissioned at different times due to technicians coming from different countries, the two system are fully operational and working together to achieve the TriGeneration system. The objective has been achieved.

3. The installation of an absorption chiller to utilise waste heat from the CoGeneration plant for chilling capacity.
   a. At the same time as the CoGeneration arrived, the absorption chiller was also installed. This unit however wasn’t commissioned until later due to a VISA issue for the technician arriving from mainland China. This was resolved and the absorption chiller is fully commissioned and integrated to create TriGeneration.

4. To improve the financial viability and services delivered to the regional community through the reduction in energy charges.
a. As stated in the original application, Maitland City Bowls Sports and Recreation Club had an average monthly consumption of 127,690Kwh for the previous 2 years. During that same 2 year period the Club peaked at 150,000Kwh consumption for November 2011.

Since the commissioning of the TriGeneration system, consumption has fallen dramatically as show in figure 1A, with actual consumption of 60,000Kwh in August 2013 and a projected 50,000Kwh in September. It must be noted that during shoulder seasons (autumn and spring) limited demand is seen for heating and cooling, and therefore the actual savings are reduced compared to peak seasons of winter and summer.

In a dollar sense, every dollar saved results in the club being able to service the community through club facilities, sporting facilities and contributions as is stipulated in the Registered Club Act. Efficiency savings pool into consolidated revenue, and at this stage, the project will result in projected savings of approximately $60,000 year one as shown in Figure 1B. As the Club expands and converts all existing package air conditioning units to fully flood systems, the energy output will be used for more days of the year and thus the effectiveness of such a system will be fully realised.

Currently the Club is adding an additional 1200 square metres of air conditioned space in the Stage 2 renovations and expansions. This alone should dramatically increase the savings and maintain or improve the buildings Kilowatt Hour consumption per square metre rating. The objective has been completed.

Energy Efficiency Improvement

Originally in the application to CEEP, it was found that a star energy rating wasn’t available for registered clubs (NABERS), therefore using consumption per square metre was seen as the best way forward, at the time, the consumption across the two year average was 28.3Kwh per square metre per month see Baseline energy Usage Annexure A, Attachment B).

After full commissioning of the TriGeneration system, no expansion of the building had been completed or started and the new consumption per square metre 14.61Kwh per square metre. This was calculated through simple mathematics of 65,761 Kwh divided by 4500 square metres. This represents an efficiency gain of 48.3% from the 2 year average and is expected to fall further as the building expands and the replacement of package air conditioning units occurs.

Improved Energy Efficiency practices

The CEEP project resulted in a technology being installed that has changed the way Maitland City Bowls Sports and Recreation Club thinks about energy consumption, ongoing usage and costs. The
next stage of renovations and building works scheduled to commence on November 1 2013 has concentrated its time and efforts to achieving efficient utility design of the building. Specifications amongst others include all LED lighting and a flooded AC systems. From previous research under a New South Wales government project, we know the breakup of our consumption.

As a consequence of the CEEP project, changes in design practices for consumption have occurred. Our Lighting (12.5%), our Chilling and Heating (24.5%) will be dramatically affected by efficient design resulting from both the CEEP and OEH project. Lighting is projected to be 4-5 times more efficient in consumption, and Heating and Cooling will be provided 5 out of 7 days from the TriGeneration plant. After all the changes are made to the Club using the knowledge we have gained from this and other projects, the new Distribution of Energy Use at Maitland City Bowls Sports and Recreation Club will be different and have a reduced total.

**Value for Money**

Originally the project was budgeted to cost $807,213. This changed upwards for 2 main reasons:

1. The Club decided that the original location for the new plant and equipment wasn’t ideal and therefore constructed a new plant room at a cost of approximately $150,000
2. The original specified cooling tower involved the old process of using large amounts of water. This was considered a risk both for health concerns of the public and the usage impacts of excessive water consumption. The unit was changed to an adiabatic cooling tower which uses between 0 and 40 litres of water per day. This change costs approximately $50,000.

