The Nexus Between Water and Energy

2014-2015
Executive Summary

Central NSW Councils (Centroc) received funding under the Australian Government’s Community Energy Efficiency Program (CEEP) Round 2 for 14 Councils participating in the Centroc Nexus between Water and Energy Program.

The purpose of this report is to provide an overview of the Nexus between Water and Energy Program (the Program), its objectives, the energy efficiency achievements and recommendations to the Australian Government and the Centroc Board resulting from the Program delivery.

Through the collaborative efforts of the national award winning Centroc Water Utilities Alliance, Centroc has successfully implemented this complex regional program on time and within budget in the context of the challenges of the reform of the Local Government sector in NSW.

Objectives of CEEP2 and the Nexus between Water and Energy

CEEP2 objectives that the Program aims to meet are:

CEEP2 Objective 1: Support a range of local councils and community organisations to increase the energy efficiency of different types of non-residential council and community-use buildings, facilities and lighting; particularly where this would benefit low socio-economic and other disadvantaged communities or support energy efficiency in regional and rural councils.

CEEP2 Objective 2: Demonstrate and encourage the adoption of improved energy management practices within councils, organisations and the broader community.

The Nexus between Water and Energy Program’s corresponding objectives were to:

1. increase the energy efficiency of a range of Council assets across 14 councils by an average of at least 15%;
2. Install a variety of energy efficiency products across the region to demonstrate the effectiveness of a variety of technologies to our members, communities and beyond our borders;
3. Build on work undertaken in the region through the CEEP Round 1 Learning and Sharing Energy Efficiency Program in revolving energy savings funds;
4. Build capacity in the region and be implementation ready for further programming in the Nexus between Water and Energy; and
5. Promote energy efficiency to our members and communities through communication of program activities and outcomes through traditional and on-line media.

In line with CEEP2 objectives the Nexus between Water and Energy Program also aimed to deliver the following benefits:

- increased embedment of energy efficiency programing in Centroc member councils.
- reduced energy costs for Centroc members and their communities.
- increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.
- reduced greenhouse gas emissions and a positive contribution to regional climate adaption.

Program Summary

Through the Centroc Water Utilities Alliance fourteen Centroc member Councils participated in a program of works aimed at increasing the energy efficiency of water and waste water pump stations and filtration plants at 30 sites across the Local Government Areas of Blayney, Bathurst, Boorowa, Cabonne, Cowra, Forbes, Harden, Lithgow, Oberon, Orange, Parkes, Upper Lachlan, Weddin, and Young.

The types of activities undertaken included:

- Improving the energy efficiency of water and sewer systems through repairs to inhibit system infiltration and leakage and reduce the pump load;
- Improving motor efficiency on sewer/
water pumps through installation of variable speed drives (VSD’s);
− Level 2 Energy Audit of a water treatment plant;
− Implementation of revolving energy funds to secure cost savings from energy efficiency programming for future works; and
− Development of a Water Loss Management Toolkit that targets reduction in energy use as a priority in water management.

**Outcomes and Benefits to Councils and their Communities**

The outcomes included in this report relate to what has been able to be measured in the timeframe for the funding with increased results anticipated over time. At least 12 months is needed to enable data collection and analysis. The report details issues relating to the monitoring of results.

To date the *Nexus between Water and Energy Program* has achieved an 8% increase in energy efficiency across 18 of the 27 sites where energy efficiency was analysed.

At these 18 sites the total energy consumption reduced from 5557MWh per annum to 5100MWh per annum, a decrease of 457MWh per annum. The total cost savings at these sites is estimated to be around $70,000 per annum and are expected to increase over time. This is more than double the estimated savings for these sites.

Of the 27 sites, 19 sites experienced a reduction in the volume of inflow (ML) to the site. The total inflow at these sites reduced from 25021 ML per annum to 20369 ML per annum, a decrease of 19% or 4652 ML per annum.

An important consideration in relation to analysis of the outcomes is that the methodology proposed for the energy efficiency improvement calculations, in line with the requirements for funding, assumed that the inflow to the sites correlated to the energy used at those sites with the energy efficiency and inflow at each site analysed.

To provide another level of information for further use, Centroc measured the *actual energy usage per site and actual cost savings*. This has informed advice on site specific issues relating to:
− Measurement
− Timeframes
− Variables e.g.
  − Energy usage of other on-site infrastructure
  − treatment processes
  − population increase
  − climate /rainfall.

The factors impacting analysis detailed in the site specific templates included in the report provide a solid platform for future programming, auditing and strategies going forward to improve energy efficiency across the Central NSW region in the area of water management.

Capacity has been built amongst our Councils in terms of their understanding of the impact that efficient management of water and waste water systems has on energy usage and associated costs. The benefit of this to Councils and their communities is an immeasurable outcome of this program.
Project Management

The *Nexus between Water and Energy Program* was a regional project managed by Centroc on behalf of the fourteen participating member Councils.

Management of this regional project by Centroc enabled the Australian Government to provide funding to multiple Councils for multiple energy efficient activities without having to manage the multitude of risks associated with a large project.

As an organisation, Centroc is focused on project management at a regional level and while well experienced to undertake a project of this magnitude, there were many lessons learned from difficulties encountered in the delivery of this Program that can inform process improvement.

Recommendations

Key observations relating to the management of a regional program of this magnitude involving multiple stakeholder and multiple activities across 30 sites has resulted in the following recommendations.

It is recommended that the Centroc Board:

- Through the Centroc Water Utilities Alliance review the outcomes of the Program including advice relating to site specific issues with a view to scoping further regional programming including:
  - Implementation of a regional manhole rehabilitation program
  - Roll out of the Regional Water Loss Management Program; and
  - Improvements to the measurement and monitoring of energy usage.
- Through the Centroc Regional Directors of Corporate Services review energy system requirements and resourcing within each Council in relation to the implementation of Revolving Energy Funds.

It is Centroc’s recommendation that the Australian Government:

- Continue funding energy efficient programs for Local Government giving consideration to the timeframes for pre and post project work needed to verify energy efficiency gains.
- Consider incremental process improvement of the funding model for energy efficiency programming going forward.
- Utilise Local Government regionally to achieve results from a broader base with less risk/work at the Australian Government level for project management.
- Consider a separate funding stream recognising the value to the Australian Government of aggregated project management.
- As Local Government administration has accountability and transparency inherent in its operations, consider regional funding rounds that are more outcomes focused for Local Government and less focused on milestone reporting. Should this be achieved it is recommended that:
  - appropriate risk management controls be put in place; and
  - frequent tailored quality stops are included in Project Plans particularly for complex regional program with multiple activities and stakeholders.
- Review amount attributed to administrative support for regional programs to recognise the greater amount of resourcing required.
- Maximize the growth in capacity and understanding of the operating environment of Local Government of CEEP Case Managers.
- Recognise that the same logo and branding for the life of the program is preferable to communicating a clear, consistent and positive message about the program and its activities.
Central NSW Councils members participating in the *Nexus Between Water and Energy Program* funded by the Australian Government.

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.
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT OBJECTIVES</td>
<td>1</td>
</tr>
<tr>
<td>ENERGY EFFICIENCY ACTIVITIES</td>
<td>3</td>
</tr>
<tr>
<td>CASE STUDIES</td>
<td>5</td>
</tr>
<tr>
<td>COMMUNICATION</td>
<td>15</td>
</tr>
<tr>
<td>OUTCOMES AND BENEFITS</td>
<td>24</td>
</tr>
<tr>
<td>PROJECT MANAGEMENT</td>
<td>35</td>
</tr>
<tr>
<td>FINANCES</td>
<td>45</td>
</tr>
<tr>
<td>NEXT STEPS</td>
<td>47</td>
</tr>
<tr>
<td>SITE BY SITE SPECIFIC ADVICE</td>
<td>50</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>134</td>
</tr>
</tbody>
</table>
The objectives of the Australian Government’s Community Energy Efficiency Program – Round 2 (CEEP2) are detailed below with the corresponding objectives of Centroc’s *Nexus between Water and Energy Program*.

**CEEP2 Objective 1:** Support a range of local councils and community organisations to increase the energy efficiency of different types of non-residential council and community-use buildings, facilities and lighting; particularly where this would benefit low socio-economic and other disadvantaged communities or support energy efficiency in regional and rural councils.

- Increase the energy efficiency of a range of Council assets across 14 councils by an average of at least 15%;

**CEEP2 Objective 2:** Demonstrate and encourage the adoption of improved energy management practices within councils, organisations and the broader community.

- Install a variety of energy efficiency products across the region to demonstrate the effectiveness of a variety of technologies to our members, communities and beyond our borders;
- Build on work undertaken in the region through the CEEP Round 1 *Learning and Sharing Energy Efficiency Program* in revolving energy savings funds;
- Build capacity in the region and be implementation ready for further programming in *the Nexus between Water and Energy*; and
- Promote energy efficiency to our members and communities through communication of program activities and outcomes through traditional and on-line media.
In addition to the objectives above, CEEP2 is expected to provide the benefits listed below with the corresponding anticipated benefits of the Nexus between Water and Energy Program.

**Better services and improved amenity of buildings and community facilities**
- The Nexus between Water and Energy Program sought increased embedment of energy efficiency programming in Centroc member councils.

**Minimising energy consumption and costs to manage the impacts of the carbon price**
- The Nexus between Water and Energy Program sought reduced energy costs for Centroc members and their communities.

**Building the knowledge and capacity of the energy services and construction industry, and supporting competitive Australian energy efficiency technology and equipment manufacturers**
- The Nexus between Water and Energy Program sought increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.

**Contributing to the national effort to reduce greenhouse gas emissions**
- The Nexus between Water and Energy Program sought reduced greenhouse gas emissions and a positive contribution to regional climate adaption.

Details on how the objectives of the Nexus between Water and Energy Program were achieved can be found in the ‘Outcomes and Benefits’ section of this report.
Energy Efficiency

In 2014, fourteen Councils in the Central NSW region embarked on a major program of works to increase energy efficiency at their water and waste water pump stations by reducing the pump load at thirty sites across the region through the relining of sewer pipes and repair of leakages and manholes in areas subject to infiltration.

Councils’ sewer and water systems baseline energy usage are currently operating below optimal efficiency. The level of efficiency is causing the sewer pumps, treatment plants and water pumps/filtration plants to be consuming excess energy. The state of the infrastructure has a direct correlation with the amount of energy required to operate. Subsequently infiltration to sewer systems and leakage from water systems has caused council’s baseline energy usage at the thirty sites to be higher than it should be.

Informed by a significant amount of audit work including smoke testing, CCTV and active leak detection, the Centroc Water Utilities Alliance’s, (CWUA) Nexus Between Water and Energy Program both grows the understanding of the nexus between water and energy from baseline usage while remediating the problem in selected lower socio-economic communities.

The Program aims to deliver substantial energy savings while introducing advice and measures for member Councils to embed ongoing activity in reducing greenhouse gas emissions.

The pumping of water requires a lot of electricity and has a significant impact on Councils’ budgets. Efforts to improve efficiencies and reduce costs will benefit communities by ensuring Councils’ rates for these essential services are kept to a minimum.

Given the recognition of the CWUA and its work, there is significant potential for further roll out of similar programming in Local Water Utilities (LWUs) in regional NSW, especially those adopting a similar structure as the CWUA.

On and in Ground Works

On and in ground works aimed at reducing infiltration and leakage have been undertaken across the region. These are as follows:

- Sewer infiltration remediation (pipe relining) at 11 Councils;
- Manhole repair program in Forbes;
- Audit of water loss at Water Treatment Plant in Boorowa;
- Installation of variable speed drives at the Water Filtration Plant in Orange; and

One of the pipe-relining providers used for sewer infiltration remediation work.
Energy resource management is a significant cost input to water supplies for treatment and pumping.

- **Water Loss Management program at Parkes and Lithgow including reticulation repairs.**

**Centroc Nexus between Water and Energy Water Loss Management Program and Toolkit**

In addition to the above, a significant part of the project is the development of the **Centroc Nexus between Water and Energy Water Loss Management Program and Toolkit**.

The Water Loss Management Program is a pilot project being undertaken in Parkes and Lithgow for the monitoring, assessment, location and repair of economically feasible leakage and water losses throughout the entire water network.

The objective is to develop a Water Loss Management Toolkit and Plan tailored to the Central NSW region identifying programming that targets reduction in energy use as the priority in water loss management.

A key feature of this initiative is the trial of the Centroc Mentoring Program (just completed) in a water utilities setting where Parkes Shire Council, who are well into this type of work will develop the program in a mentoring relationship with Lithgow as mentee who are at the beginning of this journey.

For more details on the installation of Variable Speed Drives at the Orange Treatment Plant, the Water Loss Management Toolkit and the Boorowa Water Treatment Plant Audit see the Case Studies section of this report.
Case Studies

This section contains case studies of key energy efficiency activities undertaken through the Program.

A Regional Commitment to Sustainable Energy and Water Resource Use

The Central NSW region is regularly subject to drought. In response, the CWUA has developed:

♦ Demand and Drought Management Plans for each member council to ensure town water consumption is efficient.
♦ Integrated Water Cycle Management strategies for each member council to ensure a diverse range of water supply options are considered in water security planning across the region.

The CWUA knows that recovering water supply system losses is an economic alternative to developing new water resources to improve water security. The Alliance also has a desire to deliver cost savings to customers by reducing the energy consumed in treating and transferring water losses.

Energy is a significant cost input to providing clean water supplies. The CWUA recognises utilising our coal-based resources to create electricity impacts our climate, with models predicting declining rainfall, and worsening water security, in many parts of Australia.

In response, the CWUA has developed:

♦ A Distributed Energy Plan for the largest energy using facilities of each Council.
♦ Conducted capacity building activities in sustainable energy management across the region.

A Water Loss Management Toolkit

In 2014, Centroc, with the assistance of the Australian Government, developed a Water Loss Management Toolkit (the Toolkit). The Toolkit aims to provide executive decision-makers, water business managers and operators with reference material to support improved water loss management.

The development of the kit leveraged a water loss management mentoring
Water Loss Management Program & Toolkit

program between Parkes Shire Council and Lithgow City Council.

The Toolkit targets three primary audiences and provides them with tailored collateral (Figure 1):

♦ Decision-makers including elected representatives, government officers, other water utilities and professional associations within the water sector. This Fast Facts document is intended to raise awareness of the Toolkit with these decision-makers so it may be implemented within any given CWUA utility and be a reference source of information for others to consider in managing their own systems.

♦ Water utility management and planning staff of Centroc. An overarching Water Loss Management Planning Document has been prepared, with supplementary materials including case studies and templates, to assist water managers in the Central NSW region continue to improve their water loss management capabilities.

♦ Operations and technical staff of Centroc. A Glovebox Guide has been prepared. It is intended to be a practical text to assist operators collect, analyse and appropriately respond to water loss incidents in a strategic manner both in day-to-day operations and also as an input to strategic planning.

In addition to these materials, the deployment of this Toolkit has been supported through the development and implementation of a one-day capacity building training module for Centroc member staff. This module has been delivered to CWUA members as part of the pilot project process.

Objectives of the Toolkit

The Water Loss Management Toolkit will assist managers and operators to resolve the following questions:

♦ What is water loss and why does it matter?
♦ What are the causes of water loss and how do I quantify water loss in my system?
♦ What would trigger me to manage that loss?
♦ What activities would I undertake to manage water loss and how much would they save?
A Water Loss Management Plan is the primary tool for diligent water resource management. It saves both water and energy.

- How does water loss management relate to energy savings?
- How do I identify the water loss activities that save energy and how do I measure those?
- How do I sustain the savings I have made from my investments in water loss management?
- What does the future of water loss management look like?

**Benefits of the Toolkit**

The primary benefits of the Toolkit include:

- Sharing of lessons learned across the Central NSW region in water loss management;
- Consolidation of water loss and energy management assessment techniques into one Toolkit; and
- Strengthening the understanding of cost-benefit assessment of management options.

This will assist water utilities in to realise the benefits of water loss management:

- Sustaining water supplies;
- Improving system hydraulics and utility efficiency;
- Reducing water treatment and pumping costs;
- Deferring capital expenditures; and
- Improving public awareness of water's value.

**Acknowledgements**

This Toolkit has been prepared with funding assistance from the Australian Government, Lithgow City, Orange City and Parkes Shire Councils.

In addition, this Toolkit has been prepared utilising the knowledge and experience of Lithgow, Parkes and Orange Council staff with project coordination provided by the Centroc Water Utilities Alliance.

**A Snapshot of Central NSW Water Utilities - Water and Energy Nexus**

- 16 local water utilities serving over 240,000 customers across 72,500 km²
- Centroc Water Utilities Alliance (CWUA): a Centroc initiative supporting member council collaboration and innovation to local water utilities development and efficient water supply and sewerage services
- Delivering cost savings and efficiencies to customers is a primary object of the Alliance
- Annual water demand across the region is 37,400 ML.
- Planned demand management activities, including active leak detection, will reduce water demand across the region by nearly 10%
Background

Orange City Council is a medium sized Council based in the NSW Central West with a proud record of energy conservation.

The Icely Road Filtration Plant is the primary Water Treatment Plant for Orange.

The plant operates using a standard filtration plus ozone / BAC (biologically activated carbon) process. Seven staff run the plant including four Operators supported by a three person mechanical/electrical team who also support the operation of the sewerage treatment plant and pump stations.

The electricity bill at Icely Road for the period January to October 2014 was $352k (= monthly electricity spend ranging from $24k - $38k for winter vs summer months). The Plant treated an average of 12.9 ML/day in the last year.

Voltage Optimisation

Orange City Council conducted a level 2 energy audit on three of Council’s sites (under the Office of Environment and Heritage Energy Saver program) that was concluded in May 2012.

One of the sites was the Water Filtration Plant for which Voltage Optimisation (VO) was a recommended outcome. The Business Case proposed that a capital outlay of $169k would present a payback period of up to 10 years (48MWh pa). VO has proven an effective energy saving measure in recent years at businesses such as ex-services clubs.

Electricity supply in Australia is within the statutory supply band of 216V – 253V, with the supply voltage to Icely Road Water Filtration Plant measured at an average of 244V. Given that electrical equipment is typically designed to work most efficiently between 220V – 225V, the “overvoltage” being supplied to the site is wasted electricity and wasted cost. Installing a VO device on the supply to the site reduces the site supply voltage to...
optimum levels. This would have represented an up to 9% reduction in voltage.

**Variable Speed Drives**

Centroc conducted a Distributed Energy Plan investigation (which included 10 Orange City Council sites) that was concluded in December 2012. The Water Filtration Plant was once again investigated (with reference made to the energy data from the previous energy audit), an outcome for which was a recommendation to install Variable Speed Drives (VSDs) on the large clear water and smaller backwash pump systems – a capital outlay of $69k would present savings in order of $25k each year (165,427kWh pa) and present a payback period of up to 3 years.

A VSD is a piece of equipment that can change the speed and rotational force (or torque output) of an electric motor by controlling the power that is fed into the machine. This can subsequently regulate the volume of water being pumped. In the case of Icely Road and the Clearwater pumps, the flow was historically regulated by a throttle valve downstream of the pump which would effectively have the pump overworking and wasting energy when it was partly closed.

**The Quandary - VO, VSDs or both?**

While the business case identified that installation of site VO does not provide energy savings for motors that are equipped with Variable Speed Drives (VSDs), a high-level consultant investigation indicated that maximum efficiencies could be gained from having both. Thus the initial grant funded project for Orange City Council included the installation of both technologies. Further investigation of VSDs was recommended by Council staff and as a result it was determined that VSDs may also provide an operational win as the throttle valve downstream of the pumps used to maintain the level in the cellar (for efficient operation of the ozone plant) would regularly fail and shut down the whole plant. From an energy perspective, this was a problem as Council normally runs the plant during the night (for off-peak cost savings) and when it shut down Council would have to run it during the day.

The installation of variable speed drives allows a drive/pump to run at a reduced capacity to deliver the required flow, reducing the energy used.
following day and so spend more money.

To provide surety for the funding body and Council that the correct technology would be installed, electrical engineers from GHD (Sydney based company) were engaged. It was subsequently recommended that VSDs on the three Clearwater Pumps would provide the best “bang for buck” in moving forward.

