Greenhouse Gas Reduction Strategy

October 2007

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1. Executive Summary

The Greenhouse Gas Reduction Strategy has been developed to provide a framework for the implementation of Western Water's commitment to reduce greenhouse gas emissions with an aim toward achieving carbon neutrality. The framework outlines a pathway through which we will achieve carbon neutrality by making our net greenhouse gas emissions zero by 2017.

Western Water began measuring its total greenhouse gas emissions in 2004/05 at which time its emissions were recorded as 30,434 tonnes of carbon dioxide equivalent emissions (CO_2e). In 2006/07, greenhouse gas emissions had been reduced by 21% to total emissions of 23,957 tonnes of CO_2e. It is important to recognise that various actions have already been undertaken by Western Water that have lowered emissions, therefore 2004/05 has been chosen as the base year rather than 2006/07.

Western Water will commit to reducing its greenhouse gas emissions in four milestones as follows:

- Milestone 1: Reduce greenhouse gas emissions by 25% in 2008/09 based on 2004/05 emission levels (total emissions target 22,826 tonnes of CO_2e)
- Milestone 2: Reduce greenhouse gas emissions by 50% in 2012/13 based on 2004/05 emission levels (total emissions target 15,217 tonnes of CO_2e)
- Milestone 3: Reduce greenhouse gas emissions by 75% in 2014/15 based on 2004/05 emission levels (total emissions target 7,609 tonnes of CO_2e)
- Milestone 4: Reduce greenhouse gas emissions by 100% in 2017/18 based on 2004/05 emission levels (total emissions target 0 tonnes of CO_2e)

To go carbon neutral in 2007 would cost Western Water more than $ 1 million per annum in purchasing GreenPower and carbon offsets. The target date of 10 years hence was chosen because it provides sufficient time and budget for identified and future initiatives to be undertaken over the period of two Water Plans. There is $900,000 allocated for capital expenditure and $250,000 allocated for operational expenditure on Greenhouse Gas Reduction Initiatives in the 2008-13 Water Plan.

In August 2007, an independently facilitated workshop was undertaken with Western Water employees to identify opportunities from all areas of the business to reduce greenhouse gas emissions. A consultant was then engaged to audit and/or quantify the greenhouse gas emissions savings potential for each opportunity to ensure the savings potential was valid and realistic and to assist in prioritising actions.

Western Water staff identified twenty-five opportunities that can reduce greenhouse gas emissions and require further action. These opportunities equate to approximate savings in greenhouse gas emissions of 6,395 tonnes and will be implemented over the next 5 years.

Key opportunities identified include:

- The Sunbury main office to go carbon neutral immediately by purchasing 100% GreenPower for the office
- Initiate investigations into the opportunity for the Class A Recycled Water Plant to become carbon neutral by capturing biogas from the Surbiton Recycled Water Plant
- 68% of Western Water's pump stations to go carbon neutral immediately by purchasing 100% GreenPower for the 'Bottom 66' pumps. The purchase of GreenPower will be made through efficiency savings on the 'Top 11' pumps.
- Form a partnership with the Australian Greenhouse Office in joining the Greenhouse Challenge Plus program

The Environment Committee will review Western Water's Greenhouse Gas Reduction Strategy annually. Further initiatives for greenhouse gas reduction will be identified and the Strategy updated to ensure the overall target of carbon neutrality by 2017 can be achieved.

2. Introduction

The Greenhouse Gas Reduction Strategy has been developed to provide a framework for the implementation of Western Water's commitment to reduce greenhouse gas emissions with an aim toward achieving carbon neutrality. The framework will outline a pathway through which we will achieve carbon neutrality by making our net greenhouse gas emissions zero by 2017.

This target is based on Western Water's vision "to be a leading service provider working with our community towards a sustainable future". A sustainable future requires an integrated approach to efficiently manage the resources used to operate our business.

Current State and Federal Government Policy do not require Western Water to reduce its greenhouse gas emissions. Western Water's current level of greenhouse gas emissions do not trigger the State Environment and Resource Efficiency Plans (EREPs) program or the proposed Federal Carbon Trading Program where organisations with greater than 50,000 tonnes of CO_2e will be included.

Our commitment to reducing greenhouse gas emissions is based on our understanding of its connection to climate change and consequently the availability of water supplies for future generations. For this reason we are committed to reducing the environmental impacts of our operations, using fewer resources and using them more efficiently. Reducing greenhouse gas emissions and making our business carbon neutral is a key part of this commitment to reduce our impact on climate change.

The Greenhouse Gas Reduction Strategy has been developed in accordance with Western Water's Greenhouse Gas Reduction Policy adopted by the Board in June 2007. The Strategy also recognises Western Water's Memorandum of Understanding with Sustainability Victoria by working together towards carbon neutrality, sharing our learnings with key stakeholders and confirming Western Water's leadership role in greenhouse gas reduction within the Victorian Water Industry.

The Greenhouse Gas Reduction Strategy has been developed for Western Water by Western Water. The Greenhouse Gas Reduction Strategy was developed by representatives from all areas of Western Water including representatives from the Environment Committee, the Management Team and Knowledge Managers who are responsible for the actions generated by the Strategy.

3. Background

Western Water is a statutory corporation under the Water Act 1989 and is one of Victoria's thirteen regional urban water corporations. Western Water's service area incorporates parts of Hume, Melton, Moorabool and Macedon Ranges Councils. A combination of urban and rural living, our region includes a significant proportion of land devoted to agricultural uses especially grazing and cropping. Residential customers comprise 94% of our customer base. Rapid housing development occurs in our region contributing to an average annual growth rate over 3%.

Our water district has two main storages, Lake Merrimu and Rosslynne Reservior, both of which are managed by Southern Rural Water. These reservoirs supply the Melton and Bacchus Marsh (Merrimu), and Macedon Ranges and Sunbury (Rosslynne) districts. Due to the impact of prolonged drought on local storages, Western Water has also gained access to a water allocation from Yarra systems storages, which draws on Melbourne water sources and are interlinked to supply all towns except Lancefield and Myrniong.

Western Water operates seven recycled water plants, where wastewater and trade waste collected from domestic, commercial and industrial customers, is treated. All seven recycled water plants are EPA licensed. This year, 84% of wastewater generated in our region was recycled with the National Water Commission report for 2004/05 acknowledging Western Water as the highest water recycling major urban water authority in Australia.

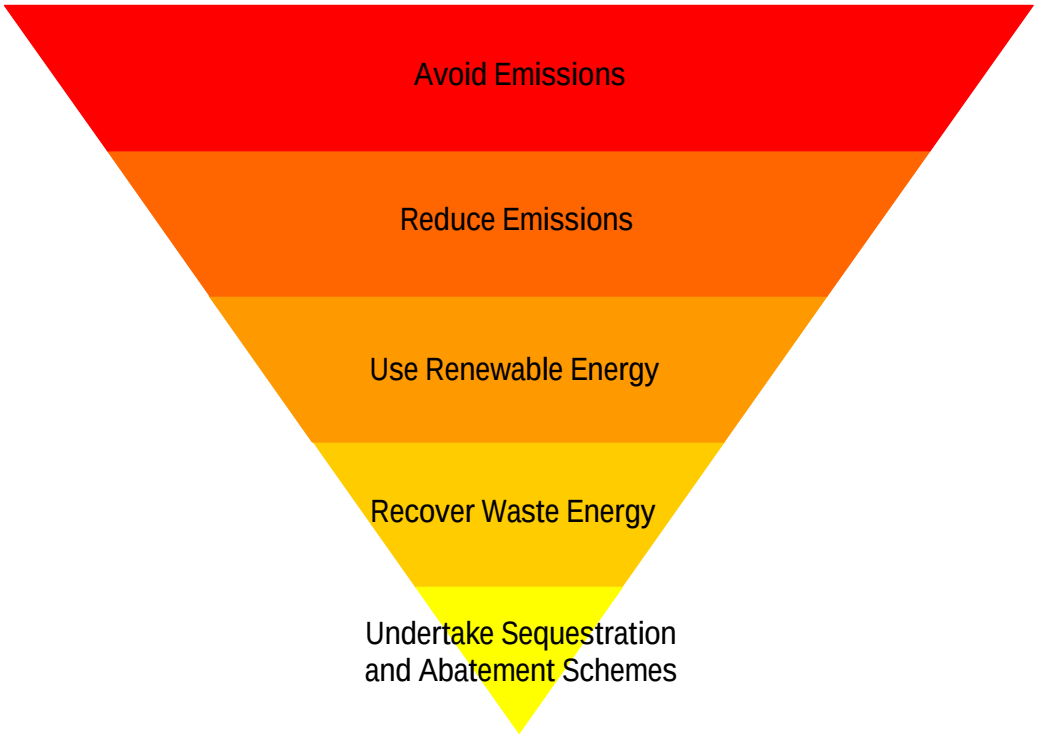
Western Water is fully owned by the Victorian Government and reports to the Minister for Water. A skills-based Board of Directors is appointed by the Minister to set our strategic direction and business policy, supported and advised by a senior management team. Western Water is responsible to the Minister through the Department of Sustainability and Environment (DSE). The Department of Human Services regulates our water quality standards while the Environment Protection Authority (EPA) controls environmental standards, particularly for wastewater discharge. The Essential Services Commission (ESC), the economic regulator for the Victorian water sector, regulates our prices, service standards and market conduct.

In June 2007, Western Water reinvigorated its Greenhouse Gas Reduction Policy to demonstrate a strong commitment to sustainability and minimising our impact on climate change. Western Water made a commitment to achieve the following priorities:

- Identify all sources of greenhouse gas emissions for Western Water and set realistic greenhouse gas reduction targets
- Identify and recommend opportunities to reduce greenhouse gas emissions including identifying energy efficiencies, offsets and renewable energy opportunities of existing, new and scheduled for upgrade infrastructure
- Measure and report greenhouse gas emissions using an industry common framework and key performance indicators
- Develop and implement a communication and education strategy to raise staff and community awareness by:
  - Linking water consumption and greenhouse gas emissions;
  - Promoting greenhouse gas reduction opportunities; and
  - Providing a pathway for behavioural change.
- Demonstrate leadership across the broader community through the establishment, facilitation and promotion of pathways towards carbon neutrality with particular reference to local stakeholders and the Victorian Water Industry
- Adopt an industry wide collaborative and co-operative approach through partnerships and shared learning

In addition, Western Water has adopted a Carbon Management Hierarchy (refer to Figure 2.1) based on the adapted EPA Victoria Waste Management Hierarchy, which will form the basis for managing opportunities identified within the Greenhouse Gas Reduction Strategy. The Hierarchy was adopted to act as a key guiding principle for the Strategy and to guide prioritisation of initiatives and opportunities.

Figure 2.1: Carbon Management Hierarchy



The Carbon Management Hierarchy allows Western Water to prioritise greenhouse gas emission reduction opportunities by firstly looking to avoid energy usage, which will be the most cost effective option and has other potential benefits for the business such as water conservation and cost minimisation. The Hierarchy also looks to encourage improving efficiency of energy use prior to seeking other alternatives such as reduction in coal powered electricity consumption through renewable energy generation and use, recovering waste heat or the least favoured option which is carbon waste disposal through carbon capture and storage. It is considered that giving alternative energy use and carbon capture and storage a lower priority will drive energy efficiency options.

It is anticipated that in order to achieve greenhouse gas emission reduction targets that a combination of all elements contained within the Carbon Management Hierarchy will be implemented.

4. Baseline Data

This section provides an overview of Western Water's carbon footprint (net greenhouse gas emissions). Understanding the size of our carbon footprint is critical in the development of a Greenhouse Gas Reduction Strategy. A robust measurement and reporting system is fundamental in order to effectively manage and track emissions reductions over time.

Also provided in this section are Western Water's projected future emissions until 2013. Future emissions are based on population growth projections, major capital projects, and energy usage data provided for the 2008 - 2013 Water Plan. This information serves as a benchmark to monitor and track the progress of any greenhouse gas reduction or carbon offset measures.

4.1 Sources of Greenhouse Gas Emissions

In order to develop a baseline assessment of Western Water's greenhouse gas emissions, our core activities and the range of greenhouse gas emissions resulting from these activities must be understood. Whilst a baseline assessment should include all emissions attributable to Western Water, this can be defined in several ways. The Australian Greenhouse Office (AGO, 2006) adopts the following emissions categories:

- Scope 1 covers direct emissions produced from sources within the boundary of an organisation and as a result of that organisation's activities. These emissions arise from activities such as electricity generation on site, transportation and on-site waste management, including the treatment of sewage, water and biosolids.

- Scope 2 covers indirect emissions generated elsewhere as a consequence of the organisation's activities, but which are physically produced by the activities of another organisation. This includes, most importantly, emissions resulting from the consumption of purchased electricity, steam or heat.

- Scope 3 includes all other indirect emissions resulting as a consequence of the organisation's activities. For example, emissions resulting from activities upstream and downstream through an organisation's supply chain such as emissions generated by a wholesaler delivering water to your business, when customers heat water and during the manufacture and installing of pumping infrastructure.

Western Water has identified Scope 1 and 2 emissions for inclusion into its baseline assessment. The availability of data and current accounting regimes of upstream and downstream organisations (each unit of emission should only be counted once, not double counted) has lead to this decision. This approach is consistent within the Victorian Water Industry and although Scope 3 emissions are not part of Western Water's baseline assessment, Western Water will continue it's work with upstream suppliers and downstream customers to ensure all emissions are accounted for correctly and greenhouse reduction opportunities are identified and actioned where appropriate.

In addition, the most significant source of Scope 3 emissions is from the pumping of water from Melbourne Water to Western Water. Melbourne Water already accounts for these emissions in their greenhouse gas itinerary and is working to reduce them with an overall target of carbon neutrality by 2018. For Western Water to include these emissions would be to double count mitigation work that is already being undertaken by another authority.

The following Table 4.1.1 outlines the various greenhouse gas emission sources included in Western Water's carbon footprint calculations and provides a brief explanation of how that source generates the greenhouse gas emission.