On the whole the project was delivered on time and on budget, with the only significant variances being the two listed above.

The Club’s conscience move to flooded air conditioning to utilise the waste heat from the CoGeneration unit is in real terms the “value” which the club has received. With an estimated life span of 20 years, the TriGeneration unit will provide savings into the future. It provides more certainty in consumption expenses, and thus reduces the risk from being at the mercy of, and reliance on, grid delivered electricity and the impacts of carbon emission penalties.

The savings both in maintenance of flooded air conditioning system versus package systems, and the reduction in usage will be the savings over time, which will show that this system has added real value to the Club and the federal government under the CEEP project.
Industry Engagement
Not applicable as the CEEP funding doesn’t exceed $1 million

3.2b Details of Recipients Activities
Throughout, Maitland City Bowls, Sports and Recreation Club were completely involved in the project for design, delivery and reporting. Our team managed the design with our architects, we managed the Civil works, consulted on the space requirements, footing requirements and integration into the Club. The Team was primarily made up of Dick Pilgrim and Ian Martin. The Club also managed 90% of all milestone submissions as required by CEEP.

During installation the project was controlled by Simons Green Energy, however at the conclusion of this, management of the project shifted back to the Club for the launch and information session.

Prior to the official launch of the project on August 15, we wrote to the local high schools inviting their attendance at a TriGeneration information session at 10am on August 15. The offer was also made to the general public through a ¼ page advertisement in the Maitland Mercury and notices around the Club and Community. Approximately 10 interested members of the general public attended this session as well as 15 staff. The session was hosted by Simons Green Energy’s Jake Thodey and Allan Aaron and covered; What is TriGeneration, Why TriGeneration, How it works, and what are the benefits (See appendix for presentation).

Nearing the end of the project Maitland City Bowls, Sports and Recreation Club and Simons Green Energy also put together a case study (see appendix for case study) and YouTube episode. This case study is now available on our website, www.maitlandcity.com.au and on the Simons Green Energy website www.simonsgreenenergy.com.au.

On an external wall of the TriGeneration plant building, the Club has also placed information about the system for all members of the public to view (see appendix for signs).
Shifts in Club Behaviour
The CEEP project has been responsible for a furthering of utility efficiency behaviour. Previously as a business we were driven by recycling and reduction. These two areas enabled us to:

- Complete co-mingled recycling with council
- Recycle cardboard
- Recycle waste food
- Reduce electricity by retrofitting lighting
- Reduce water usage by installing water less urinals

This resulted in the business reaching a position where we couldn’t improve much further without a significant investment into usage areas of the club (OEH Audit NSW 2012), and the resulting implementation of a technology to reduce key areas identified in that report. This was the installation of the TriGeneration system.

Moreover, not only has the system now been embraced by staff and club membership with the topic being presented in staff meetings, annual general meetings, YouTube, website and community flyers, the Club has taken the further step of incorporating and utilising the practices, technologies and reductions identified in these projects, into the new design and construction of Stage 2 of the Club.

The establishment of “Maitland Green” as a Club and community group, is the banner in which these behaviours and achievements are branded and presented.

Maitland Green

3.2c Benefits and Outcomes, Results and Findings
This project has been based on reducing the energy usage of Maitland City Bowls, Sports and Recreation Club. As a result the efficiencies achieved by this system vary from Summer to Winter with the most inefficient periods being that of a mild climate, namely Spring and Autumn. The waste heat is used for heating in winter and cooling in summer during these periods those efficiency results are significantly more pronounced.

As the system had been in operation for only 12 days when this report was written results and findings may vary, yet initially they provide a great indication of efficiency and net savings. The following graph shows the changes in usage patterns as the Club becomes more efficient, noting in May/June when all electric heating has been removed and gas heating installed, followed by 12 of 31 days in August using the new system. Comparing August 2013 to August 2012 a reduction in Kwh usage has been achieved of 46003. Considering this is only a partial month and includes installation
testing, this represents a saving in usage of 42% from the yearly averages in the initial application. Adjusting for increases in price, this represents an approximate dollar saving of $3000 in the first month (excluding maintenance charges.) The gathering of data over time will increase the accuracy of this number.

