Hawkesbury City Council

Energy Savings Action Plan

Revised September 2008




Energy Savings Action Revised Plan
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Acknowledgments

Acknowledgement to the following people whose contributions have added considerably to this report.

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Thank you also to the many individuals from Hawkesbury City Council whose contributions have been invaluable.

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SIGNOFF OF THE PLAN

I certify that this Energy Savings Action Plan has been prepared in accordance with the Guidelines issued by the Minister for Utilities. I am authorised to submit this Plan on behalf of the Hawkesbury City Council to the Water and Energy Programs, Sustainability Programs Division, Department of Environment and Climate Change, PO Box A290, Sydney South. NSW 1232 Level 25, 59 Goulburn Street, Sydney, NSW 2000.

Peter Jackson
General Manager

ABOUT THIS PLAN

The NSW water and energy savings initiatives were introduced by the NSW Government in May 2005. They are administered by the Department of Energy, Utilities and Sustainability (DEUS) who are now a part of the Department of Environment and Climate Change (DECC). The legislation requires certain businesses, government agencies and local councils to prepare Water and Energy Savings Action Plans by 2008. Hawkesbury City Council is required to develop an Energy Savings Action Plan (ESAP) in accordance with the guidelines set out by NSW Government.

The guidelines require Council to include the following in its ESAP:

- details of baseline energy consumption
- management review and associated management actions related to energy
- details of audits and reviews carried out to identify energy savings opportunities
- actions for implementation

The ESAP is focused on the top ten energy consuming sites operated by Council. This document has been developed to meet the requirements for development of a ESAP, and includes the following sections:

- Baseline energy performance data for all Council properties
- Management review outcomes
- Management actions
- Energy savings measures
- Associated background information

The Energy Savings Action Plan will remain in draft until approved by the DECC. The Plan then becomes a blueprint for change within the Council. In particular, further monitoring of many sites will need to be carried out to ensure a better understanding of the energy characteristics at those locations.

Legislation requires that the ESAP is adjusted and reviewed every four years to refine effective business cases for further energy efficiency measures.

This Energy Savings Action Plan is now the blueprint for funding applications concerning energy efficient projects for Council's infrastructure.

SUMMARY OF THE HAWKESBURY

Local Government began in the Hawkesbury in the 1840's with the creation of borough councils. By 1906 the whole of the area was incorporated with three Councils, the Municipalities of Windsor and Richmond and the Shire of Colo. By 1981, there was one Local Government area, known as Hawkesbury Shire. In 1989 the Shire became the City it is today.

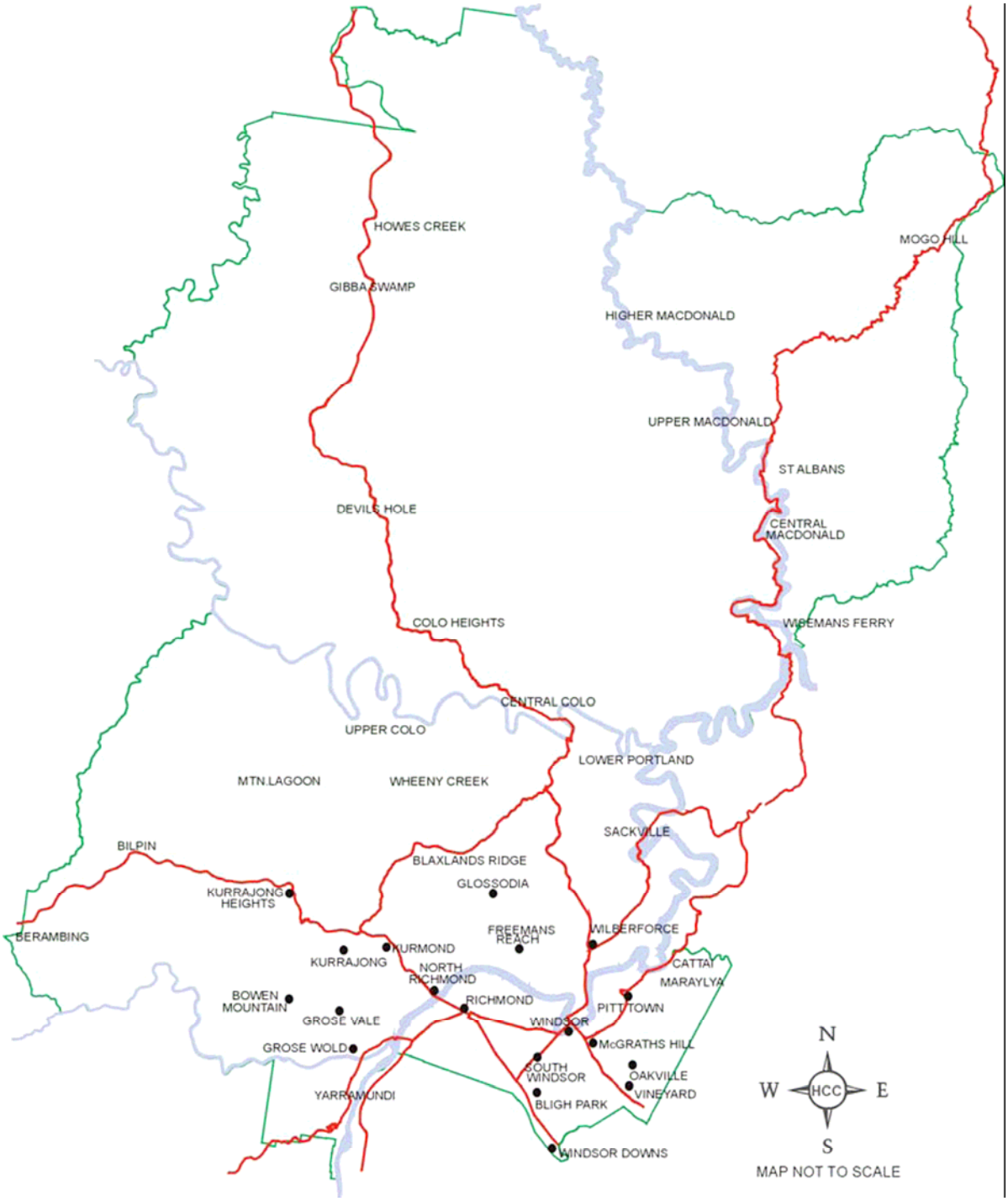
The Council area comprises 2,793 square kilometres, is home to more than 61,000 residents who live in a series of towns and villages throughout the rural hinterland.

The City of Hawkesbury extends from the Cumberland Plain in the south and east, to the foothills and escarpments of the Blue Mountains to the west and north. The Hawkesbury is divided by five rivers, and includes the Hawkesbury/Nepean, Grose, Colo and Macdonald River valleys. More than 70% of the Hawkesbury is National Park containing substantial expanses of wilderness.

The topography of the area is very diverse ranging from fertile flood plains and wetlands, to undulating hills and heavily timbered ridges through to inaccessible mountainous regions dissected by steep gorges and towering escarpments. Due to these geographic features, the Hawkesbury experiences regular flooding and bushfires, often resulting in considerable disruption to commerce and damage to agriculture and property. These physical features act as natural boundaries to development.

The Hawkesbury Local Government Area is made up of many small townships and localities in addition to the main (urban) population centres of Windsor and Richmond. Just over 35% of the population live within the township boundaries of Windsor-Richmond (an area which includes Hobartville, South Windsor and Bligh Park), while a further 59% of the population live in townships and localities situated within a 15km radius of these two principal centres. In total, almost 94% of the population live within the most south-easterly portion of the Local Government Area. The remaining 6% of the population live in small and isolated hamlets from Colo Heights, Colo Valley, Lower Portland, Webbs Creek and St. Albans in the north, to Cattai and Maraylya in the east, and Bilpin and Berambing in the west. Despite this apparent concentration, no one township or locality contains more than 11% of the total population of the Hawkesbury - a factor which has significant implications for the provision of services and facilities.

Location of Hawkesbury City in the Sydney Region



INTRODUCTION

ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS

"Electricity generation represents 43 percent of total greenhouse gas emissions in New South Wales. Rising greenhouse gas emissions contribute to the threat of global climate change, which according to the CSIRO, means a future for New South Wales of more extreme weather events with higher temperatures, lower rainfall, more storms and rising sea levels".(DEUS Guidelines 2005)

Global warming and climate change are upon us. And it is becoming more and more evident that we must take action to address it.

The Australian Conservation Foundation in their Report titled 'Australia's Inconvenient Truth' illustrated that the mean temperature has been on a steady increase during this century, in conjunction with increases in Australia's greenhouse gas emissions, as depicted in the figures below (Fig 1.1 and 1.2).

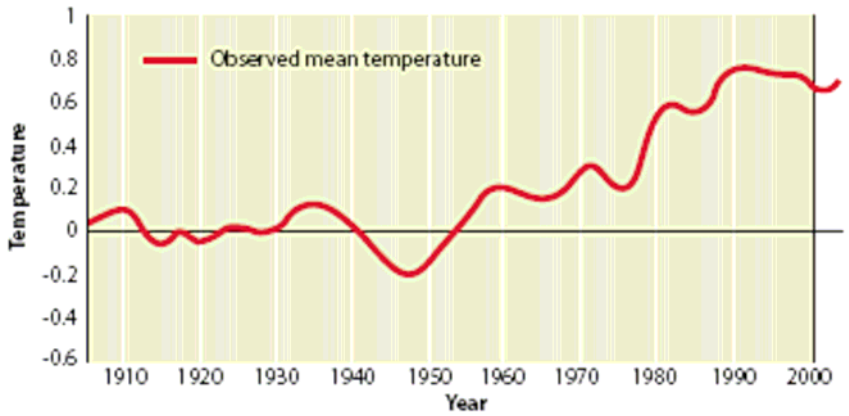


Figure 1.1: Variations of Australian Mean Temperatures 1910-2000
(Source: Australian Conservation Foundation no date, *Australia's Inconvenient Truth*. Available from : http://www.acfonline.org.au/uploads/res_aninconvenienttruth.pdf)
Hawkesbury City Council Energy Savings Action Plan – December 2006

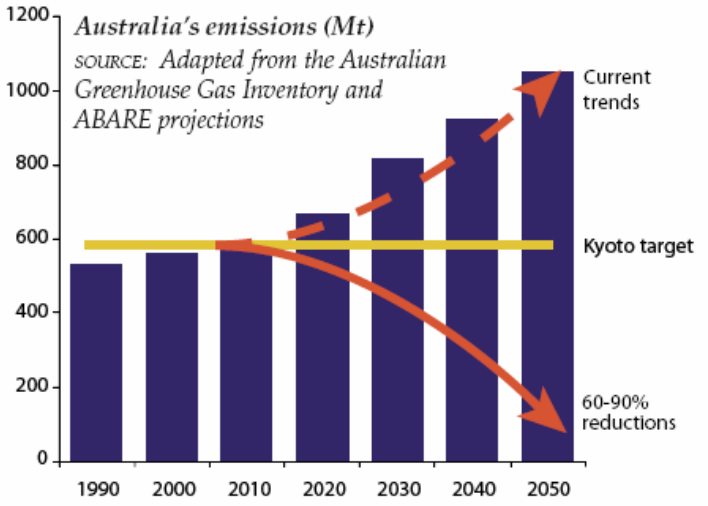


Figure 1.2: Australia's Actual and Projected Greenhouse Gas Emissions in Megatonnes 1990-2050
(Source: Australian Conservation Foundation no date, *Australia's Inconvenient Truth*. Available from : http://www.acfonline.org.au/uploads/res_aninconvenienttruth.pdf)

STATE LEGISLATION TO TAKE ACTION ~ ENERGY SAVINGS ACTION PLANS

The State Government realise that high energy users, including some local councils, play a large and important role in reducing greenhouse gas emissions.

This is reflected in the *Energy Savings Order 2005*, which was gazetted on 28 October 2005 by the Minister for Utilities. This Order requires business and government agencies with high energy use at a site and large local councils to prepare a draft Energy Savings Action Plan (ESAP) in accordance with section 34R of the *Energy and Utilities Administration Act 1987*, and submit it to the Minister for approval.

Schedule 2 designates Hawkesbury City Council as an energy user and requires the Council to prepare a draft ESAP.

HAWKESBURY CITY COUNCIL ENERGY SAVINGS ACTION PLAN

This Energy Savings Action Plan (ESAP) has been developed in accordance with the DEUS Guidelines for ESAPs, as required by the *Energy Administration Amendment (Water and Energy Savings) Act 2005.* It has also been developed with the use of the online Template Tool made available by DEUS.

The steps required in preparing an ESAP as identified in the DEUS Guidelines, and which have been followed for the preparation of this ESAP, are as follows:

1. Determine how much energy is used
2. Plan at Management Level
3. Determine opportunities to reduce energy use
4. Put the ESAP together

HISTORY OF ENERGY SAVINGS WITHIN THE ORGANISATION

Hawkesbury City Council resolved to participate in the Cities for Climate Protection (CCP) Program in April 2000, in recognition of the importance of reducing greenhouse gas emissions at the local level.