Table 4.1.1 Sources of greenhouse gas emissions included in Western Water's footprint calculations

Source	*Scope*	*Explanation*
ENERGY		
Victoria Grid Electricity	*2*	*Emission resulted from the consumption of purchased electricity from the Victorian Electricity Grid, provided by AGL. Emissions are generated at a remote location as a consequence of Western Water's activities.*
Unleaded Petrol and Diesel	*1*	*Emissions are associated with petrol and diesel consumption by Western Water owned vehicles and generators; used for back-up power supply and for bulk fuel stores located at Western Water's operational sites.*
WATER AND WASTEWATER TREATMENT		
Methane	*1*	*Fugitive methane emissions are produced from the anaerobic treatment and decomposition of volatile suspended solids in wastewater, sludge and biosolids generated at Western Water's Recycled Water Plants.*
Nitrous Oxide	*1*	*Nitrous oxide emissions are generated from the treatment and removal of nitrogen in wastewater at Western Water's Recycled Water Plants.*
Soda Ash	*1*	*Carbon dioxide is released through the use of soda ash at Western Water's Marriages Water Filtration Plant for pH control.*

4.2 Carbon Footprint

The various sources of Western Water's greenhouse gas emissions contribute in varying degrees to Western Water's total carbon footprint. The emission sources identified in Table 4.1.1 produce a range of greenhouse gases including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO_2) amongst others. Each gas has a specific capacity to absorb heat and therefore each has its own global warming potential based on its relative impact over a 100 year period as compared to carbon dioxide. In order to compare the impact of one gas against another, the carbon footprint expresses emissions of each gas in tonnes of 'carbon dioxide equivalents' or CO_2e. This is calculated by multiplying the actual mass of emissions by the appropriate emission factor or global warming potential, published by the Australian Greenhouse Office (2006).

Western Water's total greenhouse gas emissions for 2006/07 were 23,957 tonnes of CO_2e. Electricity consumption from the Victorian electricity grid formed a major source of Western Water's total carbon footprint in 2006/07 accounting for 83% of emissions. Figure 4.2.1 and Table 4.2.1 provide an overview of the relative contribution of the different emissions to Western Water's greenhouse gas emissions profile.

Figure 4.2.1 Source of Western Water's Greenhouse Gas Emissions (2006/07)

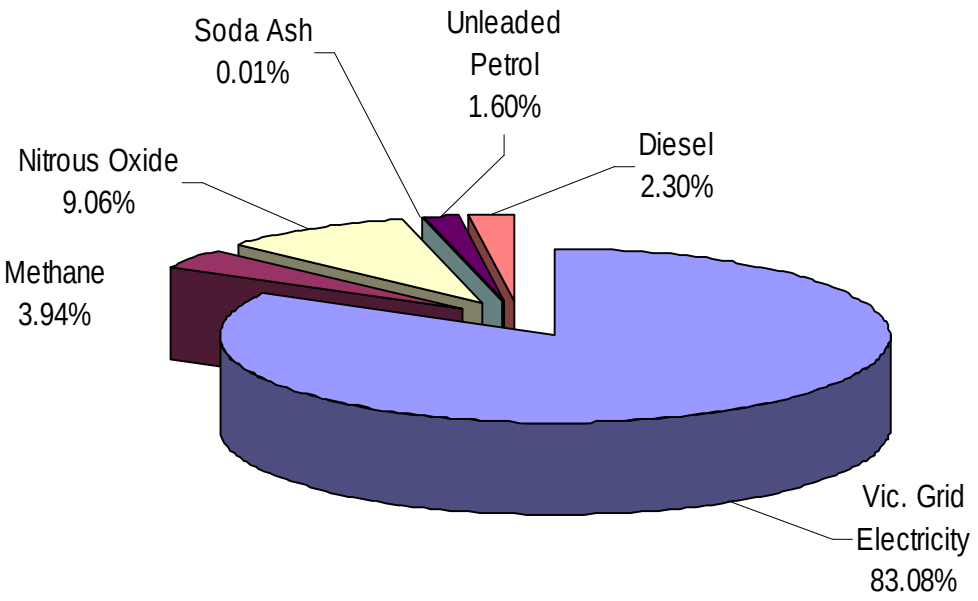
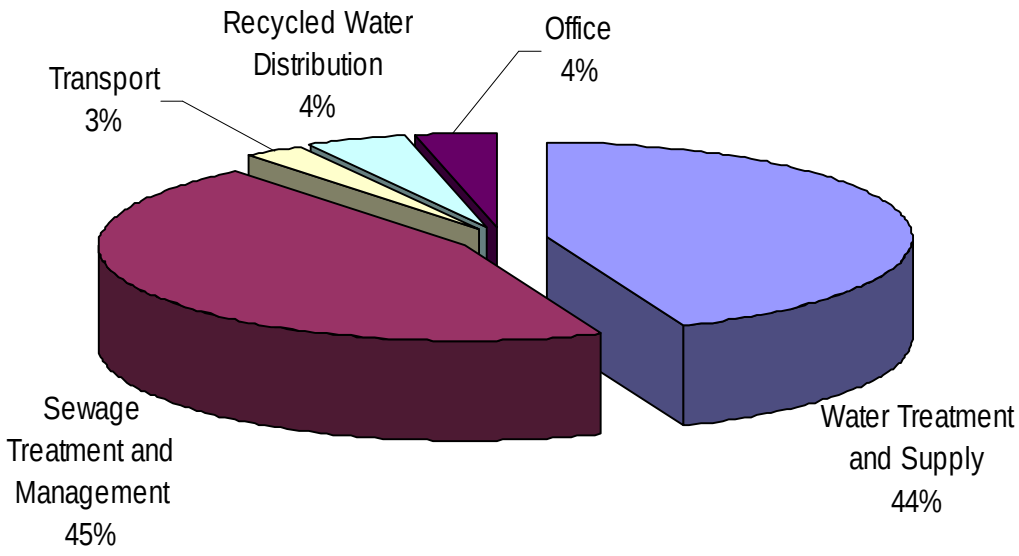


Table 4.2.1 Source of emissions that contribute to Western Water's greenhouse gas profile (2006/07)

Emissions Source	*Usage (2006/07)*	*Unit*	*Emissions Factor*	*GHG Emissions (t CO_2e)*
Unleaded Petrol	*147*	*kL*	*2.6*	*383*
Diesel	*184*	*kL*	*3*	*551*
Methane	*45*	*tonne*	*21*	*945*
Nitrous Oxide	*7*	*tonne*	*310*	*2,170*
Soda Ash	*8*	*tonne*	*0.415*	*3*
Victoria Grid Electricity	*15,022,615*	*kW*	*0.001325*	*19,905*
			Total	*23,957*

Various activities contribute to Western Water's carbon footprint. For reporting purposes these activities are categorised into 5 key areas including; administration office, transportation, water treatment and supply, recycled water distribution, sewage treatment and management. Figure 4.2.2 provides an overview of the key activities that contribute to Western Water's greenhouse gas emissions profile.

Figure 4.2.2 Activities that contribute towards Western Water's Greenhouse Gas Emissions (2006/07)



The activities that contribute greatest to Western Water's carbon footprint are sewage treatment and management followed closely by water treatment and supply. In 2006/07 these activities contributed to 89% of all greenhouse emissions. In addition:

- Of the 45% of greenhouse gas emissions contributed by sewage treatment and management, electricity consumption at the Sunbury and Melton Recycled Water Plants contributed to 39% and 34% respectively.

- Of the 44% of greenhouse gas emissions contributed from water treatment and supply, water pump stations were the major contributor to electricity consumption with Sheppard's Lane pump station contributing to approximately 30%. Other than the pump stations, the Romsey Filtration Plant is the largest water asset contributing to this group of emissions.

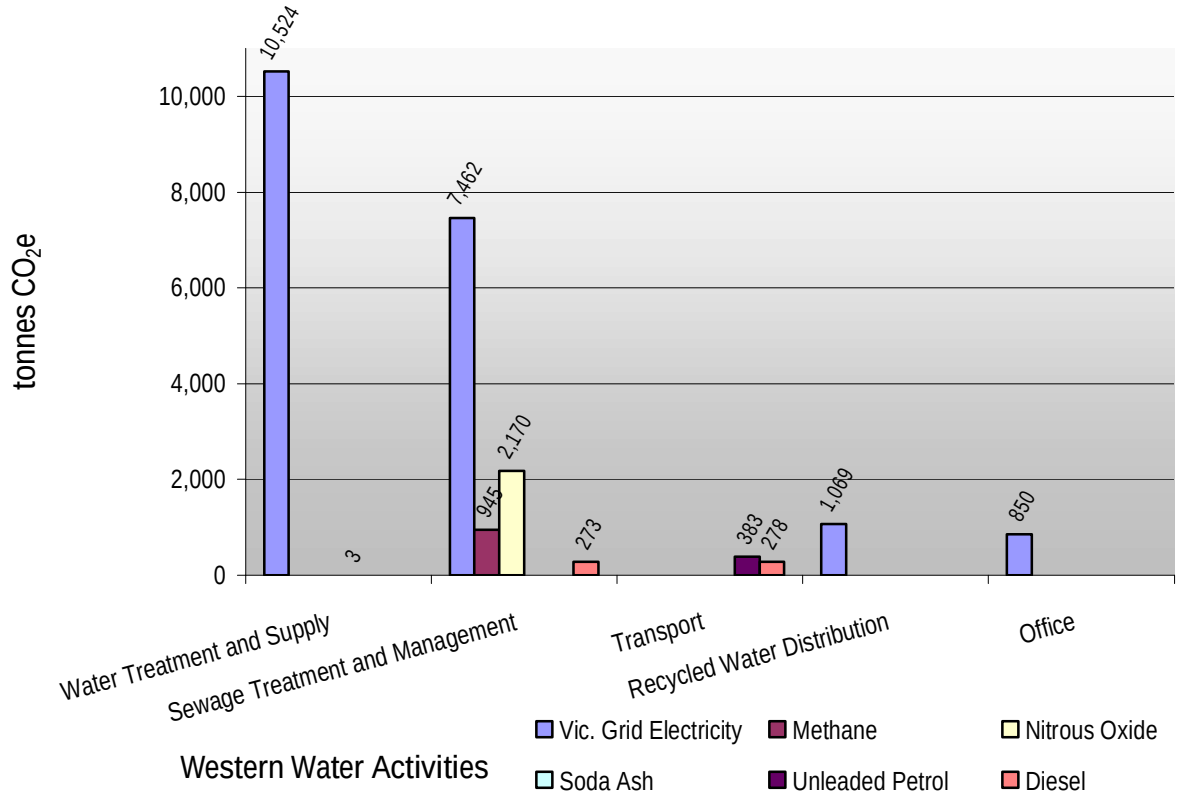
A major proportion of total emissions are from pumping activities including raw water, drinking water, sewage and recycled water pumping. Together pump stations contribute 56% to all Western Water's electricity consumption.

Table 4.2.2 and Figure 4.2.3 provide a breakdown of the key activities, the primary assets, the source of and total greenhouse gas emissions for the 2006/07 financial year.

Table 4.2.2 Key activities that contribute to Western Water's greenhouse gas emission profile (2006/07)

Key Activities	*Primary Assets (2006/07)*	*Emission Source*	*Greenhouse Emissions (t CO_2e)*
Water Treatment and Supply	*3 bulk water pump stations* *3 bulk water aerators* *3 ground water bores* *6 water filtration plants* *36 water pump stations*	*Victorian Electricity Grid* *Soda Ash*	*10,524* *3*
Sewage Collection	*53 sewage pump stations* *7 recycled water plants* *8 major diesel generators*	*Victorian Electricity Grid* *Methane* *Nitrous Oxide* *Diesel*	*7,462* *945* *2,170* *273*
Recycled Water Distribution	*5 pumping stations*	*Victorian Electricity Grid*	*1,069*
Vehicles (Transport)	*36 Unleaded Petrol* *26 Diesel*	*Unleaded Petrol* *Diesel*	*382* *279*
Administration	*Head Office (Sunbury and Gisborne)*	*Victorian Electricity Grid*	*850*

Figure 4.2.3 Breakdown of emission sources based on activities (2006/07)



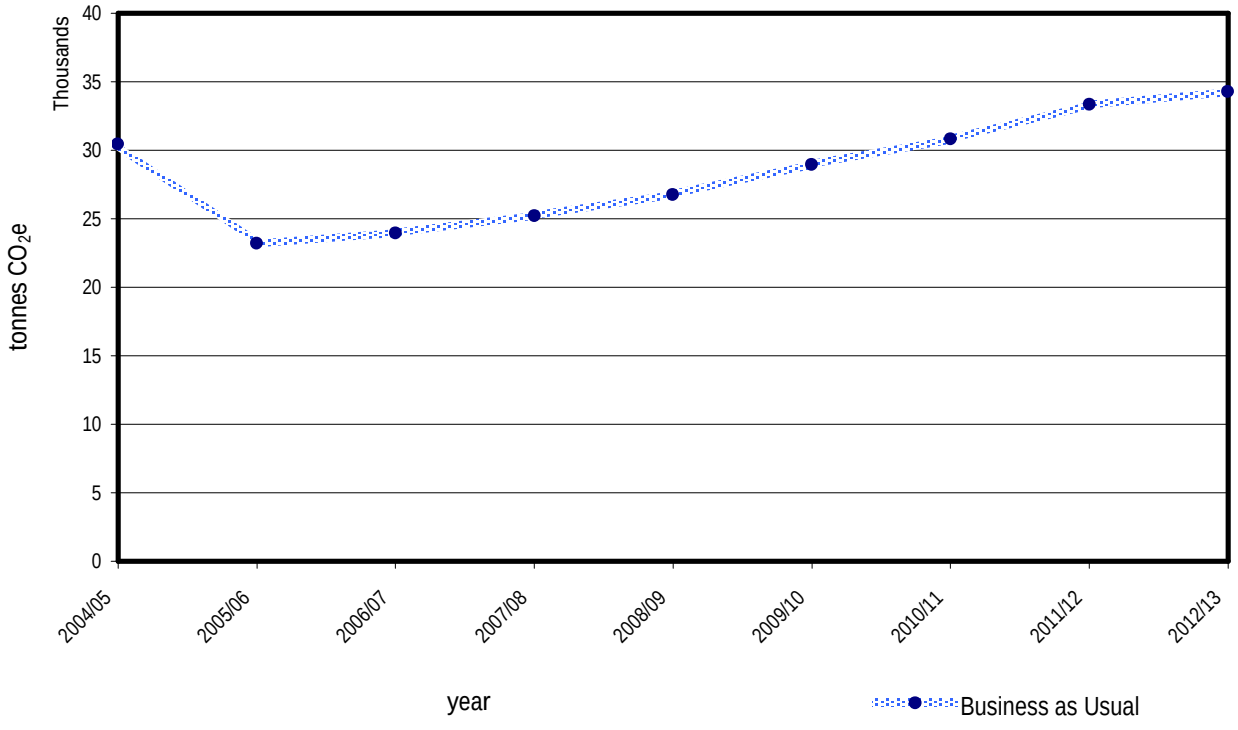
4.3 Projected future emissions

Adopting a baseline of the 2004/05 financial year, to coincide with the first year Western Water publicly reported it's greenhouse gas emissions, Western Water's carbon footprint has been projected to 2013. Forecasts have been based on information provided in the 2008-13 Water Plan including:

- Expected population growth using a combination of the Department of Sustainability and Environment's (DSE's) Victoria in Future (2004) forecast growth rate and revised with DSE's Urban Development Program (2006). These figures are used throughout the 2008-13 Water Plan as the basis for forecasting;
- Expected electricity use;
- Predicted water demand (including planned water conservation measures) and supply regimes; and
- Planned infrastructure upgrades identified.

