MWH

BUILDING A BETTER WORLD

Centroc Carbon Plus

Implementation Plan

April 2011

This document has been prepared specifically for Central NSW Councils (Centroc) in relation to the Carbon Plus Study project and should not be relied upon by other parties nor used for any other purpose without the specific permission of MWH.

REVISION SCHEDULE

REV. NO.	DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
1	18 Feb 2011	Draft for client review	Philippa Charlton	Peter Fagan	Emma Pryor
2	12 Apr 2011	Final	Philippa Charlton	Emma Pryor	Emma Pryor

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In line with our Quality System, this document has been prepared by Philippa Charlton. The document has been reviewed by Peter Fagan and signed off by Emma Pryor.

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Implementation Plan

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Table of Acronyms

Centroc	Central NSW Councils
CHP	Combined heat and power
CO_2	Carbon dioxide
CPI	Consumer Price Index
CTW	Central Tablelands Water
HVAC	Heating, Ventilating, and Air Conditioning
IPART	Independent Pricing and Regulatory Tribunal (NSW)
ISA	Integrated Sustainability Analysis
KW	Kilo Watt
LCA	Life Cycle Assessment
LED	Light-emitting Diode
MRET	Mandatory Renewable Energy Target
MW	Mega Watt
NCOS	National Carbon Offset Standard
NEM	National Energy Market
NPC	Net Present Cost
ORER	Office of the Renewable Energy Regulator
PPA	Power Purchase Agreement
PRG	Project Reference Group
PSC	Project Steering Committee
PV	Photovoltaic
REC	Renewable Energy Certificate
RET	Renewable Energy Target
TBL	Triple Bottom Line
WELS	Water Efficiency Labelling and Standards Scheme
WSS	Water Security Study

Glossary

Abatement – refers to a reduction in the degree or intensity of greenhouse gas emissions. A project or activity that reduces or otherwise prevents emissions of greenhouse gases from entering into the atmosphere.

Biofuel – a fuel produced from dry organic matter or combustible oils produced by plants. These fuels are considered renewable as long as the vegetation producing them is maintained or replanted, such as firewood, alcohol fermented from sugar, and combustible oils extracted from soy beans. Their use in place of fossil fuels cuts greenhouse gas emissions because the plants that are the fuel sources capture carbon dioxide from the atmosphere

Biogas – gas formed from anaerobic digestion of organic matter which comprises predominantly methane, carbon dioxide and water vapour. Biogas can be reused as a fuel.

Biomass – is biological material from living or deceased organisms, such as wood, waste, and biosolids. Biomass commonly refers to plant matter grown to generate electricity or produce heat.

Carbon dioxide - a heavy odourless colourless gas formed during respiration and by the decomposition of organic substances; absorbed from the air by plants in photosynthesis.

Carbon offset – a reduction in emissions, or sequestering of greenhouse gas which is made in one part of a business or entity, in order to compensate for (or offset) an emission made elsewhere.

Co-generation/combined heat and power (CHP) – refers to simultaneous generation (in one process) of useable thermal and electrical (and/or mechanical) energy, where both forms of energy are put to productive use. The addition of cogeneration capability to generating facilities and industries that produce large amounts of heat energy helps ensure that waste heat (usually in the form of steam or hot water) is used efficiently for heating, industrial use, agriculture or conversion into electricity. All power plants must emit a certain amount of heat during electricity generation (due to the laws of thermodynamics). Co-generation, or CHP, captures some of the by-product heat for heating purposes, rather than wasting it.

Commercial models – the type of commercial arrangements used to fund projects, schemes and initiatives. Commercial models may include government funding, private funding, arrangements such as a BOOT (Build Own Operate Transfer) scheme and similar schemes.

CPI – Consumer Price Index - An economic measure of inflation, calculated as the average change in prices for a fixed group (basket) of products and services considered to be either essential or universally desirable for a given population or segment of the population.

Crop waste/residue - crop residues leftover from harvesting and processing of crops. Crop residues from harvesting may include materials such as crop stalks, seeds and leaves. Residues from processing include seeds, roots, husks.

Energy efficiency – energy efficiency refers to the efficiency at which energy is used to perform processes and activities.

Energy offset – where renewable energy is used in place of fossil fuel derived electricity in other Centroc council facilities or in the community.

Greenhouse gas – a gas that contributes to the natural 'greenhouse effect'. These can be both natural and anthropogenic. The six GHGs covered by the Kyoto Protocol are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorcarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

Greenhouse initiatives – initiatives, usually by government or business, created to reduce the emission of greenhouse gas.

Gas turbine – a rotary engine used to convert gaseous fuel, via mechanical energy from the turbine, into electricity.

Gasification – producing combustible gas through the heating of waste. The gas produced can be burned in excess air to generate heat/electricity.

Green energy/power – green energy (or green power) is renewable energy/electricity purchased from accredited electricity retailers around Australia. Purchasing Green Power requires that a premium is paid on standard electricity rates and in return the energy provider purchases electricity from renewable energy sources (including wind, solar, mini-hydro and biomass) on your behalf.

HVAC (Heating, Ventilating and Air Conditioning) – the technology of indoor (including vehicle) temperature regulation. Refrigeration is sometimes also included (HVACR) in this discipline of engineering.

Integrated Sustainability Analysis (ISA) – ISA is a type of input-output life cycle assessment (LCA) model which has been developed by the University of Sydney. ISA (and other input output models) use economic data for production processes to calculate materials inputs and outputs in lieu of the detailed assessment of environmental impacts using the physical flow of materials and goods which is required for traditional LCA.

LED lights – light emitting diode (LED) lights are solid state lights which are more energy efficient than normal incandescent lighting or fluorescent lights. LEDs are now being used in some locations for energy efficient street lighting.

Life Cycle Assessment (LCA) - a process of evaluating the effects that a product has on the environment over the entire period of its life thereby increasing resource-use efficiency and decreasing liabilities.

Mitigation/mitigation opportunities – in the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently, switching to renewable energy, improving energy efficiency, and expanding forests and other 'sinks' to remove greater amounts of carbon dioxide from the atmosphere.

Materials substitution - Opportunities to reduce sustainability impacts through use of more sustainable material (e.g. recycled material) to reduce embedded sustainability impacts.

Mercury vapour lamps – a mercury vapour lamp is a gas discharge lamp that uses mercury in an excited state to produce light. Mercury vapour lamps are relatively efficient and also offer a very long lifetime.

McKinsey Cost Curve – A greenhouse abatement cost curve showing the net present cost per tonne of various abatement/mitigation initiatives.

Mandatory Renewable Energy Target (MRET) scheme – a (mandatory) renewable energy target is a government legislated requirement for power companies to source targeted proportions of their power production from renewable energy sources. The Australian scheme sets a target of 20% renewable energy by 2020. Well over fifty countries have renewable energy policy targets of some type.

National Electricity Market (NEM) – the NEM is the Australian wholesale electricity market.

Net present cost/Net present value (NPC /NPV) - A technique for assessing the worth of future payments by looking at the present cost (or value) of those future cashflows. Future payments are expressed in current terms by discounting at a predetermined rate.

Office of the Renewable Energy Regulator (ORER) - The Office of the Renewable Energy Regulator is a statutory authority established to oversee the implementation of the Australian Government's Renewable Energy Target (RET).

Offset – an activity that compensates all or part of the CO2-e (or energy emissions) of an emitting entity, by reducing the emissions, or increasing the CO_2 absorption of another entity.