Milestone 1 of the program was completed in November 2001 by developing an emissions inventory for both the Council (1998) and community sectors using 1996 baseline years.

Following this, Council set about establishing emissions reduction goals to satisfy the requirements for completion of Milestone 2 of the Program. This was completed in April 2002.

In June 2002, Council developed and adopted emission reduction goals:

1. Reduce Corporate greenhouse gas emissions from 1998 levels by 20% by 2010
2. Reduce Community greenhouse gas emissions from 1996 levels by 20% by 2010.

Benefits to Council of this reduction include increasing environmental awareness and saving money through reduced energy costs.

The implementation of innovative and effective actions also serves to position Council as a community leader in environmental best practice.

In addition, part of the requirements of Milestone 3, which was completed in June 2002, Council commenced the development of a Green Energy Strategy to set about achieving these reduction goals.

Milestone 4 involved the implementation of actions outlined in the Greenhouse Gas Reduction Strategy and was achieved in April 2003. Council then updated the baseline inventory for 2003 to determine the success of Council's energy programs, as a requirement of Milestone 5.

The emissions inventory for the Corporate sector was divided into five categories:

1. Buildings -This category accounted for emissions from Council owned and operated buildings.
2. Vehicle Fleet - Which accounted for emissions from fuel use of the Council's vehicles and plant machinery.
3. Street Lighting - This sector accounts for emissions resulting from street lighting, including Integral Energy, Country Energy/Great Southern Energy street lighting and Council's decorative park lighting.
4. Water - This category accounted for emissions resulting from the energy used to pump water for reticulation on Council owned property.
5. Waste - This category accounted for emissions that result from the breakdown of organic waste.

Council activities generated 7344 tonnes of CO2 equivalent during 2000-2001. The primary source of emissions in the Corporate sector was electricity consumption, accounting for almost 80% of emissions during 2000-2001.

Of particular note is the 1367 tonnes of CO2 equivalent produced by the Oasis Aquatic Centre, which accounted for over 18% of the total Corporate emissions.

As part of the CCP Program, Hawkesbury City Council has implemented numerous actions to reduce greenhouse gas emissions from both the Corporate and Community sectors. An example of some of the Corporate measures implemented to date:

- ✓ Installed soft starters to pump stations
- ✓ Enabled energy star facilities on all office equipment
- ✓ Promoted energy awareness among staff through staging of an 'Energy Week'
- ✓ Formed a Technical Group to coordinate the progress of energy efficient programs within the organization
- ✓ Staff education through signs, stickers and training sessions
- ✓ Installing timers on water coolers and zip boilers
- ✓ Developed maintenance schedules for Hot/Cold water systems at each facility and implement energy efficient fixtures
- ✓ Reviewed energy audits of all sewage pumps and facilities, and identify opportunities for energy conservation
- ✓ Developed an energy awareness strategy for staff
- ✓ Commenced a review of existing Council equipment in respect to energy efficiency
- ✓ Enabled energy efficiency features on all Council equipment
- ✓ Investigate options for a revolving fund for channelling monies saved through energy efficiency back into individual business units for financing further environmental initiatives
- ✓ Monitored and reported on greenhouse gas emissions and the implementation of actions and measures through the organisation
- ✓ Developed relevant forms and spreadsheets for recording emissions reduction initiatives and associated CO2 reductions
- ✓ Built awareness of energy, greenhouse and sustainability issues in the City
- ✓ Investigated options for Council purchasing and re-selling energy efficient products to the community
- ✓ Requested energy providers to include more detailed information on all energy bills, such as actual energy consumed by street lighting
- ✓ Carried out a meter audit where necessary to determine the facilities serviced by each meter and sub meter
- ✓ Schematic plans drawn to include details of the location and service layout of meters, sub meters and the assets serviced by these meters
- ✓ Incorporation of energy efficiency initiatives into the design of projects
- ✓ Reviewed results of any past energy audits
- ✓ Carry out a walk through energy audit of the high energy consuming facilities identified

Corporate measures still under investigation include:

- Developing a plan for implementing low cost energy reduction within Council buildings
- Investigating the incorporation of Green Power supply into the overall contestable supply options for street lighting
- Canvassing options for solar lighting and more efficient lighting design
- Liaise with Integral Energy over changes to street lighting infrastructure
- Commencing the development of a street lighting policy which would facilitate the replacement of older technology with new energy efficient globes in the domestic and commercial areas.
- Developing programs to reduce emissions in the commercial and industrial sector
- Developing and commencing the implementation of a strategy for increasing community awareness of energy and greenhouse issues
- Form partnerships with energy suppliers to promote energy efficiency across the City
- Document the process for energy data management in a formal procedure
- Developing a system to record and present energy consumption as well as costs to allow for the monitoring of unexpected changes in energy usage and track Counci'ls progress against its reduction goals

The process for the development of these actions was through the support of the internal Energy and Water Steering Team. The team contains members from the Financial Planning, Building Services, City Planning, Land & Water Management branches of Council.

The benefits of the Cities for Climate Protection program have included:

- All council energy and water consuming assets being included and monitored.
- All information being identified directly by an independent source.
- The program identifying missing data, spikes in energy, provides estimates and tools for Council to manage accounts and account related information.

The regular monitoring will be complemented by future quarterly updates from Planet Footprint. Planet Footprint was developed in 2006 in response to the local government demand for quick and cost effective access to energy and water performance data. They collect detailed energy and water performance data, and subject this raw information to detailed analysis and adjustment to produce a powerful yet practical report that is then delivered to councils upon demand.

In particular, Planet Footprint can compare Hawkesbury City Council's energy and water performance against the performance of other councils, and against the best in the world.

Future monitoring will nominate further actions to be implemented to obtain greater reductions in usage and green house gas emissions.

This Energy Savings Action Plan identifies a series of measures to be implemented by the nominated directorate of Council. Estimates of the upfront costs required for implementation has also been provided. In addition, dollar savings and Kg's of CO2 emissions abated with associated pay back times are provided.

MANAGEMENT REVIEW OUTCOMES

MANAGEMENT TEAM

Dianne Tierney	City Planning	Strategic Environmental Planner
John Munns	Infrastructure Services	Manager Building Services
Andrew Wales	Contractor	Omega Environmental Pty Ltd

The current performance, strengths and weaknesses were assessed in accordance with Template 2 in the "Guidelines for Energy Savings Action Plans" Department of Energy Utilities & Sustainability, October 2005.

KEY AREAS

	Low	Moderate	Minimum Sustainable	Industry Leader	Best Practice
A. Senior management Commitment		X			
B. Understanding of energy savings potential		X			
C. Energy targets and key performance indicators		X			
D. Energy metering and monitoring			X		
E. Energy management reporting		X			
F. Energy supply management			X		
G. Operating and maintenance procedures		X			
H. Accountabilities for energy management			X		
I. Training and awareness procedures	X				
J. Compliance with legal and/or regulatory requirements			X		

MANAGEMENT ACTIONS

MANAGEMENT COMMITMENT

1. Develop and implement an Operational Management Standard that effectively incorporates energy, and infrastructure management issues to prioritise the strategic direction for the allocation of required resources.

   (a) Develop draft "Resource Allocation Priority System" (RAPS)

   (b) Disseminate draft Standard for review

   (c) Finalise Standard

   (d) Develop a procedure that sets out how the Standard is to be communicated, reviewed and managed

   Notes:

   - Ensure the Standard is specific to Council's operations, including reference to organisational-specific energy and infrastructure issues, and to a framework for setting and reviewing performance improvement objectives and targets.
   - When developing the Standard, ensure it is simple to read. Keep the document clear, concise and understandable for the community.
   - Involve key staff from all operational areas in its development to ensure it is relevant and can be easily understood by all personnel.
   - At a minimum, the Standard should become the primary document that drives the energy and infrastructure programs.
   - Ensure the associate procedure for managing the Standard includes a process for the regular review to ensure it remains current and consistent with significant issues and organisational objectives. The most effective way to ensure this review is carried out is to document a specific review process whereby an assigned committee meets regularly (e.g. annually) to review and adjust specific environmental management system components.

   Responsible Directorate:

   Participant inclusion as directed by Management Executive Team (MANEX).

   Time frame

   Priority system to be commenced and substantially completed within 2010

2. Develop a strategic plan for managing energy that looks at least five years forward. Focus on targets to be achieved and systems to be established.

   Responsible Directorate:

   City Planning- Strategic Planning

   Time frame

   To be completed by 2010

3. Ensure managers are fully aware of the importance of a strategic approach to energy management within Council.

   (a) Deliver an ongoing briefing to management to educate them on energy management issues and the management frameworks and processes being developed to manage and improve energy performance within the organisation.

   (b) Incorporate environmental reviews into meetings of existing management teams and committees.

   Responsible Directorate:

   Monthly briefing reports to be provided by City Planning.

   Time frame

   2009

UNDERSTANDING OF ENERGY SAVINGS POTENTIAL

4. Develop a protocol to initiate prompt corrective action whenever personnel become aware of energy waste.

   Responsible Directorate:

   Infrastructure Services

   Time frame

   2009

COMPLIANCE WITH LEGAL AND OTHER REGULATORY REQUIREMENTS

5. Develop a central register of all environmental legal and other requirements including relevant legislation, codes of practice, community agreements, licences and permits related to energy management.

   (a) Develop process

   (b) Implement process

   (c) Document this process in a procedure.

   (d) compliance with applicable energy related laws and licences.

   Responsible Directorate:-

   Infrastructure Services

   Time frame

   Central register and implementation of compliance audits completed by 2010.

TRAINING AND AWARENESS

6. Develop and implement a process for a consistent and effective method of communicating significant and relevant energy and water management issues, and applicable regulatory requirements to key personnel.

Train operation and maintenance teams to optimise energy performance in energy intensive areas.

Notes: consider the following when developing the strategy:

i. Using existing communication methods and complement these with innovative communication such as posters and multimedia presentations.

ii. Apply innovation and new technology to help communicate key energy issues, such as:

- Notice boards
- Posters and signs
- 'Energy Week' programs
- Competitions

iii. As a key first step to improving communication, staff newsletter, develop and actively promote a key issue via presentations at team meetings, memos, posters and other promotional items.

iv. Include dedicated sections in internal newsletters, reports and memos for reporting of energy discussion items, hints and tips, performance results and other information regarding environmental issues.

Responsible Directorate:

Participant inclusion as directed by City Planning and Corporate Communications as approved by Management Executive Team (MANEX).

Time frame
Training and awareness procedures to be initiated by 2010

ENERGY TARGETS AND KEY PERFORMANCE INDICATORS

7. Develop broad and long term energy improvement objectives to provide strategic direction to the organisation's energy and water programs.

Notes:

- Ensure these are developed with employee input, and are reviewed and adjusted on a regular basis in line with the review of Council's Strategic Documents so they remain relevant.

Include development of annual quantifiable energy targets as part of the corporate planning process.

Notes:

- The targets should be set at an organisation-wide level by a management team, and then guidance provided to individual business units to set department-specific targets as they see fit.

Responsible Directorate:

Improvement initiatives to be provided through the support of the internal Energy and Water Steering Team.

These recommendations are to be reported to MANEX in the form of minutes.

Time frame:

Internal Energy and Water Steering Team to reconvene in 2008/2009.

OTHER MANAGEMENT PLANS

8. Implement a simple and streamlined process to ensure management and staff consider the current energy issues and associated indicators, objectives and targets, when developing the management and operating plans and budgets. To ensure these plans include strategic programs to address these issues and meet these objectives.

Notes:

- Improve the process for development of annual strategies, plans and budgets to become a more logical and rigorous process in regards to energy management, whereby the previous year's energy performance is analysed, current significant energy issues are identified, and new objectives, targets and strategies are set. Ensure there is a logical and seamless flow of data, information and feedback between various council committees and management levels during this review process.
- Document this entire process in a formal procedure.

Responsible Directorate:

Updated monthly information to be provided by City Planning to the Management Executive Team (MANEX)

Time frame:

Review of information to be completed by 2010.

ACCOUNTABILITIES FOR ENERGY MANAGEMENT

9. Select appropriate persons from each division to represent that Division on the Internal Energy and Water Steering Team.

Identify a staff member to act as the organisation's Energy Performance Coordinator, to oversee the implementation and maintenance of energy management frameworks and processes.

Develop terms of reference for this group, and provide tools to help the Team perform its role effectively (such as checklists, pre-set meeting agendas etc).

Notes:

- If possible, assign the role of coordinator to the Manager Corporate Services & Governance. Ensure the coordinator takes on a coordinating role only, where he/she is responsible for supporting the managers and other staff to achieve the organisations energy performance targets. Clarify the role of the coordinator to staff.