Should Western Water continue with business as usual, it is expected that its carbon footprint would increase from 30,434 tonnes of CO_2e in 2004/05 to 34,262 tonnes of CO_2e in 2012/13 as outlined in Figure 4.3.1.

Figure 4.3.1 Western Water's Greenhouse Gas Projection until 2012/13



The observed reduction in emissions from 30,434 tonnes of CO_2e in 2004/05 to 23,192 tonnes of CO_2e in 2005/06 is due to a number of factors such as previous work that has been undertaken by Western Water and includes:

- The impact of drought and water restrictions decreasing water consumption and therefore pumping and treatment demands on the system
- Significant decreased consumption of soda ash in the treatment process
- Ongoing work with energy service provider Utilicor to monitor energy usage onsite and detect opportunities for cost savings in electricity billing
- Reduction in aeration requirements at the Surbiton Recycled Water Plant due to increased dissolved oxygen monitoring

5. Objectives and Targets

The key objective of the Greenhouse Gas Reduction Strategy is for Western Water to reduce greenhouse gas emissions and work towards an aspirational target of carbon neutrality.

Western Water began measuring its total greenhouse emissions in 2004/05 at which time its emissions were recorded as 30,434 tonnes of CO_2e. In 2006/07, greenhouse emissions had been reduced by 21% to total emissions of 23,957 tonnes of CO_2e. It is important to recognise that various actions have already been undertaken by Western Water that have lowered emissions, therefore 2004/05 has been chosen as the base year rather than 2006/07.

Western Water's target is to have zero net greenhouse gas emissions, otherwise defined as carbon neutrality by 2017. To become carbon neutral in 2007 would cost Western Water more than $ 1 million per annum in purchasing GreenPower and carbon offsets. The target date of 10 years hence was chosen because it provides sufficient time for identified and future initiatives to be undertaken over the period of two Water Plans. There is $900,000 allocated for capital expenditure and $250,000 allocated for operational expenditure on Greenhouse Gas Reduction Initiatives in the 2008-13 Water Plan.

To achieve this target, Western Water will commit to reducing its greenhouse gas emissions in four milestones as follows:

- Milestone 1: Reduce greenhouse gas emissions by 25% in 2008-09 based on 2004-05 emission levels (total emissions target 22,826 tonnes of CO_2e)
- Milestone 2: Reduce greenhouse gas emissions by 50% in 2012-13 based on 2004-05 emission levels (total emissions target 15,217 tonnes of CO_2e)
- Milestone 3: Reduce greenhouse gas emissions by 75% in 2014-15 based on 2004-05 emission levels (total emissions target 7,609 tonnes of CO_2e)
- Milestone 4: Reduce greenhouse gas emissions by 100% in 2017-2018 based on 2004-05 emission levels (total emissions target 0 tonnes of CO_2e)

In intervening years, annual greenhouse gas reduction targets will be adopted for reporting purposes that are consistent with striving towards the four milestones.

To measure Western Water's progress and performance in meeting the above targets the following key performance indicators will be adopted and reported annually by Western Water.

Key Performance Indicators (KPI's):

- The amount of greenhouse gas emitted as a percentage of greenhouse gas emitted in 2004-05 (%)
- Absolute greenhouse gas emissions (tonnes CO_2e)
- Energy Use for Water Delivery (GJ per ML)
- Energy Use for Wastewater (GJ per ML)
- Total Renewable Energy Used and Produced (GJ)
- Total Renewable Energy Used and Produced as a Percentage of total Energy Used (%)

Western Water has investigated becoming a Greenhouse Challenge Plus partner with the Australian Greenhouse Office. This partnership supports and encourages management of greenhouse gas emissions through emissions inventory reporting and through the development and implementation of action plans to achieve cost effective abatement. The partnership encourages participants to demonstrate strong corporate greenhouse performance, recognises products and services with zero-net emissions including Greenhouse Friendly certification. Of particular advantage to Western Water, the partnership will include independent validation of data including audits allowing Western Water to verify claims of carbon neutrality.

There are no direct costs associated with becoming a Greenhouse Challenge Plus partner however a minor increase in data collection and auditing costs are anticipated. The benefits will easily outweigh the costs, in that additional credibility on reported data would occur, adding further weight to the Strategy, and to the reporting of outcomes for Western Water. It is planned for Western Water to become a Greenhouse Challenge Plus partner upon approval of this Strategy.

6. Emissions Reduction Opportunities

On the 17th of August 2007, an independently facilitated workshop was undertaken with Western Water employees to identify opportunities from all areas of the business to reduce greenhouse gas emissions. A consultant was then engaged to audit and/or quantify the greenhouse gas emissions savings potential for each opportunity to ensure the savings potential was valid and realistic and to assist in prioritising actions.

Opportunities were then ranked in alignment with the adopted Carbon Management Hierarchy utilising a multi-criteria assessment. Any option with a positive score is viewed as a desirable opportunity to pursue further (see Appendix B for a full list of the assessment criteria). Ranking each option gives an indication of how well it fits within Western Water's business values, skill set and core business activities. The responsible owner or Knowledge Manager of each action was then required to check the recommendation to ensure that it was accurate.

Twenty-five opportunities have been identified that require further action. These opportunities equate to approximate savings in greenhouse emissions of 6,395 tonnes and will be implemented over the next 5 years. Appendix A provides details of these opportunities in accordance with the Carbon Management Hierarchy.

Key opportunities identified include:

- The Sunbury main office to go carbon neutral immediately by purchasing 100% GreenPower for the office
- Initiate investigations into the opportunity for the Class A Recycled Water Plant to become carbon neutral by capturing biogas from the Surbiton Recycled Water Plant
- 68% of Western Water's pump stations to go carbon neutral immediately by purchasing 100% GreenPower for the 'Bottom 66' pumps. The purchase of GreenPower will be made through efficiency savings on the 'Top 11' pumps.
- Form a partnership with the Australian Greenhouse Office in joining the Greenhouse Challenge Plus program

The Action Plan in Section 7 provides a summary of these opportunities and predicted greenhouse gas savings if quantifiable.

7. Action Plan

The Action Plan outlined in Table 7.1 details all initiatives identified to date that will contribute towards delivering Milestone 1 of the emission target of a 25% reduction by 2008/09. If all potential estimated greenhouse reductions are achieved, Western Water's emissions will reduce by 6,395 tonnes CO_2e over the next 5 years.

Where estimated greenhouse reductions are unknown or if the feasibility of that recommendation requires further investigations, these actions will generally contribute to Milestone 2 and beyond to achieve carbon neutrality by 2017.

There is $900,000 allocated for capital expenditure and $250,000 allocated for operational expenditure on Greenhouse Gas Reduction Initiatives in the 2008-13 Water Plan.

The proposed actions have been placed in order of priority and incorporate appropriate details for each one such as responsibility and timeframe. Actions have been prioritised based on a Multi-Criteria Assessment (refer to Appendix B), Table 7.1 provides a point of reference for these scores.

The overall administration of the Action Plan to ensure that actions have been undertaken within the timeframe allocated will be undertaken by the Environment Committee and tracked through the Balanced Scorecard. The recommended opportunities listed in the Action Plan will be annually reviewed and progress provided to the Board.

Table 7.1: Multi-Criteria Assessment Score and Description

Score	Description
5	Opportunity has a very highly positive impact
4	Opportunity has a highly positive impact
3	Opportunity has a moderately positive impact
2	Opportunity has a positive impact
1	Opportunity has a slightly positive impact
0	Opportunity has no impact
-1	Opportunity has a slightly negative impact
-2	Opportunity has a negative impact
-3	Opportunity has a moderately negative impact
-4	Opportunity has a highly negative impact
-5	Opportunity has a very highly negative impact

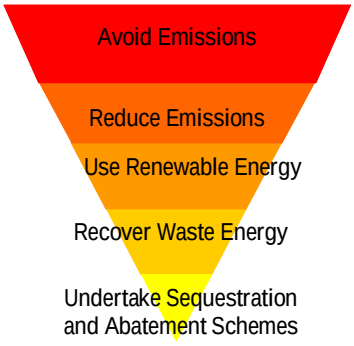


Table 7.2: Action Plan for Greenhouse Gas Reduction to be undertaken by Western Water

Multi-Criteria Assessment		Action	Potential CO_2e/yr Reduction (tonnes)	Responsible Area	Responsible Person	Completion Date	Status
Rank	Score						
1	2.87	Conduct an energy review of Melton RWP including a feasibility assessment for cogeneration	564	Melton RWP	Team Leader	Dec 2007	Commenced
2	2.85	Purchase GreenPower for the Sunbury office and investigate partnerships with electricity providers	850	Finance	Finance Officer	Nov 2007	Commenced
2	2.85	Purchase carbon abatements (Green Power) for the 'Bottom 66' electricity consuming pump stations	387	Finance	Finance Officer	June 2008	Not commenced
3	2.64	Undertake energy audits of 'Top 11' pumping stations and reduce energy consumption by 2.5%	165	Asset Management	Manager	June 2009	Not commenced
4	2.49	Develop a communication plan	NM	Communications	Manager	Nov 2007	Not commenced
5	2.43	Undertake a review of aeration control at all water and recycled water plants	47	Water Systems	Sunbury RWP Team Leader/ Environmental Engineer	Dec 2008	Not commenced
6	2.43	Adapt existing design, tendering and purchasing policies and procedures to include CO_2e reduction as a key consideration	NM	Capital Investments	Manager	June 2008	Not commenced
7	2.41	Undertake recommendations for pump operation improvements from Opportunity Study	463	Water Systems	Manager	June 2009	Not commenced
8	2.20	Develop and apply the use of energy maps	NM	Asset Management	GIS Co-ordinator	June 2008	Not commenced
9	2.12	Implement recommendations from WSDS including water conservation, pressure reduction and leakage minimisation actions	2,010	Asset Management	Manager	June 2011	Commenced
10	2.07	Review biodiversity program for potential capture of CO_2e offsets	370	Water Systems	Environmental Engineer	June 2009	Commenced
11	2.04	Adopt Green Data Centre improvements and provide a pathway for a 10% reduction in office energy use	85	Business Innovation	Systems Administrator	June 2008	Not commenced