Photovoltaics (PV) – photovoltaic panels are a technology to generate electrical power by converting solar radiation into direct current electricity.

Pump station – pump stations (also referred to as pumping stations) are facilities which include pumps, valves, pipework and the civil structure to pump fluids from one place to another.

Pyrolysis – a process that produces combustible gas, bio-oil and char from organic matter.

Plasma arc gasification – a specific type of gasification which produces syngas rich in hydrogen and carbon monoxide. This process is able to be used in fuel cells.

Resources – a resource is an entity of limited availability that needs to be consumed to obtain a benefit from it. Resources are frequently thought of as physical, such as coal, metals, water, forests, but can also be virtual, such as human capital potential, corporate reputation, etc.

Renewable energy – energy derived from non-fossil energy sources that are continuously renewed by natural processes. These include wind, solar, geothermal, wave, tidal and hydropower.

Renewable energy certificate (REC) – electronic form of currency initiated by the Renewable Energy (Electricity) Act 2000 to account for renewable energy generation. RECs may be created by eligible parties for each megawatt-hour of eligible renewable electricity generated.

Retrofit – retrofitting refers to the addition of new technology or features to existing (older) systems. It often involves augmentation or improving efficiencies of an existing system.

Scope 1 greenhouse gas emissions – these are direct emissions from an organisation such as emissions from combustion of fossil fuels or gas emissions from landfills and wastewater treatment plants

Scope 2 greenhouse gas emissions – these are indirect emissions resulting from the use of purchased electricity or heat.

Scope 3 greenhouse gas emissions – these are other indirect emissions, including those resulting from the extraction and production of materials and fuels, outsourced activities etc.

Scope 1 & 2+ greenhouse gas emissions – these are the emissions that occur throughout the production layers (modelled using the Integrated Sustainability Analysis tool) that relate to the operation of the water supply system. These emissions comprise all the emissions related to supply of electricity and other goods required to operate the water supply system infrastructure including emissions from suppliers, suppliers of suppliers and so on throughout the supply chain (e.g. emissions related to provision of mining services to the electricity sector are included)

Shifts in sustainability impacts – this refers to how much each mitigation option changed the sustainability impacts considered in this study.

Solar energy – solar energy relates to energy harnessed from the sun. Solar energy technologies are broadly categorised as passive or active and can harness energy as heat or as electricity. Active solar technologies include the use of photovoltaic panels and solar thermal collectors. Passive solar techniques include orientation of buildings, using materials with favourable thermal mass etc.

Solar thermal – solar thermal refers to technology for harnessing solar energy for thermal heat (which can then also be converted to electricity).

Substitution/materials substitution - refers to substituting conventional processes or materials to reduce embedded sustainability impacts (e.g. by using recycled materials).

Triple Bottom Line (TBL) – TBL is a method of measuring a project or process in terms of economic, environmental/ecological and social impacts. Many organisations require some form of TBL assessment to be undertaken for large projects/decisions.

Turbines – a turbine is a rotary engine that extracts energy from a fluid and converts it to useful work. Moving fluid acts on the turbine blades so that rotational energy is imparted to the rotor. This can be used as mechanical energy (such as a windmill/pump) or the rotational energy can be converted to electricity.

Tri-generation – tri-generation refers to processes that produce combined heat, power and refrigeration.

Transport modal change – this refers to a change from one transport 'mode' to another (e.g. private car use to public transport).

Executive Summary

The aim of the Centroc Carbon Plus Study is to identify potential alternatives to minimise the carbon impact of securing the water supply of the Centroc region and implementing the recommendations of the Water Security Study. This report describes a recommended plan for implementation of the Carbon Plus Study recommendations.

Preliminarily Preferred Strategy

In Stage 4 of the project, the following preliminary strategy was identified:

- WSS Energy Efficiency: Implement the identified Water Security Study energy efficiency measures (subject to further investigation during the detailed design stage).
- Wind Farm: Establish a regional scale wind farm to generate a quantity of renewable electricity equal to (or greater than) the electricity required for operation of the water security system.
- Hydro-generation: While hydro-generation did not perform as well as wind farm generation when strategic costs estimates were utilised in the strategy TBL assessment, local factors may see the costs of hydro-generation vary from the strategic estimates. Hydro-generation opportunities, if viable, could deliver up to one third of the WSS electricity requirements. It is therefore recommended that a review of the potential for hydro-generation on the water security system be carried out during detailed design to confirm costs and energy generation potential.

Risk Assessment

A risk assessment was undertaken to evaluate the risks associated with each element of the preliminarily preferred recommendations (as identified in the Stage 4 report) and to identify potential risk management approaches. The risk assessment was then used to inform the final recommended strategy. The key risks and mitigation approaches identified in the assessment were:

- **Technology costs vary from that assumed:** the assessment of carbon mitigation opportunities has been based on the best available information at this time. However, opportunities aside from those identified may become preferred or the ranking of the identified options could change over time as the price of inputs change or technologies mature. To mitigate this risk, Centroc could undertake market testing, through an Expression of Interest (EOI) process, for supply of wind energy, but with opportunity for submission of proposals related to alternative technologies (e.g. solar thermal, biomass) provided these options achieve the same electricity generation, carbon mitigation and TBL outcomes.
- **Electricity, fuel and REC prices vary from assumed:** Sensitivity analysis has shown that higher electricity prices support the implementation of the identified strategy, with the performance of all renewable energy and energy efficiency options improving. The recommended strategy does not include initiatives that will be impacted by increases in transport and fuel prices and the performance of the options is not significantly impacted by the assumed price of RECs.
- **Carbon strategy/policy:** Government's policy drivers related to Carbon are currently unclear. On the one hand, there are advantages to implementing the Centroc Carbon Plus strategy ahead of time, as later demand arising from the introduction of a Carbon price and electricity price increases may increase costs. However, if the impetus to address Carbon emissions declines, then the linkages between Carbon management and water security infrastructure funding may no longer exist and early adoption would not be preferred. However, recent Australian Government policy announcements would indicate that this scenario is unlikely.

- **Energy requirement and carbon footprint:** The Carbon footprint of the water security infrastructure operation may be higher or lower than forecast. In addition, balancing the water security electricity demand against the wind (or other renewable energy scheme) supply at each point in time is a key challenge. The selection of the procurement model for purchase of wind generated electricity and contractual arrangements will need to consider who is responsible for management of these "overs and unders", who is allocated the exposure to escalating carbon, electricity and potentially REC prices and how the expected variability in the need for renewable energy year to year will be managed.
- **Community Attitudes towards Renewable Technology:** Community acceptance of the proposed carbon mitigation strategy was highlighted as a potential risk in the risk assessment process. Raising the level of understanding of wind farm development, management and design with the community and key stakeholders, and further developing an understanding of attitudes towards the recommendation, is an important aspect of implementing the strategy. A key mitigation measure identified to manage this risk is the development and deployment of a communications plan.

  It has also been noted by stakeholders to the development of this plan that a community owned wind farm development model, providing not only WSS study electricity requirements but also community electricity demands, may be more readily accepted.
- **Funding:** Funding for the carbon management recommendations, and indeed the water security recommendations themselves, has not been secured. This is a significant risk to implementation. The development of a business case, in consultation with key State and Federal agencies, is recommended as a key mitigation activity to address the risk of a lack of funds to implement the recommendations of this study.