Assign responsibility for energy management in individual property and asset contracts.

(a) Carry out a project to correlate all energy accounts against specific assets.

(b) Establish documented processes for managers to: track energy performance of their areas of influence, for contributing to the development of actions to improve performance, for implementing these actions, and for reporting outcomes back to senior management.

(c) Develop processes for ensuring the organisation's staff liaise regularly with other managers responsible for energy management in their area to provide strategic and technical support when required.

Responsible Directorate:

Support Services & Infrastructure Services

Time frame

Accountabilities to be investigated and substantially completed by 2010.

ENERGY MANAGEMENT REPORTING

10. Request managers and supervisors to encourage staff to provide feedback on energy and water issues during team meetings, and to pass on important environmental information to staff as required.

Generate monthly reports depicting overall energy use per unit of activity (eg kWh per area) and examine results where they show large cost or usage variance from target.

(d) Agree on a logical and systematic process for reporting environmental performance to staff, management, Council, stakeholders and the community.

(e) Identify the key information each target audience needs to receive, and the format it should receive it in, and develop report templates accordingly.

(f) Consider developing environmental 'report cards' that integrate with core business reporting processes.

(g) Document the process in a procedure simply to communicate to all staff.

(h) Ensure reports provide feedback on energy program outcomes as well as energy performance.

Responsible Directorate:

City Planning

Time frame

Monthly reporting system to be commenced in 2009.

OTHER COMMUNICATION

11. Develop procedures for dealing with internal requests for energy and water information, and train all staff (especially customer service staff) on these procedures. Document the process for internal and external energy and water related communication into a formal procedure and communicate to key personnel.

Responsible Directorate:

City Planning

Time frame

Training to be completed by 2009.

OTHER- DOCUMENTATION

12. Develop management system procedures to store reports and energy use information in a database for ready access.

Responsible Directorate:

Support Services- Information Services

Time frame

2009

OPERATION AND MAINTENANCE PROCEDURES

13. Develop a protocol to initiate prompt corrective actions whenever personnel become aware of energy waste.

Responsible Directorate

City Planning -Strategic Branch

Time frame:

2010

SUPPLY MANAGEMENT

14. Develop and implement an organisation-wide purchasing and procurement procedure that incorporates consideration of energy issues at all stages.

Routinely review energy prices to determine if better rates can be attained.

Responsible Directorate:

Infrastructure Services- Building Services

Support Services- Finance

Time frame

2009

METERING AND MONITORING

15. Regularly monitor the energy use of major facilities, cost- centres or energy intensive end users.

Responsible Directorate:

Infrastructure Services- Building Services

Time frame

2009

OTHER- CORRECTIVE AND PREVENTATIVE ACTION AND SUGGESTIONS

16. Adjust existing identification processes and forms to include environmental incident and non-conformance identification, including the reporting of energy 'issues'.

    (a) Implement an incentive or rewards scheme to encourage staff to make suggestions and report incidents.

    Responsible Directorate:

    Participant inclusion as directed by the Management Executive (MANEX).

    Time frame

    2009

OTHER- AUDITS

17. Develop, implement and document a process for the regular auditing of operations against controls and procedures developed to improve energy performance.

    (a) Develop, implement and document a process for the regular inspection of properties for energy problems, and identify opportunities for improvement. Base these inspections on a set of standardised checklists (such as checking for equipment left running etc). Train a group of designated staff to carry out these checks.

        Notes:
        Ensure inspection results are communicated to staff, and consider implementing a 'competition' or similar to encourage staff to improve performance and inspection results in their work area.

    Responsible Directorate:

    Infrastructure Services- Building Services

    Support Services- Corporate Services & Governance

    Time frame

    2009.

DETAILED TECHNICAL REVIEW RESULTS AND ENERGY SAVINGS MEASURES

A key aspect of the Energy Savings Action Plan is the detailed review of energy performance at Council's highest energy consuming sites, with the aim of identifying, costing and justifying opportunities for improvement actions to be implemented.

Detailed technical reviews were carried out by Council with support from Omega Environmental Pty Ltd during 2006, 2007 and early 2008. This Chapter presents the outcomes of these reviews, with a focus on the energy performance of council's top ten energy consuming sites.

These sites and their respective energy consumption profiles are presented below.

Site	Consumption (KWh)	Cost (ex gst)	Actual Ave. rate ($/kWh)	Business Activity Indicator (BAI)	KPI consumption per BAI per day
Deerubbin Centre Precinct	1401218	$170,829	0.122	6,975m2	200Kwh/M2
Oasis Centre	1461200	$122,644	0.084	1,112,167 people p.a	1.3Kwh/person
Street Lighting	1940138	$163,407	0.084	63,732 pop serviced 3,344 lamps	30Kwh/person 580Kwh/lamp
South Windsor STP	1615747	$124,876	0.077	1,465ML	1102Kwh/ML
Council Admin Building	709668	$75,477	0.106	4,460m2	159Kwh/m2
Sewage Pump Stations	248215	$28,457	0.115	2,301ML	108Kwh/ML
McGraths Hill STP	222341	$25,166	0.113	836ML	266Kwh/ML
Fire Control HQ	162692	$20,447	0.126	1206m2	135Kwh/m2
Indoor Stadium	159282	$17,707	0.111	6,352m2	25Kwh/m2
Wilberforce Depot	116135	$12,234	0.105	1,125m2	103Kwh/m2

Combined, these sites and services had the following impact over a recent one year period:

- Consume roughly 42,000GJ of energy (70% electricity, 30% gas)
- Cost just under one million dollars to power
- Contribute about 9.5 million kilograms of CO_2e into the atmosphere, and is equivalent to:
    1. 1,433.07 tonnes of coal, or
    2. 51 trucks of coal each carrying 28 tonnes in one year
    3. 4 trucks/month

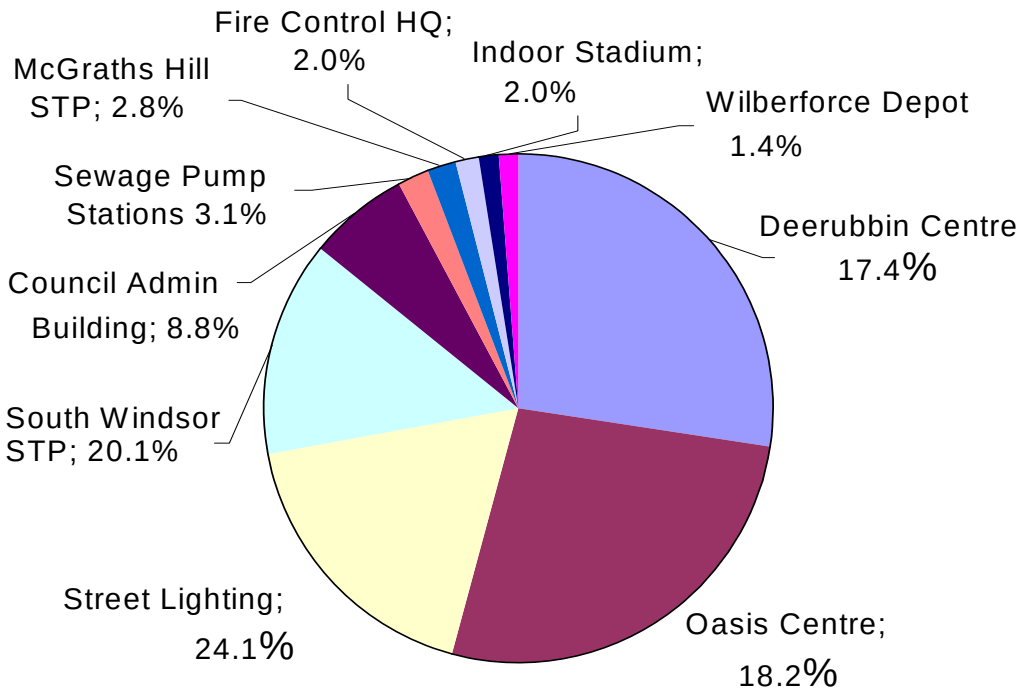


Figure 1 Energy consumption at Councils top ten sites in pie graph

This Chapter presents the following for each site:

- A description of the site
- Details of baseline energy performance
- Energy consuming equipment at the site
- Detailed analysis of energy consumption at the site

A summary of energy improvement measures proposed for the site. These measures are also detailed in Appendix A.

DEERUBBIN CENTRE PRECINCT

Lot 50 George Street, Windsor

DESCRIPTION

The Deerubbin Centre Precinct is made up of several buildings and leased sites. The most significant structure is the Deerubbin Centre which houses a library, art gallery, leased office space and carpark. The rest of the site is made up of the Old Hospital and Johnson buildings (leased office space), Peppercorn Services building (community services) and a Café.

Old Hospital

The Deerubbin Centre was opened in 2005. The Old Hospital building was re-furbished five years ago and the Peppercorn Services building was refurbished in the year 2000.

Figure 2 Deerubbin Centre – aerial photo of site

BASELINE

Energy Source	Meter No.	kWh	GJ	Cost (ex gst)	Baseline year
Electricity	NEEE0032846	1401218	5044.4	$170,829	FY-2007
Gas	5247015107		6378.0	$79,889	FY-2007
Total			**11422.4**	**$250,718**	

Baseline readings and costs for Deerubbin Centre princinct for period of one year.
Performance indicator: Building floor area (total) = 6,975m^2
Peak demand: Indeterminate – operation of key equipment under refinement

EQUIPMENT

Central to the operation of the site is a large co-generation plant housed underneath the café. This equipment provides heating and cooling for the Deerubbin Centre, Café and Old Hospital buildings.

Co-Gen Plant

Co-Gen Plant

The system is made up of the following components:

- Water cooled engine/generator – powered by natural gas and capable of generating 350kW of electricity and 520kW of waste heat
- Natural gas boiler – 870kW output
- Absorption chiller (~350kW) – used when waste heat is being supplied from the engine/generator but cooling is required in the buildings
- Regular chiller (360kW)

The generator only switches on when there is a combined heating and/or cooling load requirement above 160kW. The operation of the entire system is currently being analysed and refined due to the non-ideal operation of the equipment since commissioning. Also being addressed is the fact that Council is currently not reimbursed for any electricity exported to the grid.

The system is on-call 24 hours a day due to the requirement that the gallery be maintained at 22C and 50% relative humidity at all times. An inspection of the nightly run-

time of the equipment shows that the chiller and/or boiler are only on for significantly less than 10% of the time to achieve this.

Gallery

The other buildings at the site (Johnson building and Peppercorn Services building) remain operationally separate from the co-generation plant and rely on their own reverse cycle units for heating and cooling.

Johnson Wing Building

South side of Peppercorn Building

Lighting in the Deerubbin Centre is twin T5 lamp fixtures throughout. Some of the lighting has occupancy sensors (for example, the entry hall), while other areas are manually controlled. There are several large spotlights lighting the central skylight structure above the library. The Deerubbin car park and all other building's have T8 fluorescent lighting.

Lighting within Library

The Deerubbin carpark is naturally well ventilated – its automated exhaust system only runs when the gas levels rise to threshold levels which is determined by the air sensor system.

Basement Carpark

Hot water for the kitchens and bathrooms at the site is delivered by a total of 11 electric storage units placed throughout the buildings (3 in Old Hospital, 2 in Peppercorn, 2 in Johnson, and 4 in Deerubbin).

The Deerubbin Centre has a large goods lift and one regular lift (energy efficient design).

Most windows on the building are shaded with automatically controlled louvers. The large glass façade at the entry to the building is shaded by automated external blinds which retract once the sun has passed, or in high wind.

Western louvers

Automatic Controlled Blinds

ANALYSIS

The energy balance displayed below indicates that over 90% of energy consumption at the site goes to two areas:

1. Co-gen and associated plant operation (ie. electricity generation input and heating and cooling for the Deerubbin Centre, Old Hospital and Café), and;
2. General power for the library level of the Deerubbin Centre

Electricity consumption for this analysis was extracted from the site's detailed building management system while gas consumption was obtained from billing data.