The Decision

Laser Electrical (Orange based company) were engaged to install three Schneider Altivar 61 VSDs which began operating in early November 2014. The throttle valve will be removed in the near future providing the operators with one less problem. Council will also be measuring the actual savings through comparing electricity use pre and post VSD install (for same run times) to justify value (i.e. 3 year payback?) to the grant body.

While Orange City Council recognise that VSDs are quite common in the water and wastewater industry, this exercise required them to closely examine the pros and cons of the relatively new technology of VO as an option for installation at the Icely Road Water Filtration Plant. Council will continue to pursue recommendations from previous audits.

The Results

Energy and Management Services Pty Ltd was engaged by Orange City Council to review the energy savings achieved from the installation of VSDs on pump motors at the Icely Road Water Filtration Plant in early November 2014.

The scope of this review was to assess actual energy savings achieved to date.

It was concluded that Orange City Council has achieved a 33% energy saving from installing VSDs on three pump motors at the Icely Road Filtration Plant. Energy savings of 101,226 kWh pa will be achieved based on the 14.1 average operating hours per day for the last two years. This translates to cost savings of $17,522 pa.

Based on an installed cost of approximately $77,500 the simple payback period is 4.4 years. Note that these savings do not include potential savings from reduced maintenance costs.

It is further noted that the plant has been operating for the last two years at historically low levels due to the imposition of level 2 water restrictions. It is expected that these restrictions will be relaxed soon and the demand on the plant will increase thereby increasing the energy consumption and energy savings and decreasing the payback period.

It is noted that the site is being charged on an obsolete single rate demand tariff. If the plant can be run primarily in off peak and shoulder periods further cost savings may be achieved by switching to a three rate demand tariff.

This data is specific to the VSD technology. The energy efficiency baseline improvement template is based on the entire site’s data including other on site infrastructure.
Energy consumption can be reduced by implementing higher efficiency pumping machinery, installing power factor correction equipment, implementing a modified pumping regime and minimising water leakages.

Background

Boorowa Shire Council (BSC) engaged NSW Public Works to assist in determining potential energy savings and other cost saving measures at the Boorowa Water Treatment Plant (WTP).

About the Boorowa Water Treatment Plant

The Boorowa WTP was built in 1994 and was designed for a 3.0 ML/d or 38 L/s treated water production rate (based on a 22 hr operating day).

While the plant design capacity is 3.0 ML/d, the peak summer demand is approximately 1 ML/d and winter usage is approximately 0.3 ML/d.

The plant primarily draws water via the River Water (RW) Pumping Station (PS) from a weir on the Boorowa River. The RW PS houses two fixed speed pumps in a dry well which operate as duty and standby. Two fixed speed Bore Water (BW) pumps extract groundwater to provide an alternate water source. The two bores differ in water quality and as a result water extracted by Bore #1 requires dilution.

The WTP comprises of the following processes:

- Coagulation by Aluminium Chlorohydrate (ACH);
- Settlement by two (2) sedimentation lagoons (one in operation while the second one is in a drying mode);
- Filtration by two (2) mono media gravity filters (sand);
- Treatment with Powdered Activated Carbon (PAC);
- Disinfection by Chlorine gas.

Treated water from the filters is stored in a 300 kL treated water tank referred to as the Clear Water (CW) tank.

A pumping station comprising of two fixed speed pumps, operating as duty and standby, delivers treated water to a town reservoir located on the eastern outskirts of the town. Clear water is delivered via a dedicated DN250 rising main.

The energy consuming equipment at the WTP comprise:

- Raw Water Pumps (River Water and Groundwater Water pumps);
- Settled Water Pumps;
- Clear Water Pumps;
THE NEXUS BETWEEN WATER AND ENERGY

Filter Backwash Water Pumps;
Air Blowers for filter scouring;
Compressors for pneumatic valves;
Chemical Dosing Pumps;
Lighting;
Air-conditioning/heating of control room and chlorine dosing room heating.

The Brief

NSW Public Works was requested to complete the following:

- A site inspection by a suitably qualified and experienced civil and process engineer to examine the conditions and power consumption of major energy consuming apparatus, machinery and operations that may gain energy efficiency;
- Review production water loss, specifically including lagoon leakage;
- Verify and review site inspection observations, post inspection analysis and recommendations with NSW Public Works staff, specifically including mechanical and electrical engineers, prior to the release of the draft report;
- Deliver a draft report by 24 October 2014 including, but not limited, to the following:
  a. A current state analysis of major energy consuming apparatus (kWh and $);
  b. Site inspection assessment of civil, process, electrical and mechanical aspects of the water treatment plant;
  c. Post inspection analysis of civil, process, electrical and mechanical aspects of the water treatment plant;
  d. Recommend a costed system of work and/or optimisation of process;

Boorowa Water Treatment Plant Audit

Aerial view of the Boorowa Water Treatment Plant in relation to the town of Boorowa (source Google Maps)
e. Projected energy consumption reduction (kWh and $).

The Findings

The treatment process at Boorowa WTP is based on lagoon sedimentation. A basic annual and seasonal analysis of WTP: inflows (raw water pumping and rain) and outflows (evaporation and clear water pumping), found there to be a difference (loss) of 8.2ML that cannot be accounted for. The loss of 8.2ML/yr is approximately 4% of the WTP’s raw water intake.

Operator observation and a site inspection of the WTP by NSW Public Works engineers have determined the sedimentation lagoons to be the source of the water loss.

Analysis indicates that in addition to preventing the loss of 8.2 ML/year, 1.2 MWh of river water pumping energy could potentially be saved annually. This can be accomplished if the sedimentation lagoons are refurbished (relined) to prevent a water loss. Additionally, preventing loss of water from the lagoons will also reduce the quantity of chemicals consumed.

The Options

A number of options were developed and costed to determine cost and energy savings resulting from:

- Sedimentation lagoon refurbishment and subsequent water, energy and chemical savings;
- Utilisation of higher efficiency water pumps and/or improved pumping regimes resulting in energy savings.

The energy and chemical savings for Option 1A detailed in the report result in operational cost savings of $24K net present value over a 25 year period.

In Option 3 detailed in the report, 21.3 MWh could potentially be saved annually by completing the following works:

- Refurbishing the sedimentation lagoons (relined), to prevent a water loss of 8.2 ML from the WTP;
- Installing new river water pumps and intake screening, and
- Adopting a new clear water delivery pumping regime requiring installation of a new clearwater package pump system, and minor modification to the clear water rising main to the town reservoir (Rising Main No.2)

The energy and chemical savings for this Option result in operational cost savings of $153K net present value over a 25 year period.

Boorowa is currently reviewing the report, which has been shared with other Centroc member councils, to determine next steps.

Acknowledgements

Centroc gratefully acknowledges funding assistance from the Australian Government and the work of NSW Public Works in the development of the Energy Efficiency Audit for the Boorowa Water Treatment Plant.
Building on a growing interest and understanding of the relationship between water and energy management, Centroc’s *Nexus between Water and Energy Program* has been specifically designed to not only deliver energy efficiency programming in Central NSW, but to communicate this advice across all members of Centroc, their communities and with other Local Water Utilities in regional NSW.

Guided by a communications strategy and using researched communication tools, Centroc’s objectives have been to:

- Build on Centroc’s regional brand for Councils for positive environmental change management;
- Share information and ideas and improve communication between member Councils;
- Facilitate mutually beneficial relationships within Council, between Councils, with project partners and the broader community;
- Develop knowledge and pathways regarding energy efficiency;
- Provide support to member Councils in the roll out of advice to the community regarding the program;
- Use the experiences of this project to build the capacity of members, other Councils and the broader community;
- Ensure local industry is aware of the program, particularly the procurement elements; and
- Respond to specific stakeholder needs for information including meeting the funding body’s contractual obligations.

Centroc has used its tried and true methods of media releases, reports and presentations, adding social media and an upgraded website into the mix. Communication tools used have included:

- Centroc Website and Blog
- Social Media
- Rates Notices
- Newsletters
- Posters
- Reports to Centroc GMAC and Board
- Reports to the Centroc Water Utilities Alliance
- Reports to Councils
- Presentations to Centroc Councils
- Presentations to Peak Local Government Organisations
- Presentations to the NSW Water Industry Operator’s Association
- Presentations to other regional Local Water Utilities
- Capacity Building Workshops.

Information on how these tools assisted with the communication of the *Nexus between Water and Energy Program* are detailed below.

**Website and Blog**

Centroc has made use of its newly branded website, Blog and Facebook as the basis for social media for this program. The web based activities have been branded in line
Sharing information was a key activity in the *Nexus between Water and Energy Program* and critical to the program’s overall success.

with Centroc’s Square Deal brand and associated collateral designed in anticipation of the growing activity in the Central NSW community in managing carbon emissions.

Centroc’s website can be accessed from [www.centroc.com.au](http://www.centroc.com.au)

**The Blog** provides a platform to engage with the community about the energy efficient projects that Centroc members have undertaken as part of the *Nexus between Water and Energy Program*. Blog posts have been written in a familial voice making it easy for the community to understand and engage with comments on the projects being undertaken. Blog posts have included information about the various projects undertaken at participating Councils and the energy efficiency benefits anticipated. Once the energy efficiencies for each site have been calculated further posts will be included outlining where the efficiencies were achieved and opportunities provided through this regional project.

The Blog is also a long term record and repository of activities undertaken in energy efficiency and other sustainability activities in this region providing advice to the community on:
- Ideas
- Good value propositions; and
- Networks


**Social Media**

Utilising social media avenues such as Facebook and Twitter to distribute media releases allowed the message of Centroc’s energy efficiency activities to be picked up quickly by the community and most particularly, media outlets. Many journalists use social media as a way of sourcing stories, and by having a foot in this market, stories relating to Centroc’s activities can be picked up by the local TV news and print media to assist in further spreading the word of Centroc’s *Nexus between Water and Energy Program*.

**Animoto**

As Centroc’s social media presence grows it has begun exploring other communication tools such as Animoto to create video slide shows accessible from its Facebook, Twitter and Blogs.

A brief Animoto was developed to promote the *Nexus between Water and Energy Program’s* Water Loss Management work.
To view this go to: https://www.facebook.com/CentralNswCouncils?ref=hl

Rates Notices

Centroc provided an insert to most participating Councils to be included in their water rates notices over the November 2014 – February 2015 quarter. These inserts outlined the CEEP2 initiatives, the Nexus between Water and Energy Program and how their Local Council was participating in energy efficient activities. Rates notices were delivered to 46,000 households across the Central NSW region.

Newsletters

Council staff periodically receive e-newsletters from Centroc providing an update on Centroc activities. The Nexus between Water and Energy Program featured in these updates and provided for further engagement of Council staff in the energy efficient activities of their own and neighboring Councils.

Additionally, some Councils included their participation in the project in their own Council newsletters which provided another avenue of communication with their staff and communities on how their Council is becoming more energy efficient as well as the benefits of this to the broader community.

Posters

All 30 sites where work was completed under the Nexus between Water and Energy Program displayed a poster notifying the community that Council was introducing energy saving measures at the site with funding assistance from the Australian Government as part of the Community Energy Efficiency Program. The posters also provided the community with a contact name and number and website address should they wish to find out more about the work being done at that site or across Council and the region.

See overleaf for the poster positioned at every site where energy efficiency work was undertaken.

Reports to Centroc GMAC and Board

Centroc General Managers Advisory Committee (GMAC) and the Centroc Board meet quarterly and were presented with reports updating them on progress towards the delivery of the Nexus between Water and Energy Program at each of these meetings. Headings of these reports include:

- Progress of work on activities
- Council engagement
- Communication components
- Performance against budget.

This communication enabled key stakeholders (General Managers and
SMARTER energy use for our FUTURE!

FORBES SHIRE COUNCIL IS INTRODUCING ENERGY SAVING MEASURES ON THIS SITE

THIS PROJECT WILL REDUCE COSTS AND COUNCIL’S ENERGY FOOTPRINT.

This activity received funding from the Australian Government as part of the Community Energy Efficiency Program.

For more information about this project within Forbes contact
David Tinlin  P. 6850 2874  E. davidti@forbes.nsw.gov.au

For more information on other similar initiatives throughout Central NSW visit www.centroc.com.au/squaredeal/

The views expressed herein are not necessary the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein.
Presentations provide information to the elected representatives about the great energy efficiency activities that their Councils are undertaking as well as how they are benefiting from being part of a regional project.

Mayors of Centroc members) to be kept abreast of progress in delivering the Nexus between Water and Energy Program including issues and successes in implementing energy efficiency activities.

**Reports to the Centroc Water Utilities Alliance**

The Program of works was guided by the Project Technical Committee, being the Centroc Water Utilities Alliance comprising Water and Sewer Managers from Centroc’s 16 member Councils.

Reports on the Nexus between Water and Energy Program were provided to the CWUA at bi-monthly meetings and via WebEx over the course of the Program delivery. Each CWUA meeting included a separate CEEP2 Project Meeting which reviewed program implementation, risk management, opportunities and progress in meeting milestones.

Communication with the PTC (CWUA) was crucial for information sharing and gathering guiding program delivery while building the capacity of its members.

**Reports to Council re: Revolving Energy Funds**

All participating Councils heard a report on implementing a Revolving Energy Fund (REF) within their organisation. The objective is to have all members informed and instituting a REF to secure the cost savings from energy efficiency programming for future works.

As a result, a majority of Councils have now implemented REF’s while others are discussing the logistics, in particular, how to calculate dollar savings and the criteria for funding projects from this fund.

As a result of these reports, the Centroc Regional Directors of Corporate Services have commenced reviewing energy system requirements and resourcing within each Council. This is a positive step in raising the profile of energy efficiency programming and funding at an operational level within Councils.

**Final Reports to Council**

All Centroc members will receive a report to be heard at their Council meeting that will address the following:

- Summary of CEEP and Nexus between...
**Water and Energy Program objectives and outcomes**

- Energy efficiency savings (for participating councils)
- Recommendations to Centroc Board and Australian Government based on results of the *Nexus between Water and Energy Program*.

These reports will be followed up with recommendations of further energy efficient programming to be undertaken at a regional level.

**Presentations to Centroc Councils**

Each year the Executive Officer of Centroc travels the region presenting to Council meetings to discuss and inform the activities and benefits of Centroc. Over the past two years a segment of these presentations have been about CEEP and Centroc’s *Nexus between Water and Energy Program* and how individual Councils and the region have benefited from these programs.

These presentations provide information to the elected representatives about the great energy efficiency activities that their Councils are undertaking as well as how they are benefiting from being part of a regional project. For the Councils that were not participating in this round of funding, it provided them with an insight into what opportunities are available to them and how they can still benefit from the program even if they are not receiving grant funding (through participation in regional procurement of goods/services and/or through the sharing of knowledge of other Councils activities).

**Presentations to Peak Local Government Organisations**

In addition to presentations to Centroc members, the Executive Officer of Centroc has presented the project plan and...
Engagement with industry, particularly at the regional level, has been an important component of this program.

findings to relevant peak organisations including Executive Officers of NSW Regional Organisations of Councils and the Lower Macquarie Water Utilities Alliance. These presentations allowed the sharing of knowledge gained through the process of the Nexus between Water and Energy Program as well as feedback on how to run successful regional grant funded projects. Through these presentations Centroc has received positive feedback on the energy efficiency work done under this project.

Presentations to the NSW Water Industry Operator’s Association

Engagement with industry, particularly at the regional level has been an important component of this program with the NSW Water Industry Operators Association inviting the Centroc Water Utilities Alliance to present to 40 Water and Sewer Operators at a regional industry day in Young in November 2014.

Following significant interest in the project by industry, the CWUA Program Manager provided the keynote address to the 9th Annual WIOA NSW Water Operations Conference & Exhibition in Orange on 25-26 March 2015. The Chair of the Alliance also delivered a paper on the Water Loss Management program developed through mentoring between Parkes, Lithgow and Orange Councils.

With this year’s conference attracting 620 delegates from across the state it provided the ideal forum to showcase the activities of the Nexus between Water and Energy Program including its objectives, activities undertaken, shared learnings and plans for future energy efficiency.
activities identified through the course of the project.

**Water Loss Management Workshops**

The jewel in the crown of the *Nexus between Water and Energy Program* is the development of a Water Loss Management Toolkit. Industry leaders MWH have assisted Centroc by preparing a Guidance Toolkit on improving water loss management for the region. The process has included two workshops, one aimed at capturing lessons learned in the region and the second to build capacity across the region in Water Loss Management as an important tool for saving both water and energy. The Lesson Learned Workshop attended by engineers and operators from Parkes, Orange and Lithgow Councils, a Water Loss Management expert and facilitated by MWH was held in Orange on 18 February 2015. The intended outcome was to provide the opportunity to capture lessons learned in Water Loss Management in this region including success and improvement strategies and to build them into the Toolkit.
With Parkes, Orange and Lithgow at varying stages of the water loss management journey, the workshop had the benefit of providing participants with an opportunity to reflect on the process they have been through focusing on key strategies, successes and pitfalls. Discussion with peers and consultants enabled the sharing of knowledge and mentoring for those not so advanced in their understanding of this important water and energy resource management tool.

The Regional Water Loss Management workshop attended by 25 engineers and operators from Centroc member councils including Boorowa, Parkes, Cabonne, Oberon, Orange, Bathurst, Cowra, Lachlan, Forbes, Lithgow, Mid Western and Young was held in Cowra on 23 March 2015. The purpose of the workshop was to raise the capability of the Centroc members in water loss management providing an experience of the Toolkit and working with them to understand how to apply it in their individual context.

More details on the Water Loss Management Program are included in the Case Studies section of this report.
Program Outcomes and Achievement of Objectives

The following details the proposed objectives of the Nexus between Water and Energy Program and the achievement of these.

Objective: Increase the energy efficiency of a range of Council assets across 14 councils by an average of at least 15%.

Outcome: Fourteen Councils in the Central NSW region completed activities aimed at increasing energy efficiency at water and waste water pump stations at thirty sites across the region.

Of the thirty sites impacted by work under CEEP2, the breakdown of work is as follows:

- 18 sites—pipe relining
- 5 sites—manhole repair
- 5 sites—water loss management (energy efficiency was not analysed at 2 sites)
- 1 site—installation of VSDs
- 1 site—audit of water loss (energy efficiency was not analysed)

The methodology proposed for the energy efficiency improvement calculations in line with the requirements for funding assumed that the inflow to the sites correlated to the energy used at those sites with the energy efficiency and inflow at each site analysed.

To provide another level of information for further use, Centroc measured the actual energy usage per site and actual cost savings. This has informed advice on site specific issues relating to:

- Measurement
- Timeframes
- Variables e.g.
  - Energy usage of other on-site infrastructure
  - treatment processes
  - population increase
  - climate/rainfall

The outcomes included in this report relate to what has been able to be measured in the timeframe for the funding with increased results anticipated over time. More details are provided on in the section on Major Issues resulting in Lessons Learned and in the site specific templates later in this report.

Of the 27 sites where energy efficiency was analysed, 18 sites experienced a decrease in energy consumption. The total energy consumption at these sites reduced from 5557MWh per annum to 5100MWh per annum, a decrease of 8% or 457MWh per annum.

The total cost savings at these sites is estimated to be around $70,000 per annum. This is more than double the estimated cost savings for these sites.

Of the 27 sites, 19 sites experienced a reduction in the volume of inflow (ML) to the site. The total inflow at these sites reduced from 25021 ML per annum to 20369 ML per annum, a decrease of 19% or 4652 ML per annum.

The above demonstrates the Program’s contribution to meeting the CEEP2 objective 1.

It is to be noted that since post work monitoring commenced in October 2014 there has not been a period of intense rainfall as seen in March 2012 (when baseline data was collected). It is therefore anticipated that there will be an increase in the number of sites where...
The greatest achievement of the Program has been the capacity that has been built across Centroc member Councils in understanding the Nexus between Water and Energy in preparation for further programming.

Objective: Install a variety of energy efficiency products across the region to demonstrate the effectiveness of a variety of technologies to our members, communities and beyond our borders.