Recommended Strategy

Based on consideration of the implementation risks, the refined Strategy is presented below, with alterations to the preliminary strategy identified in Stage 4 of the project underlined.

- WSS Energy Efficiency: Implement the identified Water Security Study energy efficiency measures (subject to further investigation during the detailed design stage).
- Wind Farm Renewable Energy Production: Establish or partner in a regional scale wind farm to generate the electricity required for operation of the water security system. <u>Undertake market testing to confirm wind as the optimum renewable energy production technology and to identify the preferred delivery model prior to undertaking the renewable energy tender process. (The market testing step has been included to manage the risk that a proponent believes their technology to be competitive with wind on a TBL basis and to ensure that an optimum procurement decision is made. Having undertaken the Carbon Study, the potential benefits and disbenefits of each technology are well understood and Centroc will be entering the tender process as an informed buyer.)</u>
- Hydro-generation: Review the potential for hydro-generation on the water security system during detailed design to confirm costs and energy generation potential.

In addition, it is recommended that Centroc and member councils assess the following energy and carbon initiatives that were shown in this study to be potentially profitable and/or attractive on a TBL basis and which may assist councils to achieve general carbon and energy footprint targets:

- Council Energy Efficiency:
  - Council building energy efficiency schemes
  - Council Street-lighting programs (re-lamping with efficient globes and optimisation of operation)
- Energy from waste (wastewater gas): generation of electricity from wastewater biogas at identified facilities

- Energy from waste (landfill gas): generation of electricity from landfill gas combustion at identified facilities
- Wind Farm Energy Production: expansion of the WSS Wind Farm concept to include production of electricity to meet councils' other water supply and general electricity needs and/or community (residential, commercial and/or industrial) electricity demand.
- Hydro-generation: review of potential for hydro-generation facilities on the existing water supply system
- Tri/Cogeneration: tri or cogeneration plants on council facilities with significant heat/cooling loads
- Carbon sequestration program: partnerships with local landholders to generate sequestration offsets through Carbon sink projects(forestry, environmental plantings and soil carbon) to offset the Centroc councils' other emissions as required.

Carbon Plus Implementation Plan

The plan for implementing the recommendations of the Centroc Carbon Plus Study is as follows:

- WSS Energy Efficiency: It is recommended that, during the design and procurement of the water security infrastructure, the identified options to optimise energy efficiency be analysed and that those with a payback period of 3 years or less be implemented:
- Hydro-generation Potential: It is recommended that hydro-generation potential at each of the sites below be assessed during detailed design stages:
    - Lake Rowlands Dam Augmentation
    - Burrendong-Wellington Pipeline – Stage 1
    - Burrendong-Wellington Pipeline – Stage 2
    - Burrendong-Wellington Pipeline – Stage 3
    - Chifley to Bathurst Pipeline
- Renewable Energy Procurement: The implementation plan for progressing the renewable energy procurement option is divided into five phases:
    - Investment Decision: identification of scope of renewable energy supply (i.e. only WSS electricity requirements or other council/community demand), calculation of minimum, peak and average electricity demands and business case development leading to decision as to whether to proceed with proposal;
    - Market Testing: market discussions and an Expression of Interest (EOI) process to identify potential partners, to confirm wind as the preferred technology and to identify potential procurement model(s);
    - Procurement Decision: procurement options assessment and identification of the preferred delivery model;
    - Tender: undertaking a Request for Proposal (RFP) process to select a renewable energy proponent/supplier;
    - Implementation: planning and construction of the renewable energy facility (expected to be a wind farm).

The WSS Energy Efficiency initiatives will be evaluated and implemented as part of the design and construction of the pipelines, pump stations and treatment plant infrastructure.

It will be necessary for the timeframes to progress the wind farm opportunity to follow the implementation of the broader Water Security Study program. Indicative timings for implementing the renewable energy solution are as follows:

- Investment Decision (6 months)
- Market Testing (3-6 months)

- Procurement Decision (6 months)
- Tender Process (6-12 months)
- Implementation (3 months – 5 years) – duration will depend on whether the wind farm is a new or existing facility.

As can be seen there is potentially significant lead time (between 2 and 7.5 years) in implementing the strategy. However, implementation of the WSS recommended projects will also occur over many years and implementation of the Carbon Plus recommendations can proceed in parallel.

Strategic level costs for implementation of the Carbon Plus Strategy are shown in Table 1. The table shows the capital and operating costs assumed in the options assessment for the energy efficiency measures and wind farm. The costs shown for the wind farm facility were derived from literature values and also include an allowance for costs to manage the facility and to undertake the electricity market trading processes to match electricity supply to Centroc needs. The capital cost for the energy efficiency measures has been calculated assuming a 5% saving is achieved and that initiatives with a 3 year payback are implemented. It is important to realise that the costs have been derived for the purposes of option comparison, not project budget development and actual costs could be greater. A high end cost estimate is also provided to reflect the potential scale of this uncertainty. Cost estimation for budgeting purposes would need to be undertaken in conjunction with business case development and tendering.

The costs for implementation of the Wind Farm Renewable Energy Production procurement opportunity are expressed in Table 1 as capital costs for investment in a wind farm and ongoing operating and maintenance costs for the facility and electricity market participation. In reality, Centroc may enter into an agreement that sees a different allocation of cost between capital and operating investment (e.g. a long term power purchase agreement with a wind farm proponent may involve no capital outlay by Centroc, but rather a long term operating expenditure commitment). Levelised generation costs, expressed in $/MWh are therefore provided in Table 1.

The Net Present Cost (NPC) per MWh and per t CO2-e greenhouse gas emissions avoided are also provided in the cost table. These differ from the levelised generation costs for two reasons:

- They are calculated over the WSS study period of 50 years (with additional investment in the wind farm facility at the end of life), whereas levelised generation costs are calculated over the lifetime of the wind facility (assumed 20 years)
- The NPC figures represent the net costs, when power cost savings are included, over the WSS study period of 50 years.

The last column in Table 1 shows the NPC/t CO2-e if RECs generated by the scheme are sold up until the end date of the current Renewable Energy Target program (2030). It is important to note that if RECs generated by the wind farm were to be sold in the market rather than cancelled as required under the National Carbon Offset Standard, then it would no longer be valid to claim that renewable energy was being supplied to the WSS system. While the fact that RECs have a monetary value provides some protection should Centroc decide at a later date that carbon mitigation of the WSS operational emissions is not needed (i.e. it can sell the RECs and generate revenue to offset the cost of the electricity generation), revenue from the sale of RECs cannot be factored in if Centroc wish to claim that the electricity provided is renewable.

Table 1: Indicative Carbon Plus Strategy Costs

Strategy	Indicative Capital Cost $	Indicative Operating & Maintenance Cost $ p.a.*	Indicative Levelised Generation Cost $/MWh*/**	Indicative NPC $/MWh** (over 50 year study period)	Indicative NPC $/t CO2-e** (over 50 year study period)	Indicative NPC $/t CO2-e *** (RECs sold)
WSS Energy Efficiency						
Assumed	$500,000	N/A	N/A	-$75	-$80	N/A
High End Estimate	$700,000	N/A	N/A	-$25	-$30	N/A
Wind Farm (11MW) Renewable Energy Procurement						
Assumed	$30,000,000	$500,000	$80	$21	$22	$8
High End Estimate	$45,000,000	$1,300,000	$130	$65	$70	$50

* Operating and long run generation costs for the wind farm include an allowance for management of the facility and trading in the electricity market to manage over and under production. Hence the costs are higher than typical literature figures. There is likely to be significant variability in this management cost depending on the procurement model and allocation of risk.