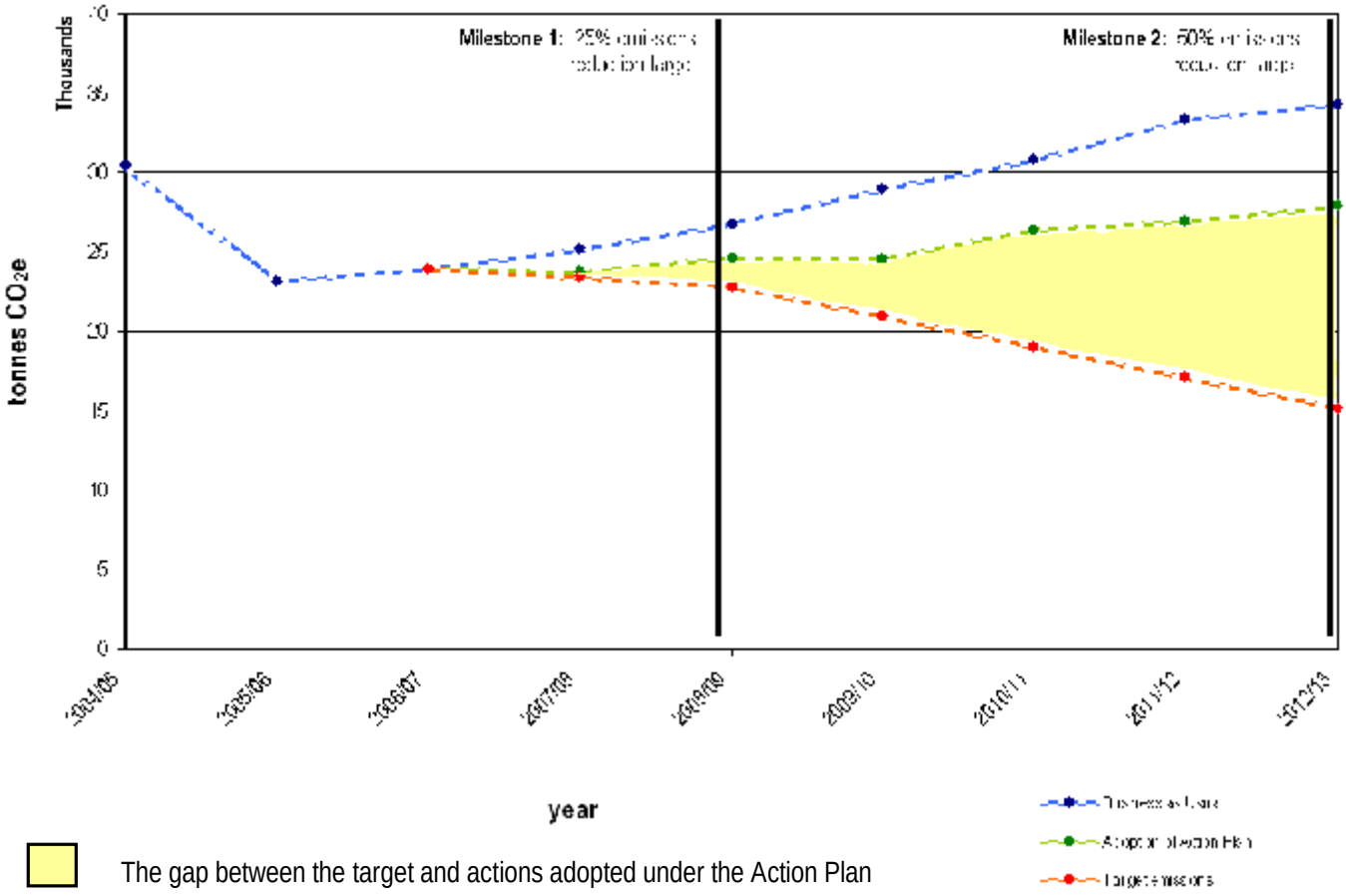
* NM = Not Measurable

Multi-Criteria Assessment		Action	Potential CO_2e/yr Reduction (tonnes)	Responsible Area	Responsible Person	Completion Date	Status
Rank	Score						
12	1.94	Conduct an energy audit of all offices operated by Western Water including lighting and air-conditioning	43	Finance	Finance Officer	June 2008	Not commenced
13	1.87	Conduct a review of methane modelling and biogas cogeneration opportunities for 6 remaining RWPs	NM	Renewable Resources	Project Engineer	June 2008	Not commenced
14	1.75	Develop a bike strategy	NM	Human Resources	Manager	June 2008	Not commenced
15	1.66	Consider a small scale photo-voltaic installation at the Sunbury Office	6.5	Renewable Resources	Manager	June 2009	Not commenced
16	1.61	Trial a 'solar bee' aeration system at the Lancefield clear water basin	131	Capital Investments	Manager	June 2008	Not commenced
17	1.58	Review Western Water Vehicle Policy including investigation into opportunities for biodiesel	20	Commercial Services	General Manager	Dec 2007	Not commenced
18	1.52	Undertake review of the trade waste policy to ensure adequate catchment management	NM	Water Systems	Manager	Dec 2008	Not commenced
19	1.51	Adopt GreenPower price for electricity during economic assessment of options	NM	Financel	Financial Accountant	June 2008	Not commenced
20	1.33	Upgrade internal energy metering including installation of smart meters at 23 largest energy sites	NM	Asset Management	Manager	June 2009	Not commenced
21	1.22	Incorporate greenhouse reduction incentives into performance plans, EBA and policies	NM	Human Resources	Manager	June 2008	Not commenced
22	1.12	Pursue research and development opportunities	NM	Renewable Resources	Manager	Ongoing	Not commenced
23	0.79	Review all offset opportunities	NM	Renewable Resources	Manager	June 2011	Not commenced
24	0.36	Undertake feasibility study for the installation of a wind turbine at Romsey RWP	1,254	Renewable Resources	Manager	June 2009	Not commenced
25	-0.04	Assess the potential for power factor correction at major energy using sites	7,795	Asset Management	Manager	June 2011	Not commenced

* NM = Not Measurable

Figure 7.1 outlines how the 25 opportunities identified will decrease our total greenhouse gas emissions by nearly 20% from our predicted business as usual path. The business as usual model predicts a significant increase in emissions based on population growth and planned projects in the 2008-13 Water Plan. However it is also clear that further initiatives will need to be identified to reach our target of 50% reduction by 2013.

Figure 7.1 Western Water's Greenhouse Gas Projections and Targets



The gap between the target and actions adopted under the Action Plan

To ensure that Western Water meets its target of 50% reduction by 2012/13 it will be necessary to close the gap between the greenhouse gas savings that will occur by adopting the Action Plan and the additional actions that are required to meet the target. Given that Western Water is at the beginning of its greenhouse gas reduction efforts it is expected that more initiatives will evolve over the next 5 years that will enable this target to be achieved.

In particular following additional actions are expected to contribute to closing the target gap:

- Quantify the actions that have currently been identified as non-measurable for greenhouse emission reduction including observing larger greenhouse gas reductions then those that have been conservatively estimated
- If some of the upcoming projects planned for Western Water adopt a carbon neutral approach then this will significantly decrease additional greenhouse gas emissions
- Investigate abatement opportunities if other options are unable to close the gap to purchase offsets to ensure greenhouse gas reduction is achieved

8. Communicating and Reporting

8.1 Communicating the Strategy

Communicating Western Water's Greenhouse Gas Reduction Strategy is key in ensuring ownership by all staff within our organisation. It is also vital that our customers, other water authorities, government bodies and the general public are aware of the high standard that Western Water sets itself in the area of greenhouse gas reduction.

It was identified during the Western Water Workshop that the key to enabling greenhouse gas reduction to occur within Western Water is to ensure that everyone within Western Water is committed as part of undertaking their general business. Therefore it will be essential to develop a Communication Plan that outlines numerous opportunities for action.

The following opportunities were identified and will be incorporated in Western Water's Communication Plan:

- Personalise the message to get people thinking about their actions including providing information signage around the office space and setting a team challenge for greenhouse reduction
- Promote greenhouse reduction behaviour such as turning lights off when not required and turning computer screens off when not in use
- Provide special events similar to the free screening to staff of the documentary "Inconvenient Truth"
- Encourage car pooling when attending meetings
- Encourage phone/video conferencing rather than attending meetings
- Document missed opportunities to ensure that they are not repeated
- Provide energy awareness training for Western Water staff

In the first instance it will be important to launch Western Water's Greenhouse Gas Reduction Strategy. As such a number of icon initiatives have been identified that will be announced as part of the launch of the Greenhouse Gas Reduction Strategy to demonstrate the action that Western Water is taking on greenhouse gas reduction. These initiatives include:

- Announcing the aim to be carbon neutral by 2017 including a 50% greenhouse gas reduction by 2013
- The Sunbury main office to go carbon neutral immediately by purchasing 100% GreenPower for the office
- Initiating investigations into the opportunity for the Class A Recycled Water Plant to become carbon neutral by capturing biogas from the Surbiton Recycled Water Plant
- 68% of Western Water's pump stations to go carbon neutral immediately by purchasing 100% GreenPower for the 'Bottom 66' pumps. The purchase of GreenPower will be made through efficiency savings on the 'Top 11' pumps.
- Announcing a partnership with the Australian Greenhouse Office in joining the Greenhouse Challenge Plus program

The Communication Plan will be completed by November 2007 and will then be rolled out both internally to staff and externally to customers, other water authorities and government bodies.

8.2 Reporting Progress

To ensure that the Greenhouse Gas Reduction Strategy is a success it will be necessary to keep relevant stakeholders informed on progress, in particular how Western Water is achieving its reduction targets.

Reporting on progress will also form a key part of the Communication Plan and will incorporate but not be limited to the following:

- Balanced Score Card – utilised to update the Board and Staff monthly on progress including a report on greenhouse gas emissions and progress against planned actions
- Presentations – at conferences and forums will be utilised to inform peers including government and water authorities on progress including regular updates at customer meetings
- Newsletters – H2infO and Recycled Water News will provide quarterly information to customers on progress
- Western Water's Environment Committee – provide monthly updates on progress to staff and a forum for new ideas and initiatives
- Western Water's Annual Report and Environment Report – provide annual reporting on progress to customers and other key stakeholders
- Government and regulator reporting – provide annual reporting to the Essential Services Commission, the Water Services Association of Australia (WSAA) National Performance Report, Sustainability Victoria as part of the Memorandum of Understanding (MOU) and the Greenhouse Challenge Plus program

9. Monitoring and Review

Monitoring and review is important to ensure appropriate implementation of Western Water's Greenhouse Gas Reduction Strategy including progress towards the Strategy targets.

The Environment Committee, lead by the Renewable Resources Team, will serve as an implementation committee and is responsible for monitoring and reviewing the Strategy. The Environment Committee meets monthly and will be responsible for:

- Monitoring the implementation of the Strategy;
- Consultation with employees and senior management;
- Updating the Strategy to document progress against plan; and
- Reviewing indicators and targets.

By becoming a partner of the Greenhouse Challenge Plus program, the Australian Greenhouse Office will ensure annual independent validation of data including audits allowing Western Water to verify claims of carbon neutrality. The data and progress against set targets will then be reported annually by the Australian Greenhouse Office allowing for additional credibility to occur, adding further weight to the Strategy, and to the reporting of outcomes for Western Water.

The Environment Committee will undertake a formal review of the Strategy annually and the results will be communicated to Senior Management and the Board. Further initiatives for greenhouse gas reduction will be identified and the Strategy updated to ensure the overall target of carbon neutrality by 2017 can be achieved.

List of Appendices

Appendix A Emissions Reduction Opportunities

Western Water has identified twenty-five emission reduction opportunities. A summery of each emission reduction opportunity is provided below and has been arranged in the order outlined in the Carbon Management Hierarchy.

Avoid Greenhouse Emissions

Communications Plan

Zero cost emissions abatement can be achieved by changing the culture of an organisation so that everyone within the organisation works towards avoiding emissions-generating activities. It is difficult to quantify the greenhouse gas emissions that can be saved due to cultural change activities however the benefit is far reaching to people's homes and the broader community and is essential to ensure the success of the Greenhouse Gas Reduction Strategy. It was identified during the Workshop that the key to enabling greenhouse gas reduction to occur within Western Water is to ensure that everyone within Western Water is committed as part of undertaking their general business. Therefore a key action will be to develop a Communication Plan that outlines numerous opportunities for action.

The following opportunities were identified and will be incorporated in Western Water's Communication Plan:

- Personalise the message to get people thinking about their actions including providing information signage around the office space and setting a team challenge for greenhouse gas reduction
- Promote greenhouse gas reduction behaviour such as turning lights off when not required and turning computer screens off when not in use
- Provide special events similar to the free screening to staff of the documentary "Inconvenient Truth"
- Encourage car pooling when attending meetings
- Encourage phone/video conferencing rather than attending meetings
- Document missed opportunities to ensure that they are not repeated
- Provide energy awareness training for Western Water staff

Recommendation: Develop a Communication Plan for implementation across Western Water.

Key characteristics: Communication Plan
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Low
Multi-Criteria Score: 2.49
Ranking: 4 out of 25

Individual Performance Reviews and Enterprise Bargaining Unit

During the Workshop it was identified that a number of greenhouse incentives could also be incorporated in to the next round of Enterprise Bargaining Agreement (EBA) negotiations and performance plans to ensure adoption of responsibility for greenhouse reduction across the whole business.

The following opportunities were identified and would need to be considered as part of the greenhouse incentives for staff:

- Link the value of sustainability and greenhouse gas reduction through the performance review process including performance plans and the Review and Performance System (RAPS)
- Encourage flexible working hours to enable staff to catch public transport or work from home if applicable
- Encourage or provide incentives for public transport use and bike use
- Develop a bike strategy for Western Water including review of office facilities to ensure that bike use is encouraged including adequate change room, shower and locker areas and bike racks
- Review all corporate policies and procedures to consider greenhouse gas reduction opportunities

Recommendation:

1. Greenhouse reduction incentives and training to be included in corporate policies, performance plans and the EBA across the business.

2. Develop a bike strategy for Western Water.

Key characteristics: EBA and Performance Plans
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Medium
Multi-Criteria Score: 1.22
Ranking: 21 out of 25

Key characteristics: Bike Strategy
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Medium
Multi-Criteria Score: 1.75
Ranking: 14 out of 25

Information technology and office

Approximately 66% of Western Water EFT staff are office-based, spending the majority of their time at their workstations. Opportunities exist to create efficiencies in the use of information technology (IT) and to encourage cultural change within the business. A number of initiatives can be incorporated permanently in to workstation equipment such as turning off the backlight to all phones when not in use. Other initiatives will require education of the business such as favouring electronic documents over printing, printing 2 pages per sheet where appropriate, and turning computer screens off when not in use.

Most phones at Western Water's office have a backlight that uses electricity 24 hours a day. Over a long period of time this backlight can significantly contribute to office greenhouse gas emissions and can contribute more than leaving a computer monitor on standby.

Turning off computer screens when leaving workstations for more than 15 minutes can save more than 50% of the energy that would have been consumed by that computer. If every computer were turned off at the screen for 50% of the time, it would be expected that a 25% reduction in greenhouse gas emissions from computer usage would result.

Also contributing to greenhouse gas emissions are screen savers. Most computers need twice as much energy to light up screen savers as they do for processing. In addition to lighting the screen, many screen savers require processing energy.

Western Water has already undertaken a number of initiatives to adopt a Green Data Centre. The following are a list of opportunities that can be incorporated in to the adoption and improvement of Western Water's Green Data Centre:

- Enable the set-up feature on office phones that turns the display off when not in use
- Develop an IT communication plan that:
  - Encourages staff to adopt computer shut down procedures including; complete shut down if away from workstations for more than 2 hours, and turn off computer screen if away from workstation for more than 15 minutes
  - Provides an overview of the range of applications the computer has to reduce electricity and paper consumption including printing 2 pages per page, PDF and emailing/faxing documents electronically, and electronic minute taking in meetings
- Provide a reminder alert for staff of the preferred computer shut down process
- Investigate the use of recycled paper in printers and trial if applicable
- Investigate providing facilities for video conferencing and improving facilities for electronic minute taking in meeting rooms
- Continue to purchase high-efficiency power supplies and equipment for new and upgraded systems and recycle IT equipment when possible and practical

The Western Water office accounted for 4% of greenhouse gas emissions by the business during 2006/07. By investigating opportunities for energy efficiency within the business it should be possible to reduce office energy use by 10% from our 2006/07 figure of 850 tonnes of CO_2e. This would save approximately 85 tonnes of CO_2e per annum and $6,000 per annum.