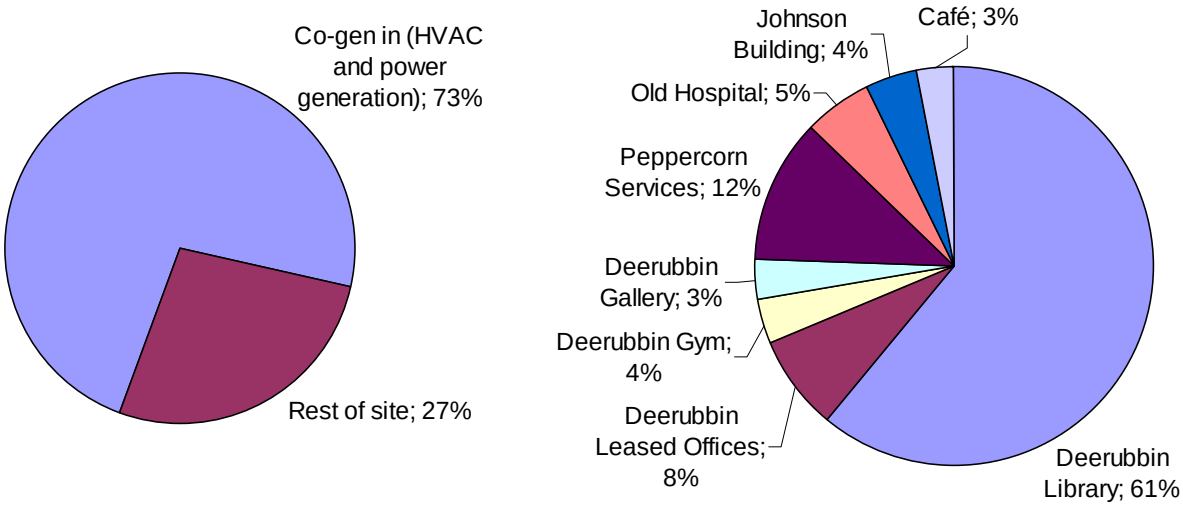


Figure 3 Deerubbin Precinct – Total energy consumption (left), and 'rest of site' consumption (right)

A somewhat more useful analysis demonstrates the high seasonality of power consumption at the site (see below). Although this analysis likely *does not* account for electricity being generated by the co-generation plant (due to no net-metering or on-selling arrangement being in place with the electricity retailer), its overall impact is likely to be relatively insignificant with numbers from the BMS indicating that only around 20% of electricity consumption would have been offset in recent months. Co-generation issues aside, the site clearly has a significant winter heating requirement.

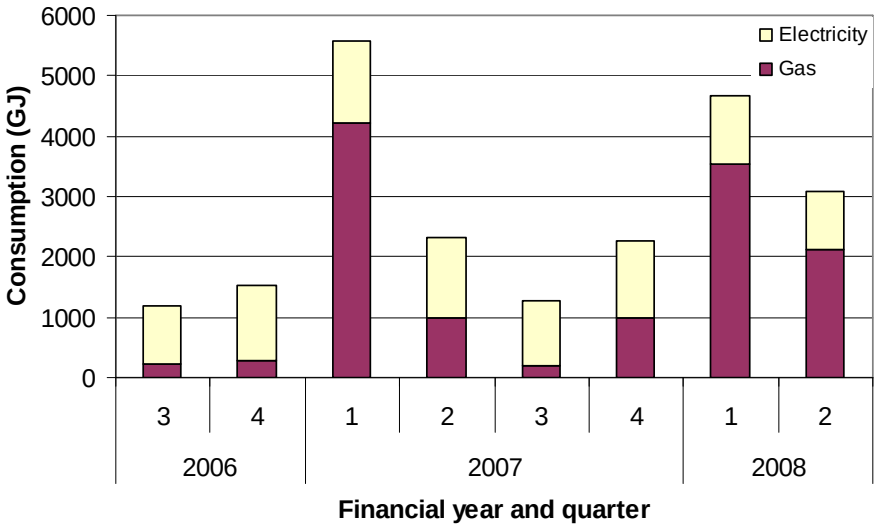


Figure 4 Deerubbin Precinct – Energy consumption by energy source and quarter

Given the somewhat uncertain operation of the co-generation plant, the site remains on regular electricity tariffs to avoid unexpected demand charges. The cost of this move can be roughly determined by comparing electricity costs to another Council building running on tariffs incorporating demand charges (Council's administration building). The difference is over 10% less for the administration building per unit of electricity. This would mean that this site, operating smoothly and on tariffs incorporating demand charges, would save around $20,000 per annum at current rates. A summary of the rates paid per unit of energy for all of Council's top ten sites is available in Appendix B.

The broader (and more important) issue at this site remains its relative inefficiency despite the presence of supposedly high efficiency and intelligent systems. During the baseline period, the site used a very substantial 4.5MJ/m^2/day.

This site has enormous potential to be a leader in efficient design and operation. Addressing the operational issues at this site should undoubtedly be Council's top priority in terms of energy efficiency projects.

MEASURES

Completed already – the Deerubbin Centre incorporates a number of energy saving features including; active sunlight control on most windows, sensor based car park ventilation, lighting sensors and an efficient lift.
Some further measures to be implemented:

1. Investigate net metering or electricity sale contract with a service provider to account for electricity generated by co-gen system

2. Resolve co-gen operational issues (with energy reduction a priority given the site's unusually high energy consumption)

3. Review electricity contract pricing (once co-gen equipment operation is resolved)

4. Place the library's central up-lights on a light-sensor override (so they are always off when sufficient day-lighting is available)

OASIS CENTRE

Church Street, South Windsor

DESCRIPTION

The Hawkesbury Oasis aquatic centre incorporates an outdoor 50m Olympic pool, 25m indoor pool and a number of other facilities. Both pools are heated, with the indoor pool operating year-round and the outdoor pool from October to April. The indoor centre was opened in 1995.

The site also includes a number of smaller leisure pools, spa, sauna, gym, aerobics room, crèche and a kiosk. The centre is typically open 6am to 9pm on weekdays and 8am to 6pm on weekends.

The centre is managed by an external organisation. Although Council receives the energy bills for this site, the full amount is on-billed to the operators.

BASELINE

Energy Source	Meter No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	NEEE0022375	1322760	4,761.9	$107,463	FY-2007
Electricity	4310010149	138440	498.4	$15,180	FY-2007
Gas	5240596354		5,842.9	$72,100	FY-2007
Total			**11,103.2**	**$194,744**	

Baseline energy indicaters for Hawkesbury Oasis over a one year period.
Performance indicator: Patronage (visitors to the site per year) = 1,112,175
Peak summer demand: 351kVA (for main account only)
Peak winter demand: 242kVA (for main account only)

EQUIPMENT

Pool heating at the site is delivered by a combination of gas hot water units and electric heat-pump units. There are three heat pump units (53kW electric each, with a COP of 4.2) and one gas boiler (750kW output). Two of the heat pumps serve the outdoor pool and one is used for the indoor pool. The gas boiler is used as an auxiliary unit for both pools and the primary heat for both spas . The indoor pool temperature is maintained at 28C.

An air heat exchanger controls air supply to the main building and no air replacement occurs after hours. The rating of the main fan unit for this system is 15kW. The site also has five reverse cycle air conditioning units which service various areas throughout the building (including the offices, gym, creche and kiosk).

Heat Pump Units

Indoor Pool Units

Spa Units

Water circulation for the indoor pools is carried out by two 11kW pumps which run 24 hours a day. There are also two smaller (1.5kW) pumps which are used for the indoor spa. Hot water for the amenities at the site is provided by two 275 litre gas storage hot water systems.

The main pool hall is lit by several large floodlights, although these are only required in the mornings and evenings as there is typically enough day-light to light the building. Lighting in the other areas of the building (gym, aerobics room, offices) is by T8 fluorescent lamps. There is also a small number of halogen down-lights used outside the kiosk. All lighting is manually controlled.

Western Glass Roof Panels & Roof Lights

Front Entrance - Automatic Doors

ANALYSIS

Energy consumption at the site throughout the year is shown below. Despite the fact that the Olympic pool is only operated for part of the year, energy consumption is still roughly double in winter compared to summer, with the vast majority of the increase taken up by increased gas consumption.

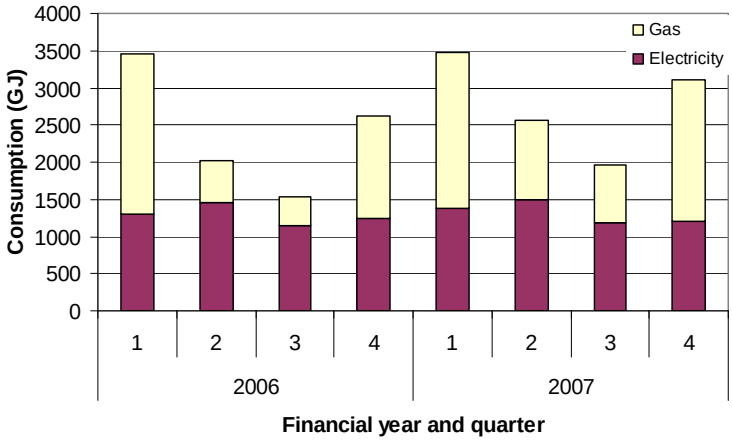


Figure 5 Oasis Centre – Energy consumption by energy source and quarter

Gas usage at the site is relatively easy to account for because it serves only three key tasks. In likely order of significance, these are: pool heating, heating of incoming air and supply of hot water to the amenities. Electricity usage is somewhat more difficult to account for, with the breakdown below based on analysis of 15-minute electricity consumption data along with rating of key pumping equipment and runtime.

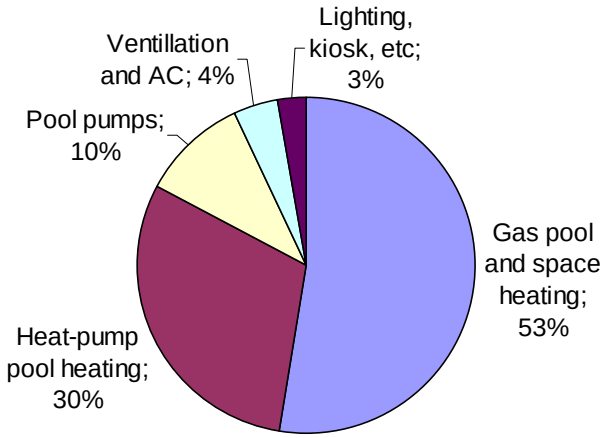


Figure 6 Oasis Centre – energy consumption by end use

With the vast majority of the site's energy going to pool heating, a significant opportunity exists for solar heating at the site. With the available roof area alone, it is anticipated that the site could meet up to 30% of its heating requirements using solar energy.

Figure 7 Oasis Centre – aerial photo of site

Before solar heating is considered, however, the indoor pool's temperature should be re-assessed. At 28C it is at the upper end of the spectrum when compared to similar facilities. Many indoor pools are successfully operated at 26C or 27C. The energy savings of even a one degree adjustment would be substantial.

The pool's circulation pumps account for the next biggest slice of energy consumption – at around 10%. A number of opportunities exist for improving the efficiency of these units, including:

- Direct replacement with high efficiency models (original document specifications indicates pump efficiency of between 52 and 64% - much higher efficiencies are available)
- Variable speed drives to scale back water circulation marginally at night (a reduction by 20% of flow rate can reduce energy consumption by around 50%)

Air replacement in the pool hall represents another significant drain on pool heating energy consumption. The site currently operates a relatively high air replacement regime to minimise corrosion of indoor equipment. Council is in the process of investigating a new low relative humidity / low air replacement method which could be implemented at the site.

An analysis of the site's average electricity consumption and power factor by time of day provides more insight into energy consumption at the site. The 'base load' consumption of around 100kW is accounted for by the operation of the heat-pumps and pool circulation pumps. The majority of the additional load seen between 5am and 10pm is associated with other equipment at the site (air conditioning, lighting, kiosk etc.).

The site has an average power factor of around 0.8. Considering this site has significant peak demand, substantial savings will result from the installation of power factor correction equipment.

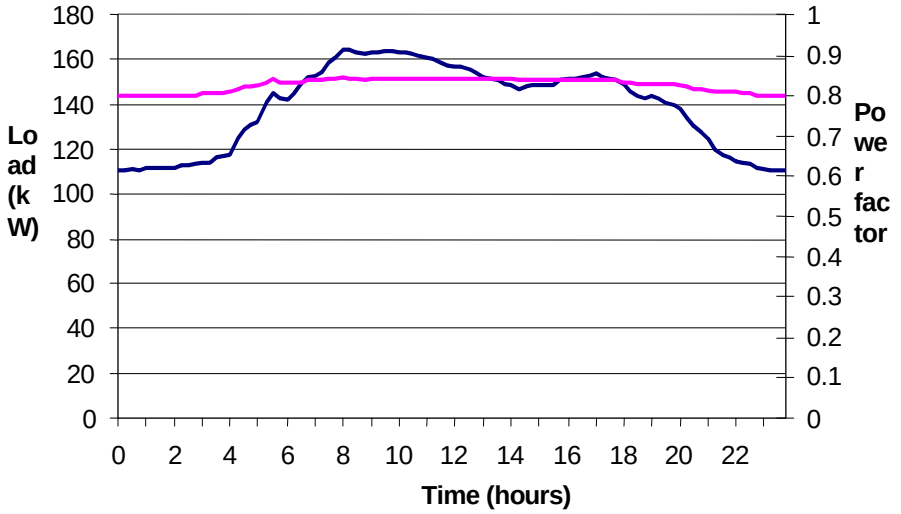


Figure 8 Oasis Centre – Average load and power factor (stable line), 2007

MEASURES

Completed already - automatic doors were installed at the main entrance to minimise heat loss from the building.
Some further measures to be implemented:

1. Reduce pool temperature set points by 1C (to 26C-27C)

2. Install solar water heating system on available roof space

3. Install power factor correction equipment at this site

4. Install VSD's on main circulation pumps (eg. 80% of usual flow rate over night)

5. Install lighting occupancy sensors in the aerobics room (note: additional opportunities may exist)

6. Replace kiosk halogen lighting with 20W IRC halogens

7. Investigate new low air replacement method for ventilation system (currently being implemented at Gosford Council)

STREET LIGHTING - COUNCIL-WIDE

DESCRIPTION

Council's network street lighting account covers the energy consumption associated with the operation of public street lighting across the local government area (LGA). Council also operates a number of gas lights in the Windsor Mall area.