By expanding the usage days from 12 to 22 (Peak and Shoulder days only) we are able to extrapolate the kilowatt hour reduction and savings. The projects first full month will achieve the kilowatt usage level of 50,000 hours, down from averages of over 120,000 per month in the previous 18 months, and a peak of 150,000 in November 2011.

<table>
<thead>
<tr>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>$14,246.65</td>
<td>$20,893.07</td>
<td>$29,663.37</td>
<td>$31,054.01</td>
<td>$29,750.61</td>
<td>$32,212.00</td>
<td>$38,283.55</td>
<td>$28,067.34</td>
<td>$18,386.41</td>
<td>$18,985.16</td>
<td>$17,322.29</td>
<td>$16,831.00</td>
<td>$17,050.44</td>
<td>$16,701.47</td>
<td>$14,400.00</td>
<td>$52,500.00</td>
</tr>
</tbody>
</table>

| Kwh     | 113258   | 110483   | 111784   | 101030   | 107783   | 109982   | 112039   | 115813   | 9578   | 102569   | 95628   | 91865.12 | 89351.75 | 45310.53 | 50000     |

| Kwh/kwh | 59.345   | 59.182   | 59.185   | 60.283   | 60.100   | 63.182   | 68.182   | 68.163   | 93.182  | 93.163   | 93.182  | 93.163   | 93.182  | 93.163   | 93.182   | 93.163   |

Total Cost: $14,246.65 $10,893.07 $29,663.37 $21,159.41 $28,070.40 $28,283.55 $20,067.34 $18,386.41 $18,985.16 $17,322.29 $16,831.00 $17,050.44 $16,701.47 $14,400.00 $52,500.00

Figure 1A

3.2d Evaluation of the Project

Since the project was applied for, awarded and consequently completed, there have been four main changes which have influenced the outcomes:

1. Additional civil works
2. Change from a water tower to Adiabatic Cooler
3. Increases in Electricity Pricing
4. Increases in Natural Gas pricing

Overall the fundamental objectives of reducing the carbon footprint and overall energy spend have been achieved.

The additional Civil works and change in cooling tower have increased the Return On Investment (ROI) as they represent an increase of some $200,000 in capital spend. Similarly the recent
significant increases in Natural Gas charges in NSW are having a negative influence. Combining this with the stabilisation of electricity increases to levels more accustomed to CPI, again the ROI has been extended.

With these factors in mind, feasibilities and early indications of savings V usage suggest a modest return before depreciation. The savings will considerably increase due to the Club’s building program which will bring another 1200 square metres of floor space onto the TriGeneration system by August 2014. Evaluations will become more accurate as time goes on, however at this point some assumptions are being made.

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Club Expansion (2 years)</th>
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<tbody>
<tr>
<td>Gas Usage</td>
<td>-$90,000.00</td>
<td>-$108,900.00</td>
</tr>
<tr>
<td>Electricity Saving</td>
<td>$110,000.00</td>
<td>$171,445.00</td>
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<tr>
<td>Depreciation Grant Write Off</td>
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</tr>
<tr>
<td>Civil (40 years)</td>
<td>-$1,100.00</td>
<td>-$1,100.00</td>
</tr>
<tr>
<td>Mechanical (25 years)</td>
<td>-$32,000.00</td>
<td>-$32,000.00</td>
</tr>
<tr>
<td>Grant Annually (10 years)</td>
<td>$36,691.50</td>
<td>$36,691.50</td>
</tr>
<tr>
<td>Maintenance</td>
<td>-$30,000.00</td>
<td>-$31,827.00</td>
</tr>
<tr>
<td>Net Profit Loss after Depreciation</td>
<td>-$6,408.50</td>
<td>$34,309.50</td>
</tr>
</tbody>
</table>