** Levelised generation costs have been shown for comparative purposes. These costs have been calculated over the life of the facility (assumed 20 years in line with typical levelised generation cost calculations) and reflect generation and management costs only. The Net Present Cost (NPC) figures represent the net costs, when power cost savings are included, over the WSS study period of 50 years. Note that it has been assumed that only the energy component of the power cost will be saved and that Centroc would continue to pay network and retail charges at each location (i.e. electricity is still delivered via the network). If a long term power purchase agreement was entered with a flat or CPI escalated $/MWh charge for electricity, then the levelised cost comparision is the net present cost of these operating payments over the contract term.

*** The NPC for the case where Renewable Energy Certificates are sold includes revenue from the sale of RECs up until the end date of the current Renewable Energy Target program (2030). It has been assumed that the RET scheme is not extended beyond 2030 and there is therefore no additional revenue from the sale of RECs after this date. NPC figures are rounded to the nearest $5.

Communications Strategy

A key element of the implementation of the recommendations of the Carbon Plus Study is the development of a communications strategy. In January 2011, Centroc, Central West Farming Services, Brand Orange and MWH signed a collaboration agreement to develop and pilot a communications strategy to support the implementation of the recommendations of the Carbon Plus Study. The strategy will target the following key audiences (to be confirmed following a stakeholder analysis to be completed in March 2011):

- General Public;
- Centroc Board;
- Agriculture and Forestry Sector;
- Energy Utilities; and
- Peak Environment Groups and Energy Associations.

The strategy will develop the following:

- Photographic collateral of the region illustrating water and energy;
- Visual design collateral surrounding the defined key objectives and messaging;
- Development and deployment of a survey of the CWFS member base;
- Development of an educational program targeting CWFS members;
- A distribution strategy to provide collateral to target audiences; and
- A detailed budget for the communication strategy.

It is anticipated that the communications strategy will be completed in September 2011, with endorsement proposed for the November 2011 Centroc Board meeting.

Monitoring and Evaluation

The monitoring and evaluation requirements related to the water security component of the Carbon Plus Strategy include:

- Monitoring of progress in implementation of the Carbon Plus Strategy in relation to the water security infrastructure projects;
- Monitoring of technology costs in the lead up to the renewable energy tender process;
- Monitoring forecasts of electricity pricing below estimates used in this analysis;
- Monitoring and evaluating the effectiveness of WSS energy efficiency initiatives; and
- Monitoring and forecasting water security infrastructure electricity consumption once commissioned.

Carbon Plus Implementation Plan by LGA

Figure 1: Implementation Plan by Local Government Area

Council	Region-Wide Strategy Implementation
Centroc	Plan and deliver a market testing and tender process to identify wind energy or alternative renewable energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Bathurst	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley Dam to Bathurst pipeline. During design, review potential for hydro-generation on the Chifley Dam to Bathurst pipeline. Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley Dam to Oberon pipeline. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Blayney	See Central Tablelands Water
Boorowa	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Cabonne	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the bulk water supply storage and water treatment facilities for Cumnock and Yeoval. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Cowra	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Forbes	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Forbes Pipeline via Gooloogong (including connection to Parkes). Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Harden	Participate in tender process to identify renewable energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.

Council	Region-Wide Strategy Implementation
Lachlan	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the integrated pipeline and storage system for Lake Cargelligo During design, review potential for hydro-generation on the Lachlan River to Lake Cargelligo pipeline. Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the off-stream storage facility at Condobolin. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Lithgow	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Oberon	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley to Oberon pipeline – including liaison with Bathurst Council. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Orange	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Orange Pipeline via Milthorpe. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Parkes	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Parkes Pipeline via Gooloogong. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Upper Lachlan	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Weddin	See Central Tablelands Water.
Wellington	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Burrendong to Wellington pipeline. During design, review potential for hydro-generation on Stages 1, 2 and 3 of the Burrendong to Wellington pipeline. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Young	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Central Tablelands Water	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the augmentation of Lake Rowlands and associated pipeline links to Orange, Forbes and Parkes. During design, review potential for hydro-generation on the Lake Rowlands Dam Augmentation. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.

Funding Opportunities

Under a commercial model whereby Centroc councils have some level of ownership in the renewable energy facility or are facilitating a privately owned scheme, there are opportunities for grant and other Government funding to be secured. In addition, while Centroc itself may not be eligible to apply for some of these grants, its partners and stakeholders may meet eligibility criteria.

The most relevant and available grant and funding opportunities are expected to be:

- State Schemes:

- Regional Business Development Scheme;
- Building the Country;
- Regional Business Employment fund;

- Federal Schemes;
  - Caring for our Country Program;
  - Commercialisation Australia;
  - Building Farm Businesses.

1 Introduction

1.1 Background

In response to the worst drought on record for the region, the Central New South Wales Councils (Centroc) undertook to complete a Water Security Study to investigate and recommend solutions to improve water supply security across the Centroc region.

The water security study considered the catchment and potential water management options. A comprehensive list of options was considered including infrastructure links networking town water supplies and improving efficiency of water delivery, new and innovative water supply opportunities, re-use options for effluent and stormwater, demand management, water pricing and trading and water management structures. The study was completed in a catchment context considering the potential for mutual benefits to towns, irrigators, mining interests and water dependent environmental assets. The water planning approach adopted represented best-practice and is in line with the ambitions set out in the National Water Initiative.

The key recommendations of the Water Security Study included:

- **Water Conservation and Demand Management:** A region-wide water conservation and demand management strategy was recommended including aspects such as a residential retrofit of inefficient water fixtures, continuation of the Water Efficiency Labelling and Standards Scheme (WELS), continuation or expansion of Water Conservation Education programs to improve efficient water use and audits of Non-Residential Water Users to identify leaks and potential areas for improvement.
- **The recommended region-wide strategy (Strategy 2a)** included:
    - Lake Rowlands Augmentation;
    - Lake Rowlands-Millthorpe Pipeline;
    - CTW-Orange Pipeline via Millthorpe;
    - Lake Rowlands to Gooloogong Pipeline;
    - Gooloogong-Forbes Pipeline (including connection to Parkes);
    - Orange-Molong Creek Dam pipeline;
    - New minor storage and water treatment facilities at Cumnock and Yeoval;
    - New minor storage at Condobolin (off-stream from Lachlan River);
    - New pipeline replacing existing channel and minor storage at Lake Cargelligo (note: a groundwater system has received emergency funding);
    - Burrendong-Wellington Pipeline;
    - Chifley-Bathurst Pipeline;
    - Chifley-Oberon Pipeline; and
    - Belubula Creek-Cadia Hill pipeline (already available).

In November 2009, the Centroc Board adopted the recommendations of the Centroc Water Security Study.

The aim of this feasibility study is to identify potential alternatives to minimise the carbon impact of securing the water supply of the Centroc region and implementing the recommendations of the Water Security Study.

1.2 Key Project Drivers

The Centroc member Councils recognise the need to be sustainable. To achieve this Centroc member councils are seeking to minimise the carbon impact of achieving water security by mitigating their impact on climate change and seeking to adapt to the impacts of climate change. In addition, a key requirement in securing grant funds for water projects is to not only demonstrate water efficiency (such as the demand management program which Centroc has committed to continue to progress across the region), but also to demonstrate that in managing water resource issues, consideration is also given to energy resource management. This is particularly important in terms of reducing emissions to mitigate climate change.