Recommendation: Adopt Green Data Centre improvement opportunities including reviewing the use of information technology within the business and provide staff education as a pathway to reduce office energy use by 10%.

Key characteristics: Green Data Centre
Total cost: $minimal annually
Savings: $6,000 annually
Tonnes CO_2e saved: 85 tonnes per annum
Risk of failure: Low
Multi-Criteria Score: 2.04
Ranking: 11 out of 25

Water Conservation, Pressure Reduction and Leakage Protection

By delivering less water to customers relative to business-as-usual, less energy is required for pumping water, avoiding greenhouse gas emissions associated with pumping activities. Additional water conservation efforts leading to emissions reductions, above and beyond existing efforts, may be included as emissions abatement.

Pressure reduction and leakage protection minimises the amount of energy required to deliver the necessary volume of water to the user. At lower pressure, less energy is required to deliver the same volume of water, as less energy is lost due to friction in pipes. By minimising the amount of leakage through the supply system, the amount of energy wasted pumping water not reaching the end user is minimised.

Western Water's Water Supply Demand Strategy, February 2007 outlines how Western Water will reduce water consumption per person per day by outlining potential water demand management options including pressure reduction and leakage minimisation. The Regional Action Plan and Water Supply Demand Strategy outlines that Western Water will achieve the following targets in relation to the 1990's average usage of 375 litres per person per day (L/c/d):

- 15% reduction in per capita water usage by 2010 – usage rate of 319 L/c/d
- 25% reduction in per capita water usage by 2015 – usage rate of 281 L/c/d
- 30% reduction in per capita water usage by 2020 – usage rate of 262 L/c/d

A wide range of water demand management and supply substitution options were investigated. Each option had a triple bottom line assessment undertaken which included an estimate of greenhouse gas emissions per megalitre per year. In order for Western Water to achieve the outlined targets a comprehensive program was recommended including:

- The mandatory water efficiency labelling scheme (WELS);
- Permanent low-level restrictions on water use;
- Inclining block tariff on residential customers;
- Introduction of the WaterMaps program for non residential customers targeting consumption reduction for customers with greater than 10 ML usage (introduced in 2007);
- Continue and enhance the community education program;
- Non-residential water audits (program 2007 - 2010);
- Leakage management program (enhance program of district metering, leak detection and repair and establishment of pressure management areas in 2008);

- Residential shower retrofit (program 2007- 2009); and
- Source substitution as follows:
  - Recycled water for Greenfield development (Eynesbury Station and Melton South);
  - Incentives for installation of rainwater tanks for developments elsewhere;
  - Control on water efficient fixtures in new development areas; and
  - Incentives for home retrofit with water efficient fixtures and fittings at point of sale.

These conservation measures are expected to have the following savings as outlined in Table 6.1 based on Western Water's estimated high growth population scenario.

Table 6.1: Predicted water consumption based on the Water Supply Demand Strategy (WSDS), February 2007

Year	2006	2011	2016
Predicted Consumption* (ML)	14,760	17,062	19,948
Consumption with conservation measures (ML)	14,760	15,506	16,861
% saving	-	9%	15%

* Predicted unrestricted consumption – does not include any conservation efforts

Therefore it also follows that there will be a 9% decrease in the predicted electricity usage for the business by 2011as 96% of electricity is used in treatment and pumping of water and wastewater. Overall however the electricity usage by the business is still expected to increase by 5% from 2006 to 2011 due to significant growth in the region which will lead to an increase in greenhouse gas emissions.

Preference of utilisation of local resources from Merrimu and Rosslynne Reservoirs over supply from Melbourne will decrease greenhouse gas emissions due to decreased pumping over long distances. However this option will be dependent upon recovery of the local supply after many years of drought and is not anticipated to occur in full during the 2008-13 Water Plan.

The actions undertaken as part of the Water Supply Demand Strategy for Western Water will save approximately 2,010 tonnes of CO_2e by 2011 (or approximately 402 tonnes of CO_2e per annum) from a business as usual consumption scenario.

Recommendation: Implement all recommendations under the Water Supply Demand Strategy to ensure water conservation, pressure reduction and leakage minimisation actions are undertaken.

Key characteristics: WSDS
Cost: $ provided in business as usual
Tonnes CO_2e saved: 2,010 tonnes by 2011
Risk of failure: Medium
Multi-Criteria Score: 2.12
Ranking: 9 out of 25

Design and Purchasing including Gravity-Fed Transfer

The opportunity exists to minimise the amount of energy that is required to operate long-term infrastructure by selecting during the design process the most energy efficient option based on net present cost (NPC) analysis. This may include looking at renewable energy options such as solar powered aerators and will involve refining design and tender documentation to ensure that plant life operational costs are adequately compared and contrasted to infrastructure capital costs.

Actively seeking/selecting gravity-fed systems when appropriate to utilise gravitational force to move water or sewage avoids the need to use energy to move water or sewage through pumping in situations where sufficient fall exists between source and destination. Design and purchasing of equipment in future should ensure that gravity options are considered as a priority. In addition it will be essential to ensure that consultants engaged to undertake design include greenhouse gas reduction as a key desirable outcome and recommend the purchase of the most efficient equipment for the task based on Net Present Costs (NPC). It will also be necessary to prepare options reports to ensure that full life cycle costs and greenhouse gas impacts are incorporated for each option as the current system favours cheaper capital expenditure options over long-term savings in operational expenditure.

To ensure that new pumping stations operate at maximum energy efficiency it is recommended that a pump procurement policy be written to provide guidance for the planning, procurement and operation of new pump stations. Included in the pump procurement policy should be the consideration of optimum hydraulic design such as the installation of flow meters inside sewer wells to monitor infiltration and pump efficiency, review of the duty – standby configuration of pumps in sewer wells and the installation of balance tanks at the start of Recycled Water Plants to balance out the need for peak pumping.

The energy consumption of a blower or pump motor can also be significantly reduced by the implementation of a Variable Speed Drive (VSD), particularly when output demand varies. This enables the motor to be operated at a more appropriate speed for the delivery rate required. It is recommended that Variable Speed Drives be considered as part of the pump procurement policy.

Recommendation: Review design and purchasing of infrastructure to ensure greenhouse gas reduction is a key consideration including:

1. Adapt option analysis and design processes to ensure that full life cycle costs are incorporated in to the assessment of each option.
2. Consultants engaged to undertake design work recommend purchase of the most efficient equipment for the task including greenhouse gas reduction as a key outcome.
3. Develop a pump procurement policy to ensure that all aspects of pump energy efficiency are considered.
4. Report greenhouse gas impacts as part of consideration of design and purchasing options including providing analysis of the cost to the business for each selected option to be carbon neutral.

Key characteristics: Infrastructure Design
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Low
Multi-Criteria Score: 2.43
Ranking: 6 out of 25

Shadow Carbon Pricing

Adopting the GreenPower price for electricity during economic assessment of options ensures that a price estimate for carbon is incorporated in to any comparison of options undertaken. Effectively this is known as adopting shadow pricing for carbon. Shadow carbon pricing has been adopted by Water Authorities across Australia viewed as leading the Greenhouse initiative including Yarra Valley Water and the Water Corporation of Western Australia.

Yarra Valley Water has adopted the price for GreenPower as a pseudo shadow carbon pricing value in lieu of a price being set for carbon as part of a carbon trading scheme, which is proposed to be adopted by the Federal Government by 2010.

By adopting the GreenPower price for electricity during economic assessment of infrastructure options Western Water will be effectively adopting a shadow carbon pricing value of $29.75 per tonne CO_2e, as GreenPower will cost Western Water an additional $39.41 per mWh based on current pricing provided by AGL. It is proposed to use these shadow prices only until market based carbon pricing becomes available.

Recommendation: Adopt the GreenPower price for electricity during economic assessment of infrastructure options.

Key characteristics: Shadow carbon pricing
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Medium
Multi-Criteria Score: 1.51
Ranking: 19 out of 25

Research and Development

Opportunities exist for Western Water to undertake partnerships with Universities, water authorities and other interested parties to explore further options for greenhouse gas reduction. There may also be potential to conduct self-operated onsite trials such as the potential to utilise biodiesel in diesel vehicles and onsite equipment such as tractors.

A range of alternative fuels exist which may be less emissions-intensive than mainstream petrol and diesel fuels. Liquified Petroleum Gas (LPG) and Liquified Natural Gas (LNG) are still fossil fuels, but potentially less carbon-intensive, which may be used in modified petrol and diesel engines respectively. Ethanol is a biofuel, which can be used as a substitute for or blended with petrol to reduce net greenhouse gas emissions. Similarly, biodiesel made from oilseed crops and waste oils can be used as a substitute for or blended with diesel to reduce net greenhouse gas emissions. Some engine modifications may be required to effectively utilise these fuels.

All operations vehicles have been converted to diesel over time with only one vehicle left to be converted during the next vehicle turn over. It may therefore be possible to investigate options to provide biodiesel as an alternative fuel source to the operational vehicles.

There may also be potential for Western Water to partner with other water authorities to provide an increased skills base and funding source to progress greenhouse issues. Western Water is investigating the opportunity to partner with North East Water and potentially other water authorities to more accurately measure and quantify lagoon greenhouse gas emissions.

Recommendation: Pursue Research and Development opportunities where there is a mutual benefit for Western Water. Including:

1. Investigate opportunities to provide biodiesel as an alternative fuel source to operational vehicles.
2. Investigate opportunities to partner with other water authorities to progress greenhouse issues.

Key characteristics: Research and Development
Cost: $10,000 annually
Tonnes CO_2e saved: Not measurable
Risk of failure: High
Multi-Criteria Score: 1.12
Ranking: 22 out of 25

Reduce Greenhouse Emissions

Energy Efficiency in Pumping Activities

A number of potential efficiency gains exist in pumping activities for the transportation of water and sewage. The operation of pumps on Western Water's water supply, recycled water and sewage systems accounts for 56% of Western Water's electricity consumption, which equates to the generation of 11,600 tonnes of CO_2e. Of the 97 pumps operated by Western Water, the 'Top 11' energy users consume more than 60,000 kWh per annum and account for 93% of the power used by pumps. The pumping from Melbourne Water is of particular note as the Shepherds Lane Water Pump Station is the largest electricity consumer and accounts for 30% of all pumping undertaken by Western Water. Figure 6.1 clearly demonstrates the significantly higher electricity use by the 'Top 11' pumps.

The amount of energy used in pumping is highly dependent on a large number of variables that can affect both the efficiency and duration of pumping.

Maintenance measures can be undertaken to maximise the efficiency of pump motors, such as alignment and balancing of the drive, and regular cleaning of the motor casing. The use of variable speed drives (VSDs) allows motors to be operated at speeds most efficient for the amount of water being delivered while still delivering adequate flows to cater for demand.

Opportunities also exist at a system level. The hydraulic design of the pumping system, and choice of pump size, can be optimised to minimise energy use required and greenhouse gases emitted. Also, it may be possible to operate pumps may be able to be operated strategically at off-peak periods to smooth electricity demand, minimising energy costs. These opportunities may be cost-effective to retrofit existing plant depending on the particular circumstances. These opportunities should also be considered when investing in new plant equipment.

The Opportunity Study that was undertaken by Sustainability Victoria in May 2007 initiated a high level energy audit and identified a number of greenhouse reduction initiatives that could be undertaken at 5 of the top energy consuming pumping stations.

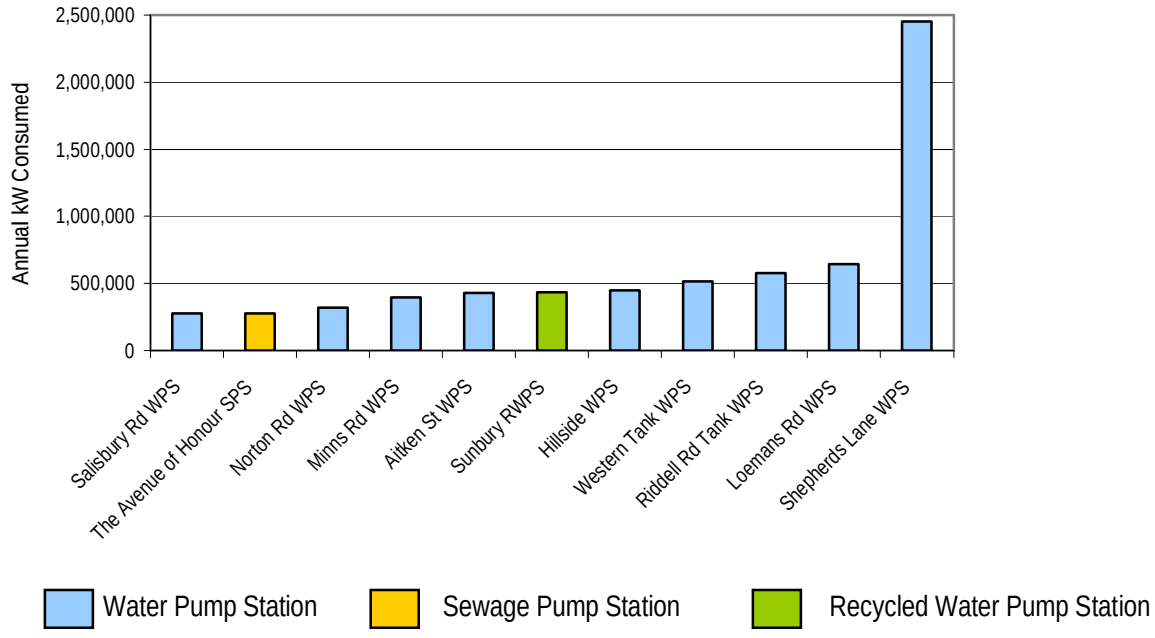


Figure 6.1: Proportional energy consumed by the 'Top 11' pumping stations

Table 6.2 outlines a summary of the findings from the Opportunity Study with regards to pump station operation and maintenance. From the preliminary study undertaken it was determined that 504 tonnes of CO_2e per annum could be saved if all initiatives were undertaken as outlined in the Table. Cost savings were also identified as a result of using less electricity on key pumping infrastructure.