Outcome: Eleven Councils across the region completed sewer infiltration remediation using sewer pipe relining with one undertaking access chamber (manhole) repair to reduce system infiltration. The regional procurement process for the pipe relining contracts required all Centroc Water Utilities Alliance members, irrespective of whether they received grant funding, to familiarise themselves with the various technologies employed by providers to determine the one appropriate to their network. A high level of audit work and technical analysis to identify the areas most likely to have an impact on the energy used at the pump station was required. This process alone increased familiarity with the operation of Council’s water and sewer networks and most particularly the link between system operation and energy usage. In doing this the majority of Councils identified other technologies such as flow metres, variable speed drives and devices to more accurately capture and monitor energy usage and have commenced work to purchase and install these.

Orange City Council, as detailed in the Case Study provided in this report, commissioned a high level consultant investigation into the pros and cons of voltage optimisation versus variable speed drives at the Icely Road Water Filtration Plant as a result of the grant funding. This, along with all reports generated through the grant funded activity have been shared amongst members of the CWUA further building their capacity and understanding of energy efficiency technologies.

Likewise the Audit of the Boorowa Water Treatment Plant providing analysis of measures to reduce energy usage has been shared with member Councils.

The Water Loss Management Program and Toolkit, also detailed in the Case Studies section of this report, has contributed significantly to an understanding of the technologies involved in monitoring water loss and the relationship between water loss and energy usage.

This program with its Lessons Learned and Regional Capacity Building Workshops and Guidance Toolkit has consolidated water loss and energy management assessment techniques in a format that can be provided to Councils across NSW.

The delivery of the Communication Plan for this program has seen advice about the various technologies implemented provided directly to 46,000 households across the Central NSW region and indirectly through various media outlets.

There has been great interest in the program of work from the Water Industry Operators Association, Water Directorate and other Councils with a number of neighboring Councils seeking to get on board the various contracts. Centroc member Councils and others have spent $1.5M on top of the CEEP2 funded program in pipe relining alone.

Testament to the success of the roll-out has been the increased amount of work in
pipe relining, access chamber repair, VSD installation and general interest in devices that can improve the energy efficiency of water and sewer operations.

The variety of technologies and sharing of the success or issues associated with these between Centroc members, their communities as well as other organisations provides potential pathways for greater energy efficiency gains in the future.

The above demonstrates the Program’s contribution to meeting the CEEP2 objective 2.

As a result eleven out of fourteen Central NSW Councils have now implemented REFs while others are discussing the logistics, in particular, how to calculate dollar savings and the criteria for funding projects from this fund.

As a result of these reports, the Centroc Regional Directors of Corporate Services have commenced reviewing energy system requirements and resourcing within each Council. This is a positive step in raising the profile of energy efficiency programming and funding at an operational level within Councils.

Local Water Utility Managers and Operators have not only gained increased knowledge of their networks and their relationship to energy savings but also an increased interest in continuing the journey.

For example, the work done by Orange City Council through the Program has highlighted that energy savings at the Orange Sewage Treatment Plant (STP) should be sought from areas other than those that are flow dependent. An aeration options report aimed at reducing aeration energy demand is planned with other improvements underway to reduce dewatering power costs.

Following the work completed in Forbes, a regional access chamber (manhole) rehabilitation contract is being scoped as well the implementation of the Regional Water Loss Management Program to achieve greater energy efficiency and reduce costs for Councils.

Capacity built through the networking and mentoring between Councils has been highly evident as a positive outcome of the grant funded activity. It has further enhanced the already strong collaborative

**Objective:** Build on work undertaken in the region through the CEEP Round 1 Learning and Sharing Energy Efficiency Program in revolving energy savings funds.

**Outcome:** All participating Councils heard a report on implementing a Revolving Energy Fund (REF) within their organisation. The objective is to have all members informed and instituting a REF to secure the cost savings from energy efficiency programming for future works.

**Objective:** Build capacity in the region and be implementation ready for further programming in the Nexus between Water and Energy.

**Outcome:** As detailed above, possibly the greatest achievement of the Program has been the capacity that has been built across Centroc member Councils in understanding the nexus between water and energy in preparation for further programming. The Program has also provided data necessary to build solid business cases for future funding.
A benefit of the program is the increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.

Objective: Promote energy efficiency to our members and communities through communication of program activities and outcomes through traditional and on-line media.

Outcome: Advice about the Nexus between Water and Energy Program, its objectives and benefits was presented to Centroc members and their communities through regular media releases, newsletters, rates inserts, presentations to Councils, other Water Utility Alliances, Conferences, Industry groups and through social media including Centroc’s Blog, Twitter and Facebook. The variety of communication vectors assisted the wide spread promotion of the Program. Details are provided in the Communications section of this report.

Achievement of Program Benefits

The Nexus between Water and Energy Program proposed four benefits to be achieved through the completion of the Program. These benefits and progress in achieving them are as follows:

**Benefit: Increased embedment of energy efficiency programming in Centroc member councils.**

**Benefit: Reduced energy costs for Centroc members and their communities.**

**Benefit: Increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.**

**Objective: Promote energy efficiency to our members and communities through communication of program activities and outcomes through traditional and on-line media.**

**Achievement: Centroc member Councils have long recognised the importance of reducing energy consumption in providing urban water supplies. Over the past five years Centroc has undertaken the following energy management initiatives in relation to water:**

- Development of a renewable energy and offset plan, Centroc Carbon Plus Study, 2012 for the additional water security investments required in the region;
- Auditing and development of a Distributed Energy Plan for the largest energy using facilities of each Council which captured many of the water and sewage plants to identify efficiency savings; and
- Conducted capacity building activities across the membership in general sustainable energy management activities.

**Achievement: The delivery of the Nexus between Water and Energy Program looking at measures to reduce the level of energy required to pump and treat water has served to further embed energy efficiency programming within Council’s operations.**

Evidence of this is the implementation of Revolving Energy Funds and further review of energy system requirements and resourcing within each Council.

**Benefit: Reduced energy costs for Centroc members and their communities.**

**Benefit: Increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.**

**Achievement: The cost savings estimated for this project were calculated as a direct relationship between the amount of reduction of inflow to pump and treatment plants and the cost of electricity. Cost savings do not take into account the savings that can be attributed to maintaining old/inefficient infrastructure. The estimated savings across the 29 sites analysed was $113,425.00 per annum. The cost savings for the sites where work was undertaken for CEEP2 were calculated by multiplying the energy consumption (kWh) saved by the c/kWh rate currently**
being charged for the site.

For large consuming sites, where rates are broken down into peak, shoulder and off-peak, savings have been calculated using the off-peak rate, which is lower than the peak and shoulder rates.

The savings do not include any network charges or environmental charges (SRES, LRETS etc.). Savings are calculated purely on the c/kWh energy rate.

Also it is important to note that, as detailed elsewhere in this report, Centroc measured the actual energy usage per site and actual cost savings which has informed advice on site specific issues relating to measurement, timeframes and variables.

The total actual savings achieved is estimated to be around $70,000 per annum. This is more than double the estimated savings for these sites.

**Benefit:** Increased awareness and capability to adopt energy efficiency practices throughout Centroc member Councils and their communities.

**Benefit:** Reduced greenhouse gas emissions and a positive contribution to regional climate adaption.

**Achievement:** With an emphasis on capacity building and communication as a key tool in the delivery of the *Nexus between Water and Energy Program* particularly through the development of the Water Loss Management Toolkit, mentoring activities and implementation of the Project’s Communication Plan, Centroc members now have:

- More familiarity with the impact that water management has on energy usage and measures that can be taken to manage this.
- Greater understanding of their water and sewer networks and where energy efficiencies can be gained.
- More awareness of energy efficiency program measurability.
- More conversations about energy management.
- Increased interest in more programming to reduce energy usage associated with the pumping and treating of water.

**Achievement:** In the context of climate change adaptation and mitigation, Centroc has identified work in renewables and energy efficiency as a priority for the Central NSW region.

Centroc member Councils have a strong track record of engagement in tackling climate change driven by both the financial imperative to save money and the environmental imperative to reduce greenhouse gas emissions.

The *Nexus between Water and Energy Program* has provided a solid platform to build further work in reducing energy usage.

**Other Benefits**

Other benefits achieved through the *Nexus between Water and Energy Program* includes:

- Management of existing systems to optimal performance avoiding costs of energy consumption attributed to breakages and the need to bring new infrastructure on line with both its energy build costs as well as energy maintenance costs.
To manage the risks associated with measurement difficulties requires the use of multiple monitoring techniques to protect against unexpected results.

- Improved system knowledge improves the level of service through reduced customer interruptions
- Reduced energy consumption through accurate pumping rates to match demands, in place of constant pumping rates to service reservoirs
- Direct energy and chemical savings from reduction in water treated through improved network efficiency at the water treatment plant; this will also need to be monitored over a longer term to quantify savings resulting from this program
- The indirect energy savings, in addition to those seen at Councils sites, include the reduction of suppliers’ energy consumption and the transportation energy used by our chemical supply companies’ – these are more complex to quantify
- Environmental and public health impacts from pipe relining. A reduction in wet weather infiltration events and the scale of these will lead to reduced sewer overflows from pumping stations around Sewage Treatment Plants. For example at Orange STP this will also lead to greater re-use of sewage effluent at the Cadia goldmine as re-use must cease during bypass events. Through the Water Loss Management component of the Nexus between Water and Energy Program the following benefits have been noted:
  - Greater ability to service current and future demands, whilst being able to pump enough to keep up with increased demands seen by increased information available from the implementation of District Metered Area (DMA) metering
  - A more reliable network usage available to allow for correct sizing and type of pumps required to be the most energy efficient reducing energy consumption in the long term
  - Critical pressure point monitoring undertaken so leak events and system anomalies can be quickly detected to allow rapid responses to reduce the amount of water lost and energy used in pumping from the treatment plant to reservoirs
  - Active leak detection of all water mains within the reticulation system identifying a number of leaks which will deliver significant water savings in the long-term

**Major Issues resulting in Lesson Learned**

While 18 out of the 27 sites where energy efficiency was analysed experienced a decrease in energy consumption, a number of major issues were identified that impacted on the outcomes of this grant and that will be addressed in future programming though Centroc and the individual Council members.

As outlined elsewhere in this report, these issues have led to an increase in the capacity of Centroc member Council’s management of their local water utilities and an increased understanding of the nexus between this and energy usage.

**Major issues resulting in lessons learned are as follows:**

**Methodology for calculating energy use**

The linear relationship between flow savings and energy savings assumed in the methodology used for measuring the energy use and benefits of the Program is reasonable in some infrastructure (e.g. pumps), but in other cases (e.g. treatment) the relationship may be non-linear. The significance of this issue would
need to be determined by reviewing the actual treatment processes of member Councils.

For example, more energy is needed to treat sewerage than to treat rainwater or stormwater infiltration into a system. Also the process of treating sewerage varies between Councils, for example the Bathurst STP is a continually operating system while Boorowa is a trickling filter plant. A trickling filter plant uses microorganisms for treatment with generally low power consumption whereas a continuous operation plant uses more energy.

While Centroc’s proposed methodology for calculating baseline infiltration is reasonable, to baseline energy savings appropriately, the inflow will need to be corrected for other factors such as climate and population growth.

Lesson Learned: The methodology for calculating energy use and energy benefit from the activities undertaken in the Nexus between Water and Energy Program may need to be altered depending on the infrastructure being impacted and for other factors such as climate and population growth.

The percentage of pipes relined has been in most cases a small percentage of the total system. Added to this are the many variables that can impact on the measurement of energy use from works completed at each site.

Variables

The Verification of Energy Savings and International Performance Measurement & Verification Protocol provide guidance that could be adapted and applied to identify a measurement plan for the Centroc Program. (Source: MWH Review of Method for Calculating Energy Use and Energy Benefit)

Timeframe for monitoring

A six month period is an insufficient timeframe to accurately monitor the impact of works undertaken at each site.

Since the post work monitoring period commenced in October 2014 there has not been a period of intense rainfall as seen in March 2012.

Lesson Learned: It is difficult to accurately determine the actual outcomes for such a large scale regional program of works within the timeframe allowed through the funding program. At least 12 months is necessary to enable data collection and analysis.

Recommendation: It is recommended that future funding rounds in Energy Efficiency programming consider the timeframes for pre and post project work needed to verify energy efficiency gains.

Monitoring devices

For many sites there is only one meter to measure energy usage. At sites, such as a
Further investigation is required into the reduction of energy usage for processes such as aeration and dewatering as a possible regional program with the potential for further savings.

Sewage Treatment Plant, for example, it is difficult to separate the energy consumed by other infrastructure at the site such as building, lighting, and air conditioning from that used by the pumps or treatment plants alone.

Audit advice

Through the implementation of the Nexus between Water and Energy Program it has been determined that the audit information that was relied on to apply for funding was lacking in detail and accuracy. Much data is recorded manually and in some locations is not read on weekends or public holidays. For example, in Lithgow the historic GIS system has not been completely accurate and must be continuously updated with new information as it is understood. In particular the implementation of system upgrades must be captured in the GIS system to keep the system up to date to improve confidence and usefulness of this information.

A positive outcome of the Program has been the increased knowledge of the variety of technology available for this purpose and its practical application.

Lesson Learned: Improved monitoring devices will need to be installed to measure the energy efficiency of future work with an outcome of the Program being the increased knowledge of these and capacity to share advice between member Councils.

Energy billing

Energy billing has also proven an issue with larger consuming sites billed monthly and smaller or tariff sites billed quarterly. In the case of small sites it is necessary to work out the exact date range of the electricity bill and amount of inflow and rainfall for the same period of time. Larger sites are easier to analyse. Also impacting on measurement of energy efficiency at specific sites has been:

- changes to retail providers for some small sites in July 2014; and
- Lack of access to sites for meter readers.

These issues have resulted in inconsistent invoicing and a need to provide estimates for bills to calculate savings.

Identification of energy consumption

High energy use facilities at STPs are aeration, mixing and dewatering. Aerators in particular are one of the highest energy consuming items involved in the treatment process. Inefficient or badly managed aerators will contribute to unnecessary or inefficient use of energy.

During the course of the Program Young Shire Council commissioned a new STP. The old plant was a trickling filter system and the new plant is an aerated STP using UV and aeration processes. Young is
working to reduce the energy usage at the new STP by installing VSDs on aerators and by scheduling processing to off-peak times.

As a result of the Program, Orange City Council plans to commission a report aimed at options to reduce aeration power demand.

**Lesson Learned: Further investigation is required into the reduction of energy usage for processes such as aeration and dewatering as a possible regional program with the potential for further savings.**

**Other Lessons Learned**

- Not all projects can be undertaken in-house and specialist consultants are required to help as they will be more in touch with the latest and best suited technology on the market. Specialist consultants also add their experience from their delivery of many similar projects allowing Councils to adopt their lessons learnt, hence saving costs.

- Involvement of all levels of the organisation is crucial to the successful implementation of these projects as local knowledge can never be understated.

**Opportunities for local Industry**

A number of local contractors and suppliers were engaged for energy efficiency activities completed under the *Nexus between Water and Energy Program*. These are detailed in the Program Management section of this report. All tenders and quotes were advertised within the Centroc region (as well as further afield) where Centroc already enjoys solid relationships with local industry.

Aside from benefits of using local providers to the local and regional economy, the providers also benefit from increased capacity in responding to Local Government tenders and experience working on innovative programming making them more competitive when tendering for work. Added to this is the reputation gained from working with Local Government with providers benefitting from shared contacts between Councils.

Councils also benefit from having local contractors and suppliers on hand to provide assistance, if required, throughout the duration of program delivery.

**Low Socio-Economic benefits**

Of the 14 LGAs included in this project 8 (Blayney, Cowra, Harden, Lithgow, Parkes, Upper Lachlan, Young and Weddin) are ranked in the lowest 50% of the ABS Index of Relative Socio-Economic Disadvantage 2011. Of these Cowra and Parkes have a higher incidence of socio-economic disadvantage (ABS-SEIFA, 2011 (cat. no. 2033.0.55.001)).

Council rates for water and sewer are an unavoidable rateable cost to communities with the pumping of water the highest consumer of energy for most Councils. Efforts to improve efficiencies and reduce costs will ultimately benefit the low socio-economic target groups by ensuring rates for these essential services are kept to a minimum.

Councils who participated in the Program selected lower socio-economic areas as the location for work to be completed. These areas are generally older with ageing infrastructure and the highest incidence of infiltration.
Ancillary benefits to the target community from the *Nexus between Water and Energy Program* include:

- Improved infrastructure and living conditions
- Improved water security
- Improved energy efficiencies and cost savings
- Increased community understanding of energy efficiency
- Increased capacity of Councils to provide better levels of service in water and sewer management.

**Evaluation of the Impact on the Community**

At the 2012 Centroc Summit, the region’s annual strategic planning forum, Mayors and community leaders from Centroc’s then 17 member Councils identified energy efficiency as the region’s greatest priority, voting hands down for action to be taken to tackle escalating electricity charges and to look at renewable energy sources.

96% of participants surveyed voted to improve their management of energy, water and waste thus securing a clear direction for Centroc’s future work in the area of energy resilience in the region, with exploration of the link between water and energy and regional programming around energy efficiency for Councils overwhelmingly nominated as priority areas.

The priority program initiative for regional action identified was the nexus between water and energy with the energy required for pumping of water identified as a huge and unavoidable rateable cost for Council in the region.

Also informing the Program was evidence from Council community strategic planning.

The delivery of this Program is part of a broader range of regional initiatives aimed at improving the energy efficiency of Centroc member Councils endorsed by the Centroc Board as a peak organisation of Central NSW communities.

**Communication to the Community**

During the project there have been 7 media releases sent to local media outlets and via social media which have resulted in local media coverage of the *Nexus between Water and Energy Program*.

The level of engagement with the community has benefited from Centroc’s increased social media presence through its newly badged website, Blog, Facebook
and Twitter feed with 110 ‘likes’ on Facebook and 353 “followers” on Twitter. These have both more than doubled in the past 12 months. Numerous Facebook posts and tweets have gone out regarding the Nexus between Water and Energy Program which have been shared and retweeted by Centroc’s followers.

Find Centroc on Facebook at: https://www.facebook.com/CentralNswCouncils and on Twitter at: https://twitter.com/centrocNSW

Added to this has been the distribution of rates notices to 46,000 households across the Central NSW region and presentations at industry events attended by over 600 delegates.

For more advice go to the Communications section of this report.

**Broader Uptake**

As detailed earlier in this report there has been great interest in the Nexus between Water and Energy Program from the Water Industry Operators Association, Water Directorate and other Councils with Centroc Councils spending over $1.5M on top of the CEEP2 funded program in pipe relining alone.

Further to this Orange and Lithgow City Councils, Parkes Shire Council and Centroc contributed an additional $64,696 for the development of the Water Loss Management Toolkit. The cost for this exceeded the allowable amount of CEEP2 funding for this type of activity.

Recently leading industry group the Water Directorate has opened negotiations with Centroc with a view to disseminating the Water Loss Management Toolkit to a wider audience including all Councils in NSW.

Improved Energy Management in the Community

Indications of improved energy management in the community arising from demonstration from the Program are yet to be measured. Centroc members have, however, heard reports on implementing a Revolving Energy Fund (REF) within their organisation.

This is a positive step in raising the profile of energy efficiency programming and funding at an operational level within Councils that will have a flow on benefit to the community.

As part of its future programming the Centroc Water Utilities Alliance also has a desire to deliver cost savings to customers by reducing the energy consumed in treating and transferring water losses through the implementation of a Regional Water Loss Management Program.

Increased knowledge of the Nexus between Water and Energy Program, technologies to reduce energy usage and lessons learned from this Program will inform the uptake of a broader regional program of work to be scoped. The variety of technologies and sharing of the success or issues associated with these has laid the pathway for greater energy efficiency gains in the future.
Centroc has proven expertise in the management of innovative, collaborative regional programs succeeding through the good will and industry of its members and staff.