A comprehensive assessment of the potential carbon impact of the proposed water security scheme is required, as is a plan to ensure that those emissions are minimised and offset.

1.3 Project Scope

Centroc has obtained grant funding for the Carbon Plus Study under the Planning Component of the Australian Government's Water for the Future initiative through the Strengthening Basin Communities Program.

The scope of this project is to undertake a strategic level planning assessment of the options to sustainably manage the carbon emission impact of the proposed water security study and to develop a plan of action to implement the most appropriate of those options in parallel with the continued implementation of the recommendations of the water study. The project is being conducted in six stages:

1. Develop a sustainability assessment framework and indicators: these indicators will form the basis of assessing the carbon management options to identify the most appropriate options from a triple bottom line (TBL) basis. This framework is summarised in Section 2.
2. Develop a stakeholder consultation plan: identify key stakeholders and engage them in the process of developing and assessing the options considered in the Carbon Plus Study (the Study). The plan is now finalised and in the process of being implemented as part of the Study.
3. Prepare forecasts for identified sustainability indicators including carbon emissions: before attempting to solve a problem, it is important to understand (and where possible, measure) the extent of the issue. Developing forecasts of carbon emissions from the existing water supply system and comparing those to the forecasts as a result of implementing the Water Security Study recommendations helps to quantify the extent of potential impact of the program. This modelling work was completed in 2010 and is summarised in Section 2.
4. Identify options for emissions management and improved sustainability outcomes: in this stage, a wide spectrum of potential management actions were identified and assessed (against the TBL defined in stage 1) to identify the most suitable actions to adopt for the Centroc region. This assessment included identifying opportunities to:
    a. avoid generating emissions;
    b. substitute fossil fuel generated power with renewable or alternative energy sources;
    c. ensure the purchase of sustainable materials; and
    d. offset emissions through sequestration and offset programs.

    The outcomes of this stage of the project are summarised in Section 2.
5. Develop implementation plans: development of an implementation plan detailing the anticipated timing, capital and operating costs for the recommended sustainability improvement strategies for the region (this report).
6. Reporting: the study process and findings are to be documented in a comprehensive technical report.

1.4 Implementation Planning

This report describes a recommended plan for implementation of the Carbon Plus Study recommendations. The scope of the plan includes:

- Risk assessment and identified risk mitigation approaches: Assessment of implementation difficulties and risks that may give rise to some level of reconsideration of the preliminarily preferred options identified in Stage 4.
- Mitigation options: Identification of a recommended suite of mitigation options to achieve Centroc's sustainability objectives and a process for implementing the recommendations.
- Implementation timing: Implementation schedule and strategic level capital cost and operating cost estimates for sustainability improvement options and carbon management strategies by region and local government area.
- Implementation details: These include:
    - Planning considerations.
    - Potential project Government and non-Government project partners.
    - Commercial models that could be utilised to implement the preferred options.
    - Potential funding opportunities.
- Mitigation diagram: A "wedge diagram" depicting forecast carbon emissions under the Water Security Plan and the cumulative impact of the identified mitigation activities.
- Monitoring and evaluation processes: Recommended processes for tracking progress in implementing the Carbon Plus strategy and evaluating results.

2 Summary of Options Identification and Assessment Outcomes

This section summarises Stages 1 through 4 of the project to provide context for the implementation plan.

2.1 Sustainability Assessment Framework

In Stage 1 of this project, the sustainability assessment framework (to be used to assess options) was developed in consultation with the Centroc Carbon Plus Project Steering Committee (PSC) and Project Reference Group (PRG). As part of the development of the framework, the group identified the key regional economic, environmental and social drivers, relevant to water security and the Carbon Plus project, and corresponding sustainability indicators as shown in Table 2.

Table 2: Recommended Indicators

Category	Priority	Indicator	Baseline & WSS Forecast	Options Assessment
Environmental	Impact on climate change	Greenhouse gas emissions	✓	✓
	Resource use and biodiversity	Primary energy use	✓	✓
		Materials flow	✓	✓
		Water consumption	✓	✓
		Land use disturbance	✓	✓
Social	Community wellbeing	Employment	✓	✓
		Wages and Salaries	✓	✓
		Health and safety (Scored by PRG and PSC)	-	✓
		Amenity (visual impact etc) (Scored by PRG and PSC)	-	✓
	Community leadership	Innovation & leadership (Scored by PRG and PSC)	-	✓
Economic	Economic prosperity	Gross operating surplus (profits) (at national and regional level)	✓	✓
		Imports	✓	✓
	Project Affordability	Net Present Cost/ unit improvement	✓	✓

Performance of each option against the majority of the indicators was calculated from project strategic planning level cost estimates and modelling of shifts in the selected indicators used in the ISA assessment. Scoring guides were developed to help the PRG and PSC assess the qualitative indicators.

2.2 Sustainability Forecasts

In Stage 3 of this project, the University of Sydney Integrated Sustainability Analysis (ISA) tool was used to model baseline and forecast impacts of the Water Security Study recommendations. The key outcomes of the modelling were:

- The WSS project will result in the creation of jobs, totalling approximately 6,000 employment years over the 50 year period. Approximately half of these jobs will be associated with the capital construction and half with ongoing operation and maintenance of the water supply network.
- The family income arising from the WSS projects over the 50 year period is approximately $416 M with approximately half the income generated in the construction period and half due to operation and maintenance.
- The adopted Water Security Study took into account minimising energy consumption as part of the assessment of the most appropriate strategy to adopt. The connection to Lake Rowlands was assessed as being significantly less energy intensive than the strategy investigated involving connection from Chifley Dam.
- However, without mitigation measures in place, the proposed Water Security Study projects are more energy intensive than the current water supplies and will increase the emissions, energy and material flow "footprint" of the Centroc water supply operations by approximately 80%.
- The total greenhouse emissions footprint of the project is approximately 1,680,000 t CO2-e. Of this, operating emissions total approximately 1,550,000 t CO2-e.
- Operating emissions comprising only Scope 1 and Scope 2 emissions (direct emissions from consumption of fuels and indirect emissions due to consumption of electricity and heat) comprise approximately 1,200,000 t CO2-e.
- The impacts incurred as a consequence of the capital construction are minor in comparison to the energy, greenhouse and materials flow impacts incurred due to operation of the system over the 50 years.
- The forecast electricity consumption for the water security infrastructure is approximately 26,000 MWh p.a. Operational sustainability impacts are, almost exclusively, related to the production of the electricity needed to operate the system over the 50 year period.

Therefore, options to reduce operational energy requirements, to source electricity from alternative low/no emissions sources and to offset any remaining operational emissions were a key focus of Stage 4 of the project when options for improved sustainability performance were identified.