BASELINE

Energy Source	Metre No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	4310020212	1940138	6984.5	$163,407	FY-2006
Gas	5240192215		196.3	$3,051	FY-2007
Gas	5240192218		146.5	$2,354	FY-2007
Total			**7327.3**	**$168,812**	

Baseline energy indicators for streetlighting over a one year period.
Performance indicator: Population serviced (total LGA population) = 61,000
Peak summer demand: 445kW
Peak winter demand: 445kW

EQUIPMENT

There are 21 different types of street lighting lamps in operation across the LGA, totalling 3,344 in number (as at January 2007). The most common lamps used are listed here:

Technology	Lamp rating (W)	Number
Mercury Vapour	80	1,436
Fluorescent	40	730
Mercury Vapour	250	301
High Pressure Sodium	250	290
High Pressure Sodium	150	229
Mercury Vapour	125	119
Mercury Vapour	400	70
Mercury Vapour	50	45
Remaining Lamps	Misc	124
Total		**3,344**

Different types of shreet lighting lamps with their rating and frequency.

The gas lights in the Windsor Mall area run 24 hours a day (owing to fact gas lights are not equipped to self-start). These lights have however, been fitted with a light sensor which is connected to a bypass valve, allowing the lamps to roughly halve their consumption (or better) during daylight hours.

ANALYSIS

Apart from the gas lights, Hawkesbury Council's make up of street lighting is fairly typical of other Australian councils. The bulk of minor road lighting is taken up by 80 watt

mercury vapour lamps, with more significant lighting requirements often being met with 150 or 250 watt high pressure sodium lamps. The exact breakdown by technology has been provided below.

The number of lamps in the LGA is slightly below average at around 18 residents per lamp (typical expectation is around 10 to 15 residents per lamp). This is not cause for concern, but rather serves as a rough guide that all streetlights have most likely been accounted for in the inventory provided above.

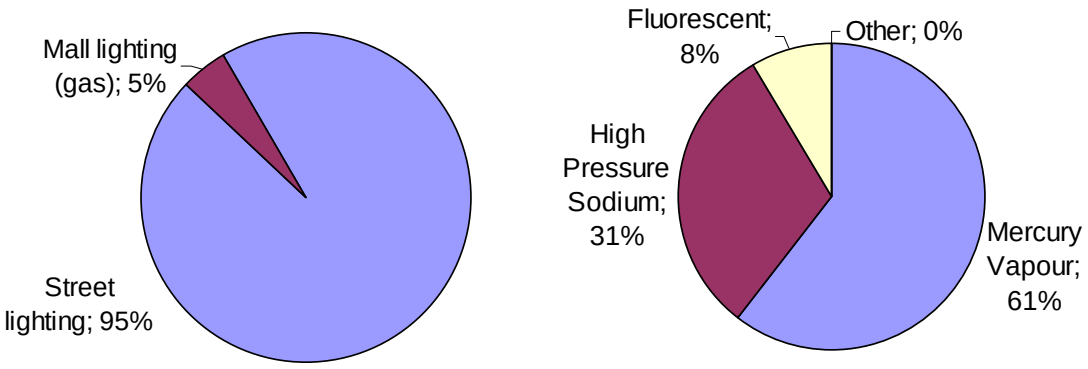


Figure 9 Street lighting – Total energy consumption (left), and electric lighting demand by technology (right)

There are clearly three dominant lighting technologies in use in the Hawkesbury: mercury vapour, high pressure sodium and fluorescent. Out of these, both high pressure sodium and fluorescent lamps already have a relatively high efficiency (lumens per watt). Mercury vapour lamps, on the other hand, deliver relatively poor performance and therefore represent an ideal opportunity for improving lighting efficiency.

A popular energy efficient replacement for the 80 watt mercury vapour lamp is the twin T5 fluorescent lamp. It delivers an impressive energy consumption reduction (including ballasts and so on) from 96 to 30 watts per lamp. Although these lamps have slightly lower light output, their maintenance factor is far better than the mercury lamps (i.e. their ability to maintain lighting levels over their lifetime). These lamps have now been trialled in several Sydney councils.

MEASURES

To be implemented:
1. Continually investigate energy efficient alternatives eg (replace all (~1,400) 80W mercury vapour lamps with twin T5 alternatives

SOUTH WINDSOR SEWAGE TREATMENT PLANT

Fairey Rd, South Windsor, NSW

DESCRIPTION

The South Windsor Sewage Treatment Plant currently serves around 17,000 residents. Apart from processing sewerage from the sewage system, the site is also equipped to process deliveries on truck (from septic pump out systems). The site utilises the activated sludge method of processing raw sewage.

The plant was opened in 1988 and was upgraded in 1992 and 2003 (adding additional capacity both times).

BASELINE

Energy Source	Meter No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	NEEE0022383	1615747	5,816.7	$124,876	FY-2007
Total			**5,816.7**	**$124,876**	

Baseline energy indicators for Sth Windsor Sewage Treatment Plant over a one year period.
Performance indicator: Total sewage volume processed (1/5/06 to 30/4/07) = 1,465ML
Peak summer demand: 324kVA
Peak winter demand: 288kVA

EQUIPMENT

There are many processes operating at the plant at any one time. Broadly speaking, raw sewage entering the plants goes through the following processes before discharge to ponds:

- Initial screening
- Primary sedimentation
- Anaerobic reactors
- Main aerators
- Clarifiers

Each stage typically has a series of pumps and motors controlling the processes. The most energy intensive of these are the blowers for the aeration tanks. There are six of these in total, each rated at roughly 20kW. During the day, on average, four of these are operating, with two typically operating after hours. Combined, these units would make up over 30% of the sites energy consumption.

Aeration Tanks

Apart from the main steps mentioned above, there are also a number of auxiliary processes and equipment at the site. These include:

- The de-watering unit – operating for several hours per day

De-watering Unit

- Main amenities and office building – including air conditioning, lab, washing facilities and garage
- Control room air conditioning – two 2.8kW units operating 24 hours a day
- Site security lighting

Control Room

ANALYSIS

Month to month the site has relatively stable energy consumption, with variations of up to 15% (maximum), presumably mainly related to slight variations in demand.

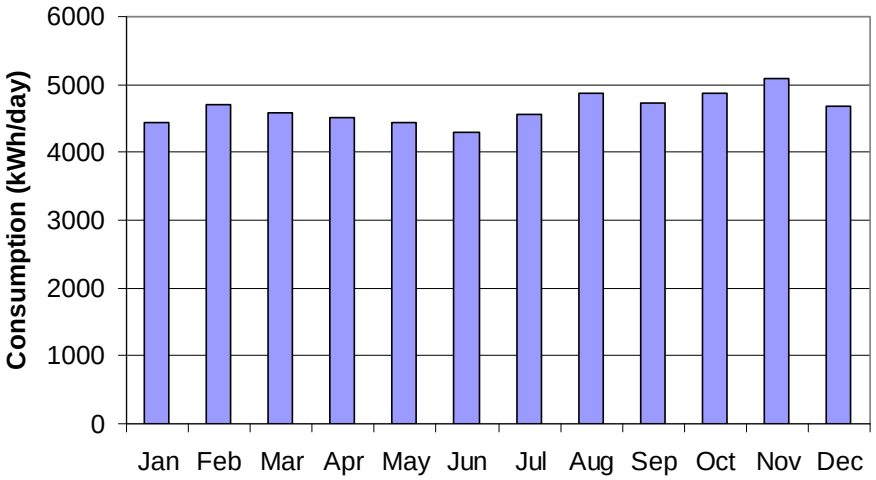


Figure 10 South Windsor STP – Monthly energy consumption, 2007

The average daily load profile paints a similar, fairly stable, picture of energy demand. With a noticeable morning and evening peak, consumption drops back around 20% overnight. Like the Oasis Centre, the site has a significant demand profile and improvable power factor, but is presently not fitted with power factor correction equipment.

In November 2007, demand at the site peaked at 347kVA and 0.83 power factor. With appropriately installed power factor correction equipment this peak demand would drop back to at least 295kVA. At current demand charges on this account (of ~$7.40/kVA/month) this translates into a substantial potential saving of around $4,500 per year.

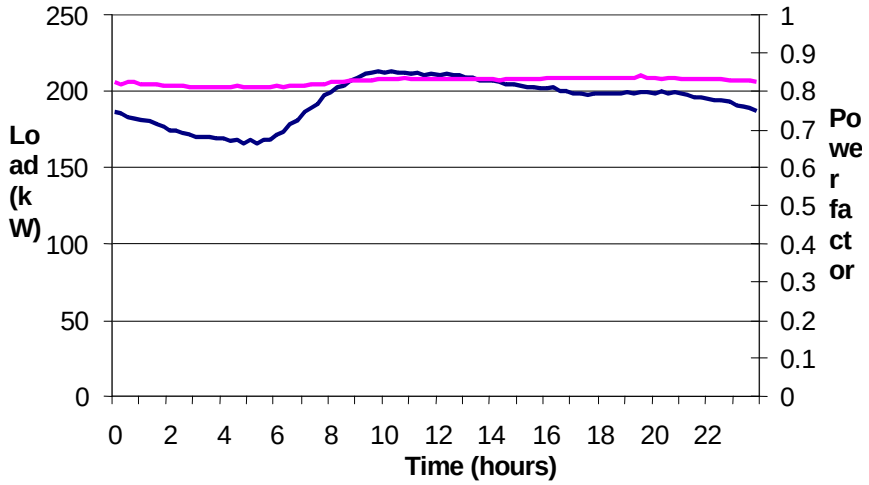


Figure 11 South Windsor STP – Average load and power factor (stable line), 2007

As the site's single largest load, the blower motors are also worth investigating in terms of achieving actual energy reduction. The fact that these motors are already staged in their operation is beneficial (i.e. with three linked to each device, only the required number are running at any one time). However, the linking of these motors to variable speed drives controlled by dissolved oxygen or other process sensors could yield further savings.

Site Plan

Even if such a system was deemed not to be feasible for the blower motors, a similar set-up should be investigated for other process stages at the plant.

MEASURES

Completed already - Soft starters installed on key equipment.
Some further measures to be implemented:

1. Use dissolved oxygen (or other process-specific) sensors linked to Variable Speed Drives for improved operation of blower motors

2. Install power factor correction equipment at this site

3. Set air conditioning in control room to minimum 24C in summer and 21C in winter.

4. Install Variable Speed Drives on other key variable-demand equipment

5. Install domestic heat pump hot water system for amenities area

COUNCIL ADMINISTRATION BUILDING

350-366 George Street, Windsor

(including old library and cottage)

DESCRIPTION

Council's administration precinct includes four buildings, three of which are included in this analysis (the main Administration Building, Old Library and Cottage). The Windsor Function Centre is a leased site and falls under a different metering point. The site layout and physical footprint of each building can be seen below.

Council Administration Building

Reverend Turner Cottage

The buildings contain Council offices, leased office space (the Old Library) and the Council Chambers. Total floor area of the buildings is roughly 4,500 square metres and the site accommodates about 140 staff.

Aerial view of Council administration building site

BASELINE

Energy Source	Meter No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	NEEE0011330	709668	2,554.8	$75,477	FY-2007
Total			**2,554.8**	**$75,477**	

Baseline energy indicators for Council Administration building site over one year.
Performance indicator: Building floor area (total) = 4,460m^2
Peak summer demand: 273kVA
Peak winter demand: 252kVA

EQUIPMENT

The main HVAC (heating, ventilation, air conditioning) equipment installed at this site is 27 years old (the same age as the buildings in their current configuration). The site is serviced by four main plant rooms: three in the administration building and one for the old Library. In the administration building, the area serviced by plant room one makes up the original building (which pre-dates the rest of the site).

Plant room two and the old library plant room service the greatest area and each is equipped with a 53kW (electric) chiller. Each of the four plant rooms are equipped with roughly 80kW of re-heats which operate in either two or three stages.

The operation of each plant room is controlled via a Building Management System (BMS). The start time of each system depends on building temperature, with 'early start' activated by low or high internal building temperature. There is also an override which prevents re-heating if outside air temperature rises above 18C.