**INTERNAL RESOURCING**

Centroc staff undertook all aspects of project co-ordination and management of the Nexus between Water and Energy Program with the following personnel providing a key resource:

- Sponsoring General Manager’s, Parkes and Forbes Shire Councils
- Centroc Executive Officer
- Centroc Water Utilities Alliance Program Manager
- Energy and Training Program Manager
- Compliance and Cost Savings Program Manager
- Finance Officer
- Executive and Administration Assistants

Through the work of the abovementioned and the collaborative efforts of the national award winning Centroc Water Utilities Alliance, Centroc has successfully implemented this complex regional program on time and within budget in the context of the challenges of the reform of the Local Government sector in NSW.

While Centroc sees enormous benefits for its members through the acquisition and management of regional grants, the diversion of existing resources to manage large scale innovative programs such as the Nexus between Water and Energy is challenging.

This has seen the need for other Centroc projects to be delayed until resources are freed from program delivery requirements sometimes compromising the scoping of future cost saving initiatives of value to Centroc members.

Further discussion of administrative costs is included later in this report.

The role of regional program delivery coordination comes at a cost to Centroc and while the benefits for members possibly outweigh the resourcing issues, it is definitely worthy of consideration in evaluating participation in such funding opportunities in the future.

Participating Councils also had a designated Project Manager who was the coordinator for on- ground works relating to the Nexus between Water and Energy Program activities undertaken at each Council. These Council Project Managers worked closely with Centroc staff to ensure that the activities were on track or that Centroc was made aware early on if there were any issues with implementation or budget that may impact on project milestones.

Communication between Centroc and the Council Project Managers was maintained fortnightly and bi-monthly through
fortnightly teleconferences of those with current activities (members of the Project Steering Committee) and bi-monthly meetings of the Centroc Water Utilities Alliance (the Project Technical Committee) attended by all Council Project Managers.

In addition ad hoc teleconferences and meetings were convened throughout the course of the project in relation to specific issues requiring technical input from Council Project Managers.

OUTSOURCED CONSULTANCIES

Consultants used included:

- **Simply Sustainable**, used for advice, assistance and review of the baseline energy tables for all sites
- **VAADA (Visual Arts And Design Agency)**, assisted with the development of the Communications Plan, Centroc website, blog and signage posted at each site
- **MWH**, contracted to develop the Water Loss Management Toolkit including the facilitation of Lessons Learned and Regional Capacity Building Workshops
- **Karin Stark**, sustainability professional contracted to provide additional resources for the procurement of the Water Loss Management Toolkit
- **Savewater! Alliance**, assisted with the production of bill inserts to be distributed with Council rates notices
- **Water Loss Management**, contracted to provide support to both Parkes and Lithgow Councils in the monitoring, assessment, location and repair of leakages and water losses throughout their respective water networks
- **Marsdens Law Group**, provided specialist legal advice to Centroc in negotiating contracts with providers
- **Crowe Horwath Auditors**, provided audit services for the 2013-2014 financial year audit and will also audit the final project accounts

Notable in the delivery of the *Nexus between Water and Energy Program* was the significant increase in the amount of on and in-ground works undertaken due to the success of the program roll-out. It is anticipated that this will continue beyond the funded program of works.

IDENTIFYING AND MANAGING DIFFICULTIES (resulting in Lessons Learned)

Centroc as an organisation is focused on project management at a regional level and while well equipped to undertake a project of this magnitude, there were many lessons learned from difficulties encountered in its delivery that can inform process improvement. These lessons will be used in managing future projects and cover areas such as:

1. Administration Costs
2. Risk Management
3. Coordination and Timing
4. Project Quality
5. Staff Turnover (Council)
6. Change in Government priorities
7. Fit for the Future – Reform of LG
1. Administration Costs

Centroc has experience managing projects within constrained budgets and was well positioned to manage the Nexus between Water and Energy Program with the limited administration budget allowed for projects under CEEP.

While the need to cap administration costs is understood, it unfortunately imposes financial pressure on organisations managing complex regional projects such as the Nexus between Water and Energy Program. There are considerable additional costs involved in managing a project that incorporates fourteen Councils and thirty sites compared to one Council, even if that Council was undertaking multiple projects at multiple sites. Further, there are considerable administrative cost savings for funding entities as they deal with one organisation instead of fourteen.

The difference with the Nexus between Water and Energy Program is the additional staff time required to comply with reporting to the funding entity and the additional quality stops and requirements imposed by undertaking a regional grant funded program. This is more so the case with new funding programs where there is an increased level of transparency and accountability expected.

Further to this is the costs and resourcing required by the Project Manager in relation to governance for a regional grant funded program. For example, in the case of Centroc, before invoices from contractors for work undertaken at Councils participating in the grant funded activity can be paid approval needs to be provided by that Council. Once approval is obtained the Council can be invoiced for their contribution to the cost (which is less 50% of the total cost being the CEEP2 contribution up to the threshold of funding granted for their component of the project).

Delays in obtaining approvals and in receiving payment from Councils and the time and resources required to chase these while trying to comply with contractual obligations with providers and the funding body is time consuming and costly not to mention demanding on Program Management and finance staff.

As good governance enables management of these issues, efficient and transparent processes have had to be in place due to the inherent risks in a project of this magnitude. These are further compounded by the additional layer of transparency and accountability required in Milestone reporting to the funding body.

Once again the delivery of a program of works such as this relies heavily on the effort and good will of Centroc’s staff and member Councils and the strong collaborative bond that exists through the Centroc Water Utilities Alliance.

2. Risk Management

A key component to self-managing regional projects is the amount of risk management undertaken by the regional entity. This risk management, while...
place a larger workload on the project management team as well as increased costs and time pressures, allows the funding entity, in this case the Australian Government, to be reassured of their level of exposure.

While risk management is a part of project management, a benefit to funding a regional project is that the funding entity has less risks to manage as the program manager manages more risks than in normal project management (due to the number of players in the project).

In the case of the Nexus between Water and Energy Program the value of the regional contracts for the major component of work undertaken by member Councils, pipe relining, were the largest ever entered into by Centroc on behalf of their members. Centroc went to great lengths to ensure that the governance and probity around these contracts was addressed and as such used the Australian Standard contract (AS-4000) as opposed to Centroc’s own template contract.

The AS4000 contracts required the work to be completed under the CEEP2 funding agreement to be included in separable portions requiring a huge amount of work to be undertaken upfront to obtain the necessary data from participating councils. Despite this rigorous risk management approach, during the course of the program delivery one of the three contractors went into administration requiring yet more legal advice and administrative efforts to resolve. This was done to the satisfaction of all involved and work was completed under a novated contract on time and on budget.

The tendering and legal costs associated with the original contracts with the three providers used for pipe relining were paid for by Centroc outside the project budget. This process was, however, seen as crucial to managing the risks associated with such large contracts with Australian Government funding at stake.

Throughout the course of the program delivery there were multiple areas where risks were managed by Centroc and the CEEP Program Manager informed once the risks were identified, managed and solutions brought forward for approval.

The inclusion of risk assessment as a regular agenda item at Project Technical Committee meetings where the Project Plan Risk Register was reviewed, perceived risks discussed and controls put in place is a key tool in program delivery. This is particularly the case for complex programs with long delivery timeframes in changeable environments.

3. Co-ordination and Timing

Centroc is proud to report that all eight Milestone Reports were delivered on-time with only minor negotiations required with the CEEP Program Manager over delays in the delivery of specific items. These were quickly resolved to the Department’s satisfaction and payment made promptly to enable further work to be undertaken.

Only one contract variation was required in the early stages of the program delivery due to the change in scope of works to be undertaken by Orange City Council, the withdrawal of Wellington Shire Council and changes to the sites identified to be impacted by the program of works.
The importance of this relationship and the understanding of the operation and governance of each organisation gained through the delivery of the CEEP round 1 project cannot be underestimated. Centroc would like to take the opportunity to acknowledge the work of Ms Emma Cole whose advice and guidance was invaluable in the delivery of the Nexus between Water and Energy Program.

While milestones were delivered in line with the Project Plan deadlines, timing and co-ordination was an issue throughout the course of the program delivery particularly given the complexities of the activities to be delivered.

As each Council was in charge of managing their own activity, Centroc had to ensure that these internal stakeholders stayed on track to ensure the regional project schedule was met.

Specific timing issues can be attributed to:

- The amount of pipe relining completed across the region.
- Further investigation of the scope of some activities and a general increase in knowledge leading to some additional steps.
- Lead times in the supply of equipment.
- Staff turnover; and

Firstly, the time required to tender for, negotiate and gather the data needed for the separable portions of the Pipe Relining contracts had to be done prior to the sign off of the Project Plan in order for the contracts to be in place in time to meet milestone deadlines. This process, compounded by the requirements of the Tendering Guidelines for NSW Local Government in accordance with the Local Government Act, took eight months and had to be undertaken at Centroc’s cost outside the project budget.

While the Pipe Relining contracts commenced in line with milestone requirements, the vast amount of work to be completed across the region required three separate contractors to complete within the timeframe. This added to the time and administrative costs to manage three separate contractors including the scheduling of works, delivery of reports and CCTV in line with contractual requirements and to manage invoicing as detailed above.

In the case of Orange City Council, further investigation and scoping of work planned under the grant, while resulting in a contract variation and additional time, achieved a far better result for Council as well as a detailed report paid for by Council and shared with other CWUA member Councils. See the Case Study provided in the Energy Efficiency section of this report.

Lead times required by suppliers for the delivery of energy efficient equipment to be installed also caused unanticipated delays.
Other co-ordination and timing difficulties can be attributed to staff turnover within participating Councils and the impact of the Local Government reform on Council’s engagement. Even with mitigation strategies in place, both these issues resulted in some significant challenges to be managed. More advice is provided below.

4. Project Quality

A key lesson learned by Centroc in the management of the CEEP1 LASEEP project was the need for frequent Quality Stops in the Project Plan to ensure project quality is maintained throughout the entirety of the project. This is especially important when managing a regional project given the many stakeholders (internal and external) and the need to continually remind them of the Project’s Objectives and the pathways to achieving these. As a result more tailored Quality Stops were introduced throughout the Nexus between Water and Energy Project Plan.

Frequent tailored Quality Stops were crucial to the relatively smooth delivery of this program particularly given the many complex activities involved, the number of stakeholders and the value of the Australian Government grant.

5. Staff Turn-over

A risk of ‘high’ was attributed to the turnover of staff, both at a Council level and at a Centroc project management level, as these staff are quite often keepers of intimate knowledge of the project. Council staff turnover is a risk that Centroc has previously managed by ensuring strong communication of the objectives, benefits and activities associated with the Program to incoming staff ensuring that Council’s activities remain on track and within budget. This is a benefit of a regional project as Centroc manages this risk across the fourteen participating councils rather than the CEEP2 Program Manager.

An unforeseen challenge was the difficulty for Councils’ in the region to replace qualified Engineering staff at a time of unrest in the Local Government sector. In one case this meant that there was no-one within the Council to pick up responsibility for the project for several months while a suitable replacement was recruited. Unfortunately the new recruit resigned within a few months and another appointment was made. While a mentoring program was in place there was no one to mentor.

This instance resulted in considerable delays and false starts in program delivery within the Council, compounded by a loss of knowledge of the operation of Council’s water and sewer system. While problematic at the time, this scenario provided the opportunity for more intensive mentoring between member Councils once a suitable staff member was found and an increased capacity in Council’s understanding of their system and its energy usage.

The Centroc Program Manager acknowledges the diligence of the current staff at this Council for the efforts they have made to get the program activities
on track and on budget under difficult circumstances.

6. Change in Government Priorities

During the course of the delivery of the Nexus between Water and Energy Program there has been significant shift in the Australian Government’s policy and priorities in relation to energy efficiency programming and funding that have impacted on the communication of the program’s aims and objectives.

Following the change of Government and re-assignment of portfolios by the current Government the Department had its first of three name changes to the Department of Industry and then again to the Department of Industry and Science.

While these were not significant in terms of the Communications Plan activities, the move away from use of the Community Energy Efficiency Program branding and the language that could be used in promoting the energy efficiency work made promotion less cohesive. While there was no formal advice from the Department regarding the messages that could be promoted the “clean energy future” shifted to more of an “energy productivity” message.

Aside from the impact of the change of policy on promotion of the Program, it also had repercussions for the willingness of member Council to take-up Energy Funds.

Having had experience promoting activities undertaken through both CEEP1 and CEEP2 funding, it is far easier to promote a program with a clear logo and branding than one where the only reference to the grant funding was through use of the wording— “This activity received funding from the Australian Government.”

7. Fit for the Future – Reform of Local Government

An overriding consideration in the management of the Nexus between Water and Energy Program has been the impact of the NSW Government’s Fit for the Future Local Government Reform process on the level of engagement by the fourteen participating Centroc member Councils.

Another risk managed internally by Centroc in the past has been the turnover of Centroc staff in the course of managing large sometimes long running regionally funded projects. Lessons have been learned relating to the need to ensure that more than one person in the organisation is familiar with the project and that all project documentation is sufficiently detailed to ensure a seamless handover.

Centroc is pleased to advise that in the case of the Nexus between Water and Energy Program – there has been one Program Manager who has worked consistently in the delivery of the project over the past eighteen months.

It is also important to acknowledge the strong mentoring support provided by members of the Centroc Water Utilities Alliance.

While not always possible, there is no doubt that the consistency of personnel through-out the duration of the program delivery is a huge benefit.
Councils’ have been under increasing internal organisational pressures in the lead up to 30 June deadline for submissions. This is in addition to the day-to-day pressures for Councils of delivering and maintaining infrastructure for their communities while delivering an ever growing array of services.

TECHNOLOGY ISSUES - FLOW MONITORING

Data requirements for the Nexus between Water and Energy Program were informed by Centroc’s Regional Distributed Energy Plan and the development of an Energy Technology Evaluation Model. Having said this, Centroc members are at varying stages of project readiness for introducing energy efficiency programming and in understanding the collection and analysis of data needed to demonstrate efficiency gains.

Given that the Program identified the nexus between water and energy, a significant amount of audit work necessary to inform the Project Plan (outside the project budget) was undertaken by participating Councils prior to the signing of the funding agreement in August 2013.

Audit work using smoke testing and CCTV informed the program of works including sewer pipe relining and leakage and manhole repairs in areas subject to infiltration with the overall aim being to increase the energy efficiency of the site identified.

A project Energy Efficiency Baseline and Improvement Report was provided as part of the funding application and was the subject of additional advice following a technical viability assessment conducted by consultants SKM.

Project evaluation, specifically the methodology for the Energy Efficiency Baseline and Improvement Reporting requirements was the subject of further peer review with a Literature Review commissioned by Centroc through industry specialists MWH.

Despite this, it was only through the course of the program delivery that the potential advantages of installing flow meters both upstream and downstream of the sites identified as a means of capturing changes in the infiltration to the site became apparent.

This was the most significant technology issue that impacted on the program evaluation though the timeframe required to install flow meters and analyse the data would have exceeded the timeframe for the grant funded activity.

It also became evident during the course of the program evaluation, that the quality of audits on which the application was based were not always accurate. This issue applied to the majority of activities undertaken through the Nexus between Water and Energy Program and wasn’t specific to one technology or one Council.

It is understood by Centroc and all member Councils that there is a need to be ‘grant ready’ but it always remains as to how much should be invested into grant readiness.

Centroc has a proud track record in devising and delivering innovative cutting-edge regional programming that, while attempting to meet funding criteria, builds knowledge and capacity of its members and their communities at the same time.
Valuable lessons about the technologies that need to be used to monitor and evaluate energy efficiency gains in water networks and of other technologies that can be employed to build on the work already done have been learned and shared by the Centroc Water Utilities Alliance throughout the course of this program with a number of next steps identified to work towards increased energy efficiencies.

RECOMMENDATIONS

Centroc Board

It is recommended that the Centroc Water Utilities Alliance:

♦ Review the outcomes of the Program including advice relating to site specific issues with a view to scoping further regional programming including:
  - Implementation of a regional manhole rehabilitation program
  - Roll out of the Regional Water Loss Management Program; and
  - Improvements to the measurement and monitoring of energy usage.

♦ Through the Centroc Regional Directors of Corporate Services review energy system requirements and resourcing within each Council in relation to the implementation of Revolving Energy Funds.

Australian Government

It is Centroc’s recommendation that the Australian Government:

♦ Continue funding energy efficient programs for Local Government giving consideration to the timeframes for pre and post project work needed to verify energy efficiency gains.

♦ Consider incremental process improvement of the funding model for this program going forward.

♦ Utilise Local Government regionally to achieve results from a broader base with less risk/work at the Australian Government level for project management.

♦ Consider a separate funding stream recognising the value to the Australian Government of aggregated project management.

♦ As Local Government administration has accountability and transparency inherent in its operations, consider regional funding rounds that are more outcomes focused for Local Government and less focused on milestone reporting. Should this be achieved it is recommended that:
  - appropriate risk management controls be put in place; and
  - frequent tailored quality stops are included in Project Plans particularly for complex regional program with multiple activities and stakeholders.

♦ Review amount attributed to administrative support for regional programs to recognise the greater amount of resourcing required.

♦ Maximize the growth in capacity and understanding of the operating environment of Local Government of CEEP case managers.

♦ Recognise that the same logo and branding for the life of the program is preferable to communicating a clear, consistent and positive message about the program and its activities.

BUILDING ON LESSONS FROM CEEP ROUND 1

Finally Centroc would like to compliment the CEEP administrators for recognising the challenges in Round one and resolving these in Round two. For example, it took 6
months for the Activity Tables to be negotiated in Round one. By Round two that process had been eliminated and replaced by an approved Project Plan.

The smooth delivery of this Program can also be attributed to the strong collaborative working relationship between the Centroc Program Manager and the CEEP Program Manager initiated during the course of Centroc’s delivery of its first project funded under CEEP round 1. Central NSW Councils thanks the Australian Government for its contribution to the Nexus between Water and Energy Program.
The Nexus between Water and Energy Program was delivered on time and within the Australian Government budget.

Value-Add

Value-add activities included the Water Loss Management Toolkit where tenders for the scope of work exceeded the allowable amount of CEEP2 funding. Orange City Council, Lithgow City Council, Parkes Shire Council and Centroc, seeing the value of this activity and its application beyond Centroc borders, agreed to contribute an additional $64,696 to the development of the Toolkit.

Other value-add contributions made by Councils included the contracting of specialist consultants by Orange City Council to review the technology proposed in the funding application for installation at the Icely Road Filtration Plant to ensure the best result. They also commissioned a high level analysis of the energy savings achieved by the installation of variable speed drives at this site.

Centroc contracted energy consultants, Energy & Management Services to review the energy savings at a number of sites to validate in-house analysis at a cost to Centroc.

As detailed in the Project Management section of this report, Centroc’s administrative costs for the management of this complex regional program far exceeded the administration budget allowed for projects under CEEP2. This is without doubt the most significant budgetary issue that arose during the delivery of the Program.

All of the above was expenditure not included in the CEEP 2 Project budget. Final contribution from the Australian Government is less than initially agreed due to some Councils not spending the full amount of funding allocated to activities at some of their sites. The under spend is attributable to the amount of pipe relining and water loss work that Councils were able to complete in relation to the sites identified for energy efficiency work.

Additional Council Contributions

While there were no unexpected costs resulting from the technology used a number of Council’s contributions to the project were over the 50% originally budgeted with additional pipe relining undertaken. This accounts for the increase of $316,259 in Councils contributions to the Program.

CEEP2 key players: (L to R) Kate Barker, (Centroc’s Energy and Training Program Manager), Meredith Macpherson (Centroc Water Utilities Alliance Program Manager), Emma Cole (Community Energy Efficiency Program Manager), and Lee Chapman (Centroc’s Compliance and Cost Savings Program Manager).
Councils completed as much on the ground work as possible relating to the specific pump or treatment plant identified.

**Budget Variations**

There was only one variation to the Funding Agreement negotiated during the life of the Program which included amendment to the program budget at the time of the submission of the Project Plan at Milestone 2. This was due to the withdrawal of Wellington Shire Council from the Program resulting in a reduction to the budget of $100K ($50k CEEP2 contribution and $50k recipient contribution) and changes to the scope of works for Orange City Council where funding allocated for the installation of both voltage optimisation and variable speed drives at the Icely Road Filtration Plant was reduced and the dollars reassigned to pipe relining.