Industry initiatives including Cogeneration and TriGeneration feed in tariffs would significantly increase the viability of these units during times of reduced demand and could supplement large electricity generators during times of peak demand. A feed in tariff would need to be between 20-25 cents per Kilowatt hour (September 2013). Moreover, Natural Gas costs are now pushing the project into negative returns. If projected increases occur over the coming years in New South Wales, negative returns will happen. If New South Wales developed an initiative involving a special discount for small scale natural gas generators or a discount in the price per Gigajoule, then projects such as this would become more common place. This industry and government action would put considerable downward pressure on CO₂ emissions as the generated power is close to its usage location, thus reducing line loss and assist in CO₂ reduction targets as Natural Gas contributes less CO₂ per Kilowatt hour to the atmosphere.

Life Cycle Costs and Benefits
The TriGeneration system has a lifecycle of some 25 years with major overhauls at 10 year intervals. The costs of maintenance over this time will be offset by the reductions in maintenance costs associated with the removal of 300 Kilowatts worth of refrigerant driven compressors and condensers. The main moving components of the system are now:

1. Air movement fans
2. Valve actuators
3. Gas driven CoGeneration unit
4. Pumps

This compares with the need to service and maintain 10 maintenance intensive compressors and condensers which have a life span of 15-20 years, some of which are already 10 years old. Bringing forward these replacements in Club driven capital works, has an initial high cost, yet ongoing maintenance and life span of the Air Handling Units will increase as they are just a fan unit rather
than a fan/compressor/condenser combined. Environmental benefits include the reduction in the used ozone depleting refrigerant gas in the air conditioning system, and the reduction in carbon dioxide emissions as cooling and heat is derived from waste not from energy intensive compressors.

Although not calculated, it is expected that apart from overhauling the CoGeneration unit every 10 years, no significant maintenance will need to be performed. Occasionally a pump may need to be replaced and regular filter cleaning will be required as it is under the alternative system, but this should be the extent of any ongoing costs. A massive benefit to any organisation.

Milestones and Submission Dates
The review of milestones upon completion is an area that changes could have been made. In the CEEP application, estimates and quotes are obtained and delivery and construction times are approximated. Unfortunately time delays do occur, especially with wet weather and importations from other countries. Although this CEEP project did complete on time and was launched on August 15, extra time would have been helpful. Realistically an October completion date would have been more appropriate.

All milestones up to Milestones 6 and 7 where completed on time. Milestone 6 was delayed slightly as commissioning and operating results were not available at the time as stated in the requirements, and Milestone 7 was delayed due to increased clarity requirements in the final report. As both these milestones were post commissioning, this has meant that the Club has had the burden of carrying the full capital expenditure costs without the final payments from CEEP. In hindsight, the initial application should have considered this and placed a minimal payment as a final amount to avoid the actual situation of having a large final amount.

3.2f Statement of Budget performance
Two main areas accounted for the majority of all variance.

1. The increase in Civil Works (approximately $150,000)
2. The change to an adiabatic cooler from a water tower (approximately $50,000)

Other smaller variances not included in the original budget estimate have included:

1. Change in system specification, installation and documentation
2. The relocation of gas meters
3. The need for increased concreting of plinths
4. The need for steel plinths
5. Site survey for construction layout
6. Acoustic study
7. Engineering
8. Fire prevention

Overall the approved application focusing on the Air Conditioning component and TriGeneration Plant only varied by the cooler change, the remainder has been on budget from the detailed final quotation dated 18th October 2012. No increase in cost has been passed to CEEP. It is worth noting that these increases were the result of the conscience decisions by Maitland City Bowls, Sports and
Recreation Club to increase the longevity of the system by having a suitable plant room and reducing the susceptibility to health concerns by moving to a adiabatic cooler from a water tower (legionnaires disease)

The final all up cost of the project was $980,698.84 ex GST. This is an increase of $246,868.84 or 33% from the original approved application cost of $733,830 ex GST. Grant funding split now represents CEEP 37.41% Club 62.59%.