2.3 Sustainability Options Assessment

In Stage 4 of the project, the approach taken to identify and evaluate options was as follows:

- Benchmark review of energy and carbon offset strategies employed by others;
- Review of existing Centroc region energy and carbon offset initiatives;
- Review of Centroc region resources (e.g. wind, solar, land etc);
- Brainstorming of energy and carbon mitigation opportunities for the proposed water security infrastructure with the MWH project team and the PSC and review of opportunities by the PSC and the PRG to identify gaps and non-viable options;
- Characterisation of the options and modelling of shifts in sustainability impacts for each option using the University of Sydney's ISA)tool multipliers (these multipliers quantify the shift in each sustainability indicator per thousands of dollars spent in each industry sector);

- Scoring of qualitative indicators by the PSC and the PRG and TBL assessment of the options based on the modelling of quantifiable indicators and scoring of the qualitative indicators;
- Sensitivity analysis to explore the dependency of the Triple Bottom Line results on key assumptions; and
- Identification of a preliminarily recommended mitigation strategy.

2.3.1 Identified Energy and Carbon Mitigation Opportunities

Table 3 shows the mitigation opportunities identified in Stage 4 of the study.

Table 3: Identified Mitigation Opportunities

Group	Opportunity	Description
Wind - Small Scale (<500 kW)	1.1 Wind on pump stations <50 kW: small wind turbines on all water security pump stations.	Options 1.1-1.6 would see small, individual wind turbines installed at individual pump stations or buildings. Turbines of up to 15 kW capacity would be mounted on or adjacent to buildings on masts of approximately 10-20m in height. Turbines of up to 50 kW capacity would be mounted adjacent to facilities on masts of 20-40m Small scale wind turbines are readily available and the technology is well advanced.
	1.2 Wind on pump stations <15 kW: very small wind turbines on all water security pump stations.	
	1.3 Wind 50 kW on each pump station: small wind turbines on some water security pump stations,	
	1.4 Wind 15 kW on each pump station: very small wind turbines on some water security pump stations.	
	1.5 Wind on Council buildings (up to 15 kW)	
	1.6 Facilitation of wind schemes in community (up to 15 kW)	
Wind - Utility Scale (>500 kW turbines)	2.1 Regional farm(s)	Option 2.1 is a larger grouping of 'utility scale' towers. Approximately 4-8 utility scale turbines are required to meet the water security infrastructure demand (depending on the size of the individual turbines used)
Hydro	3.1 Hydro on WSS pipelines	Turbine facility housed in a building along pipeline route. Mini-hydro technology is well proven but use in Centroc is not widespread.
	3.2 Hydro on augmented Lake Rowlands	Turbine located on dam spill way.
Solar – Small scale < 30 kW	4.1 Solar on pump stations <30 kW	Solar PV Small arrays mounted on or adjacent to buildings. Solar PV is an established and proven technology. However, use of the technology for larger commercial scale installations (>10 kW) is not widespread.
	4.2 Solar 30 kW (10kW/phase) on each pump station	
	4.3 Solar 30kW on Council buildings	Solar PV. Small arrays mounted on or adjacent to buildings.
	4.4 Facilitation of roof top Solar PV in community	Solar PV typically 1.5kW. Small arrays mounted on or adjacent to buildings.
	4.5 Facilitation of solar hot water in community	Solar Hot Water Small arrays mounted on or adjacent to buildings.
Solar – utility scale >250 kW	4.6 Regional concentrated solar PV	Large scale PV (Concentrated). Concentrated solar PV has not yet been widely demonstrated in Australia but some installations exist overseas in countries such as Spain.

Group	Opportunity	Description
Solar – Utility Scale (>250 kW)	4.7 Regional solar thermal	Solar Thermal using: • Parabolic Trough; • Parabolic Dish; and • Power Towers Solar Thermal has not yet been widely demonstrated in Australia. A 3MW demonstration solar thermal plant has been constructed at Lake Cargelligo. Solar Thermal is the most developed solar energy generation technology and many installations exist overseas in countries such as Spain and America.
Natural Gas Co- and Trigeneration	5.1 Small (265 kW) cogen on water security system	Gas Turbine Combined cycle Biofuel engine Steam turbine Emissions to air from combustion of fuel minimal due to use of clean burning natural gas. Negligible noise generation. Technology is widely used in Australia and overseas. Note that a large scale cogen on the water security system is only viable if a large heat or cooling load is located in close proximity to the pump station.
	5.2 Large (1-1.5 MW) cogen for water security system	
	5.3 Small cogen on Council facility	
	5.4 Large cogen on Council facility	
Energy from Waste	6.1 Landfill gas combustion	Combustion and gas turbine Technology is widely used in Australia and overseas.
	6.2 Wastewater gas combustion	
	6.3 Biomass (waste) combustion	Fluidised bed combustion and gas turbine. Technology is well developed and used in Australia (Actew ACT, Lidell NSW – co-fired coal/biomass) and overseas (Europe, USA)
	6.4 Biomass (unsorted MSW) combustion	
	6.5 Biomass (waste) pyrolysis	Pyrolysis and/or gasification producing energy and char. Emissions to air from combustion of fuel managed through emissions treatment. Noise managed through appropriate siting and housing. Small scale plants and pilot plants exist but technology is not proven on a large scale.
	6.6 Biomass (crop) pelletisation for use in existing power plant	Pelletisation of waste. Crop waste is crushed, dried and formed into pellets and transported to coal fired electricity plant to substitute for fossil fuel. Electricity would then be purchased back from power generator. Pelletisation of fuels is widely used overseas. A pilot project to utilise biomass pellets in the Delta power plant is underway in Centroc.
Energy from biomass	7.1 Biomass (crop) combustion	Fluidised bed combustion with gas turbine utilising purchased crops. Technology is well developed and used in Australia and overseas.
	7.2 Biomass (crop) pelletisation for use in existing power plant	Biomass is crushed, dried and formed into pellets and transported to coal fired electricity plant to substitute for fossil fuel. Electricity would then be purchased back from power generator. Pelletisation of fuels is widely used overseas. A pilot project to utilise biomass pellets in the Delta power plant is underway in Centroc.
Green energy	8.1 Green energy purchase	Purchase green energy from retailer. Green energy production could be from various sources and various locations although options exist to nominate the source of energy generation. A number of organisations in Australia have entered into long term power purchase agreements with retailers for the purchase of renewable energy.

Group	Opportunity	Description
Energy Efficiency & Community Schemes	9.1 Water security study energy efficiency initiatives	Various technologies which are proven.
	9.2 Council fleet electric vehicle scheme	Electric vehicle schemes. Technology is developing and electric vehicles are now available on the market (e.g. Mitsubishi iMieV) Various trials are being carried out in Australia (e.g. Vic Government is trialling and electricity vehicle fleet)
	9.3 Council Building energy efficiency scheme	Building efficiency measures estimated to achieve 20% reduction in electricity use per building (including options such as double glazing, behavioural change programs, geo-exchange for heating and cooling). Technology is proven and has been applied elsewhere
	9.4 Community Building energy efficiency scheme	
	9.5 Lighting programs	Replacement of street lighting lamps with more efficient lamps (e.g. LED lamps can achieve up to 50% reduction in electricity consumption), implementing design standards and operational protocols. Technology is proven and has been applied elsewhere.
	9.6 Transport modal changes	Transport modal changes (e.g. Incentives to increase use of bikes and buses). Technology is proven and has been applied elsewhere
Carbon Sequestration and Offsets	10.1 Carbon sequestration – plantations/environmental plantings	Carbon sequestration. Offset projects would result in plantations or revegetation projects on private or Council land. Offset projects would also include soil management practices where farmers modify fertiliser application practices or better manage carbon in soils. Carbon offset through forestry and revegetation is well established and is practiced in Australia and overseas. Research into carbon offset through soil management is underway in Australia to improve the accuracy of carbon accounting methodologies.
	10.2 Carbon sequestration – soil management	
	10.3 Offset purchase	Market based offset. Well developed markets for offsets exist overseas and in Australia voluntary carbon offset standards have been developed. Purchase of offsets to mitigate emissions is widely practices within Australia and overseas.