**Regional Benefit**

As Centroc was the recipient of the CEEP grant, all monies needed to go through the Centroc budget for auditing purposes. All contractors have had to invoice Centroc directly and Centroc passed on invoices to the relevant Councils for their portion of the invoice. This creates an easily managed financial process from the Contractor, Council and the Federal Government’s point of views. It also adds to project control, with this type of centralised administration of regional projects recommended. It does however add to the administrative pressures for the management of regional grants of this magnitude.

It is recommended that consideration of greater levels of administrative support be awarded to regional projects to recognise the greater amount of resourcing required.

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<td>Total Project Cost</td>
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To date Centroc’s Australian Government funded Nexus between Water and Energy Program has achieved an 8% increase in energy efficiency across 18 of the 27 sites where energy efficiency was analysed.

The outcomes included in this report relate to what has been able to be measured in the timeframe for the funding with increased results anticipated over time.

An important consideration in relation to analysis of the outcomes is that the methodology proposed for the energy efficiency improvement calculations, in line with the requirements for funding, assumed that the inflow to the sites correlated to the energy used at those sites with the energy efficiency and inflow at each site analysed.

To provide another level of information for further use, Centroc measured the actual energy usage per site and actual cost savings. This has informed advice on site specific issues relating to:

- Energy usage of other on-site infrastructure
- Treatment processes
- Population increase climate /rainfall

In this respect, the Nexus between Water and Energy Program has laid a solid foundation for future energy efficiency programming across Centroc’s member Councils.

Further regional programming will seek to address site specific issues and lessons learned, in particular, the measurement and monitoring of energy usage to more accurately target where energy efficiency gains can be made.

Capacity has been built amongst our Councils in terms of their understanding of the impact that efficient management of water and waste water systems has on energy usage. The benefit of this to Councils and their communities is an immeasurable outcome of this Program.

NEXT STEPS

As part of the next steps in this Nexus between Water and Energy journey the Centroc Water Utilities Alliance will review the outcomes of the Program including advice relating to site specific issues with a view to scoping further regional programming to achieve greater efficiencies and cost savings.

Of note is the work undertaken in relation to the development of a Regional Water Loss Management Program and the potential for this to be rolled out across Centroc member Councils and Councils outside Centroc’s borders.

Collaboration between Alliance members and the sharing of knowledge gained from participation in the Program will be invaluable in scoping future work including regional rollout of the manhole rehabilitation project completed in Forbes.

In relation to the implementation of Revolving Energy Funds, the Centroc Regional Directors of Corporate Services have commenced reviewing energy system requirements and resourcing within each Council. This is a positive step in raising the profile of future energy efficiency programming and funding at an operational level within Councils.
Collaboration between Alliance members and the sharing of knowledge gained from participation in the Program will be invaluable in scoping future work.

RECOMMENDATIONS

The following recommendations for the Centroc Board and the Australian Government are based on key observations, learnings and recommendations from the Nexus between Water and Energy Program.

It is recommended that the Centroc Board through:

- The Centroc Water Utilities Alliance review the outcomes of the Program including advice relating to site specific issues with a view to scoping further regional programming including:
  - Implementation of a regional manhole rehabilitation program
  - Roll out of the Regional Water Loss Management Program; and
  - Improvements to the measurement and monitoring of energy usage.
- The Centroc Regional Directors of Corporate Services review energy system requirements and resourcing within each Council in relation to the implementation of Revolving Energy Funds.

It is Centroc’s recommendation that the Australian Government:

- Continue funding energy efficient programs for Local Government giving consideration to the timeframes for pre and post project work needed to verify energy efficiency gains.
- Consider incremental process improvement of the funding model for this program going forward.
- Utilise Local Government regionally to achieve results from a broader base with less risk/work at the Australian Government level for project management.
- Consider a separate funding stream recognising the value to the Australian Government of aggregated project management.
- As Local Government administration has accountability and transparency inherent in its operations, consider regional funding rounds that are more outcomes focused for Local Government and less focused on milestone reporting. Should this be achieved it is recommended that:
  - appropriate risk management controls be put in place; and
  - frequent tailored quality stops are included in Project Plans particularly for complex regional program with multiple activities and stakeholders.
- Review amount attributed to administrative support for regional programs to recognise the greater amount of resourcing required.
- Maximize the growth in capacity and understanding of the operating environment of Local Government of CEEP case managers.
- Recognise that the same logo and branding for the life of the program is preferable to communicating a clear, consistent and positive message about the program and its activities.

ACKNOWLEDGEMENTS

Centroc thanks the Australian Government for the opportunity to build on the work completed in the Central NSW region through CEEP Round 1 with funding in CEEP Round 2 and acknowledge the tremendous support provided by CEEP Program Managers with specific mention of Ms Emma Cole for her expertise and guidance.
The Centroc CEEP2 Program Manager, Ms Meredith Macpherson also acknowledges the support and hard work of Centroc staff in the delivery of this Program:

- Ms Jenny Bennett, Executive Officer
- Ms Kate Barker, Energy & Training Program Manager
- Ms Lee Chapman, Cost Savings & Compliance Program Manager
- Ms Ann Thomas, Finance Officer
- Ms Verity Page, Executive Assistant

Special mention must also be made of the Centroc Water Utilities Alliance without whom this Program would not have been possible.

Centroc looks forward to implementing more energy efficient activities for its members and their communities and to sharing this with other Councils.
Site by Site Specific Advice

Waste Water Treatment Works
Sewer Infiltration Remediation—Pipe Relining

Bathurst received $65,000 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping water/waste water.

TECHNOLOGY

Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm /flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 21.7% (588ML) over the 7 months between October 2014 and April 2015, compared to the baseline period of October 2011 to April 2012.

The energy consumption at the site has remained relatively stable between the period prior to and after the completion of the work.

Chart 1 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October...
2011 to April 2012, and October 2014 to April 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of rainfall, however post works, it appears to have less of an effect on inflow.

Chart 2 shows the trends for ML/day and kWh/ML. The ML/day since the work was completed has decreased by around 20% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Bathurst Waste Water Treatment Works was approximately 1.3% of the entire network that leads to the site.
- During March 2012 there was intense rainfall in Bathurst, where 121mm of rain fell over a 5 day period. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.
- The Waste Water Treatment Plant is a continuous operation plant rather than a batch operation. This means that the energy consumed by the plant is unlikely to reduce, despite the large reduction in inflow.
- The population of Bathurst has grown by approximately 1.04% (1722 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.
- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the *Nexus between Water and Energy Program* with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
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<td><strong>Activity Type and Measure</strong></td>
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<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
</tr>
</tbody>
</table>
| • Inflow - 4319 ML pa  
| • 1,723m to be relined (0.44% of total system)  
| • Total system = 391.4km  
| • New inflow– 3893 ML pa |
| **Cost of Activity** | $160,000 |
| **Estimated Cost Savings** | $430 pa |
| **Adjusted baseline energy usage** | 1,858,170 kWh (1/10/2011-30/4/2012) |
| **Adjusted baseline inflow** | 2,706 ML |
| **Adjusted baseline energy efficiency** | 687 kWh x 3.6 = 2,473 MJ per ML |
| **Adjusted baseline rainfall** | 679mm |
| **Post works energy usage** | 1,897,420 kWh (1/10/2014-30/4/2015) |
| **Post works inflow** | 2,118 ML |
| **Post works energy efficiency** | 896 kWh x 3.6 = 3,226 MJ per ML |
| **Post works rainfall** | 406mm |
| **Cost savings** | There has been no reduction in the amount of energy consumed at the site, despite there being a significant reduction in the volume of inflow. Due to the Waste Water Treatment Works being a continuous operation, it is difficult to demonstrate cost savings. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site. |
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council. There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period. On completion of the pipe relining, the inflow to the site had decreased by 27% (55.4ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2011 to March 2012.

The energy consumption at the site has reduced by 15% (18,431 kWh) between the period prior to and after the completion of the work, or 36,862 kWh per annum.

Chart 3 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the period prior to and after the completion of the work. Chart 4 shows the trends of ML/day and kWh/ML.
rainfall (mm) for the periods of October 2011 to March 2012, and October 2014 to March 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of intense rainfall, however post works, it appears to have less of an effect on inflow.

Chart 4 shows the trends for ML/day and kWh/ML. The kL/day since the work was completed has reduced by around 27% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

♦ The pipe relining undertaken upstream of the Blayney Treatment Works was approximately 1.16% of the entire network that leads to the site.

♦ During March 2012 there was intense rainfall in Blayney, where 85mm of rain fell over a 2 day period. The inflow to the site during the 2 days of rain was 12.39ML, which was well above the daily average. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.

♦ The population of Blayney has grown by approximately 1.03% (192 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;

♦ Roll-out of the Regional Water Loss Management Program; and

♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
Blayney Shire Council - Treatment Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
</tbody>
</table>
| **Reporting Data (Measuring Energy Efficiency and Additional Data)** | • Inflow - 360 ML pa  
• 593m to be relined (1.16% of total system)  
• Total system - 51.2km  
• New inflow – 337 ML pa |
| **Cost of Activity** | $67,500 |
| **Estimated Cost Savings** | $3,206pa |
| **Adjusted baseline energy usage** | 120,143 kWh (1/10/2011-31/3/2012) |
| **Adjusted baseline inflow** | 202.2ML |
| **Adjusted baseline energy efficiency** | 594 kWh x 3.6 = 2,138 MJ per ML |
| **Adjusted baseline rainfall** | 669mm |
| **Post works energy usage** | 101,712 kWh (1/10/2014-31/3/2015) |
| **Post works inflow** | 146.8 ML |
| **Post works energy efficiency** | 692 kWh x 3.6 = 2,491 MJ per ML |
| **Post works rainfall** | 222mm |
| **Cost savings** | $1,678 per annum |
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

**ENERGY EFFICIENCY**

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 27% (41.5ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2011 to March 2012.

The energy consumption at the site has reduced by 54% (15,274 kWh) between the period prior to and after the completion of the work, or 30,548 kWh per annum.

Chart 5 shows the patterns of energy consumption, inflow, and rainfall.
consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to March 2012, and October 2014 to March 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of intense rainfall, however post works, it appears to have less of an effect on inflow.

Chart 6 shows the trends for ML/day and kWh/ML. The kL/day since the work was completed has reduced by around 27% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

♦ The pipe relining undertaken upstream of Pump Station 1 was approximately 1.55% of the entire network that leads to the site.
♦ The inflow to Pump Station 1 is not measured, so the inflow is estimated as 75% of the total flow to the Treatment Plant.
♦ During March 2012 there was intense rainfall in Blayney, where 85mm of rain fell over a 2 day period. The inflow to the site during the 2 days of rain was 9.29ML, which was well above the daily average. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.
♦ The population of Blayney has grown by approximately 1.03% (192 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including: Implementation of a regional manhole rehabilitation program; Roll-out of the Regional Water Loss Management Program; and Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

Blayney Shire Council - Pump Station 1
**Blayney Shire Council**

<table>
<thead>
<tr>
<th>Building, Facility or Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
</tbody>
</table>

**Reporting Data (Measuring Energy Efficiency and Additional Data)**
- Inflow – 270 ML pa
- 593m to be relined (1.55% of total system)
- Total system - 38.2km
- New inflow - 253 ML pa (6%)
- 75% of total catchment flows through this site

| Cost of Activity | $67,500 |
| Estimated Cost Savings | $313 pa |

| Adjusted baseline energy usage | 28,110 kWh (1/10/2011-31/3/2012) |
| Adjusted baseline inflow | 151.6 ML (75% of 202.2 ML) |
| Adjusted baseline energy efficiency | 185 kWh x 3.6 = 666 MJ per ML |
| Adjusted baseline rainfall | 670.8mm |

| Post works energy usage | 12,836 kWh (1/10/2014-31/3/2015) |
| Post works inflow | 110.1 ML (75% of 147.8 ML) |
| Post works energy efficiency | 117 kWh x 3.6 = 421 MJ per ML |
| Post works rainfall | 222mm |

Cost savings: $8,889 per annum
Sewage Treatment Works
Sewer Infiltration Remediation—Pipe Relining

Boorowa received $27,000 in matched funding for a sewer infiltration project and audit of water loss that will reduce energy and costs associated with pumping water/waste water.

TECHNOLOGY

Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had increased by 2% (640kL) over the 3 months between October 2014 and January 2015, compared to the baseline period of September 2012 to December 2012.

The energy consumption at the site has reduced by 9% (56 kWh) between the period prior to and after the completion of the work, or 224 kWh per annum.

Chart 7 shows the patterns of energy consumption (kWh), inflow (ML) and rainfall (mm) over the period before and after the pipe relining. Chart 8 shows the trends for kl/day and kWh/ML.
rainfall (mm) for the periods of September 2012 to December 2012, and October 2014 to January 2015.

Chart 8 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 12% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Sewage Treatment Works was approximately 3% of the entire network that leads to the site.
- The Sewage Treatment Works is a trickling filter plant, using microorganisms for treatment with generally low power consumption.
- The Sewage Treatment Works is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
- The population of Boorowa has grown by approximately 1.05% (123 people) between 2011 and 2014.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
### Boorowa Council - Sewage Treatment Works

<table>
<thead>
<tr>
<th>Building, Facility or Site 4</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Boorowa Council - Sewage Treatment Works</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Long Street, Boorowa NSW 2586</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Treatment Works</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>24,582 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>263 kWh x 3.6 = 947 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 11.5 ML pa = 10,891 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>- Inflow – 93.5 ML pa</td>
<td></td>
</tr>
<tr>
<td>- 502.4m to be relined (3% of total system)</td>
<td></td>
</tr>
<tr>
<td>- Total system -16.5km</td>
<td></td>
</tr>
<tr>
<td>- New inflow– 82 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$25,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$449 pa</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>595 kWh (20/9/2012-19/12/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>37.35 ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>16 kWh x 3.6 = 58 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>100.7mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>539 kWh (1/10/14-6/1/15)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>37.99 ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>14 kWh x 3.6 = 50 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>92.6mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$65 per annum</td>
</tr>
</tbody>
</table>
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 11% (2.95ML) over the 3 months between October 2014 and January 2015, compared to the baseline period of September 2011 to December 2011.

The energy consumption at the site has reduced by 6% (110 kWh) between the period prior to and after the completion of the work, or 440 kWh per annum.
Chart 9 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of September 2011 to December 2011, and October 2014 to January 2015.

Chart 10 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 23% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Campbell Street Pump Station was approximately 2% of the entire network that leads to the site.
- 67% of the total catchment that leads to the Sewage Treatment Works flows through the Campbell Street Pump Station.
- The Campbell Street Pump Station is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
- The population of Boorowa has grown by approximately 1.05% (123 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
<table>
<thead>
<tr>
<th>Building, Facility or Site 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reporting Data (Measuring Energy Efficiency and Additional Data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inflow - 63 ML pa</td>
</tr>
<tr>
<td>• 235m to be relined (2% of total system)</td>
</tr>
<tr>
<td>• Total system - 11km</td>
</tr>
<tr>
<td>• New inflow - 55 ML pa</td>
</tr>
<tr>
<td>• 67% of total catchment flows through this site</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost of Activity</th>
<th>$30,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost Savings</td>
<td>$245 pa</td>
</tr>
<tr>
<td>Adjusted baseline energy usage</td>
<td>1,700 kWh (26/9/2011-20/12/2011)</td>
</tr>
<tr>
<td>Adjusted baseline inflow</td>
<td>26.89 ML</td>
</tr>
<tr>
<td>Adjusted baseline energy efficiency</td>
<td>63 kWh x 3.6 = 226.8 MJ per ML</td>
</tr>
<tr>
<td>Adjusted baseline rainfall</td>
<td>248mm</td>
</tr>
<tr>
<td>Post works energy usage</td>
<td>1,590 kWh (1/10/2014-7/1/2015)</td>
</tr>
<tr>
<td>Post works inflow</td>
<td>23.94 ML</td>
</tr>
<tr>
<td>Post works energy efficiency</td>
<td>66 kWh x 3.6 = 237.6 MJ per ML</td>
</tr>
<tr>
<td>Post works rainfall</td>
<td>92.6mm</td>
</tr>
<tr>
<td>Cost savings</td>
<td>$128 per annum</td>
</tr>
</tbody>
</table>
As the work completed at the Boorowa Water Treatment Plant involved an audit, no technology was installed. NSW Public Works was contracted to complete a site inspection to examine the conditions and power consumption of major energy consuming apparatus, machinery and operations that may gain energy efficiency at the WTP. The audit included a review of production water loss, specifically lagoon leakage.

The final report provides a current state analysis of major energy consuming apparatus (kWh and $) and a post inspection analysis of civil, process, electrical and mechanical aspects of the water treatment plant. It recommends a costed system of work and/or optimisation of process and a projected energy consumption reduction (kWh and $). For more details refer to Case Study.

ENERGY EFFICIENCY

Boorowa Council engaged NSW Public Works to assist in determining potential energy savings and other cost saving measures at the Boorowa Water Treatment Plant (WTP).

Further information on the work undertaken at this site can be found in the Case Study.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Building, Facility or Site 6

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site</th>
<th>Boorowa Council - Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Geraldine Street, Boorowa NSW 2586</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Audit of Water Loss</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>91,320 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>435 x 3.6 = 1,566 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 15 ML = 23,490 MJ pa</td>
</tr>
</tbody>
</table>
| Reporting Data (Measuring Energy Efficiency and Additional Data) | Inflow – 210 ML pa  
New inflow= 195 ML pa |
| Cost of Activity                  | $14,000                                 |
| Estimated Cost Savings            | $1,958 pa                               |
THE NEXUS BETWEEN WATER AND ENERGY

Molong Sewage Treatment Plant
Sewer Infiltration Remediation—Pipe Relining

Cabonne received $125,000 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping water/waste water.

TECHNOLOGY

Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm /flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 27% (9.3ML) over the 3 months between October 2014 and December 2014, compared to the baseline period of October 2011 to January 2012.
The energy consumption at the site has increased by 3% (535 kWh) between the period prior to and after the completion of the work, or 2,140 kWh per annum.

Chart 11 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to January 2012, and October 2014 to December 2014.

Chart 21 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 30% compared to the periods prior.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:
- The pipe relining undertaken upstream of the Molong Sewerage Treatment Plant was approximately 6.7% of the entire network that leads to the site.
- The Molong Sewerage Treatment Plant is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
- The population of Molong has grown by approximately 1.04% (17 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
### Cabonne Council - Molong Sewage Treatment Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Cabonne Council - Molong Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Wellington Road, Molong 2866</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>76,577 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>473 kWh x 3.6 = 1,703 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 6 ML = 10,218 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inflow – 162 ML pa</td>
</tr>
<tr>
<td></td>
<td>• 1623m to be relined (6.7% of total system)</td>
</tr>
<tr>
<td></td>
<td>• Total system – 24.3km</td>
</tr>
<tr>
<td></td>
<td>• New inflow– 156 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$125,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$840</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>20,197 kWh (6/10/2011-10/1/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>34.75 ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>581 kWh x 3.6 = 2,092 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>268.6 mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>20,732 kWh (1/10/2014-8/12/2014)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>25.5 ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>813 kWh x 3.6 = 2,927 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>145mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>There has been no reduction in the amount of energy consumed at the site since the pipe relining work was completed, despite there being a significant reduction in the volume of inflow. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.</td>
</tr>
</tbody>
</table>
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm /flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/ Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

**ENERGY EFFICIENCY**

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 40% (17ML) over the 3 months between November 2014 and January 2015, compared to the baseline period of November 2011 to January 2012.

The energy consumption at the site shows a decrease of 80% however it is thought that this is an inaccurate figure as the electricity bill was estimated and an actual
read has not occurred since mid-2014.

Chart 13 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of November 2011 to January 2012, and November 2014 to January 2015.