3.2g New Baseline Energy and improvements

In accordance with annexure A of the CEEP contract, below is a summary of the approved application’s initial assumption, and the actual results achieved after 12 days of operation. These results are extremely early and can be (have been) negatively affected by seasonal factors. In this case a warm winter in 2013.

Further to the spreadsheet below, the outcome of this project is likely to achieve a simple Return On investment of approximately 6 years after CEEP assistance and excluding GST. This is also dependent on the predicted price of electricity and natural gas, as well as the increased relevance of this system to the Club through expansion and further conversion of the air conditioning system to accept hot and cold water.

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**Figure 1B**

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**Annexure A, Attachment B**

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**Table:**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Base Dish Usage</th>
<th>Projected Improvement</th>
<th>Actual improvement</th>
<th>Improvement at 20km per square per</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finesrate kilowatts per square metre</td>
<td>4000kph</td>
<td>26.3</td>
<td>35.0</td>
<td>34.81</td>
</tr>
<tr>
<td>Return on investment</td>
<td>Project Cost</td>
<td>Application ROI</td>
<td>Gas/Grn $/kwh</td>
<td>$/kwh</td>
</tr>
<tr>
<td></td>
<td>$321,631.82</td>
<td>4</td>
<td>8,000</td>
<td>$10.50</td>
</tr>
</tbody>
</table>

**Notes:**

1. These measurements are based on the first 12 days of operation.
2. It must be noted that winter 2013 was one of the warmer to record reducing the need for soil heat.
3. These results are based on increased the ROI and gas pricing laws as cost.
4. The Club will be looking in the near future and again the effectiveness of this system.
5. The original application including EEP Grant achieves the 4 year ROI at 3% as projected.

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**Project Title:** Trigeneration and Electric Dual Heating Benefit

**Project ID:** CEEP1099

**Funding Recipient:** Maitland City Council, Sports and Recreation Club

**Date:** 12/06/2013

**Building, Facility or Site:** Maitland City Council, Sports and Recreation Club

**Location:** Arthur St, Rutherford

**Type of Building:** Registered Club

**Activity Type and Measure:** Trigeneration

**Energy Efficiency Estimate Method:** N/A as described in the approved application

**Baseline Energy Usage:** 28,380kwh per square metre

**Baseline Energy Efficiency:** N/A as described in the approved application

**Energy Efficiency Improvement:** New baseline replaced is 34.83kwh per square metre

**Reporting Data:** kWh Usage Data and Energy Bills

**Cost of Activity:** $580,698.84

**Estimated Savings:** Approximately $100,000 per annum excluding maintenance
Appendix to CEEP1099
Final Report
Extend an

Invitation

to interested members of the community
to attend an information session
and official grand opening of our

150Kw TriGeneration Plant

on Thursday 15 August 2013
from 10am

RSVP @ Reception for catering purposes.

Maitland City Bowls, Sport & Recreation Club
14 Arthur St, Rutherford NSW 2320 Ph: (02) 4939 1200 www.maitlandcity.com.au
Maitland City Bowls Sports & Recreation Club - Trigeneration and Electric Duct Heating Retrofit

**Background**

Founded in 1937, Maitland City Bowls Sports and Recreation Club was established to facilitate the game of Lawn Bowls in the Maitland City area. Throughout the years, the Club has grown the operation to include a 33 room motel, a boxing gym, beverage, catering and gaming service, as well as function facilities. The Club employs 45 staff.

The Club has one main community building in the Regional Suburb of Rutherford and is currently the home base to most local sporting clubs, and community organisations, including cricket, football and AFL. The Club’s vision is to become the “Centre of the Community” for the West Maitland area.