By adopting a simple payback period of less than 3 years in alignment with EPA requirements for greenhouse gas reduction at licensed sites a more realistic saving of 463 tonnes of CO_2e per annum was identified. These recommendations require further investigation prior to Western Water adoption to ensure the technical validity of each high level recommendation. Any opportunities identified with a greater than 3 year payback will be further investigated to identify if there are any further savings that could be undertaken.

Table 6.2: Recommendations from the Opportunity Study, Sustainability Victoria May 2007

Location	Recommendations	Energy Type	Estimated Energy Savings $/annum	Estimated Energy Savings kWh/annum	Estimated Cost to Implement $	Estimated Payback Period Years	CO_2e Tonnes/ annum	Notes
Shepherds Lane Water Pump Station	Optimise operation of two pumps when the planned flows through the station are increased.	Electricity	$10,595	143,174	Nil*	Immediate	189.7	No incremental investment as station controls will be updated during proposed capacity increase.
Romsey Water Filtration Plant	Operate high-lift water pumps during off peak electricity periods	Electricity	$642	Nil	$l,500	2.3 years	Nil	No energy saving however there is reduced power cost by changing pump operating times to off peak operation. Investment is estimated cost to reprogram CITECT operating schedules.
Bacchus Marsh Recycled Water Pump Station	Off peak operation for Irrigator boom.	Electricity	$8,184	Nil	$12,000	1.5 years	Nil	Implementation cost is based on $8,000 for in-house installation of CITECT module, smart meter at $1000 and $3,000 modification to CITECT screens to allow access to the lessee.
Bacchus Marsh Recycled Water Pump Station	Upgrade water pump for irrigation system/	Electricity	$3,345	30,660	$20,000	6 years	41	Estimated price for suitable high suction pump including cost of installation in existing shed.
Sunbury Recycled Water Pump Station	Optimise multi-pump operation when provision for additional balancing storage is complete	Electricity	$18,477	205,807	$20,000	1.1 years	273	Implementation cost is based on installation of suction transducers, installation of actuators for both pumps and interface into CITECT control.
Sunbury Recycled Water Pump Station	Increase off peak operation by shifting morning peak pumping when new storage in place.	Electricity	$5,200	Nil	Nil	Immediate	Nil	
Total			$46,443	379,641	$53,500		503.7	

* Requires further investigation as some additional infrastructure may be required to implement this recommendation that was not originally provided.

Recommendation:

1. Undertake further investigation and if viable, undertake recommendations for pumping operation improvements with a payback time of up to 3 years as outlined in the Opportunity Study commissioned by Sustainability Victoria.
2. All recommendations for pumping operation improvements beyond a payback time of 3 years to be considered for grant funding and further investigation.

Key characteristics: Pump operation
Total cost: $33,500 +/- 30%
Savings: $43,100 per annum
Tonnes CO_2e saved: 463
Risk of failure: Medium
Multi-Criteria Score: 2.41
Ranking: 7 out of 25

'Top 11' Pumps

Undertaking energy audits of the 'Top 11' energy-consuming pumps in Western Water's system may highlight further opportunities to significantly reduce energy consumption. Shepherds Lane Water Pump Station, Bacchus Marsh Irrigation Pump and Sunbury Recycled Water Pump Station are all in the 'Top 11' and were investigated as part of the Opportunity Study however the other 8 pump stations are yet to be investigated and could provide significant opportunity for energy reductions of up to 2.5% savings per pump station. This could equate to another 165 tonnes of CO_2e saved if applicable. Investments that can be funded within existing budgets and with a short payback period of up to 3 years should be commenced immediately.

Recommendation: Undertake energy audits of 'Top 11' energy-consuming pump stations and identify actions to reduce power consumption by 2.5%. Implement actions within budget and with a less than 3 year payback time.

Key characteristics: Top 11 pumps
Total cost: $10,000 +/- 30%
(Plus the cost of implementation)
Savings: $13,950 per annum
Tonnes CO_2e saved: 165
Risk of failure: Medium
Multi-Criteria Score: 2.64
Ranking: 3 out of 25

'Bottom 66' Pumps

It is considered that there are limited cost effective opportunities to reduce the greenhouse emissions from our smaller pump stations due to the large capital cost that would be required to be invested for a small cost saving outcome. During 2006/07, 66 pump stations consumed less than 20,000 kW each. In total, these 'Bottom 66' consumed 291,965 kW.

If Western Water was to purchase GreenPower for the 'Bottom 66' pump stations, this would cost an estimated $12,000 per year (based on $39.41 per mWh for GreenPower and 2006/07 electricity usage) and will result in 68% of Western Water's pump stations becoming carbon neutral.

The additional GreenPower cost of $12,000 per annum can be directly offset against a saving of $13,950 per annum for an increase in efficiency of 2.5% for the 'Top 11' pump stations.

Recommendation: Purchase GreenPower for the 'Bottom 66' energy-consuming pump stations.

Key characteristics: GreenPower
Total cost: $12,000 annually
Tonnes CO_2e saved: 387
Risk of failure: Low
Multi-Criteria Score: 2.85
Ranking: 2 out of 25

Asset Management

Western Water currently collects energy consumption and cost data from electricity bills and fuel cards and reports annually on its greenhouse gas emissions. Western Water has a well established Power Database and also utilises Utilicor to monitor energy usage onsite and detect opportunities for cost savings in electricity billing. Whilst the current energy reporting is comprehensive and several opportunities for savings have already been undertaken there still remains potential to enhance the existing system.

The relative contribution of the major pieces of equipment to energy consumption onsite has not been assessed. In order to gain a better understanding of priority issues onsite it is important that we identify where high energy consumption exists. An understanding of high-energy users will assist in identifying energy inefficiency at the plants and will highlight further opportunities for energy reduction.

The Opportunity Study that was undertaken by Sustainability Victoria in May 2007 recommended an upgrade of internal metering systems including the installation of smart electricity meters at the 23 large power consuming sites and interfaced into the existing Citect modules where they are installed at these properties.

Citect is a software development company specialising in the Automation and Control industry. Western Water utilises a software product developed by Citect, which is the Supervisory Control And Data Acquisition program (SCADA). The power use at each of these properties can be monitored on a continual basis through the connection to SCADA. The data captured from SCADA at pump stations, water filtration and recycled water plants can then be referenced to flows and performance of equipment can be measured in real time. This data could then also be utilised to monitor power use at each point as well as optimise the overall power use for the Western Water systems allowing correct selection when operating multiple pumps over the total system to ensure efficiency is maximised. The historical data for each site could also be provided by AGL to assist in analysing ongoing energy performance.

At a micro level portable power meters and suitable data loggers can be used to measure the performance of individual pump assets and switchboards. This portable equipment would be used to analyse individual pumps and switchboards where energy efficiency appears to be suboptimal or there is unusual energy use patterns. Table 6.3 outlines the recommendations from the Opportunity Study with relation to asset management.

Table 6.3: Recommendations from the Opportunity Study, Sustainability Victoria May 2007

Location	Recommendations	Energy Type	Estimated Energy Savings $/annum	Estimated Energy Savings kWh/annum	Estimated Cost to Implement $	Estimated Payback Period Years	CO_2e Tonnes/ annum	Notes
Western Water Energy and Greenhouse monitoring and reporting	Upgrade of internal energy metering systems. Link smart metering at 23 large sites to the SCADA system.	Electricity	Nil	Nil	$31,000	Not applicable	Nil	No savings claimed through implementation of improved monitoring. Investment is based on $1200 per CITECT site to connect smart meters plus the purchase on one portable power- meter for use across all assets.

In the first instance it is recommended that a web package offered by AGL be trialled for a period of one year at four key high power using sites to examine if this package can offer further benefit on the features offered by the SCADA system. Should this trial prove to be successful it could then be extended to other key sites however if SCADA proves to be more beneficial then its installation across the top energy using sites would be rolled out at the end of the one year trial period. The connection to the AGL website is estimated to cost $1,000 per connection per annum in contrast to the upgrade to SCADA costing $31,000 +/- 30% in total.

Recommendation: Upgrade internal energy metering systems including installation of smart metering at 23 large power use sites via SCADA or web metering.

Key characteristics: Energy metering
Cost: $4,000 per annum
Tonnes CO_2e saved: Not measurable
Risk of failure: Medium
Multi-Criteria Score: 1.33
Ranking: 20 out of 25

Energy Maps

More accurate real time energy monitoring of the system can also be used to determine the energy required to service the various population centres with water and sewage services. This information can then be utilised to develop an energy map for the water, recycled water and sewer systems. These maps show the amount of energy required to supply water, recycled water and sewer services to Western Water's customers and hence enables the amounts of greenhouse gases produced due to the supply of the services to various regions to be compared and accurately represented on water bills.

These maps enable informed decisions to be made when comparing options on energy usage along with the current financial modelling enabling more holistic decisions to be made during design and construction. For example, the energy intensity of supply from Melbourne Water versus utilising localised storages.

Energy maps also facilitate evaluation of the impact that water savings measures have on the energy requirements for providing water supply, recycled water and sewage services to different areas within Western Water.

Recommendation: Develop and apply the use of energy maps.

Key characteristics: Energy maps
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Low
Multi-Criteria Score: 2.20
Ranking: 8 out of 25

Changes in Wastewater and Water Treatment Practices

The opportunity exists to improve the energy efficiency of water and wastewater treatment by installing energy efficient technologies, or optimising the operation of existing technologies to minimise energy use. A common problem in the operation of treatment plants is the inefficient aeration of water. Many plants over-aerate by between 10 to 40% due to inefficient control of dissolved oxygen.

Western Water has been proactive in implementing dissolved oxygen controls with dissolved oxygen probes being installed in the aeration tanks at the Melton Recycled Water Plant to control the operation of the blowers. Improved operating control of the blowers has resulted in significant greenhouse gas savings, as well as reducing maintenance costs.

The Opportunity Study that was undertaken by Sustainability Victoria in May 2007 identified that there may be an opportunity to reduce the pressure of the existing aeration compressor at Romsey Water Filtration Plant. The recommendations from this study are outlined in Table 6.4.

Table 6.4: Recommendations from the Opportunity Study, Sustainability Victoria May 2007

Location	Recommendations	Energy Type	Estimated Energy Savings $/annum	Estimated Energy Savings kWh/annum	Estimated Cost to Implement $	Estimated Payback Period Years	CO_2e Tonnes/annum	Notes
Romsey Water Filtration Plant	Reduce pressure of the existing aeration compressor	Electricity	$3,118	29,274	Nil	Immediate	38.8	
Romsey Water Filtration Plant	Reduced aeration operation during winter months (6 months)	Electricity	$637	5,977	$1500	2.4 years	8.0	Implementation cost is based on time required to modify time schedules in SCADA.

Recommendation: Undertake a review of aeration at all water and recycled water treatment plants including opportunities for dissolved oxygen control.

Key characteristics: Aeration
Total cost: $1,500 +/- 30%
Savings: $3,755 annually
Tonnes CO_2e saved: 47
Risk of failure: Medium
Multi-Criteria Score: 2.43
Ranking: 5 out of 25

Catchment Management

Opportunities may exist to treat water and recycled water to a lesser degree if source control catchment management is undertaken. This may include implementing more rigorous trade waste management controls and maintaining cleaner catchments, which will lead to less energy required to treat the water to remove contaminants.

It may also include providing separate treatment streams at recycled water plants so that recycled water is treated so that it is fit for purpose. For example, reducing the amount of nutrient removal required for agricultural recycled water use whilst maintaining nutrient removal for environmental flows, which will lead to less energy and chemical use. It would therefore be necessary to review the ability of recycled water plants to separate water streams according to their end purpose to allow for different treatment standards.

A trade waste review is scheduled to be undertaken by the end of 2007 and it is recommended that a review of the trade waste policy be conducted to ensure that trade waste customers are encouraged to treat prior to discharge. Monitoring and auditing of trade waste customers should also be undertaken to maintain control of these discharges.

In addition it is recommended that provision be made for a community education campaign to encourage non-trade waste customers to control the quality and quantity of wastewater entering the sewage system.

Recommendation: Undertake a review of the trade waste policy to ensure adequate catchment controls are in place, including communication to customers on minimising contaminants entering the sewerage system.

Key characteristics: Trade waste policy
Cost: $minimal annually
Tonnes CO_2e saved: Not measurable
Risk of failure: Medium
Multi-Criteria Score: 1.52
Ranking: 18 out of 25

Vehicle Choice and Fuel Substitution

Emissions from the use of motor vehicles may be reduced through the choice of vehicles that are 'fit for purpose' and the use of less emissions-intensive fuels. Smaller vehicles and vehicles with hybrid petrol-electric drive trains (i.e. Toyota Prius, Honda Civic) use less fuel than larger vehicles to travel the same distance.

The current Western Water Vehicle Policy in the Human Resources Manual includes Vehicle Equivalent Upper Limits for employees under Employment Contracts who can salary sacrifice leased vehicles at full cost recovery to Western Water. Eighteen vehicles are covered by this system and of those all are petrol and currently only 4 are four cylinder vehicles. By placing incentives in the policy it may be possible to get a conversion rate of 75% to more fuel-efficient vehicles, which would be an additional ten vehicles. Incentives could include passing the cost savings for less petrol consumed on to staff to change from six cylinder vehicles to four cylinder petrol vehicles, hybrid petrol-electric drive trains or six cylinder diesel vehicles. Changing an additional ten vehicles over to more efficient vehicles could save up to 20 tonnes of CO_2e per annum.

It is noted that current Fringe Benefit Tax (FBT) laws around packaged vehicles offer a disincentive to reduce vehicle usage as the more kilometres that a car is driven the lower FBT rate that applies to the driver.

Recommendation:

1. Review Western Water vehicle policy to provide incentives to downsize cars including 4 cylinder, alternative fuel sources and hybrids with a 75% conversion target.
2. Investigate FBT costs compared to fuel and greenhouse gas savings from lower kilometre usage.