Chart 14 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 39% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

♦ The pipe relining undertaken upstream of the Canowindra Sewerage Treatment Plant was approximately 4.7% of the entire network that leads to the site.
♦ The Canowindra Sewerage Treatment Plant is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
♦ There have been issues with the electricity meter gaining access to the site, and many of the electricity bills from July 2014 onward have been estimated. Until the site has an actual read, the energy consumption at the site is uncertain.
♦ The population of Canowindra has grown by approximately 1.04% (15 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Cabonne Council

<table>
<thead>
<tr>
<th>Building, Facility or Site</th>
<th>Cabonne Council - Canowindra Sewage Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Building, Facility or Site</td>
<td>Cabonne Council - Canowindra Sewage Treatment Plant</td>
</tr>
<tr>
<td>Location (address)</td>
<td>Wenz Lane, Canowindra 2804</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Sewage Treatment Plant</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>19,531 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>127 kWh x 3.6 = 457 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 7 ML = 3,199 MJ pa</td>
</tr>
<tr>
<td>Reporting Data (Measuring Energy Efficiency and Additional Data)</td>
<td></td>
</tr>
<tr>
<td>Inflow – 154 ML pa</td>
<td></td>
</tr>
<tr>
<td>1415m to be relined (4.7% of total system)</td>
<td></td>
</tr>
<tr>
<td>Total system – 29.8km</td>
<td></td>
</tr>
<tr>
<td>New inflow – 147 ML pa</td>
<td></td>
</tr>
<tr>
<td>Cost of Activity</td>
<td>$125,000</td>
</tr>
<tr>
<td>Estimated Cost Savings</td>
<td>$284 pa</td>
</tr>
<tr>
<td>Adjusted baseline energy usage</td>
<td>8,733 kWh (7/11/2011-8/2/2012)</td>
</tr>
<tr>
<td>Adjusted baseline inflow</td>
<td>43.545 ML</td>
</tr>
<tr>
<td>Adjusted baseline energy efficiency</td>
<td>201 kWh x 3.6 = 724 MJ per ML</td>
</tr>
<tr>
<td>Adjusted baseline rainfall</td>
<td>388.7 mm</td>
</tr>
<tr>
<td>Post works energy usage</td>
<td>1,320 kWh (1/11/2014-31/1/2015)</td>
</tr>
<tr>
<td>Post works inflow</td>
<td>26.262 ML</td>
</tr>
<tr>
<td>Post works energy efficiency</td>
<td>50 kWh x 3.6 = 180 MJ per ML</td>
</tr>
<tr>
<td>Post works rainfall</td>
<td>157.1 mm</td>
</tr>
<tr>
<td>Cost savings</td>
<td>$8,629 per annum</td>
</tr>
</tbody>
</table>
Caravan Park Pump Station

Sewer Infiltration Remediation—Pipe Relining

Cowra received $477,688 in matched funding for a sewer infiltration project that will reduce energy and costs associated with pumping water/waste water.

TECHNOLOGY

Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 29% (10.6ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2011 to March 2012.

The energy consumption at the site has
decreased by 10% (1,390 kWh) between the period prior to and after the completion of the work, or 2,780 kWh per annum.

Chart 15 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to March 2012, and October 2014 to March 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of rainfall, however post works, it appears to have less of an effect on inflow.

Chart 16 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 29% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:
♦ The pipe relining undertaken upstream of the Caravan Park Pump Station was approximately 42.3% of the entire network that leads to the site.
♦ 26% of the total catchment that leads to the Sewage Treatment Plant flows through the Caravan Park Pump Station.
♦ During February and March 2012 there was intense rainfall in Cowra, where 166mm of rain fell over a 7 day period. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.
♦ The population of Cowra has grown by approximately 1% (51 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
# Cowra Shire Council - Caravan Pump Station

<table>
<thead>
<tr>
<th>Building, Facility or Site 9</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Cowra Shire Council - Caravan Pump Station</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Lachlan Street, Cowra NSW 2794</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Pump Station</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>32,611 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>191 kWh x 3.6 = 688 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 7 ML = 4,816 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
</tbody>
</table>
|  | • Inflow – 171 ML pa  
|  | • 5,597m to be relined  
|  | • Total system - 16.962km  
|  | • New inflow–164 ML pa  
|  | • 26% of total catchment flows through this site |
| **Cost of Activity** | $357,500 |
| **Estimated Cost Savings** | $329 pa |
| **Adjusted baseline energy usage** | 14,250 kWh (1/10/2011-31/3/2012) |
| **Adjusted baseline inflow** | 36.7ML |
| **Adjusted baseline energy efficiency** | 388 kWh x 3.6 = 1,397 MJ per ML |
| **Adjusted baseline rainfall** | 716.9mm |
| **Post works energy usage** | 12,860 kWh (1/10/2014-31/3/2015) |
| **Post works inflow** | 26.1ML |
| **Post works energy efficiency** | 493 kWh x 3.6 = 1,775 MJ per ML |
| **Post works rainfall** | 209.4mm |
| **Cost savings** | $809 per annum |
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 54% (31.7ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2011 to March 2012.

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**TECHNOLOGY**

**ENERGY EFFICIENCY**

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Chart 17—Cowra Showground Pump Station Energy Consumption, Inflow & Rainfall

Chart 18—Cowra Showground Pump Station Trends for kL/day & kWh/ML
The energy consumption at the site has decreased by 2% (134 kWh) between the period prior to and after the completion of the work, or 268 kWh per annum.

Chart 17 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to March 2012, and October 2014 to March 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of rainfall, however post works, it appears to have less of an effect on inflow.

Chart 18 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 54% compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Showground Pump Station was approximately 7.1% of the entire network that leads to the site.
- 20% of the total catchment that leads to the Sewage Treatment Plant flows through the Showground Pump Station.
- The electricity bills for the site were estimated during early 2015.
- During February and March 2012 there was intense rainfall in Cowra, where 166mm of rain fell over a 7 day period. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.
- The population of Cowra has grown by approximately 1% (51 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
**Cowra Shire Council**

<table>
<thead>
<tr>
<th>Building, Facility or Site 10</th>
<th>Cowra Shire Council – Showground Pump Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Building, Facility or Site</td>
<td>Cowra Shire Council – Showground Pump Station</td>
</tr>
<tr>
<td>Location (address)</td>
<td>Grenfell Road, Cowra NSW 2794</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Pump Station</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>14,107 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>107 kWh x 3.6 = 385 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 6 ML = 2,310 MJ pa</td>
</tr>
<tr>
<td>Reporting Data (Measuring Energy Efficiency and Additional Data)</td>
<td></td>
</tr>
<tr>
<td>Inflow – 132 ML pa</td>
<td></td>
</tr>
<tr>
<td>1,201m to be relined (9% of total system)</td>
<td></td>
</tr>
<tr>
<td>Total system - 13.142km</td>
<td></td>
</tr>
<tr>
<td>New inflow– 126 ML pa</td>
<td></td>
</tr>
<tr>
<td>20% of total catchment flows through this site</td>
<td></td>
</tr>
<tr>
<td>Cost of Activity</td>
<td>$300,000</td>
</tr>
<tr>
<td>Estimated Cost Savings</td>
<td></td>
</tr>
<tr>
<td>Adjusted baseline energy usage</td>
<td>7,294 kWh (1/10/2011-31/3/2012)</td>
</tr>
<tr>
<td>Adjusted baseline inflow</td>
<td>58.5ML</td>
</tr>
<tr>
<td>Adjusted baseline energy efficiency</td>
<td>125 kWh x 3.6 = 450 MJ per ML</td>
</tr>
<tr>
<td>Adjusted baseline rainfall</td>
<td>717mm</td>
</tr>
<tr>
<td>Post works energy usage</td>
<td>7,160 kWh (1/10/2014-31/3/2015)</td>
</tr>
<tr>
<td>Post works inflow</td>
<td>26.8ML</td>
</tr>
<tr>
<td>Post works energy efficiency</td>
<td>267 kWh x 3.6 = 961 MJ per ML</td>
</tr>
<tr>
<td>Post works rainfall</td>
<td>209mm</td>
</tr>
<tr>
<td>Cost savings</td>
<td>$78 per annum</td>
</tr>
</tbody>
</table>
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 8% (21ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2011 to March 2012.

The energy consumption at the site has decreased by 6% (15,233 kWh) between the period prior to and after the completion of the work, or 30,466 kWh.
per annum.

Chart 19 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to March 2012, and October 2014 to March 2015. From the chart it can be seen that prior to the works, the inflow seemed to peak during times of rainfall, however post works, it appears to have less of an effect on inflow.

Chart 20 shows the trends for ML/day and kWh/ML. The ML/day since the work was completed has reduced by 7% compared to the periods prior.

FACTORs EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

♦ The pipe relining undertaken upstream of the Sewerage Treatment Plant was approximately 8.3% of the entire network that leads to the site.
♦ The plant used to be a continuous operation and has now been changed to a batch operation.
♦ The UV unit at the site has been changed
♦ Alterations to the pumps have been made through the management of the aerators.
♦ During February and March 2012 there was intense rainfall in Cowra, where 166mm of rain fell over a 7 day period. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.
♦ The population of Cowra has grown by approximately 1% (51 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Cowra Shire Council - Sewage Treatment Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 11</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Cowra Shire Council - Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>North Logan Road, Cowra NSW 2794</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>28,118 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>43 kWh x 3.6 = 155 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 27 ML = 4185 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>• Inflow – 659 ML pa</td>
<td></td>
</tr>
<tr>
<td>• 8,032m to be relined (8.3% of total system)</td>
<td></td>
</tr>
<tr>
<td>• Total system - 95.9km</td>
<td></td>
</tr>
<tr>
<td>• New inflow– 632 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$357,500</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$121</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>265,832 kWh (1/10/2011-31/3/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>273ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>974 kWh x 3.6 = 3,506 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>717mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>250,599 kWh (1/10/2014-31/3/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>252ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>994 kWh x 3.6 = 3,578 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>209mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$1,387 per annum</td>
</tr>
</tbody>
</table>
Forbes Shire Council

Sewer Pump 6A
Manhole rehabilitation

Forbes received $50,081 in matched funding for a sewer infiltration project that will reduce energy and costs associated with pumping water/waste water.

TECHNOLOGY

Forbes Shire Council undertook to reduce infiltration to the sewer network through the replacement of access chamber (manhole) lids. This was based on earlier smoke testing work indicating that a large number of manhole lids were defective and allowing water inflow to the Council’s sewer mains. By replacing the lids and reducing this inflow, there would be energy savings from reduced pumping costs at the pump stations and sewer treatment plant.

Council received three quotations for the work and contracted local plumbing contractors, Complete Plumbing. The work involved the replacement of the manhole lids and surrounds with new cast iron lids which are much more water tight and durable than the older concrete lids and surrounds. 76 manhole lids in various locations including backyards, footpaths and roadways were replaced.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the manhole rehabilitation, the inflow to the site had increased significantly over the 3 months between November 2014 and February 2015, compared to the baseline period of November 2012 to February 2013.

The energy consumption at the site has decreased by 1% (16 kWh) between the period prior to and after the completion of the work, or 64 kWh per annum.

Chart 21 shows the patterns of energy consumption (kWh), inflow (ML) and rainfall.
rainfall (mm) for the periods of November 2012 to February 2013, and November 2014 to February 2015.

Chart 22 shows the trends for kL/day and kWh/ML.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

◆ The volume of inflow to the site is not measured, but rather the number of pump starts and the run time of the pumps. The volume has been calculated by multiplying the number of pump starts, by the run time, by the flow rate (L/s).
◆ There are 2 pumps at Pump Station 6A.
◆ Pump Station 6A is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
◆ The population of Forbes has grown by approximately 1.03% (290 people) between 2011 and 2014.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

◆ Implementation of a regional manhole rehabilitation program;
◆ Roll-out of the Regional Water Loss Management Program; and
◆ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
**Forbes Shire Council**

<table>
<thead>
<tr>
<th>Building, Facility or Site 12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Forbes Shire Council – Sewer Pump Station 6A</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Newell Highway, Forbes NSW 2871</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Pumping Station</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Manhole program</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>7,223 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>296 kWh x 3.6 = 1,066 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 0.73ML = 778 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>• Inflow – 24.37 ML pa</td>
<td></td>
</tr>
<tr>
<td>• New inflow– 23.639 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$20,520</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$77</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>1,107 kWh (2/11/2012-5/2/2013)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>25ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>44 kWh x 3.6 = 158 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>54mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>1,091 kWh (14/11/2014-18/2/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>48ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>23 kWh x 3.6 = 83 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>139mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$18 per annum</td>
</tr>
</tbody>
</table>
Sewer Pump 12
Manhole rehabilitation

TECHNOLOGY

Forbes Shire Council undertook to reduce infiltration to the sewer network through the replacement of access chamber (manhole) lids. This was based on earlier smoke testing work indicating that a large number of manhole lids were defective and allowing water inflow to the Councils sewer mains. By replacing the lids and reducing this inflow, there would be energy savings from reduced pumping costs at the pump stations and sewer treatment plant.

Council received three quotations for the work and contracted local plumbing contractors, Complete Plumbing. The work involved the replacement of the manhole lids and surrounds with new cast iron lids which are much more water tight and durable than the older concrete lids and surrounds. 76 manhole lids in various locations including backyards, footpaths and roadways were replaced.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the manhole rehabilitation, the inflow to the site had increased significantly over the 3 months between December 2014 and March 2015, compared to the baseline period of December 2012 to March 2013.

The energy consumption at the site has increased significantly between the period prior to and after the completion of the work.
Chart 23 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of December 2012 to March 2013, and December 2014 to March 2015.

Chart 24 shows the trends for ML/day and kWh/ML.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

♦ The volume of inflow to the site is not measured, but rather the number of pump starts and the run time of the pump. The volume has been calculated by multiplying the number of pump starts, by the run time, by the flow rate (L/s).

♦ There is 1 pump at Pump Station 12.

♦ Pump Station 12 is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.

♦ The population of Forbes has grown by approximately 1.03% (290 people) between 2011 and 2014.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;

♦ Roll-out of the Regional Water Loss Management Program; and

♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Forbes Shire Council—Sewer Pump 12

<table>
<thead>
<tr>
<th>Building, Facility or Site 13</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
</tr>
<tr>
<td>• Inflow – 2.885 ML pa</td>
</tr>
<tr>
<td>• New inflow – 2.856 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
</tr>
</tbody>
</table>
Forbes Shire Council

Sewer Pump 1
Manhole Rehabilitation

TECHNOLOGY

Forbes Shire Council undertook to reduce infiltration to the sewer network through the replacement of access chamber (manhole) lids. This was based on earlier smoke testing work indicating that a large number of manhole lids were defective and allowing water inflow to the Council’s sewer mains. By replacing the lids and reducing this inflow, there would be energy savings from reduced pumping costs at the pump stations and sewer treatment plant.

Council received three quotations for the work and contracted local plumbing contractors, Complete Plumbing. The work involved the replacement of the manhole lids and surrounds with new cast iron lids which are much more water tight and durable than the older concrete lids and surrounds. 76 manhole lids in various locations including backyards, footpaths and roadways were replaced.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the manhole rehabilitation, the inflow to the site had increased significantly over the 3 months between November 2014 and February 2015, compared to the baseline period of October 2012 to January 2013.

The energy consumption at the site has decreased by 51% (4,807 kWh) significantly between the period prior to
and after the completion of the work, or 19,228 kWh per annum.

Chart 25 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2012 to January 2013, and November 2014 to February 2015.

Chart 26 shows the trends for kL/day and kWh/ML.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:

♦ The volume of inflow to the site is not measured, but rather the number of pump starts and the run time of the pump. The volume has been calculated by multiplying the number of pump starts, by the run time, by the flow rate (L/s).

♦ There are 2 pumps at Pump Station 1.

♦ Pump Station 12 is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.

♦ The population of Forbes has grown by approximately 1.03% (290 people) between 2011 and 2014.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the *Nexus between Water and Energy Program* with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;

♦ Roll-out of the Regional Water Loss Management Program; and

♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Forbes Shire Council

<table>
<thead>
<tr>
<th>Building, Facility or Site 14</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Forbes Shire Council - Sewer Pump Station 1</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Lawler Street, Forbes NSW 2871</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Pump Station</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Manhole program</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>22,558 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>296 kWh x 3.6 = 1,066 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 2.28 ML = 2,430 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inflow – 76.11 ML pa</td>
</tr>
<tr>
<td></td>
<td>• New inflow – 73.826 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$20,520</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$215</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>9,342 kWh (10/10/2012-31/1/2013)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>42.3ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>221 kWh x 3.6 = 796 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>59.8mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>4,535 kWh (13/11/2014-11/2/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>69.5ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>65 kWh x 3.6 = 234 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>138.8mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$5,595 per annum.</td>
</tr>
</tbody>
</table>
Forbes Shire Council undertook to reduce infiltration to the sewer network through the replacement of access chamber (manhole) lids. This was based on earlier smoke testing work indicating that a large number of manhole lids were defective and allowing water inflow to the Council’s sewer mains. By replacing the lids and reducing this inflow, there would be energy savings from reduced pumping costs at the pump stations and sewer treatment plant.

**ENERGY EFFICIENCY**

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the manhole rehabilitation, the inflow to the site had increased by 21% (81ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2012 to March 2013.

The energy consumption at the site has decreased by 13% (7,267 kWh) between the period prior to and after the completion of the work, or 14,534 kWh per annum.

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Chart 27—Forbes Sewer Pump 11 Energy Consumption, Inflow & Rainfall

Chart 28—Forbes Sewer Pump 11 Trends for kL/day & kWh/ML
Chart 27 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2012 to March 2013, and October 2014 to March 2015.

Chart 28 shows the trends for kL/day and kWh/ML.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:

- The volume of inflow to the site is not measured, but rather the number of pump starts and the run time of the pumps. The volume has been calculated by multiplying the number of pump starts, by the run time, by the flow rate (L/s).
- There are 3 pumps at Pump Station 11.
- The population of Forbes has grown by approximately 1.03% (290 people) between 2011 and 2014.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.
## Forbes Shire Council—Sewer Pump Station 11

<table>
<thead>
<tr>
<th>Building, Facility or Site</th>
<th>Forbes Shire Council – Sewer Pump Station 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Willow Ave, Forbes NSW 2871</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Pump Station</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Manhole program</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>115,026 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>296 kWh x 3.6 = 1,066 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 12 ML = 12,792 MJ pa</td>
</tr>
</tbody>
</table>
| Reporting Data (Measuring Energy Efficiency and Additional Data) | • Inflow – 388 ML pa  
• New inflow– 376 ML pa |
| Cost of Activity          | $20,520                                      |
| Estimated Cost Savings    | $916                                         |
| Adjusted baseline energy usage | 58,004 kWh (1/10/2012-31/3/2013)            |
| Adjusted baseline inflow  | 391.4ML                                      |
| Adjusted baseline energy efficiency | 148 kWh x 3.6 = 533 MJ per ML               |
| Adjusted baseline rainfall | 208.2mm                                      |
| Post works energy usage   | 50,737 kWh (1/10/2014-31/3/2015)            |
| Post works inflow         | 472.6 ML                                     |
| Post works energy efficiency | 107 kWh x 3.6 = 385 MJ per ML               |
| Post works rainfall       | 238.8mm                                      |
| Cost savings              | $662 per annum.                             |
Forbes Shire Council

Waste Water Treatment Plant
Manhole Rehabilitation

TECHNOLOGY

Forbes Shire Council undertook to reduce infiltration to the sewer network through the replacement of access chamber (manhole) lids. This was based on earlier smoke testing work indicating that a large number of manhole lids were defective and allowing water inflow to the Council's sewer mains. By replacing the lids and reducing this inflow, there would be energy savings from reduced pumping costs at the pump stations and sewer treatment plant.

Council received three quotations for the work and contracted local plumbing contractors, Complete Plumbing. The work involved the replacement of the manhole lids and surrounds with new cast iron lids which are much more water tight and durable than the older concrete lids and surrounds. 76 manhole lids in various locations including backyards, footpaths and roadways were replaced.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had increased significantly over the 3 months between December 2014 and February 2015, compared to the baseline period of December 2011 to March 2012.

The energy consumption at the site has increased by 5% (419 kWh) between the period prior to and after the completion of the work.