2.3.2 Assessment Results

The costs and TBL performance results of the mitigation options, incorporating qualitative scores collected at the workshop are presented in Figure 2. The figure shows the TBL performance of each mitigation option when broader economic, social and environmental aspects are considered in accordance with the adopted sustainability framework.

It can be seen from Figure 2 that the options with the highest cumulative TBL scores are energy efficiency programs related to the water security infrastructure, council buildings and street lighting programs (Options 9.1, 9.3 and 9.5) and the regional wind farm (Option 2.1). Energy from landfill gas combustion (Option 6.1) and carbon sequestration in plantations (Option 10.1) also perform well on a TBL basis.

The energy efficiency programs, lighting program and the landfill gas electricity generation score well on a TBL basis primarily due to their low cost. The regional wind farm is a higher net cost option (i.e. net cost once electricity cost savings are subtracted) but would deliver full mitigation of the operational emissions of the WSS infrastructure. This option also scores well against the innovation and leadership indicator although this is offset somewhat by a lower than average amenity score.

Large scale cogeneration on the pump stations or Council facilities (Options 5.2 and 5.4), biomass waste to energy (Option 6.3) and carbon soil management (Option 10.2) are the next most optimum solutions on a TBL basis. These options are closely followed by regional solar thermal (Option 4.7), wastewater biogas (Option 6.2) and facilitation of solar hot water and rooftop PV schemes in the community (Option 4.4 and Option 4.5).

A McKinsey style curve was developed plotting TBL score against the extent of carbon mitigation for each option (Figure 3). The performance of options follows the same order as described in the previous section.

Figure 3 also shows the footprint of the water security infrastructure for:

- Total emissions (approximately 1,680,000 t CO2-e) comprising emissions throughout all production layers for the capital investment and operation of the system
- Operating emissions Scope 1 & 2+ (approximately 1,550,000 t CO2-e) comprising emissions from all production layers but for operational emissions only
- Operating emissions Scope 1 & 2 only (approximately 1,200,000 t CO2-e) comprising emissions associated with production layer 1 only (direct emissions of which there are none in this case) and production layer 2 (emissions from purchase of electricity).

It can be seen from the McKinsey curve, that the requirements to mitigate each level of emissions differ. The curve identifies the most optimum strategies (on a TBL basis) for mitigating the impacts on climate change of the water security infrastructure are:

- Total emissions: Regional wind farm to provide electricity for water security infrastructure operational needs combined with Water Security Study efficiency measures, Council building energy efficiency and street light programs along with energy from landfill gas electricity generation to provide an offset for the remaining emissions. Alternatively, as there is scope to increase the quantity of electricity supplied from the wind farm (by installing/purchasing more generation capacity) energy efficiency schemes and the landfill gas electricity generation may not be required.
- Operational emissions Scope 1 & 2: As above
- Scope 1 & 2 operational emissions: Regional wind farm to provide electricity for water security infrastructure operational needs solely or combined with a program of Council building energy and/or water security infrastructure efficiency measures.

Centroc has decided, in the first instance, to consider mitigation of the Scope 1 & 2 operational emissions impacts of the project (the third case above). This decision is based on the fact that predominantly the project emissions are related to Scope 2 operational emissions (that is emissions due to the consumption of electricity) and that the responsibility for emissions produced further down the supply chain and for capital components is not clear cut. In many instances suppliers have taken action to reduce their own emissions and that is not captured in a high level strategic carbon footprint.