In 2011/12 the Club embarked on an energy audit in response to all time high electricity consumption following the last round of major renovations in 2009. This audit identified the HVAC system which consisted of electric duct heating across 6 air handling units as a large consumer of energy. A key conclusion was the need to move away from electric duct heating to hot water based heating.

At the same time, Club representatives attended a Simons Green Energy, energy efficiency seminar at Castle Hill RSL Club. The seminar identified the energy reduction opportunities that Cogeneration and Trigeneration can provide the club.

For Trigeneration to be effective at the Maitland club, both the heating (in winter) and cooling (in summer) had to be provided. The change from electric duct heating to a hot water based system would provide the heat requirement in winter and the Trigeneration system’s Absorption Chiller would supplement the existing Electric Chiller plant in summer.

Maitland City Bowls Sports and Recreation Club applied for, and was successful in securing a grant from the Australian Government’s Community Energy Efficiency Program (CEEP) in the first round of the program. The proposed solution included a 150 Kw Trigeneration system along with retrofitting five electric duct heating units and piping the system for a new hot-water based system. The removal of the electric duct heating system has eliminated 120 Kw of electric heating load. The new Trigeneration system now provides heating from waste heat from the Cogeneration unit’s engine. This was a leap forward for the Club with the Trigeneration system providing both supplementary heating and cooling for present demand and for foreseeable future expansion that will increase demand to cater for a further 2000 square metres of gaming, catering and function areas in 2013/2014.

Thanks to the Government’s contribution of approximately 50% of the total cost of the project, the payback period will be less than 5 years, with a return on investment of over 20% per annum. Grid-based electricity consumption will be heavily reduced which will benefit the Club’s members and the community through lower emissions, lower expenses and increased profits that will be re-invested into the Club and the local community.

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**Project Name:** Maitland City Bowls Sports & Recreation Club - Trigeneration and Electric Duct Heating Retrofit

**Site Owner:** Maitland City Bowls Sports & Recreation Club

**System Supplier:** Simons Green Energy

**Integrated Trigeneration system consisting of:**

Cogeneration system details: ENER-D 150 Natural Gas Cogeneration System
- Total Electrical Output: 150kW (e)
- Total Thermal Output: 230kWth

Absorption Chiller system details: Shuanglong FPC38H2 absorption chiller
- Total Thermal Output: 135kWth

**Estimated payback period with CEEP funding:** 4.5 years

**Estimated Carbon Reductions per year:** Approx. 500 Tonnes per annum

**First Year Cost Savings:** Approx. $50,000

**System Applications:**
- Base load electricity supply for modern sport and recreation club
- Space heating for club via cogeneration system providing hot water to in-duct radiators
- Preheating of domestic hot water to reduce load on existing hot water heaters
- Gas hot water boiler boost system to provide heat during off peak periods when the cogeneration system is not operating
- Cooling for club via absorption chiller providing chilled water to cooling system, alongside existing electric chiller.

**Australian Government**

Department of Resources, Energy and Tourism

This activity received funding from the Department of Resources, Energy & Tourism as part of the Community Energy Efficiency Program.
“The Trigeneration project has been made significantly more viable with the CEEP grant. The project will allow us to continue seeking other revenue generating and expense saving opportunities associated with energy and environmental efficiency. Having already completed an Office of Environment and Heritage energy audit, installing a large solar system, completing as much recycling as possible and employing efficient building design, the deployment of an embedded energy system was a natural progression that will save around $3 million dollars over the life of the equipment,” said Ian Martin.

Simons Green Energy was engaged to design, supply, install and maintain the Trigeneration system and worked closely with East Coast Air Conditioning to ensure a smooth integration with the HVAC system.

Project Scope – Combined Heat, Power & Cooling Maitland City Bowls Sports and Recreation Club main building currently uses, on average, 127,690 kWh of electricity per month. A large amount of this electricity is for the electric duct heating system. To cost effectively increase the efficiency of the building, Maitland City Bowls Sports & Recreation Club replaced this inefficient HVAC system with a 150 kW natural gas fired Trigeneration system. The system will generate electricity, hot water for space heating and chilled water to reduce the operation (and expense) of the club’s current electric chillers.