Chart 29—Forbes WWTP Energy Consumption, Inflow & Rainfall

Chart 30—Forbes WWTP Trends for kL/day & kWh/ML
Chart 29 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of December 2011 to March 2012, and December 2014 and February 2015.

Chart 30 shows the trends for ML/day and kWh/ML.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:

- The population of Harden has grown by approximately 1.02% (56 people) between 2011 and 2014.
- The Waste Water Treatment Plant is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
# Building, Facility or Site 16

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site</th>
<th>Forbes Shire Council – Waste Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Newell Hwy, Forbes NSW 2871</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Treatment Plant</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Manhole program</td>
</tr>
</tbody>
</table>

## Energy Efficiency Estimate Method

<table>
<thead>
<tr>
<th>Baseline Energy Usage</th>
<th>603,899 kWh pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Energy Efficiency</td>
<td>296 x 3.6 = 1,066 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 41 ML = 43,706 MJ pa</td>
</tr>
</tbody>
</table>

### Reporting Data (Measuring Energy Efficiency and Additional Data)

- Inflow – 2,038 ML pa
- New inflow– 1,997 ML pa

<table>
<thead>
<tr>
<th>Cost of Activity</th>
<th>$20,520</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost Savings</td>
<td>$1,202</td>
</tr>
</tbody>
</table>

### Adjusted Data

- Adjusted baseline energy usage: 242,333 kWh (1/11/2012-31/3/2013)
- Adjusted baseline inflow: 289ML
- Adjusted baseline energy efficiency: 839 kWh x 3.6 = 3,020 MJ per ML
- Adjusted baseline rainfall: 196.2mm

- Post works energy usage: 209,894 kWh (1/11/2014-31/3/2015)
- Post works inflow: 271ML
- Post works energy efficiency: 775 kWh x 3.6 = 2,790 MJ per ML
- Post works rainfall: 142.4mm

| Cost savings       | $3,544 per annum |
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council. There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had increased significantly over the 3 months between December 2014 and February 2015, compared to the baseline period of December 2011 to March 2012.
The energy consumption at the site has increased by 5% (419 kWh) between the period prior to and after the completion of the work.

Chart 31 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of December 2011 to March 2012, and December 2014 and February 2015.

Chart 32 shows the trends for ML/day and kWh/ML.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:

- The population of Harden has grown by approximately 1.02% (56 people) between 2011 and 2014.
- The Waste Water Treatment Plant is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

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Harden received $100,000 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping water/waste water.
**Harden Shire Council – Harden/Murrumburrah Waste Water Treatment Plant**

<table>
<thead>
<tr>
<th>Building, Facility or Site 17</th>
<th>Harden Shire Council – Harden/Murrumburrah Waste Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Building, Facility or Site</td>
<td>Harden Shire Council – Harden/Murrumburrah Waste Water Treatment Plant</td>
</tr>
<tr>
<td>Location (address)</td>
<td>Araluen Rd, Murrumburrah NSW 2587</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Treatment Plant</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>28,136 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>240 kWh x 3.6 = 864 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 2 ML = 1,728 MJ pa</td>
</tr>
<tr>
<td>Reporting Data (Measuring Energy Efficiency and Additional Data)</td>
<td></td>
</tr>
<tr>
<td>• Inflow – 117 ML pa</td>
<td></td>
</tr>
<tr>
<td>• 1,123m to be relined (3.4% of total system)</td>
<td></td>
</tr>
<tr>
<td>• Total system – 33.3km</td>
<td></td>
</tr>
<tr>
<td>• New inflow– 115 ML pa</td>
<td></td>
</tr>
<tr>
<td>Cost of Activity</td>
<td>$240,000</td>
</tr>
<tr>
<td>Estimated Cost Savings</td>
<td>$162</td>
</tr>
<tr>
<td>Adjusted baseline energy usage</td>
<td>8,190 kWh (13/12/2011-20/3/2012)</td>
</tr>
<tr>
<td>Adjusted baseline inflow</td>
<td>8.2ML</td>
</tr>
<tr>
<td>Adjusted baseline energy efficiency</td>
<td>999 kWh x 3.6 = 3,596 MJ per ML</td>
</tr>
<tr>
<td>Adjusted baseline rainfall</td>
<td>404.8mm</td>
</tr>
<tr>
<td>Post works energy usage</td>
<td>8,609 (16/12/2014-25/2/2015)</td>
</tr>
<tr>
<td>Post works inflow</td>
<td>21ML</td>
</tr>
<tr>
<td>Post works energy efficiency</td>
<td>405 kWh x 3.6 = 1,458 MJ per ML</td>
</tr>
<tr>
<td>Post works rainfall</td>
<td>116.8mm</td>
</tr>
<tr>
<td>Cost savings</td>
<td>No cost savings can be identified at this time as neither the inflow or the energy consumption at the site has reduced since the pipe relining work was completed. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.</td>
</tr>
</tbody>
</table>
Pump Station Cook St
Water Loss Management

Lithgow received $138,340 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping water/waste water.

TECHNOLOGY

Through a collaborative project between Parkes and Lithgow, a pilot project for the monitoring, assessment, location and repair of economically feasible leakage and water losses throughout the entire water network to reduce the energy consumed in treating and transferring water losses has been completed. This work will be on-going and has informed the development of a Water Loss Management Toolkit as detailed in the Case Study.

ABB Aquamaster and Watermaster’s flow meters have been installed at the outlet of each service reservoir. Aquamasters are an all renewable energy type with a battery and solar panel for supply of data logger power installed on sites without mains supply. ABB Watermasters were installed at reservoirs where mains supply is available.

District Metered Areas were fitted with a Pressure logging device linked to telemetry for remote monitoring. A software program, Visenti linked via telemetry has been installed to monitor critical pressure points and flow.

The system will allow Council to better anticipate water loss through the network further increasing the energy efficiency of the Water Treatment Plant and Water Pump Stations.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) and dividing it by the volume of inflow (ML) to the site during the same period. The energy efficiency of the Lithgow Water Treatment Plant is 2.17kWh/ML.

The work undertaken as part of the Water Loss Management at this site estimates that once the work is completed, there will be a reduction of 66L per connection per day, or 141 ML per year.

The estimated cost savings on completion of the work is $16 per year.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
◆ Implementation of a regional manhole rehabilitation program;
◆ Roll-out of the Regional Water Loss Management Program; and
◆ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
### Lithgow City Council—Cook Street Pump Station

<table>
<thead>
<tr>
<th>Building, Facility or Site 18</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Lithgow City Council – Cook Street Pump Station</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Cook St, Lithgow NSW 2790</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Pump Station</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Water loss management</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>950 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>0.68 kWh x 3.6 = 2.4 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 154 ML = 370 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>• Inflow – 1401 ML pa</td>
<td></td>
</tr>
<tr>
<td>• New Inflow– 1247 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$30,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$48</td>
</tr>
</tbody>
</table>
Through a collaborative project between Parkes and Lithgow, a pilot project for the monitoring, assessment, location and repair of economically feasible leakage and water losses throughout the entire water network to reduce the energy consumed in treating and transferring water losses has been completed. This work will be on-going and has informed the development of a Water Loss Management Toolkit as detailed in the Case Study.

ABB Aquamaster and Watermaster’s flow meters have been installed at the outlet of each service reservoir. Aquamasters are an all renewable energy type with a battery and solar panel for supply of data logger power installed on sites without mains supply. ABB Watermasters were installed at reservoirs where mains supply is available.

District Metered Areas were fitted with a Pressure logging device linked to telemetry for remote monitoring. A software program, Visenti linked via telemetry has been installed to monitor critical pressure points and flow

The system will allow Council to better anticipate water loss through the network further increasing the energy efficiency of the Water Treatment Plant and Water Pump Stations.

The energy efficiency was calculated by taking the electricity usage (kWh) and dividing it by the volume of inflow (ML) to the site during the same period. The energy efficiency of the Lithgow Water Treatment Plant is 229.34kWh/ML.

The work undertaken as part of the Water Loss Management at this site estimates that once the work is completed, there will be a reduction of 66L per connection per day, or 141 ML per year.

The estimated cost savings on completion of the work is $2,087 per year.

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Lithgow City Council—Treatment Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 19</th>
<th>Lithgow City Council – Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Building, Facility or Site</td>
<td>Lithgow City Council – Treatment Plant</td>
</tr>
<tr>
<td>Location (address)</td>
<td>Bell Road, Lithgow NSW 2790</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Treatment Plant</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Water loss management</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>87,138 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>62 kWh x 3.6 = 223 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 224 ML = 49,952 MJ pa</td>
</tr>
</tbody>
</table>
| Reporting Data (Measuring Energy Efficiency and Additional Data) | Inflow – 1401 ML pa  
New inflow – 1177 ML pa |
| Cost of Activity | $320,000 |
| Estimated Cost Savings | $76,631 |
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm /flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 7% (14ML) over the 7 months between October 2014 and April 2015, compared to the baseline period of October 2011 to April 2012.

The energy consumption at the site has increased by 2% (890 kWh) between the period prior to and after the completion of the work.
Chart 33 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October to April 2011-2015.

Chart 34 shows the trends for kL/day and kWh/ML. The kL/day since the work was completed has reduced by 7%, compared to the periods prior.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:
♦ The pipe relining undertaken upstream of the Sewage Treatment Works was approximately 2.2% of the entire network that leads to the site.
♦ The population of Oberon has grown by approximately 1.02% (118 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
<table>
<thead>
<tr>
<th>Building, Facility or Site 20</th>
<th>Oberon Council – Sewage Treatment Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Building, Facility or Site</td>
<td>Oberon Council – Sewage Treatment Works</td>
</tr>
<tr>
<td>Location (address)</td>
<td>Curtis St, Oberon NSW 2787</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Treatment Works</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>79,104 kWh pa</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>199 kWh x 3.6 = 716 MJ per ML</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Reduction of 48 ML = 34,368 MJ pa</td>
</tr>
<tr>
<td>Reporting Data (Measuring Energy Efficiency and Additional Data)</td>
<td></td>
</tr>
<tr>
<td>Inflow – 397 ML pa</td>
<td></td>
</tr>
<tr>
<td>864m to be relined (2.2% of total system)</td>
<td></td>
</tr>
<tr>
<td>Total system – 39km</td>
<td></td>
</tr>
<tr>
<td>New inflow– 349 ML pa</td>
<td></td>
</tr>
<tr>
<td>Cost of Activity</td>
<td>$107,500</td>
</tr>
<tr>
<td>Estimated Cost Savings</td>
<td>$2,397</td>
</tr>
<tr>
<td>Adjusted baseline energy usage</td>
<td>42,484 kWh (1/10/2011-30/4/2012)</td>
</tr>
<tr>
<td>Adjusted baseline inflow</td>
<td>205ML</td>
</tr>
<tr>
<td>Adjusted baseline energy efficiency</td>
<td>207 kWh x 3.6 = 745 MJ per ML</td>
</tr>
<tr>
<td>Adjusted baseline rainfall</td>
<td>742mm</td>
</tr>
<tr>
<td>Post works energy usage</td>
<td>43,374 kWh (1/10/2014-30/4/2015)</td>
</tr>
<tr>
<td>Post works inflow</td>
<td>191ML</td>
</tr>
<tr>
<td>Post works energy efficiency</td>
<td>227 kWh x 3.6 = 817 MJ per ML</td>
</tr>
<tr>
<td>Post works rainfall</td>
<td>521mm</td>
</tr>
<tr>
<td>Cost savings</td>
<td>There has been no reduction in the amount of energy consumed at the site, despite there being a significant reduction in the volume of inflow. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.</td>
</tr>
</tbody>
</table>
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had increased significantly over the 3 months between November 2014 and January 2015, compared to the baseline period of November 2012 to January 2013.
The energy consumption at the site has also increased between the period prior to and after the completion of the work.

Chart 35 shows the patterns of energy consumption (MWh), inflow (ML), rainfall (mm) and energy efficiency (kWh/ML) for the periods of November 2012 to January 2013, and November 2014 and January 2015.

Chart 36 shows the trends for ML/day and inflow (ML) for the periods between October 2011 to March 2012 and October 2014 to March 2015. The ML/day since the work was completed has reduced by 10%, compared to the same period in 2011-2012. The inflow for the period October 2014 to March 2015 has also reduced by 10% compared to the same period in 2011-2012.

FACTORS EFFECTING THE RESULTS

From interviews with staff, factors effecting results were as follows:
- The pipe relining undertaken upstream of the Sewage Pumping Station was approximately 2% of the entire network that leads to the site.
- The Sewage Pumping Station is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
- The population of Oberon has grown by approximately 1.02% (118 people) between 2011 and 2014.

BENEFITS

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
Oberon Council – Sewage Pumping Station

<table>
<thead>
<tr>
<th>Building, Facility or Site 21</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Oberon Council – Sewage Pumping Station</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Fairfax St, Oberon NSW 2787</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Pumping Station</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>89,709 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>$110 \text{ kWh} \times 3.6 = 396 \text{ MJ per ML}$</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 97 ML = 38,412 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
</tbody>
</table>
|  | • Inflow – 813 ML pa  
|  | • 864m to be relined (2% of total system)  
|  | • Total system – 40km  
|  | • New inflow – 716 ML pa |
| **Cost of Activity** | $107,500 |
| **Estimated Cost Savings** | $2,241 |
| **Adjusted baseline energy usage** | 6,654 (7/11/2012-23/1/2013) |
| **Adjusted baseline inflow** | 51ML |
| **Adjusted baseline energy efficiency** | $130 \text{ kWh} \times 3.6 = 468 \text{ MJ per ML}$ |
| **Adjusted baseline rainfall** | 58mm |
| **Post works energy usage** | 9,155 (1/11/14-31/1/2015) |
| **Post works inflow** | 83ML |
| **Post works energy efficiency** | $111 \text{ kWh} \times 3.6 = 400 \text{ MJ per ML}$ |
| **Post works rainfall** | 257mm |

**Cost savings**

No cost savings can be identified at this time as neither the inflow or the energy consumption at the site has reduced since the pipe relining work was completed. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.
TECHNOLOGY
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY
The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 25% (625ML) over the 7 months between October 2014 and April 2015, compared to the baseline period of October 2011 to April 2012.

Orange received $220,690 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping waste water/waste water.
The energy consumption at the site has increased by 6% between the period prior to and after the completion of the work.

Chart 37 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to April 2012, and October 2014 and April 2015.

Chart 38 shows the trends for ML/day and inflow (ML) for the periods between October 2011 to April 2012 and October 2014 to April 2015. The ML/day since the work was completed has reduced by 25%, compared to the same period in 2011-2012. From the charts it can be seen that prior to the works, the inflow seemed to peak during times of rainfall, however post works, it appears to have less of an effect on inflow.

FACTORS EFFECTING THE RESULTS
From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Sewerage Treatment Works was approximately 0.6% of the entire network that leads to the site.
- During March 2011 there was a period of intense rainfall in Orange, where 42mm of rain fell in a 1 day period, which resulted in 21.41ML of inflow to the site. In January 2014, after the pipe relining work was completed, 44mm of rain fell in one day, resulting in 16.73ML of inflow to the site.
- The Sewerage Treatment Works is a continuous operation plant rather than a batch operation. This means that the energy consumed by the plant is unlikely to reduce, despite the large reduction in inflow.
- The frequency of the aerators have been changed at the site. Aerators are the biggest consumers at the site, responsible for approximately 50% of the total energy consumption.
- There have been no major infrastructure changes to the plant, however there may have been process changes.
- The population of Orange has grown by approximately 1.05% (2012 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS
Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS
The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
## Orange City Council

<table>
<thead>
<tr>
<th>Building, Facility or Site 22</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Orange City Council – Sewage Treatment Works</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Phillip Street, Orange NSW 2800</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Treatment Works</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
</tbody>
</table>

### Energy Efficiency Estimate Method

<table>
<thead>
<tr>
<th>Baseline Energy Usage</th>
<th>2,641,892 kWh pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Energy Efficiency</td>
<td>564 kWh x 3.6 = 2,030 MJ per ML</td>
</tr>
</tbody>
</table>

### Reporting Data (Measuring Energy Efficiency and Additional Data)

- Inflow – 4,683 ML pa
- 2,698m to be relined (0.6% of total system)
- Total system – 430km
- New inflow – 4,168 ML pa

### Cost of Activity

- $300,000

### Estimated Cost Savings

- $50,392

### Adjusted baseline energy usage

- 1,525,133 kWh (1/10/2011-30/4/2012)

### Adjusted baseline inflow

- 2508 ML

### Adjusted baseline energy efficiency

- 608 kWh x 3.6 = 2,189 MJ per ML

### Adjusted baseline rainfall

- 638.5 mm

### Post works energy usage

- 1,616,355 kWh (1/10/2014-30/4/2015)

### Post works inflow

- 1883 ML

### Post works energy efficiency

- 858 kWh x 3.6 = 3,089 MJ per ML

### Post works rainfall

- 469.5 mm

### Cost savings

There has been no reduction in the amount of energy consumed at the site, despite there being a significant reduction in the volume of inflow. Due to the Sewage Treatment Works being a continuous operation, it is difficult to demonstrate cost savings. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.
Filtration Plant
Installation of Variable Speed Drives

Orange received $33,287 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with treating water/waste water.

**TECHNOLOGY**

Laser Electrical (Orange) installed three Schneider Altivar 61 Variable Speed Drives (VSDs) on the large clear water and smaller backwash pump systems that began operation in early November 2014. A VSD is a piece of equipment that can change the speed and rotational force (or torque output) of an electric motor by controlling the power that is fed into the machine.

This can subsequently regulate the volume of water being pumped. In the case of the Icely Road Water Filtration Plant and the clear water pumps, the flow was historically regulated by a throttle valve downstream of the pump which would effectively have the pump overworking and wasting energy when it was partly closed. For more details refer to the Case Study in this report.

**ENERGY EFFICIENCY**

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the installation of the variable speed drives, the inflow to the site had increased by 24% (576ML) over the 7 months between October 2014 and April 2015, compared to the baseline period of October 2011 to April 2012.

The energy consumption at the site has increased by the equivalent amount between the period prior to and after the completion of the work.

Chart 39 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October to April 2011-2015.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:
- The population of Orange has grown by approximately 1.05% (2012 people) between 2011 and 2014.
- The information provided in this energy efficiency table is shown only as monthly data. A detailed analysis was undertaken by e21 using half-hourly data to demonstrate the improvements at the site and the energy savings achieved through the installation of the variable speed drives. The report describes: “Orange City Council has achieved a 33% energy savings from installing VSDs on three pump motors at the Icely Road Filtration Plant. Energy savings of 101,226 kWh pa will be achieved based on the 14.1 average operating hours per day for the last two years. This translates to cost savings of $17,522 pa.”

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the Nexus
between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

Chart 39—Orange Filtration Plant Energy Consumption, Inflow & Rainfall
## Orange City Council – Filtration Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 23</th>
<th>Orange City Council – Filtration Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Orange City Council – Filtration Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Icely Rd, Orange NSW 2800</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Filtration Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Installation of variable speed drives</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>1,701,186 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>422 kWh x 3.6 = 1,519 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 4,035 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$240,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>914,536 kWh (1/10/2011-30/4/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>2,441 ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>375 kWh x 3.6 = 1,350 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>1,132,667 kWh (1/10/2014-30/4/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>3,017 ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>375 kWh x 3.6 = 1,350 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>469.5mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$17,522 per annum—based on the analysis undertaken by e21.</td>
</tr>
</tbody>
</table>
The existing system has been enhanced by providing an emergent technology solution that actively locates leakage within the network as failure is occurring. A network of online Seba acoustic detection loggers have been installed around the main consumption areas that detects changes in audio frequency of water flow due to pinhole leakages within the network and triangulates the location based on feedback from other loggers to determine the location prior to major water loss. Based on prior frequency of breakages and losses from these, the theoretical water savings over the period of installation is upward of 300ML per year.

Energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.
The inflow to the site has decreased by 7% (142ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2012 to March 2013.

The energy consumption at the site has decreased by 3% (35,469 kWh) between the periods measured, or 70,938 kWh per annum.

Chart 40 shows the patterns of energy consumption (MWh), inflow (ML), and rainfall (mm) for the periods of October 2012 to March 2013, and October 2014 and March 2015.