In addition to the main equipment there are also a number of reverse cycle and split system units servicing various areas of the buildings, these include:

- Computer room system (5.5kW electric)
- Computer room backup system (6kW electric, rare usage)
- Mayor's office (6.4kW electric, rare usage)
- Cottage (~3kW electric)
- Old Library split system

Reverse Cycle Air-conditioner on Roof

Office Lighting

Indoor lighting at the site is predominantly by fluorescent tubes controlled manually by switches in each office area. A recent upgrade has seen the majority of lighting at the site changed from T8 to T5 tubes (roughly 1,000 tubes were changed). The upgrade included drop-in replacements with new starters as well as electronic ballasts fitted in all fixtures. The resulting demand savings would be around 10 watts per tube. Some areas of the building remain with the old lighting, including the old Library and the

carport areas.

There is some outdoor lighting at the site which is controlled by a combination of light sensors and timers.

Outside Lighting

Hot water at the site is delivered by several electric storage systems and auto-boilers in the staff kitchen areas. There are nine electric storage water heaters (typically smaller ~80 litre units) servicing kitchens and bathrooms at the site. There are also approximately seven instant hot water boilers at the site (two of which are refrigeration units delivering chilled water as well).

ANALYSIS

Energy consumption at this site is below the average for similar council buildings in Australia. On average, during the baseline period, the site used 1.58MJ/m^2/day compared to an average of 2MJ/m^2/day for similar buildings (Planet Footprint analysis). This better-than-average performance is partly explained by highly refined control logic and appropriately zoned air conditioning at the site. Analysing the data presented above does, however, reveal a number of opportunities for further savings to be made.

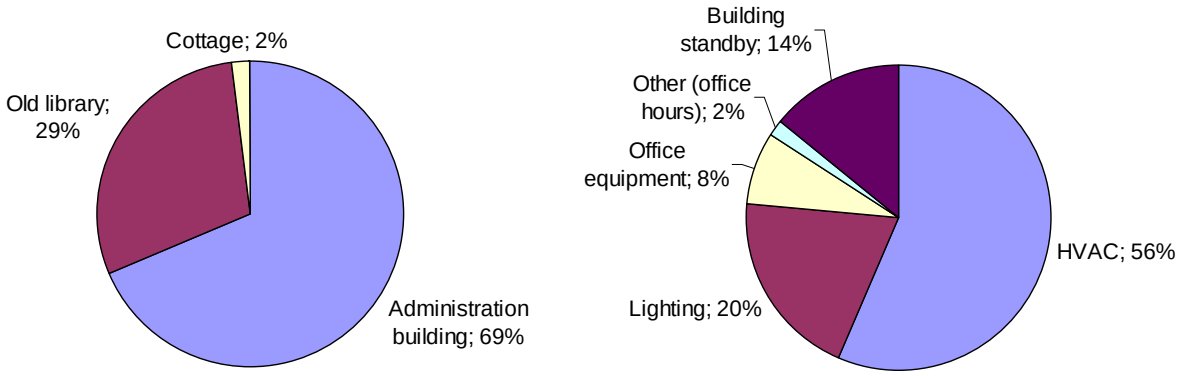


Figure 13 Administration Precinct – energy consumption by building from sub-metering data (left), and estimated energy consumption by end use (right)

The building's peak demand occurs in winter when re-heats are operating to warm the building for the day. A smaller peak occurs in summer, with the lowest usage during the key holiday months.

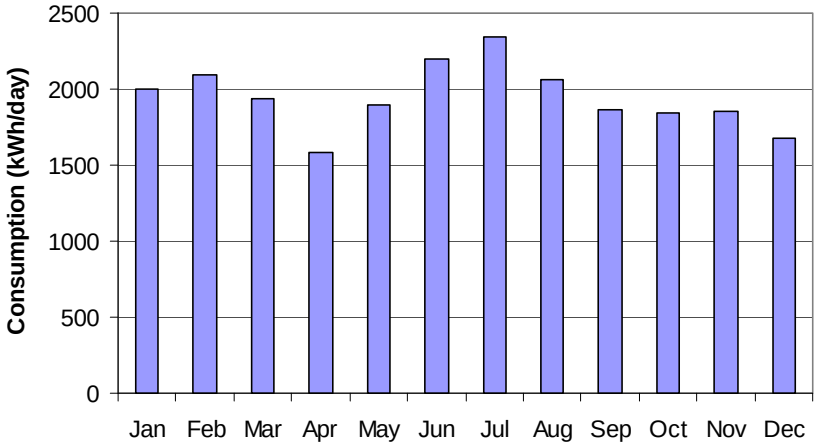


Figure 14 Administration Precinct – Monthly energy consumption, 2007

Although a leased area of the site, the old Library is consuming more than its expected share of energy. The building occupies roughly 22% of the site's floor area, but consumes 29% of the energy. This is partly explained by the building's design, including a high central ceiling/roof structure proving a challenge for heating and cooling. Opportunities do, however, exist to improve lighting at this site, including the more appropriate usage of the central skylights (which at present are more of a hindrance than benefit due to glare).

Old Library (leased office space)

Another significant opportunity for energy saving at the site is presented by building standby load. As defined in the energy balance chart below, this is the site load determined from 15-minute consumption data occurring between 9pm and 5am on weeknights and all day most weekends. Excluding some essential loads such as server room air conditioning and outdoor security lighting, this base "standby" load is around 22kW during these periods. When multiplied out, this represents a significant 14% of total energy consumption at the site. Although a portion of this can be adequately explained by other 'essential' loads such as refrigeration and exit lighting, it is anticipated that a number of opportunities exist to greatly reduce this amount. For example, office equipment left on standby overnight, computers left on 24 hours a day and so on.

Power factor correction equipment is installed at this site and during times of peak demand is doing its job. There is, however, a significant dip in power factor occurring daily at a regular time (around 6pm) which is worth investigating (see below).

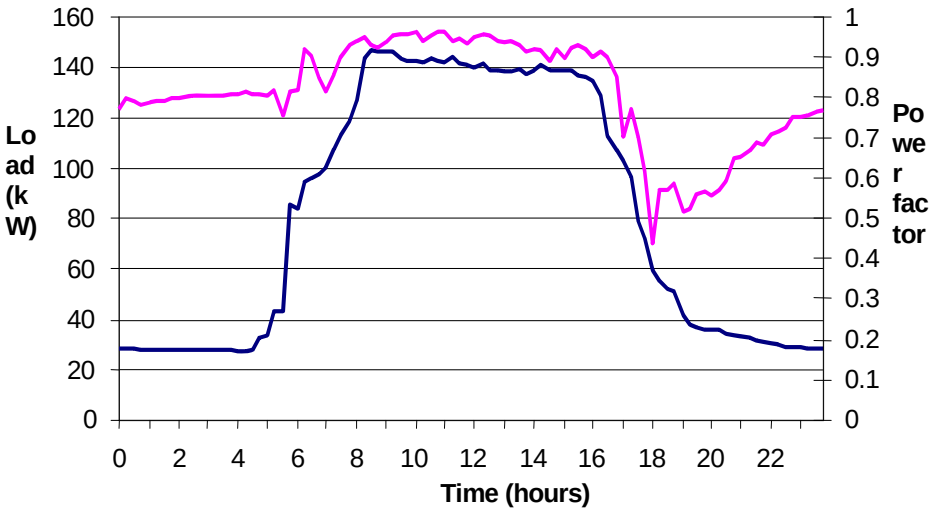


Figure 15 Administration Precinct – Average load and power factor (top line), 2007

MEASURES

Completed this year - T5 lighting upgrade throughout building.

Other measures to be implemented:

1. -Upgrade of building's HVAC systems (8-12 reverse cycle units)
2. Upgrade lighting in old Library (including de-lamping and day-lighting glare reduction)
3. Targeted 4kW reduction in building standby (after-hours audit, install timing devices etc)
4. Investigate and address irregular operation of power factor correction equipment
5. Investigate opportunities for improved roof insulation in the administration building
6. Investigate automatic controlled louvers in Main Atrium

Foyer Atrium

SEWAGE PUMP STATIONS - VARIOUS LOCATIONS

DESCRIPTION

Roughly half of the LGA's dwellings are connected to the sewerage system operated by Council. This system not only consumes significant amounts of energy at the treatment stage (see South Windsor and McGraths Hill STP sections), but also before this, with the many pump stations which supply these plants.

Sewerage Pump Station 'P'

It should be noted that Council only operates the sewerage infrastructure in part of the LGA – the water supply network is operated by Sydney Water.

BASELINE

Energy Source	Meter No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	Multiple	248215	893.6	$28,457	FY-2007
Total			**893.6**	**$28,457**	

Baseline energy indicators for sewage pump stations for a one year period.
Performance indicator: Total sewage volume processed (1/5/06 to 30/4/07) = 2,301ML
Peak summer demand: Not available
Peak winter demand: Not available

EQUIPMENT AND ANALYSIS

Hawkesbury council operates 23 sewage pump stations of varying size across the area. As can be seen in the figure below, the vast majority of energy consumption occurs at the top four pump stations.

Sewerage Pump Station 'C'

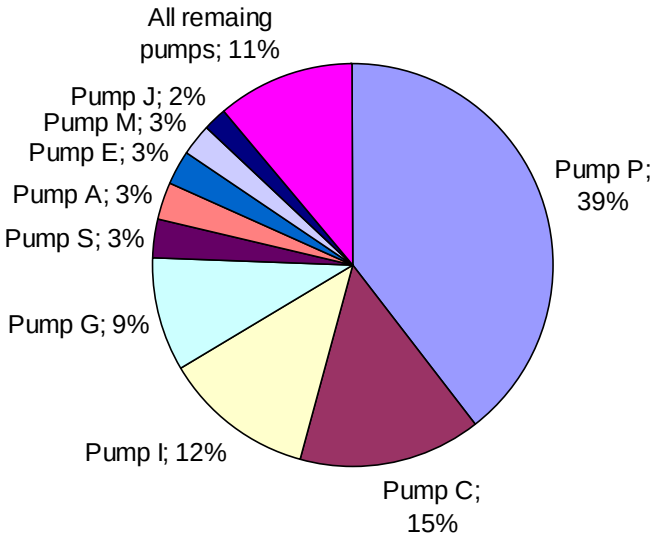


Figure 16 Pump Stations – Total energy consumption

The main pump equipment at the top energy consuming sites have been upgraded to more efficient units over recent years. There is, however, likely to be some further opportunity for integration of variable speed drives and improved control at these sites. The extent of this opportunity is not presently well understood and should be further analysed.

MEASURES

Completed - Upgrade to more efficient units (some pump stations).

Other measures to be implemented:

1. Investigate opportunities for further saving (including Variable Speed Drives)
2. Ensure all pump stations are upgraded, as required to more efficient units

MCGRATHS HILL SEWAGE TREATMENT PLANT

Mulgrave Rd, McGraths Hill

DESCRIPTION

The McGraths Hill Sewage Treatment Plant treats sewage from the suburbs of Windsor, South Windsor, McGraths Hill, Vineyard and Pitt Town. The plant is made up of four trickle filters and associated equipment.

The site has been in operation since the 1930's, with major upgrades in 1969 and 2000 (adding capacity and adding ponds for phosphorus reduction, water reuse and recycling).

BASELINE

Energy Source	Metre No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	43100101533	222341	800.4	$25,166	CY-2007
Total			**800.4**	**$25,166**	

Baseline energy indicators for McGraths Hill Sewage Treatment Plant over a one year period.
Performance indicator: Total sewage volume processed (1/5/06 to 30/4/07) = 836ML
Peak summer demand: 114kVA
Peak winter demand: 108kVA

EQUIPMENT AND ANALYSIS

Two of the trickle filters at the site are hydraulically driven (the original units), while the other two are electrically driven. Most of the site's energy consumption is not associated with the operation of these units, but rather the operation of the irrigation pumps, odour control blowers and re-circulation pump.

Trickle Filters

Screen Motor

The irrigation pumps are two 22kW units operated up to 18 hours a day in summer and as low as half-an-hour a day in winter. This seasonal variation in demand is reflected in the monthly load profile of the site (refer to next page).

There are three motors driving the odour control unit. These operate 24 hours a day and are rated at 3kW and two times ~0.5kW or less.

The re-circulation pump is roughly 10kW in size and typically operates 7am to 4pm.

The staff at the treatment plant has a small amenities and office area with equipment including: fluorescent lighting, electric hot water system (160 litres), washing machine and a small air conditioning unit.

The site also has a large shed to house the community transport vehicles. A small office is located inside including fluorescent lighting, electric hot water system (160 litres) and an electric motor for each roller door, six in total.

Community Transport Shed

To complete general agricultural duties around the property a shed is provided which houses equipment.