Key characteristics: Vehicle policy
Cost: $minimal annually
Tonnes CO_2e saved: 20 tonnes per annum
Risk of failure: Medium
Multi-Criteria Score: 1.58
Ranking: 17 out of 25

Lighting and Air Conditioning

A number of new technologies exist with the potential to improve the energy efficiency of internal and external lighting systems. Compact fluorescent lamps can be installed in place of regular incandescent bulbs. High efficiency fluorescent tubes can replace conventional fluorescent tubes and ferro-magnetic ballasts. High-pressure sodium lamps can replace mercury-vapour lamps in external applications. In all lighting applications, clean, reflective light fittings can maximise the available light from the lamp.

The retrofit of the office at Sunbury has taken into account energy efficient lighting features and has significantly decreased its power consumption by as much as 20% from the baseline value. However opportunity still exists within the other office locations at Gisborne, Melton and Sunbury to review lighting features and install skylights when applicable.

Opportunities also exist to review the air conditioning utilised in the Sunbury office to increase the temperature range for heating and cooling and to change the settings from summer to winter. Office air conditioning often represents a substantial portion of a commercial buildings energy bill. The cooling load on air conditioning systems can be reduced by:

- Appropriate air conditioning temperature set-point
- Equipment maintenance
- Where possible reducing glare and heat gain from exposed glass during summer by external shading (one economical method is to use external shade cloth or shade film, which can be easily applied)
- Reduction of office heat sources (i.e. excessive lighting and equipment use)

Reduction of the cooling load on the air-conditioning system directly translates into cost savings, better system performance, and lower capital costs for new systems as a smaller unit can be selected.

Building air conditioning systems are normally adjusted to provide a fixed minimum quantity of fresh air, which minimises summer cooling requirements (i.e. when the outside ambient temperature is high) and winter heating requirements (i.e. when the outside ambient temperature is low). However this system prevents the use of a greater proportion of cooler outside air during cool days in spring and autumn where there is still a need for building cooling i.e. using a fresh-air economy-cycle.

Equipment is available from most air conditioning unit manufacturers to enable their air-conditioners to take advantage of outside air for cooling on days of lower ambient temperature.

Automated control systems should also be considered to minimise the operating times required for the air conditioning systems. These control features can include stop/start schedules, automated fresh air economy cycle, optimum air conditioning start and after hours air conditioning zone isolation.

It is estimated that a more efficiently operated air conditioning system at the Sunbury office could save the organisation up to 5% of its electricity consumption, which translates to a saving of 43 tonnes of CO_2e per annum.

Recommendation: Conduct an energy audit of the lighting and air conditioning features at all offices operated by Western Water in alignment with energy efficiency gains on lighting that have already been undertaken at Sunbury.

Key characteristics: Air conditioning
Total cost: $ 5,000 +/- 30%
Savings: $3,000 per annum
Tonnes CO_2e saved: 43 tonnes per annum
Risk of failure: Low
Multi-Criteria Score: 1.94
Ranking: 12 out of 25

Power Factor Correction

Power factor correction is a method to increase the efficiency of electrical transmission by reducing the power losses associated with reactive supply, as compared to real supply. Power Factor Correction attempts to adjust the power factor of an electrical load from typically around 0.6 to 1.0. Power factor improvement would reduce greenhouse gas emissions be a reduction in transmission losses in supply infrastructure. This greenhouse gas reduction is on the network side of the supply meter, therefore, clarification would need to be sought in regards to ownership of the potential carbon credit.

Western Water's sites are located in the Powercor Distribution network. Currently, Powercor base its customer's peak electrical demand on kilowatts (KW), rather than kilovolt-amperes (KVA). This results in limited financial incentive to enhance the power factor at Western Water's sites in the current climate.

If Powercor were to elect to change its distribution tariffs to a KVA demand base, significant financial incentives would make this opportunity more financially viable. The next price redetermination for power networks is scheduled to take effect in 2011. Western Water should consider the impacts of this review with the potential to change to a KVA demand. Whilst there is currently limited financial incentive, it may be feasible to improve power factor correction if the demand is nearing system capacity and/or if the network provider mandates improvements under supply agreements.

It is recommended that power factor correction is considered during energy reviews at Western Water's larger pump stations and other larger assets. If all Western Water's power consuming assets were to be upgraded with power factor correction systems, assuming the current average power factor is 0.78 over all assets with an annual supply load factor of 0.6 and an overall power factor improvement to 0.97, then potentially 779 tonnes of CO_2e could be saved.

Recommendation: Assess potential of power factor correction at major assets during ongoing energy and supply reviews.

Key characteristics: Power factor correction
Total cost: $119,000 +/- 30%
Savings: $7,795 per annum
Tonnes CO_2e saved: 779 tonnes per annum
Risk of failure: High
Multi-Criteria Score: -0.04
Ranking: 25 out of 25

Use Renewable Energy

Wind Energy

Wind energy is one of the lowest cost renewable energy technologies with the development of wind turbine technologies relatively mature. Because the energy output of a wind turbine is a function of the cube (power of 3) of the wind speed, the financial viability of this technology depends largely on the quality of the wind resource at the installation site. Advantages of wind turbines are low maintenance needs and the availability of the installation site for complementary uses. Disadvantages are the fluctuation of energy output with wind speed, and potential aural and visual amenity issues for surrounding communities.

Victoria's Wind Atlas has identified that the average wind speed in the north of Western Water's region is relatively high compared to most areas within Victoria. Figure 6.2 illustrates the potential to capture wind energy in this region.

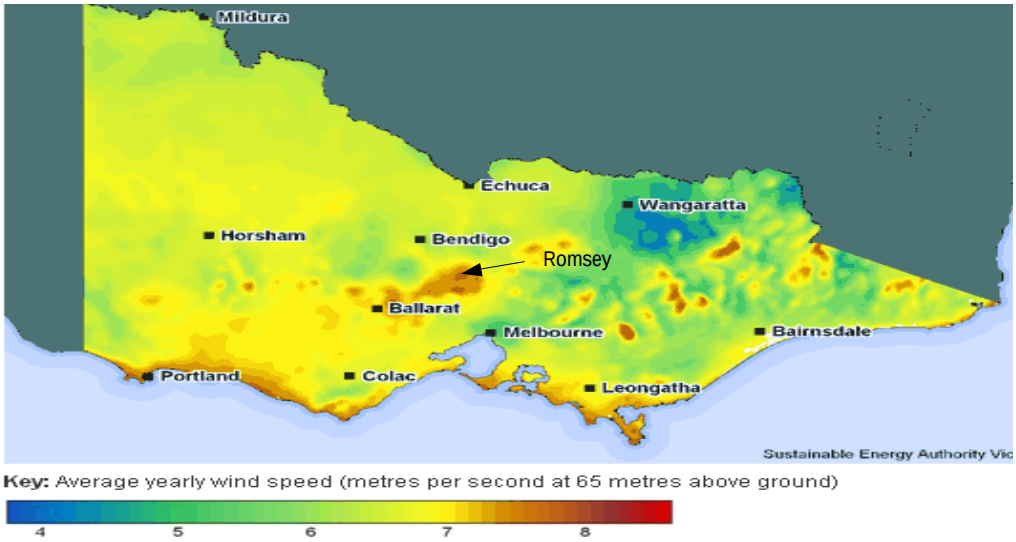


Figure 6.2: Image from Victoria's Wind Atlas identifying locations of high wind generation potential
Source: http://www.sv.sustainability.vic.gov.au/renewable_energy/resources/wind/wind_resources.asp (Sept 2007)

Based on this information, Western Water could consider the installation and operation of a stand-alone wind turbine at the Romsey Recycled Water Plant. This unit could potentially be designed to be a mid sized system (200 to 500 kW output rating). The capital cost of this type of turbine currently ranges from $2,000 per kW installed capacity (refurbished unit) to $3,000 per kW for new turbines. An assessment has been conducted based on the installation of a new 300 KW capacity unit. A similar standalone unit has been successfully installed at Elgo Winery in Central Victoria. Typically, a single wind turbine of 300 kW capacity would have a rotor in excess of 30 metres diameter with a turbine hub height of 50 metres above the ground.

The main issues with standalone mid sized turbines are their physical footprint, their availability and capital cost. Community acceptance of a project of this type in the region is essential, as is regulatory approvals to install a structure of this size and assessment of environmental impacts. All these factors must be carefully considered in an area such as Romsey. Therefore, it is recommended that a more detailed feasibility of this option be conducted.

Recommendation: Undertake a feasibility study for the potential installation of a standalone mid sized wind turbine at Romsey RWP.

Key characteristics: Wind turbine - Romsey
Total cost: $900,000 +/- 30%
Savings: $63,000 per annum
Tonnes CO_2e saved: 1,254 tonnes per annum
Risk of failure: Medium
Multi-Criteria Score: 0.36
Ranking: 24 out of 25

Solar Photovoltaic

Solar photovoltaic (PV) cells are an easily recognisable form of renewable energy generation. It is expected that major technology developments will be made in coming years, and as such the cost per unit of electricity generated, although presently high, will be reduced. However, solar PV systems can be installed stand-alone, and may be a cost-effective solution for energy applications a considerable distance from the existing grid.

There is potential for Western Water to install a small-scale photovoltaic system at the Sunbury office. An evaluation has been completed based on the installation of 2.8 kW grid connected array. It should be noted that this evaluation does not include possible subsidies that are available from Federal and State Governments for some applications, which can include funding of up to $8,000. Although the carbon offsets are minimal, such an installation would demonstrate Western Water's commitment to Greenhouse Gas Reduction through investment in renewable technologies.

Recommendation: Consider a small-scale photovoltaic installation at the Sunbury office.

Key characteristics: PV for Sunbury
Total cost: $ 30,600 +/- 30%
Savings: $549 per annum
Tonnes CO_2e saved: 6.5 tonnes per annum
Risk of failure: Low
Multi-Criteria Score: 1.66
Ranking: 15 out of 25

An opportunity also exists to trial a solar aerator. Known as a 'solar bee', there is potential for a trial to be established at Lancefield Basin where capital works are currently in progress. An aerator is required at this location to combat the problem of blue green algae. Aside from pumps stations, aerators are one of Western Water's major consumers of power. A number of reservoirs currently utilise electrically driven aerators at high operating cost and large greenhouse gas emissions.

At concept design, a 30 kW aerator is proposed for the Lancefield Basin. This aerator is expected to operate at 75% capacity for 12 hour per day. Using this aerator as a baseline for a comparison, if a 'solar bee' was utilised rather than an electrical powered aerator, 98,550 kW could potentially be saved per annum which is equivalent to a saving of 131 tonnes of CO_2e and $10,950 per year.

Recommendation: Trial the application of a 'solar bee' aeration system at the Lancefield Basin with the potential for it to be utilised more widely across Western Water.

Key characteristics: Solar bee
Total cost: $ 61,675 +/- 10%
Savings: $10,950 per annum
Tonnes CO_2e saved: 131 tonnes per annum
Risk of failure: Medium
Multi-Criteria Score: 1.61
Ranking: 16 out of 25

Mini-Hydro Generation

A developing technology in the water industry is the use of mini-hydro turbines to generate electricity where pressure differential exists in reticulated water supply systems and waterways particularly at pressure reduction valve (PRV) sites. While this technology has the potential to generate a steady supply of renewable energy, technical challenges exist such as managing downstream supply pressure to customers and maintaining sufficient flow and pressure differential available for the generator to be viable.

Western Water has completed an opportunity study in association with Sustainability Victoria in May 2007 that assessed the potential for power generation from its larger Pressure Reducing Valves (PRV's). The analysis indicated that the energy dissipated over these reducing stations was not sufficient to justify consideration of mini-hydro plants. A review of mini-hydro power generation potential should be conducted if opportunities arise in the future.

Recover Waste Energy

Methane Capture and Reuse

Methane gas is a major end product of the anaerobic wastewater treatment process. As methane has a Global Warming Potential 21 times as powerful as carbon dioxide (CO_2), management of fugitive methane emissions has a major greenhouse gas reduction benefit. Methane emissions can be managed by using the methane as a fuel source. Flaring methane is the most primitive treatment of methane. While this energy is not used for productive use, combustion reduces the carbon in methane to CO_2. Therefore flaring to reduce harmful impacts of methane is still beneficial and the wastewater treatment process becomes carbon neutral. A more productive use of this methane is to drive a biogas-fuelled turbine for electricity generation. This option has the potential additional benefit of offsetting electricity use elsewhere, such as for aeration.

A preliminary assessment of the potential for biogas cogeneration has been undertaken with the most suitable site being identified at the Melton Recycled Water Plant (Surbiton). It was estimated that if all available gas is consumed to maximise the generation of electricity that 81 kW of electrical energy could be generated annually for $310,000, a cost estimate of +/-50%.

This preliminary study does not take in to account additional biogas generation potential due to upgrade works scheduled to commence in July 2008, high growth rates in the Melton region or trials that are currently being undertaken at Surbiton with ultrasonic treatment of the sludge blanket releasing more methane. Therefore it is highly likely that the study significantly underestimates the overall methane production potential for the plant.

Powercor is in the process of duplicating a 750 kV transformer and high voltage overhead cables to ensure that an adequate power supply is made available for the increased energy demands of the Class A Recycled Water Plant and upgrade of the existing plant. This power supply upgrade will be undertaken for the significant costs of $3,600 recoverable upfront with $394,000 to be recovered through electricity tariffs to Western Water over a number of years. Western Water is committed to this upgrade taking place due to upgrade works planned for the treatment plant. However future upgrades of the power supply system could be deferred if an onsite cogeneration plant is installed particularly if this was coupled with a natural gas back up which would also reduce greenhouse gas emissions. The current financial assessment of the biogas cogeneration does not take into account these potentially significant cost savings that could be achieved.

There may also be additional opportunity to capture waste heat to heat the digester with the exhaust heat coming from the biogas generators, which would increase treatment efficiency of the treatment plant and may have the potential to increase biogas generation. The Clean In Place (CIP) hot water unit on the Class A Recycled Water Plant may also be able to utilise this same source of waste heat.