Chart 41 shows the trends for ML/day and kWh/ML.

FACTORs EFFECTING THE RESULTS
From interviews with staff, factors effecting results were as follows:

♦ The Back Yamma Road Pump Station supplies water to the North Parkes Mine as well as the town of Parkes. The consumption at the Mine has increased since 2011.
♦ The work undertaken under the CEEP2 program at the Back Yamma Road Pump Station was only for the pump supplying water to the town.
♦ The Pump Station has 4 meters; one for town consumption, one for Mine consumption and the two remaining pumps are only used during times of drought (have not been used since 2000). The ratio of town consumption to Mine consumption is 1:1.
♦ The electricity meter at the Back Yamma Road includes the 4 pumps, as well as the building, air conditioning etc.
♦ Improvements commenced at the site in March 2014 and are ongoing.
♦ The pumps at the Back Yamma Road Pump Station are ageing, and have not undergone any major maintenance.
♦ Under CEEP1, there were high efficiency motors and power factor correction devices installed at the site.
♦ The population of Parkes has grown by approximately 1.01% (134 people) between 2011 and 2014.
♦ Since 2011, there have been an additional 180-200 connections to the water supply in Parkes.

BENEFITS
Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS
The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
### Building, Facility or Site 24

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site</th>
<th>Parkes Shire Council – Back Yamma Road Pump Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Back Yamma Rd, Parkes NSW 2870</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Pump Station</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Water loss management</td>
</tr>
<tr>
<td>Energy Efficiency Estimate Method</td>
<td></td>
</tr>
</tbody>
</table>

#### Baseline Energy Usage
- 855,217 kWh pa

#### Baseline Energy Efficiency
- 614 kWh x 3.6 = 2,210 MJ per ML

#### Energy Efficiency Improvement
- Reduction of 56 ML = 123,760 MJ pa

#### Reporting Data (Measuring Energy Efficiency and Additional Data)
- Inflow – 1,393 ML pa
- New inflow – 1,337 ML pa

#### Cost of Activity
- $43,750

#### Estimated Cost Savings
- $6,955

#### Adjusted baseline energy usage
- 1,029,783 kWh (1/10/2012-31/3/2013)

#### Adjusted baseline inflow
- 1,938 kWh

#### Adjusted baseline energy efficiency
- 531 kWh x 3.6 = 1,912 MJ per ML

#### Adjusted baseline rainfall
- 172.2 mm

#### Post works energy usage
- 994,314 kWh (1/10/2014-31/3/2015)

#### Post works inflow
- 1,796 ML

#### Post works energy efficiency
- 554 kWh x 3.6 = 1,994 MJ per ML

#### Post works rainfall
- 193 mm

#### Cost savings
- $3,229 per annum
TECHNOLOGY
Council has enhanced its existing water loss management system within its potable water network which currently relies on bulk flow meters, data loggers and contracted leakage detection services to monitor. Predefined algorithms that assess baseline usage and compare with actual usage are used to determine areas that require further investigation and ultimately repair of water mains to reduce leakage and thus reduce the total volume of water pumped and treated at water treatment plant.

The existing system has been enhanced by providing an emergent technology solution that actively locates leakage within the network as failure is occurring. A network of online Seba acoustic detection loggers have been installed around the main consumption areas that detects changes in audio frequency of water flow due to pinhole leakages within the network and triangulates the location based on feedback from other loggers to determine the location prior to major water loss. Based on prior frequency of breakages and losses from these, the theoretical water savings over the period of installation is upward of 300ML per year.

Installation of leading industry software that data mines information from the Seba system as well as the existing bulk water and data logger network coupled with existing water network SCADA data allows Council to maximise system efficiency and predict demand with better accuracy, leading to further energy consumption reductions.

ENERGY EFFICIENCY
The energy efficiency was calculated by taking the electricity usage (kWh) for the
THE NEXUS BETWEEN WATER AND ENERGY

period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

The inflow to the site has decreased by 4% (63ML) over the 6 months between October 2014 and March 2015, compared to the baseline period of October 2012 to March 2013.

The energy consumption at the site has decreased by 3% (2,453 kWh) between the periods measured, or 4,906 kWh per annum.

Chart 42 shows the patterns of energy consumption (MWh), inflow (ML), and rainfall (mm) for the periods of October 2012 to March 2013, and October 2014 and March 2015.

Chart 43 shows the trends for ML/day and kWh/ML. The ML/day since the work was completed has reduced by 4% compared to the periods prior.

FACTORS EFFECTING THE RESULTS
From interviews with staff, factors affecting results were as follows:

♦ The Treatment Plant supplies water to the North Parkes Mine as well as the town of Parkes. The consumption at the Mine has increased since 2011.
♦ The Pump Station has 4 meters; one for town consumption, one for Mine consumption and the two remaining pumps are only used during times of drought (have not been used since 2000). The ratio of town consumption to Mine consumption is 1:1.
♦ The electricity meter at the Treatment Plant includes the pumps, as well as the building, air conditioning etc.
♦ Improvements commenced at the site in March 2014 and are ongoing.
♦ The equipment at the site is ageing, and has not undergone any major maintenance.
♦ The population of Parkes has grown by approximately 1.01% (134 people) between 2011 and 2014.
♦ Since 2011, there have been an additional 180-200 connections to the water supply in Parkes.

BENEFITS
Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS
The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
### Parkes Shire Council – Albert Street Water Treatment Plant

<table>
<thead>
<tr>
<th>Building, Facility or Site 26</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Parkes Shire Council – Albert Street Water Treatment Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Albert Street, Parkes NSW 2870</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Water loss management</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>96,745 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>96 kWh x 3.6 = 346 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 51 ML = 17,646 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>• Inflow – 1,012 ML pa</td>
<td></td>
</tr>
<tr>
<td>• New inflow– 961 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$175,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$2,190</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>90,191 kWh (1/10/2012-31/3/2013)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>1,460ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>61 kWh x 3.6 = 220 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>172.2mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>87,738 kWh (1/10/2014-31/3/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>1,397ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>63 kWh x 3.6 = 227 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>193mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$223 per annum</td>
</tr>
</tbody>
</table>
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council. There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period. On completion of the pipe relining, the inflow to the site had decreased by 49% (112ML) over the 5 months between November 2014 and March 2015, compared to the baseline period of November 2011 to March 2012.

The energy consumption at the site has decreased by 33% (14,566 kWh) between

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**Chart 44**—Parkes Kennedy Street Pump Station Energy Consumption, Inflow & Rainfall

**Chart 45**—Parkes Kennedy Street Pump Station Trends for kL/day & kWh/ML
the period prior to and after the completion of the work, or 34,958 kWh per annum. Chart 44 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of November 2011 to March 2012, and November 2014 and March 2015.

Chart 45 shows the trends for kL/day and kWh/ML for the periods between November 2011 to March 2012, and November 2014 and March 2015. The ML/day since the work was completed has reduced by 49%, compared to the same period in 2011-2012.

From the charts it can be seen that prior to the works, the inflow seemed to peak during times of intense rainfall, however post works, it appears to have less of an effect on inflow.

FACTORS EFFECTING THE RESULTS
From interviews with staff, factors effecting results were as follows:

♦ The pipe relining undertaken upstream of the Kennedy Street Pumping Station was approximately 10.6% of the entire network that leads to the site.
♦ The inflow to Pump Station 1 is 97% of the total flow to the Sewage Treatment Works.
♦ During March 2012 there was a period of intense rainfall in Crookwell, where 190mm of rain fell over a 9 day period, which resulted in 60.9ML of inflow to the site, approximately 6.8ML/day. Since the work was completed in October 2014, there have been no periods of intense rainfall to the extent of what was experienced in 2012, however in January 2015, 44mm of rain fell in 1 day which resulted in 3.2ML of inflow to the site.
♦ The Pumping Station is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
♦ All electricity bills received for this site between November 2014 and March 2015 have been estimated.
♦ The population of Crookwell has grown by approximately 1.05% (115 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS
Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS
The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.

Upper Lachlan Shire Council – Kennedy Street Pumping Station
### Upper Lachlan Shire Council

#### Building, Facility or Site 27

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site</th>
<th>Upper Lachlan Shire Council – Kennedy Street Pumping Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Kennedy Street, Crookwell NSW 2583</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Pump Station</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Sewer infiltration remediation</td>
</tr>
</tbody>
</table>

**Baseline Energy Usage**

- 24,680 kWh pa

**Baseline Energy Efficiency**

- 45 kWh x 3.6 = 162 MJ per ML

**Energy Efficiency Improvement**

- Reduction of 339 ML = 54,108 MJ pa

**Reporting Data (Measuring Energy Efficiency and Additional Data)**

- Inflow – 546 ML pa
- 3,300m to be relined (10.6% of total system)
- Total system – 31km
- New inflow– 212 ML pa
- 97% of total catchment flows through this site

**Cost of Activity**

- $210,000

**Estimated Cost Savings**

- $12,352

**Adjusted baseline energy usage**

- 44,740 kWh (1/11/2011-31/3/2012)

**Adjusted baseline inflow**

- 229.5ML

**Adjusted baseline energy efficiency**

- 195 kWh x 3.6 = 702 MJ per ML

**Adjusted baseline rainfall**

- 647mm

**Post works energy usage**


**Post works inflow**

- 117.9ML

**Post works energy efficiency**

- 256 kWh x 3.6 = 922 MJ per ML

**Post works rainfall**

- 338.5mm

**Cost savings**

- $10,713 per annum
Sewage Treatment Works
Sewer Infiltration Remediation—Pipe Relining

TECHNOLOGY
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY
The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 49% (115ML) over the 5 months between November 2014 and March 2015, compared to the baseline period of November 2011 to March 2012.

The energy consumption at the site has decreased by 3% (1,425 kWh) between the period prior to and after the completion of the work, or 3,420 kWh per annum.

Chart 46—ULSC Sewage Treatment Works Energy Consumption, Inflow & Rainfall

Chart 47—ULSC Sewage Treatment Works Trends for kL/day & kWh/ML
Chart 46 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of November 2011 to March 2012, and November 2014 and March 2015.

Chart 47 shows the trends for kL/day and kWh/ML for the periods between November 2011 to March 2012, and November 2014 and March 2015. The ML/day since the work was completed has reduced by 48%, compared to the same period in 2011-2012.

From the charts it can be seen that prior to the works, the inflow seemed to peak during times of intense rainfall, however post works, it appears to have less of an effect on inflow.

FACTORS EFFECTING THE RESULTS
From interviews with staff, factors effecting results were as follows:
♦ The pipe relining undertaken upstream of the Kennedy Street Pumping Station was approximately 10.3% of the entire network that leads to the site.
♦ During March 2012 there was a period of intense rainfall in Crookwell, where 190mm of rain fell over a 9 day period, which resulted in 62.8ML of inflow to the site, approximately 7ML/day.
Since the work was completed in October 2014, there have been no periods of intense rainfall to the extent of what was experienced in 2012, however in January 2015, 44mm of rain fell in 1 day which resulted in 3.3ML of inflow to the site.
♦ The Sewage Treatment Works is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.
♦ All electricity bills received for this site between November 2014 and March 2015 have been estimated.
♦ The population of Crookwell has grown by approximately 1.05% (115 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

BENEFITS
Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

NEXT STEPS
The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:
♦ Implementation of a regional manhole rehabilitation program;
♦ Roll-out of the Regional Water Loss Management Program; and
♦ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
Upper Lachlan Shire Council – Sewage Treatment Works

<table>
<thead>
<tr>
<th>Building, Facility or Site 28</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
</tr>
<tr>
<td>• Inflow – 563 ML pa</td>
</tr>
<tr>
<td>• 3,300m to be relined (10.3% of total system)</td>
</tr>
<tr>
<td>• Total system – 32km</td>
</tr>
<tr>
<td>• New inflow– 219 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
</tr>
</tbody>
</table>
| **Cost savings** | $992 per annum.
Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm /flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 27% (10ML) over the 3 months between November 2014 and February 2015, compared to the baseline period of October 2011 to January 2012.
Chart 48 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October 2011 to January 2012, and November 2014 and February 2015.

Chart 49 shows the trends for kL/day and kWh/ML for the periods between October 2011 to January 2012, and November 2014 and February 2015. The kL/day since the work was completed has reduced by 33%, compared to the same period in 2011-2012.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:

✧ The pipe relining undertaken upstream of the Sewage Treatment Plant was approximately 8.7% of the entire network that leads to the site.

✧ During November 2011 there was a period of intense rainfall in Grenfell, where 60mm of rain fell in 1 day, which resulted in inflow to the site of 570kL. The average inflow for the 2011-2012 period was 413kL/day. In January 2015, 60mm of rain fell in 1 day, which resulted in inflow to the site of 416kL. The average inflow for the 2014-2015 period was 276 kL/day.

✧ The Sewage Treatment Plant is a low energy consuming site, and therefore is on a tariff rate and billed quarterly rather than monthly.

✧ The population of Grenfell has decreased by approximately 0.99% (50 people) between 2011 and 2014.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the *Nexus between Water and Energy Program* with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

✧ Implementation of a regional manhole rehabilitation program;

✧ Roll-out of the Regional Water Loss Management Program; and

✧ Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
# Weddin Shire Council

<table>
<thead>
<tr>
<th>Building, Facility or Site 29</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Weddin Shire Council – Grenfell Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Memory Street, Grenfell NSW 2810</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Treatment Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>16,725 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>109 kWh x 3.6 = 392 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 22 ML = 8,624 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inflow – 153 ML pa</td>
</tr>
<tr>
<td></td>
<td>• 2,719m to be relined (8.7% of total system)</td>
</tr>
<tr>
<td></td>
<td>• Total system – 31.278km</td>
</tr>
<tr>
<td></td>
<td>• New inflow – 131 ML pa</td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$210,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$341</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>3,370 kWh (24/10/2011-24/01/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>38.5ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>88 kWh x 3.6 = 317 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>359mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>1,775 kWh (1/11/2014-10/2/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>28.1ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>63 kWh x 3.6 = 227 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>245mm</td>
</tr>
<tr>
<td><strong>Cost savings</strong></td>
<td>$1,857 per annum</td>
</tr>
</tbody>
</table>
Sewage Treatment Plant
Sewer Infiltration Remediation—Pipe Relining

Young received $100,000 in matched funding for a sewer infiltration project aimed at reducing energy and costs associated with pumping water/waste water.

TECHNOLOGY

Infiltration to sewer systems from broken pipes allowing infiltration from the surface through storm/flood events or from illegal domestic inflow is causing sewer pumps and treatment plants to consume excess energy by pumping more water/waste water than is necessary. Through the repair of these pipes using pipe relining systems the aim was to reduce energy used to pump water/waste water by reducing system infiltration.

A rigorous regional procurement process resulted in the contracting of three providers to inspect, clean, supply, install, and test an acceptable sewer liner for the sewer mains specified by Council.

There are a number of systems commonly used including a cured in place liner (Insituform) a spiral wound (Interflow) and a close fit lining system (Kembla/Abergeldie). The system used depends on Council’s preference though for the most part a cured in place liner has been installed.

ENERGY EFFICIENCY

The energy efficiency was calculated by taking the electricity usage (kWh) for the period since the work was completed and dividing it by the volume of inflow (ML) to the site during the same period.

On completion of the pipe relining, the inflow to the site had decreased by 34% (101ML) over the 3 months between October 2014 and February 2015, compared to the baseline period of October 2011 to February 2012.

Chart 50—Young Sewage Treatment Plant Energy Consumption, Inflow & Rainfall

Chart 51—Young Sewage Treatment Plant Trends for kL/day & kWh/ML
The energy consumption at the site has decreased significantly between the period prior to and after the completion of the work, due to the commissioning of a new Sewerage Treatment Plant.

Chart 50 shows the patterns of energy consumption (MWh), inflow (ML) and rainfall (mm) for the periods of October to February 2011-2012, 2012-2013 and 2014-2015.

Chart 51 shows the trends for ML/day and kWh/ML for the periods between October to February 2011-2012, 2012-2013 and 2014-2015. The ML/day since the work was completed has reduced by 34%, compared to the same period in 2011-2012.

**FACTORS EFFECTING THE RESULTS**

From interviews with staff, factors effecting results were as follows:

- The pipe relining undertaken upstream of the Sewage Treatment Plant was approximately 2.3% of the entire network that leads to the site.
- During March 2012 there was intense rainfall in Young, where 240wmm of rain fell over a period of 6 days. The average daily inflow to the site during the period was 6.58ML, more than double the daily average for the month. Since the work was completed in October 2014, there have been no similar periods of intense rainfall, and therefore it is difficult to measure the exact impact of the pipe relining on infiltration to the system.

In August 2014, Young Shire Council commissioned a new Sewage Treatment Plant. The new plant consumes a higher amount of electricity than the previous trickling filter plant. The site is now classified as a large consuming electricity site, rather than a tariff site.

- The population of Young has grown by approximately 1% (20 people) between 2011 and 2014. Despite the increase in population, the inflow to the site has decreased.

**BENEFITS**

Through improved knowledge of system operation, Council have increased their understanding of where energy is used in the pumping and treating of water and identified measures that may be beneficial to increasing energy efficiency and reducing costs.

**NEXT STEPS**

The Centroc Water Utilities Alliance will review the outcomes of the Nexus between Water and Energy Program with a view to scoping further regional programming aimed at achieving increased energy and cost savings in the treating and pumping of water including:

- Implementation of a regional manhole rehabilitation program;
- Roll-out of the Regional Water Loss Management Program; and
- Improvements to the measurement and monitoring of energy usage.

It is anticipated that engagement in these activities will further embed energy efficiency programming within Council’s operations.
**Young Shire Council – Sewage Treatment Plant**

<table>
<thead>
<tr>
<th>Building, Facility or Site 30</th>
<th>Young Shire Council – Sewage Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name of Building, Facility or Site</strong></td>
<td>Young Shire Council – Sewage Treatment Plant</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>Chillingworks Road, Young NSW 2594</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Treatment Plant</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Sewer infiltration remediation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td>1,538,158 kWh pa</td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td>1890 kWh x 3.6 = 6804 MJ per ML</td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td>Reduction of 84 ML = 571,536 MJ pa</td>
</tr>
<tr>
<td><strong>Reporting Data (Measuring Energy Efficiency and Additional Data)</strong></td>
<td></td>
</tr>
<tr>
<td>• Inflow – 814 ML pa</td>
<td></td>
</tr>
<tr>
<td>• 1,800m to be relined (2.3% of total system)</td>
<td></td>
</tr>
<tr>
<td>• Total system – 78km</td>
<td></td>
</tr>
<tr>
<td>• New inflow– 730 ML pa</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$270,000</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$19,745</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy usage</strong></td>
<td>38,447 kWh (1/10/2011-29/2/2012)</td>
</tr>
<tr>
<td><strong>Adjusted baseline inflow</strong></td>
<td>297 ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline energy efficiency</strong></td>
<td>129 kWh x 3.6 = 464 MJ per ML</td>
</tr>
<tr>
<td><strong>Adjusted baseline rainfall</strong></td>
<td>328.5mm</td>
</tr>
<tr>
<td><strong>Post works energy usage</strong></td>
<td>273,523 kWh (1/10/2014-28/2/2015)</td>
</tr>
<tr>
<td><strong>Post works inflow</strong></td>
<td>196 ML</td>
</tr>
<tr>
<td><strong>Post works energy efficiency</strong></td>
<td>1,408 kWh x 3.6 = 5,069 MJ per ML</td>
</tr>
<tr>
<td><strong>Post works rainfall</strong></td>
<td>180mm</td>
</tr>
</tbody>
</table>

**Cost savings**

There has been no reduction in the amount of energy consumed at the site, despite there being a significant reduction in the volume of inflow, due the commissioning of a new Sewage Treatment Plant in 2014. Further investigative work may be beneficial to identify future projects to increase the energy efficiency at the site.
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 Central NSW Councils… (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: 16 June 2015
Name: Brian Steffen
Position: General Manager
Organisation: Forbes Shire Council

Witness Signature: ...
Date: 16 June 2015
Name: Janelle Clarke
Position: Executive Secretary
Organisation: Forbes Shire 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 1982, the Crimes Act 1914 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.