With the government’s contribution of $403,606 and a total investment of just over $1 million, the system is expected to reduce thermal energy demand by 1.1 GWh per annum and reduce carbon emissions by 600 tonnes. Supplementing the electric chillers with chilled water in summer will reduce overall electricity demand. The estimated payback period is less than 5 years.

Simons Green Energy was appointed as the prime contractor for the project in November 2012. Simons worked closely with East Coast Air Conditioning, who carried out the retrofitting of the electric duct heaters to a water based system. The Cogeneration unit was built to Simons’ specification by ENER-G PLC in the UK and a matching Absorption Chiller was built by Shuangliang, in China. Installation commenced in May 2013 with system components delivered to site on 16th June. The system will be commissioned by Simons in early August and will be launched on 15th August 2013.

System Details
The combined heat, power and cooling solution comprises a ENER-G 150 Cogeneration unit, a Shuangliang Absorption Chiller, a hot water storage tank, a dump heat radiator, an adiabatic water cooler and a gas fired hot water boiler.

The cogeneration system was supplied as a complete factory tested packaged unit with engine, generator sets, controls and heat recovery system.

What is Co & Trigeneration?
Cogeneration, also known as Combined Heat and Power (CHP), is the simultaneous production of two forms of energy - electricity and heat - from a single fuel source. Cogeneration uses a natural gas-powered engine to generate electricity on site and converts the waste heat from the engine into usable heat for space heating, process heat for manufacturing, domestic hot water, heating for swimming pools and similar applications. On site Cogeneration Systems have a total efficiency of up to 85%, as compared to the 30% efficiency of coal-fired grid-supplied electricity.

Trigeneration is the combination of a Cogeneration system and an Absorption Chiller which converts gas into electricity, heating and cooling. The waste heat from the Cogeneration system is converted into chilled water for air conditioning, refrigeration or other cooling purposes.

On site electricity generated by a Cogeneration & Trigeneration system is cheaper and cleaner than coal-fired grid-supplied electricity. Cogeneration and Trigeneration thereby provides substantial cost savings, significantly improved energy efficiency and up to 50% lower carbon emissions.

Benefits
- Reduces energy costs by $50,000 per year
- Produces 752 MWh of electricity each year when operated 15 hours per day
- Provides 236 kW(t) of thermal output in the form of hot water as a “free” by-product from the engine’s waste heat stream
- Reduces carbon emissions by 500 tonnes per annum which is equivalent to planting 5000 trees per year
- Provides expanded heating capacity for future club development
- Results in a payback period of less than 5 years with a return on investment of over 20% per annum

Derek Simons, CEO of Simons Green Energy said “The Trigeneration System at Maitland Bowls and Recreation Club will be a great platform for others to follow, and demonstrates the leadership of the Club’s management. We are very proud to be part of the Club’s project and it reinforces the commitment to sustainability within the Clubs industry.”
TRIGENERATION

Combined Heat, Power and Cooling (CHPC) is the simultaneous production of electricity, heat and cooling using a natural gas fired engine and a non electric chiller.

TECHNICAL DATA

<table>
<thead>
<tr>
<th>PLANT SIZE</th>
<th>150 kW Trigeneration System</th>
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<tbody>
<tr>
<td>SYSTEM DETAILS</td>
<td>160 kW Ener-G Cogeneration unit</td>
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<tr>
<td></td>
<td>RXZ38H2 Shuangliang Absorption Chiller</td>
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<tr>
<td>FUEL SOURCE</td>
<td>Natural Gas</td>
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<td>APPLICATION</td>
<td>Electricity, heating, cooling and domestic hot water</td>
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<td>BENEFITS</td>
<td>Cheaper and Cleaner electricity</td>
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<td></td>
<td>Improves energy efficiency</td>
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<td>Cut CO2 Emissions</td>
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