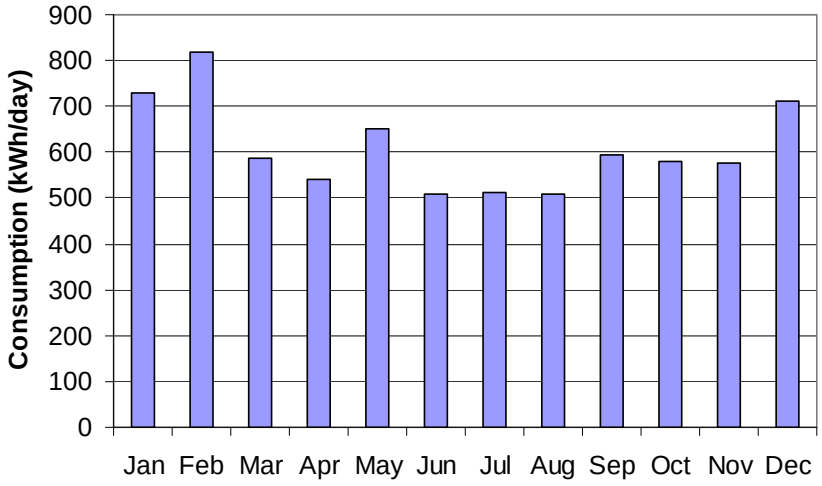


Figure 17 McGraths Hill STP – Monthly energy consumption profile, 2007

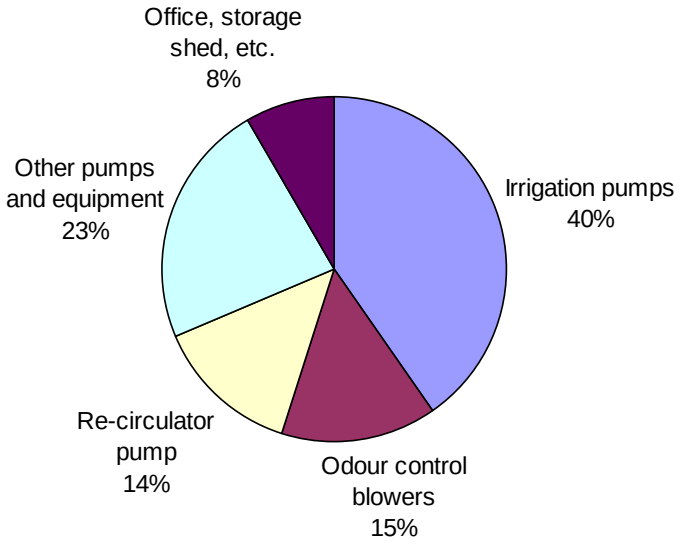


Figure 18 McGraths Hill STP – Energy consumption by end use

With the irrigation pumps estimated to be consuming around 40% of the site's total energy consumption they should be a priority in terms of energy saving. A number of opportunities exist:

- Operate the irrigation system via a variable speed drive and seek to maximise hours of operation (in order to reduce flow rate and therefore overall power consumption)
- Simplify layout and increase pipe diameter of irrigation network (this may not be feasible, but the same flow rate to power consumption benefits apply, *in addition to* those above)

Various pumping sites

This site is currently not charged for peak power consumption (as it remains on regular tariffs). If Council does decide to change this in the future (to take advantage of reduced tariffs) it should be noted that the site has relatively poor overall power factor (this would be adequately addressed by the installation of power factor correction equipment).

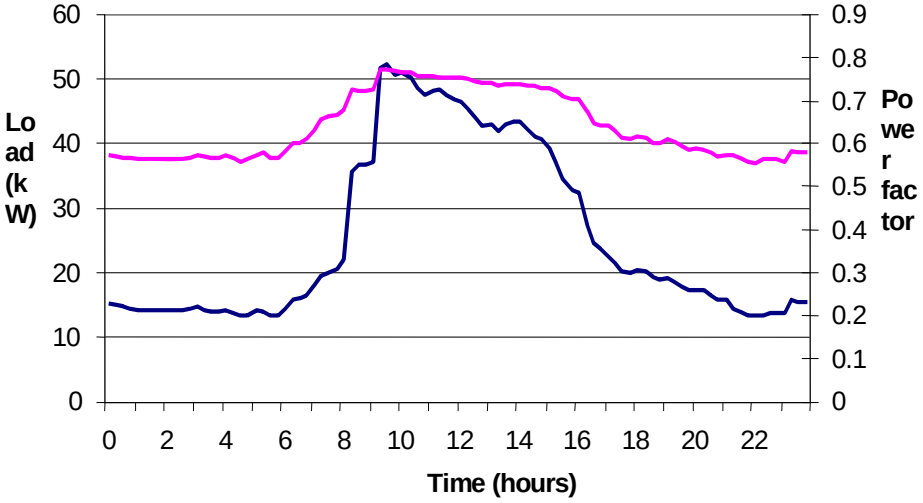


Figure 19 McGraths Hill STP – Average daily load and power factor (stable line), 2007

MEASURES

Some measures to be implemented:

1. Install Variable Speed Drives on irrigation pumps and aim to reduce operational flow-rate as much as possible
2. Install domestic heat pump hot water system for amenities area
3. Investigate power factor correction equipment
4. Install light sensor equipment for agriculture shed and replace with energy efficient globes

Agriculture Shed

WILBERFORCE FIRE CONTROL HEADQUARTERS

Macquarie Rd, Wilberforce

DESCRIPTION

The Wilberforce Fire Control Headquarters utilises the site of the old Colo Council office and Council Chambers. The site incorporates a training area, several offices, catering facilities and some fire service garages.

Rear Entrance

Although this site is occupied by a group which is external to the Council, energy bills are paid by Council as part of its contribution to the service.

Front Entrance

BASELINE

Energy Source	Metre No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	43100101600	162692	585.7	$20,447	FY-2007
Total			**585.7**	**$20,447**	

Baseline energy indicators for Wilberforce Fire Control Headquarters over a one year period.
Performance indicator: Building floor area (estimate inc. RFS site at front) = 1206m^2
Peak summer demand: ~60kW (estimate)
Peak winter demand: ~80kW (estimate)

*This site also has a LPG (bottled gas) connection – usage deemed insignificant (likely top be less than 1% of site total).

EQUIPMENT AND ANALYSIS

The Wilberforce Fire Control building serves as a general office space for a few key staff, a training facility and a Control Centre. As a result, apart from being a hub of activity for a small percentage of time, the building is otherwise only occupied by a handful of staff.

Training Centre

The building has a 33.5kW air conditioning system which is at least zoned so the training wing of the building is not operating unless occupied. It is understood that the areas serviced by the unit are insulated. Given the building's construction it would certainly be possible to retrofit under floor insulation in some areas.

The catering area sits in a separate building and is air conditioned by its own reverse cycle unit. This system remains on 24 hours a day at a set point of 22C. The main equipment inside the building is a large fridge and freezer (both with compressor ratings of ~1.5kW electric) and a zip boiler. The oven is a gas unit (connected to LPG bottles outside).

Main Catering Building

Lighting throughout the buildings is standard T8 fluorescent lamps. There is a total of 200 lamps, although many of these are in low use areas such as the kitchen and training area (and are therefore off most of the time).

Hot water for the catering area is from an electric storage system. The location of a possible additional system for the main building was unknown. In any case, consolidation of these systems and replacement with a domestic solar or heat pump hot water system would be beneficial.

The Wilberforce Fire Station building sits closest to the road and contains a small amount of equipment (fridge, zip boiler etc). A catering truck is also housed in this building and is connected to electricity at all times (refrigeration equipment running and battery charging).

Garage Facility

The building's electricity consumption history (below) indicates no distinct seasonal trend in consumption. The site's consumption is clearly more dependant on the level of demand for its facilities (training, operation as a Control Centre, etc).

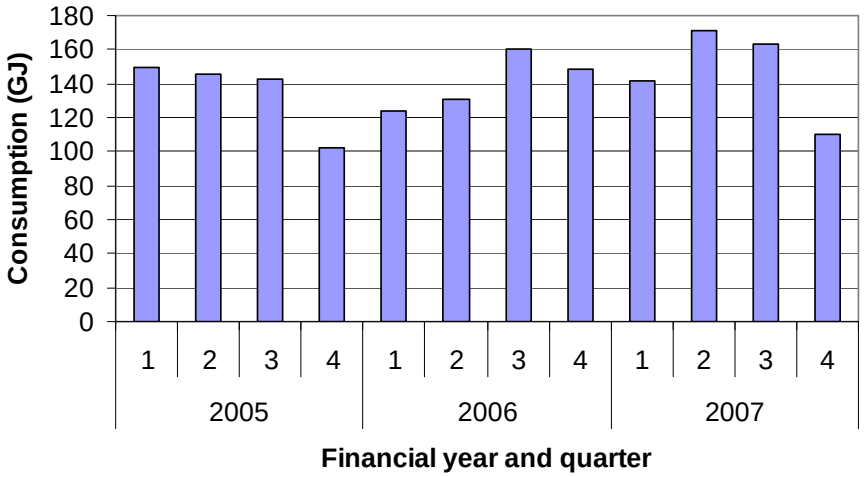


Figure 20 Fire Control HQ – Energy consumption by quarter

MEASURES

Measures to be implemented:

1. Insulate all ceiling areas (minimum R3.5) and under floor (where accessible)

2. Install domestic heat pump hot water system for building

HAWKESBURY INDOOR SPORTS STADIUM

Stewart St, South Windsor

DESCRIPTION

The Hawkesbury Indoor Sports Centre has two main sporting halls which include six multi-use basketball-sized courts. In between these sits a reception/waiting area, kiosk, offices, change rooms and general purpose area.

Main Entrance

The site is open 9am to 10pm on weekdays and 8:30am to 3pm on Saturdays.

The centre is managed by an external organisation. Although Council receives the energy bills for this site, it is understood that the full amount is on-billed to the operators.

BASELINE

Energy Source	Metre No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	NEEE0043694	159282	573.4	$17,707	FY-2007
Total			**573.4**	**$17,707**	

Baseline indicators for Hawkesbury Indoor Sports Stadium over a one year period
Performance indicator: Building floor area (estimate) = 6,352m^2
Peak summer demand: 82kVA
Peak winter demand: 89kVA

EQUIPMENT AND ANALYSIS

The most significant load at this site is the hi-bay lights in the main halls. There are roughly 100 of these in total. The main halls are fairly well naturally lit during the day, so these lights are generally only needed in the evenings. Their influence on overall energy use can clearly be seen in the site's average demand profile below.

Main Hall Hy-bay Lights

With these lights alone making up around half of the site's energy use, they represent an ideal opportunity for energy saving. Council is currently investigating a new energy efficient hi-bay fixture which reduces the power consumption of these units by more than half (to 160 watts per fixture).

Other lighting in the centre includes car park lighting and fluorescent lighting in the office, waiting and change room areas.

Each hall has a number of large exhaust fans to cool the building in summer (six in total). These have all been fitted with variable speed drives, although the primary motivation for this was to reduce noise pollution to surrounding dwellings.

Kiosk Area

The remaining energy users at the site include:

- Kiosk refrigeration and freezer requirements
- Five vending machines
- Electric hot water system for change rooms
- Reverse cycle air conditioning for the office

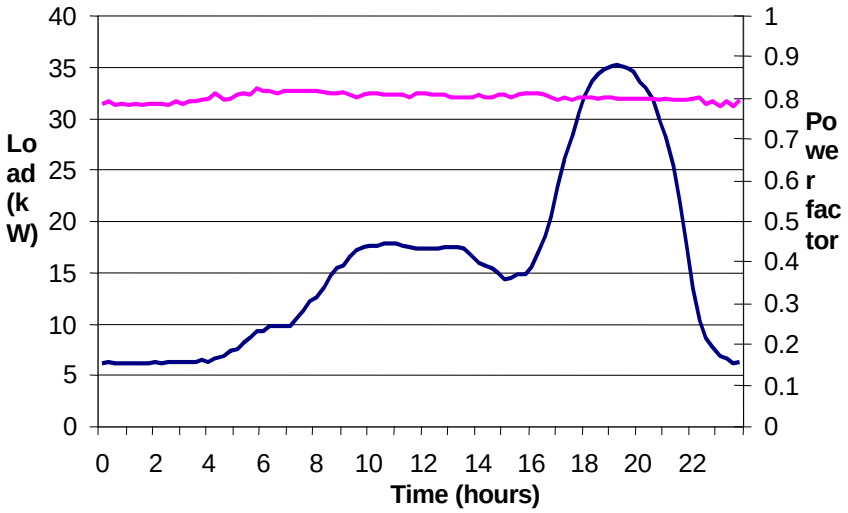


Figure 21 Indoor Sports – Average daily load and power factor (stable line), 2007

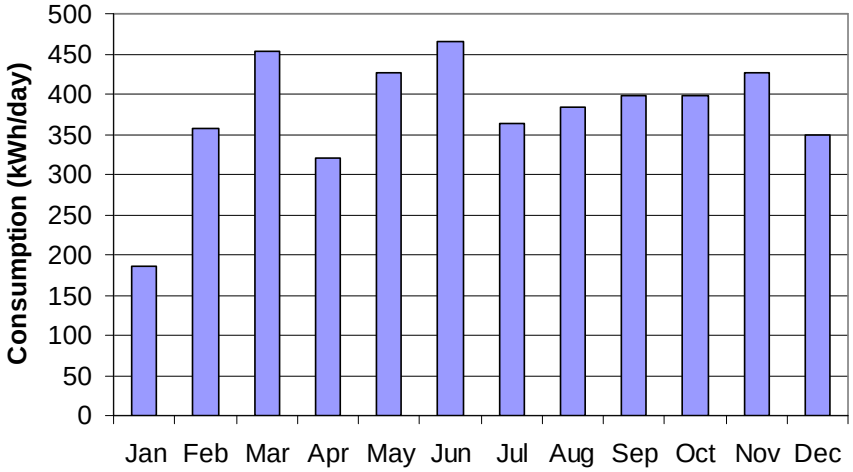


Figure 22 Indoor Sports – Monthly energy consumption profile, 2007

MEASURES

Some measures to be implemented:

1. Install energy efficient hi-bay replacements (~100 fittings)

2. Install domestic heat pump hot water system for change rooms

3. Place non-perishable drinks fridges and vending machines on timer switches (off 11pm till 7am)

4. Carry out a lighting refit to a T5 LL MT Adaptor System

WILBERFORCE DEPOT

Old Sackville Rd, Wilberforce

DESCRIPTION

The Wilberforce Depot is Council's main works depot. It is made up of four main buildings which house the office and store, mechanical workshop, carpenter's area, and amenities. The site also has a refuelling area and a parking area for Council's waste trucks.