The Class A Recycled Water Plant is expected to utilise 71 kWh during peak production of 5 ML per day. Based on preliminary figures, by installing an 81 kWh biogas cogeneration plant on the existing treatment plant there is potential to make the Class A Recycled Water Plant carbon neutral as all its power can be generated from the biogas cogeneration plant.

The opportunities highlighted above outline real potential to review the energy requirements for the Melton Recycled Water Plant and reduce greenhouse gas emissions significantly through changes in energy source options. Given the renewable energy opportunities at the site, there may also be an opportunity to make Surbiton the first operational site to be carbon neutral although this will require further investigation.

Recommendation: Conduct an energy review including a feasibility assessment for a biogas cogeneration plant for the Melton Recycled Water Plant to ensure that all opportunities are captured prior to the completion of the construction of the upgrade and the Class A Recycled Water Plant.

Key characteristics: Biogas capture - Melton
Total cost: $310,000 +/-50%
Savings: $51,892 per annum
Tonnes CO_2e saved: 675 tonnes per annum
Risk of failure: Medium
Multi-Criteria Score: 2.87
Ranking: 1 out of 25

Methane Capture Review

Less information is available on the methane capture options for the other six recycled water plants that Western Water operates. During the opportunity study conducted with Sustainability Victoria in May 2007 the potential for biogas cogeneration from the Bacchus Marsh Recycled Water Plant was investigated and found that opportunity existed for methane capture and recovery. Due to lack of data, the assumptions behind the preliminary assessment require further investigation. It is recommended that a review of the biogas cogeneration potential for all Recycled Water Plants be undertaken to enable a more accurate account of the potential opportunity.

Recommendation: Conduct a review of the biogas cogeneration for Western Water's Recycled Water Plants (excluding Surbiton) to identify opportunities for power generation and develop modelling to determine more accurate methane yields.

Key characteristics: Methane capture - review
Total cost: $50,000
Savings: To be quantified
Tonnes CO_2e saved: To be quantified
Risk of failure: High
Multi-Criteria Score: 1.87
Ranking: 13 out of 25

Sequestration and Abatement Schemes

Forest Sequestration on Western Water properties

Trees and other plants store (sequester) carbon dioxide from the atmosphere as they grow, through the process of photosynthesis. While soils may lose carbon following cultivation, the amount of carbon in forest soils can increase over time. Forests represent a carbon storage point or sink when they are actively growing and sequestering carbon at a rate that exceeds any soil carbon and other emissions. The rate at which forests sequester carbon is influenced by site productivity characteristics such as climate, topography and soils, as well as tree characteristics and management actions.

Western Water recognises its existing biodiversity program as an important approach to offset its greenhouse gas emissions. However, to maximise confidence in the quality of the carbon sequestration claimed, Western Water must adopt an Australian Greenhouse Office accredited carbon accounting framework.

Recent sequestration projects in Australia estimated that approximately 741 tonnes of CO_2e could be absorbed per acre of trees planted. Therefore, if Western Water plants and maintains 0.5 acres per year as part of its biodiversity program, it is estimated that approximately 370 tonnes of CO_2e could be sequestered as part of its biodiversity strategy.

It is important to note that it is estimated that Western Water would be required to revegetate approximately 1,295 acres of forest to sequester all of its emissions for 2006/07, making a tree planting option on its own unrealistic for the business.

Recommendation: Review biodiversity program for potential to capture CO_2e emission offsets.

1. Engage independent consultants to evaluate CO_2e offset potential and reporting requirements.
2. Adopt an accredited carbon accounting framework for Western Water's biodiversity program.
3. Monitor, record and develop existing biodiversity program in accordance with the adopted framework.

Key characteristics: Biodiversity
Total cost: $15,000
Savings: $0 per annum
Tonnes CO_2e saved: 370 tonnes per annum
Risk of failure: Medium
Multi-Criteria Score: 2.07
Ranking: 10 out of 25

Abatement Schemes

Abatement schemes, or carbon offsets are actions undertaken deliberately outside of normal operations that result in the removal of greenhouse gas emissions from the atmosphere, or reduced greenhouse gas emissions when compared with business-as-usual. Many retail companies such as Greenfleet, Easy Being Green, Carbon Neutral, Climate Positive and Elementree now sell carbon offsets, sourced from forestry, energy efficiency, renewable energy, and landfill gas projects. Offsets are usually purchased in units of *tonnes of* CO_2e *offset*.

Offsets can be purchased to reduce the size of your carbon footprint against all sources of greenhouse gas emissions including wastewater treatment, electricity use, vehicle use, and aircraft flights. Because no single standard exists for carbon offsets, the products offered by each company, may differ in 'quality'.

It is important that any offset product considered for purchase is well understood. The publication *Carbon Offset Providers in Australia 2007* published by RMIT Global Sustainability considers these issues in detail.

Rather than purchasing a carbon offset from a retailer, Western Water may invest in abatement schemes by forming partnerships with other business sectors that have potential for renewable energy generation or expertise in abatement options. Such abatement schemes could include:

- Investment in capacity off takes at a large commercial wind farm by contributing to the capital of a wind farm rather than purchasing GreenPower from a retailer. As a guide of indicative costs associated with this type of activity, an assessment has been conducted based on the average unit costs and performance outputs from seven major wind farms established in Australia over the last decade. If Western Water contributed to a 2,000 kW wind turbine (typical sized unit for a modern wind farm) located with others of a similar size in a commercial wind farm, indicative costs would be approximately $1874 per kW installed capacity with a load factor availability of 36%. In this case, the wind turbine capacity and consequential tonnes of greenhouse gas emissions saved is scaleable depending on the level of investment chosen.
- Participation in larger scale solar power stations that typically use technology that tracks the sun and either increases the intensity of solar radiation hitting the cell surface or is used to directly produce steam to drive a steam turbine generator. This technology is in its infancy in Australia with the first large-scale unit being planned for construction near Mildura, Victoria. This plant capacity is designed for a 1,000 kW output with predicted low installed costs of $2.72 per watt output. This compares favourably to the unsubsidised cost of traditional photovoltaics, which costs approximately $11 per watt output.
- Investment in larger micro-hydro plant, typically located at a dam or very large pressure reducing station. Based on the micro-hydro located at the Waranga Western Channel, a micro-hydro generator with an output power of 4,000 kW and a capital investment of $6,100,000 has the potential to offset 23,320 tonnes of CO_2e, which is the majority of Western Water's emissions. This example has an estimated pay back period of 5.1 years.
- Investigate opportunities to substitute electricity applications with natural gas or other available fossil fuels that have lower carbon emissions than that produced from centralised coal based power generators. This option could potentially involve the installation of a gas-fired turbine or engine based cogeneration plant at a large factory or commercial building which is sized to provide a surplus from that which is required for the plant. The surplus power produced would then be exported and allocated to Western Water as a carbon offset. Until recently these cogeneration projects have not been viable with paybacks of greater than 10 years however with the recent rapid increases in power prices and the likely impacts of carbon values on coal based power it could now be a real option. A gas fired combined cycle cogeneration plant can typically operate at efficiencies of up to 75% (40% electrical conversion with the remaining 42% as recovered thermal energy). Taking power from this source would reduce the carbon output by at least 63%.
- Assess options for the supply of distributed power sourced from waste gas produced from Municipal Landfill Sites or other third party biogas sources. This is similar to the cogeneration concept described above, however there is normally little potential for heat recovery for these systems so financial returns and greenhouse gas reduction efficiency is lower than for cogeneration cases.

The type of abatement options identified above, have the potential to deliver relatively large reductions measures that are remote from the Western Water's current operational activities. For joint development options and participation in renewable energy generation the main issue would be the selection of the best projects and partner organisations. The other issue is gaining acceptance as a viable partner for prospective developers. Given that many corporate entities will similarly be looking for carbon offsets, there is likely to be considerable competition in partnering in suitable abatement projects, particularly as values are assigned to carbon. It would also be important that Western Water undertake 'local' projects within the region to ensure that the investment was in the region.

Whilst generation of power is clearly a non-core business direction for Western Water, these types of abatement options can potentially serve as an effective physical hedge against the risk of high power prices resulting from carbon offsets or pricing. This hedge will by ongoing regardless of whether there is direct allocation of carbon benefits or simply derived benefits from the energy production acting as offsets to similarly price carbon premiums paid for power used at Western Water's operational assets.

The different abatement options should be assessed against traditional offset, options such as GreenPower, in terms of cost, potential greenhouse gas savings, social impact and business risk to further identify desirable projects and partnerships.

Recommendation: Review offset opportunities including:

1. Monitoring the development of Australian Greenhouse Office accredited offset providers.
2. Consider the purchase of offsets and partnerships with other organisations in conjunction with potential GreenPower options.
3. Identify potential offset options to be incorporated into the capital budget for the next Water Plan.

Key characteristics: Offsets purchase
Total cost: To be quantified
Savings: $0 per annum
Tonnes CO_2e saved: To be quantified
Risk of failure: High
Multi-Criteria Score: 0.79
Ranking: 23 out of 25

Sourcing *GreenPower*

GreenPower is electricity sourced from renewable sources including the sun, wind, water and waste that are purchased by the electricity retailer on the customers' behalf. Most major retail electricity providers have GreenPower products, which can be readily accessed by domestic, commercial and industrial energy users. While GreenPower users still have their electricity delivered through the central power grid, their energy retailer commits to sourcing an amount of electricity equal to the consumer's use from Government accredited renewable sources.

Only renewable energy products that display the GreenPower "tick" are government accredited. For a renewable energy product to gain endorsement from the GreenPower program it must be generated from:

- Eligible renewable energy sources that meet strict environmental standards
- A new renewable energy facility that was built since January 1997 – other renewable energy such as old hydro exists but may not be accredited as it is already contributing energy to the electricity grid

Different 'qualities' of GreenPower can be purchased, depending on the mix of energy sources used ranging from 10% to 100% GreenPower. A product that is 10% GreenPower will have 10% renewable energy purchased from government accredited sources meeting the above criteria and the other 90% will be renewable energy from old established renewable energy sources such as old hydro. This does not mean that the final product is not carbon neutral rather that it does not initiate new investment in renewable energy, as it would have been used by the energy retailer to supply the electricity grid anyway.

It is possible to remove 83% of Western Water's carbon emissions by buying GreenPower for the total electricity consumption by the business. However based on current contractual rates offered by AGL, the total cost to the business is estimated to be more than $1 million. In addition, purchasing GreenPower for the whole organisation does not facilitate adopting energy efficient and innovative practices and is therefore viewed as a least desirable option.

The opportunity exists to purchase GreenPower for the Sunbury office only. This would allow the Sunbury office to become the first Western Water site to be carbon neutral and would assist in providing an alternative energy message for the majority of staff. Coupled with messages about energy conservation and the existing energy conservation features within the building, the purchase of GreenPower for the Sunbury office would allow staff to view Western Water walking the walk. As the Sunbury office consumes approximately 4% of the electricity utilised by the business, purchasing GreenPower would cost an additional $27,035 per annum for the business.

The additional cost of GreenPower to the business is however cost recoverable by adopting a Green Data Centre, which can potentially save 10% of electricity utilised by the office (a saving of $6,000 per annum), and improving air conditioning, which can save a further 5% of electricity utilised by the office (a further saving of $3,000 per annum).

In addition to these savings, Western Water's administration office has recently been retrofitted with energy efficient lights, light sensors, passive solar design, and minimal hot water usage. Based on documentation supplied by Hume City Council, the Sunbury Administration Office produced 950 tonnes per year of CO_2e emissions prior to any Western Water retrofits. Since Western Water's retrofits and relocation, the Sunbury Administration Office produces an estimated 765 tonnes per year *(annual CO_2e estimates based on Hume City Council's State of the Environment Report, 2006-2007 and Western Water's May 07 – August 07 electricity bills)*. These measurements indicate the energy efficient retrofits made to the Sunbury Administration Office have reduced greenhouse gas emissions by 20%. This is a significant greenhouse gas saving resulting in a cost saving of an estimated $16,000 per annum.

The greenhouse gas saving outlined above indicates that an estimated $25,000 has and will be saved by implementing energy efficiency measures across the office. It is considered that once the planned future energy efficiency and cultural change initiatives are implemented, a full cost recovery will be achieved for 100% GreenPower to be purchased for the Sunbury Office.

It is also recommended that a partnership with electricity providers be further investigated, as there may be an opportunity to reduce the cost of purchase of GreenPower further by allowing dual logo opportunities on water billing and notices to occur in customer communication.

Recommendation:

1. The Sunbury office to become carbon neutral by purchasing 100% GreenPower.
2. Investigate opportunities for partnerships with electricity providers to reduce GreenPower costs.

Key characteristics: GreenPower
Cost: $27,035 per annum
Tonnes CO_2e saved: 850 tonnes per annum
Risk of failure: Low
Multi-Criteria Score: 2.85
Ranking: 2 out of 25

Appendix B Multi-Criteria Assessment

The following multi-criteria were adapted from a list provided by Melbourne Water and were utilised to assess all opportunities and provide a ranking:

1. Suitability to the organisation
   - Does the option fit with Western Water's Vision and Values?
   - Does the option potentially cause political issues?

2. Environmental impact
   - Does the option affect threatened, endangered or other species?
   - Would waste streams be produced or avoided?

3. Social impact
   - Does the option affect the local community?

4. Life cycle impact
   - Does the option have significant impacts associated with the raw materials, manufacturing/production and disposal of materials?
   - Is there embedded energy associated with the option and is it significant in comparison with the potential operational energy savings?

5. Financial impact
   - Is the option within budget?
   - Does the option save expenditure?
   - Does the option increase expenditure?

6. Operability and Maintainability
   - Can the option be operated and maintained by the business and the service providers within their existing skill base or would new specialist service providers be required?
   - What is the lifespan of the option?
   - If fuel is generated by the option can it be utilised by the business? For example, is there sufficient wind for turbines?

7. Technological maturity
   - Is the technology available off the shelf?
   - Has its performance been demonstrated at a reference site of similar size?