BASELINE

Energy Source	Metre No.	KWh	GJ	Cost (ex gst)	Baseline year
Electricity	4310029404	116135	418.1	$12,234	FYQ2/06-Q1/07
Total			**418.1**	**$12,234**	

Baseline energy indicators for Wilberforce Depot over a one year period.
Performance indicator: Building floor area (estimate) = 1,125m^2
Peak summer demand: ~70kW (estimate)
Peak winter demand: ~70kW (estimate)

EQUIPMENT AND ANALYSIS

The main load at this site is lighting from hi-bay fittings (total of approximately 60 fittings). Unlike the sports centre, however, many of these appear to be left on during the day despite the presence of sufficient day-lighting in most areas.

Other lighting at the site is mainly from T8 fluorescent lamps lighting areas including the office, amenities and half of the store. There are several security floodlights which operate overnight and are controlled by a light sensor.

The site's air compressor would be the next biggest user – rated at 18.5kW and likely to be running for approximately 12 hours per day.

There are only two air conditioners installed at the site at present. There is a reverse cycle system for the main office and a small wall mounted unit for the mechanic's office.

The site also currently has its own small sewage treatment system, but will soon be connected to the main network.

As expected with the above equipment and usage, energy consumption at the site remains fairly stable throughout the year.

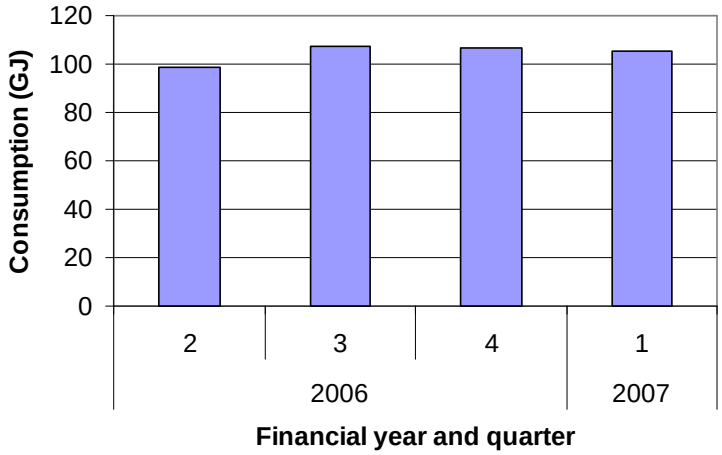


Figure 23 Wilberforce Depot – Energy consumption by quarter (baseline period)

MEASURES

Some measures to be implemented:

1. Install energy efficient hi-bay replacements (~60 fittings)

2. Carry out a lighting refit to a T5 LL MT Adaptor System

3. Replace air compressor with a Variable Speed Demand (VSD) unit. It does not run all the time only when required with considerable energy savings.

APPENDIX A – POSSIBLE ENERGY SAVINGS ACTIONS BY SITE

Site	Measure	Cost	Yearly Savings						
			KWh	MJ	Pk-kVA	$	CO2	Payback	Completion
Site name	Summary description, accompanied by supporting information in the associated report section	Upfront cost of measure	Electricity consumption	Gas consumption	Peak demand (electricity)	Dollar saving	Kg of CO2-e	Simple payback (in years)	Planned completion date
Deerubbin	Set-up net metering or electricity sale contract with energy provider to account for electricity generated by co-gen system	TBA	TBA			TBA		TBA	2010
Deerubbin	Resolve co-gen operational issues (with energy reduction a priority given the site's unusually high energy consumption)	TBA	TBA			TBA		TBA	2010
Deerubbin	Review electricity contract pricing (once co-gen equipment operation is resolved)	TBA	TBA			$20,000		TBA	2010
Deerubbin	Place the library's central up-lights on a light-sensor override (so thay are always off when sufficient day-lighting is available)	$1,500	7,008	0	0	$841	7,428	1.8	2008
Oasis	Automatic doors installed to minimise heat loss	$51,000	TBA			TBA	0	TBA	2008
Oasis	Reduce pool temperature set points by 1c (26-27C)	$0	50,000	250,000	0	$9,750	69,525	0.0	2008
Oasis	Install solar water heating system on available roof space	$90,000	100,000	500,000	0	$19,500	139,050	4.6	2012
Oasis	Install power factor correction equipment at this site	$14,000	0	0	53	$4,706	0	3.0	2009
Oasis	Install Variable Speed Drive's on main circulation pumps (eg 80% of usual flow rate over night)	$10,000	32,850	0	0	$3,942	34,821	2.5	2009

Site	Measure	Cost	Yearly Savings						
			KWh	MJ	Pk-kVA	$	CO2	Payback	Completion
Site name	Summary description, accompanied by supporting information in the associated report section	Upfront cost of measure	Electricity consumption	Gas consumption	Peak demand (electricity)	Dollar saving	Kg of CO2-e	Simple payback (in years)	Planned completion date
Oasis	Install lighting occupancy sensors in the aerobics room (note: additional opportunities may exist)	$1,000	1,752	0	0	$210	1,857	4.8	2009
Oasis	Replace kiosk halogen lighting with 20W IRC halogens	$100	1,533	0	0	$211	1,625	0.5	2008
Oasis	Investigate new low air replacement method for ventilation system (currently being implemented at Gosford Council)	$150,000	TBA			TBA	TBA	TBA	TBA
Streetlights	Replace all (~1,400) 80W mercury vapour lamps with twin T5 alternatives	$400,000	367,920	0	84	$51,610	389,995	7.8	2015
SWSTP	Completed - Soft starters installed on key equipment	TBA	TBA			TBA	TBA	TBA	Completed
SWSTP	Use dissolved oxygen (or other process-specific) sensors linked to VSD's for improved operation of blower motors	$30,000	48,000	0	0	$5,760	50,880	5.2	2010
SWSTP	Install power factor correction equipment at this site	$14,000	0	0	50	$4,440	0	3.2	2009
SWSTP	Set air conditioning in control room to minimum 24C-21C	$0	2,000	0	0	$240	2,120	0.0	2008
SWSTP	Install domestic heat pump how water system for amenities area	$2,500	2,920	0	2	$528	3,095	4.7	2010
SWSTP	Install Variable Speed Drives on other key variable-demand equipment	TBA	TBA			TBA		TBA	TBA
Admin	Upgrade of building's HVAC systems (8-12 reverse cycle units)	$350,000	TBA			TBA		TBA	Tender
Admin	Upgrade lighting in old Library	$4,000	4,000	0	2	$658	4,240	6.1	2010

Site	Measure	Cost	Yearly Savings						
			KWh	MJ	Pk-kVA	$	CO2	Payback	Completion
Site name	Summary description, accompanied by supporting information in the associated report section	Upfront cost of measure	Electricity consumption	Gas consumption	Peak demand (electricity)	Dollar saving	Kg of CO2-e	Simple payback (in years)	Planned completion date
	(including de-lamping and day-lighting glare reduction)								
Admin	Targeted 4kW reduction in building standby (after-hours audit, install timing devices etc)	$3,000	17,600	0	0	$2,112	18,656	1.4	2009
Admin	Investigate and address irregular operation of power factor correction equipment	TBA	TBA			TBA		TBA	2008
Admin	Investigate opportunities for improved roof insulation in the administration building	TBA	TBA			TBA		TBA	2010
Admin	Investigate automatic controlled louvers in Main Atrium	TBA	TBA			TBA		TBA	2009
Pumps	Completed - Upgrade to more efficient units (some pump stations)	$15,000	TBA			TBA		TBA	Completed
Pumps	Investigate opportunities for further saving (including Variable Speed Drives)	TBA	TBA			TBA		TBA	TBA
Pumps	Ensure all pump stations are upgraded, as required to more efficient units	On going	TBA			TBA		TBA	TBA
MHSTP	Install Variable Speed Drives on irrigation pumps and aim to reduce operational flow-rate as much as possible	$10,000	26,400	0	0	$3,168	27,984	3.2	Completed
MHSTP	Install domestic heat pump hot water system for amenities area	$2,500	2,920	0	2	$350	3,095	7.1	2010
MHSTP	Investigate power factor correction equipment	TBA	TBA			TBA		TBA	TBA
MHSTP	Install light sensor equipment for	$1,500	TBA			TBA		TBA	TBA

Site	Measure	Cost	Yearly Savings						
			KWh	MJ	Pk-kVA	$	CO2	Payback	Completion
Site name	Summary description, accompanied by supporting information in the associated report section	Upfront cost of measure	Electricity consumption	Gas consumption	Peak demand (electricity)	Dollar saving	Kg of CO2-e	Simple payback (in years)	Planned completion date
	agriculture shed and replace with energy efficient globes								
FireHQ	Insulate ceiling (minimum R3.5) and under floor (where accessible)	$7,000	9,125	0	0	$1,095	9,673	6.4	2010
FireHQ	Install domestic heat pump hot water system for building	$2,500	2,920	0	2	$350	3,095	7.1	2009
IndoorSport	Install energy efficient hi-bay replacements(~100 fittings)	$25,000	45,625	0	25	$5,475	48,363	4.6	Tender
IndoorSport	Install domestic heat pump hot water system for change rooms	$2,500	7,300	0	2	$876	7,738	2.9	2010
IndoorSport	Place non-perishable drinks fridges and vending machines on timer switches (off 11om to 7am)	$100	1,500	0	0	$180	1,590	0.6	Tender
IndoorSport	Carry out a lighting refit to all T5 LL MT Adaptor System	$35,806	61,466	0	0	$7,376	65,154	4.9	Tender
Depot	Install energy efficient hi-bay replacements (~ fittings)	$15,000	27,375	0	15	$3,285	29,018	4.6	2010
Depot	Carry out a lighting refit to a T5 LL MT adaptor System	$64,755	188,179	0	0	$22,581	199,470	2.9	2010

Note: The planned completion dates for individual projects have been categorised according to and proposed resource allocation. The projects with the largest payback in the shortest number of years will be completed first. Some projects have been completed or have gone out to tender at the time of printing and will be amended in further submissions.

APPENDIX B - AVERAGE ELECTRICITY COST BY SITE

The electricity tariffs charged at Council's top ten sites indicate significant variance from one site to another. While some of this variance can be attributed to size (with larger sites often able to broker lower average rates) there appears to be significant opportunity for savings to be made in some areas.

Note that whilst this is not an energy saving initiative, cost savings made through such adjustments could potentially be re-invested in energy reduction measures.

A simple analysis, using available data from the baseline period, is presented below.

Site	Consumption (kWh)	Cost per year (ex gst)	Actual Ave. Rate ($/kWh)
Deerubbin Centre Precinct	1401218	$170,829	0.122
Oasis Centre	1461200	$122,644	0.084
Street Lighting	1940138	$163,407	0.084
South Windsor STP	1615747	$124,876	0.077
Council admin Building	709668	$75,477	0.106
Sewage Pump Stations	248215	$28,457	0.115
McGraths Hill STP	222341	$25,166	0.113
Fire Control HQ	162692	$20,447	0.126
Indoor Stadium	159282	$17,707	0.111
Wilberforce Depot	116135	$12,234	0.105