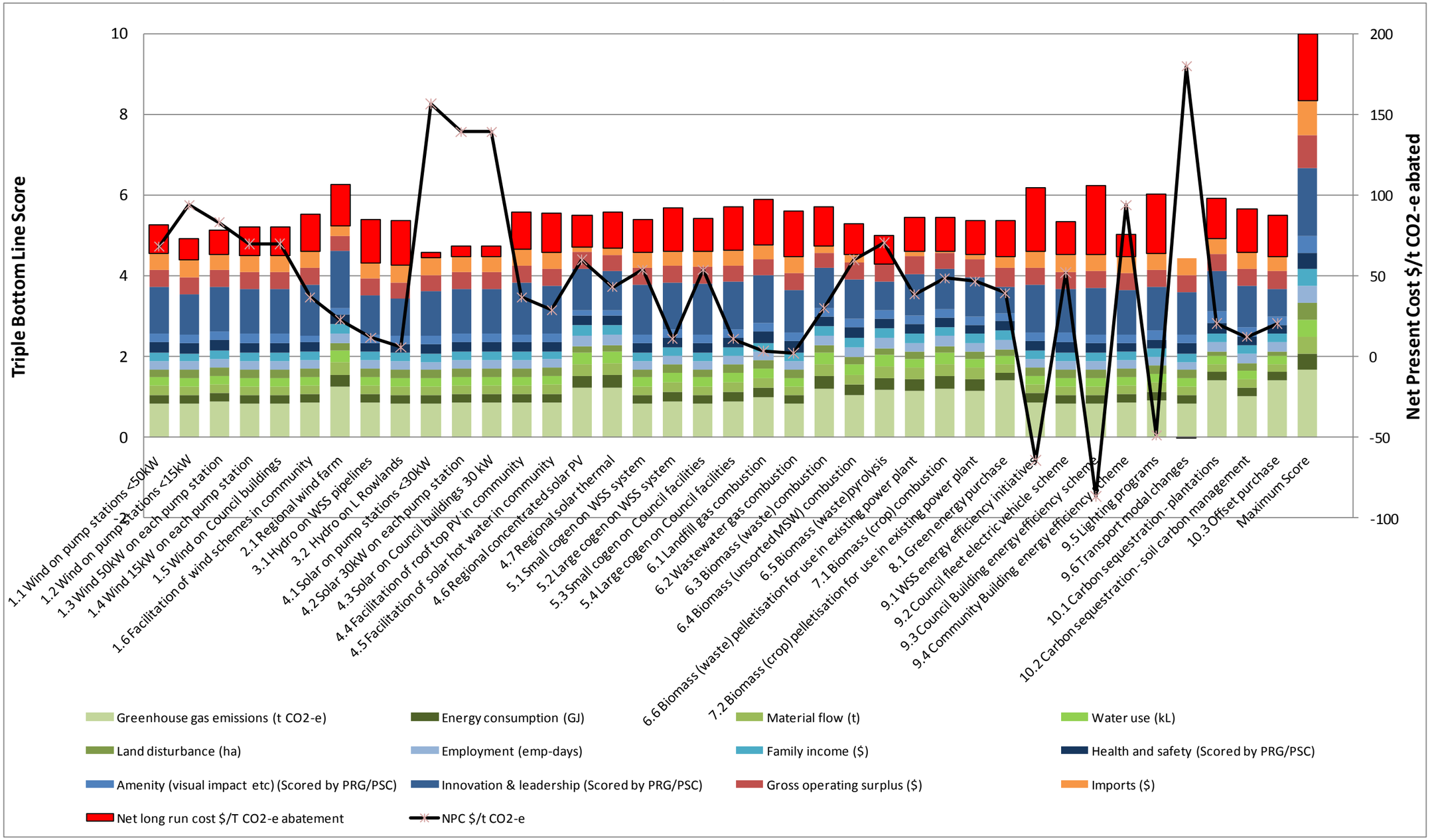

Figure 2: Triple Bottom Line Assessment

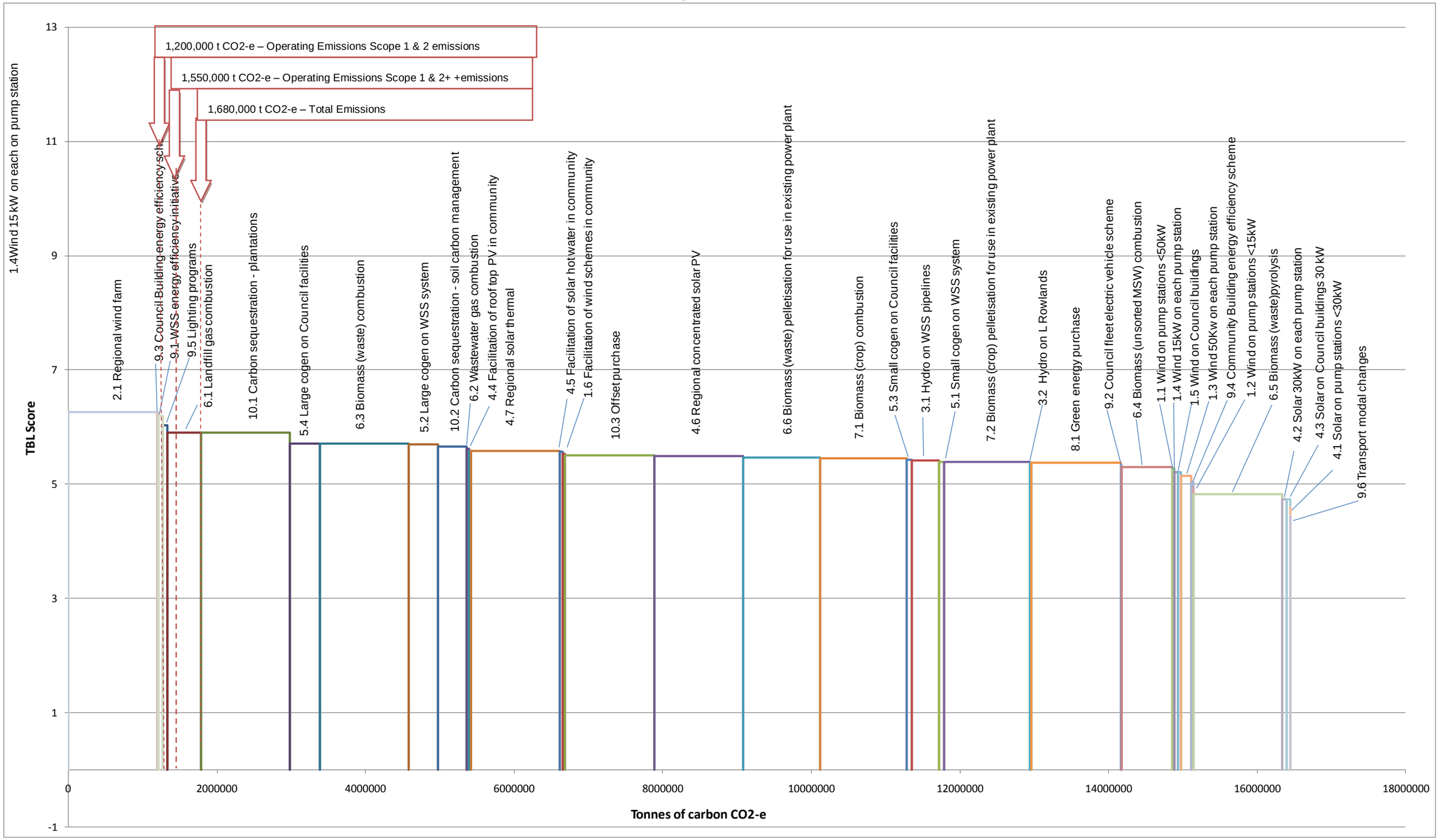

Figure 3: McKinsey Triple Bottom Line Curve

2.4 Preliminary Recommended Strategy

The preliminary recommended strategy, identified in Stage 4, for mitigation of the energy and carbon emissions associated with the operation of the water security infrastructure is to:

- WSS Energy Efficiency: Implement the identified Water Security Study energy efficiency measures (subject to further investigation during the detailed design stage).
- Wind Farm: Establish a regional scale wind farm to generate a quantity of renewable electricity equal to (or greater than) the electricity required for operation of the water security system.
- Hydro-generation: While hydro-generation did not perform as well as wind farm generation when strategic costs estimates were utilised in the strategy TBL assessment, local factors may see the costs of hydro-generation vary from the strategic estimates. Hydro-generation opportunities, if viable, could deliver up to one third of the WSS electricity requirements. It is therefore recommended that a review of the potential for hydro-generation on the water security system be carried out during detailed design to confirm costs and energy generation potential.

These options all scored, or in the case of hydro-generation have the potential to score, in among the top five options in the TBL assessment and bear a direct relationship with the Water Security Study operational energy requirements.

In addition, it is recommended that Centroc councils assess the following energy and carbon initiatives that were shown to be potentially profitable and/or attractive on a TBL basis and that have applicability to general council operations:

- Council Energy Efficiency: council building energy efficiency schemes and council Street-lighting programs
- Energy from waste (wastewater gas): generation of electricity from wastewater biogas at identified facilities
- Energy from waste (landfill gas): generation of electricity from landfill gas combustion at identified facilities
- Tri/Cogeneration: plants on council facilities with heat/cooling loads
- Carbon sequestration program: partnerships with local landholders to generate sequestration offsets through Carbon sink projects (forestry, environmental plantings and soil carbon) to offset Centroc Councils other emissions as required.

2.4.1 Options to Mitigate Other Sustainability Impacts

The majority of the sustainability impacts related to the water security infrastructure arise from the consumption of electricity in the operation of the system. However, opportunities to improve local sustainability impacts were investigated:

- Biodiversity and land use mitigation. Opportunities include:
    - Generation (and retirement) of biodiversity credits to offset water security land use on surplus council land.
    - Purchase (and retirement) of biodiversity credits from the NSW bio-banking scheme.
- Regional employment: Opportunities exist to maximise local employment opportunities arising from the water security scheme.

- Materials substitution. Opportunities to reduce sustainability impacts through use of more sustainable concrete products for construction of the Lake Rowlands augmentation dam wall were investigated. However, it appears that the potential for use of alternative concrete materials is limited due to a number of factors, including difficulty in demonstrating compliance with Australian regulations.

3 Strategy Risk Assessment

A risk assessment was undertaken to evaluate the risks associated with each element of the preliminarily preferred recommendations and to identify potential risk management approaches. The risk register and assessment, along with the risk ranking criteria, are provided in Appendix 2. The risk assessment developed by the project team was reviewed by the PRG and discussed with the PSC and updated as a result.

3.1 Key Risks and Mitigation Measures

The key risks and mitigation approaches identified in the assessment are described below.

Technology costs vary from that assumed: The technology costs for the various options considered are strategic estimates and, while they are based on the best available information, a number of factors may lead to these costs being higher or lower than assumed:

- Technology advances – these could lead to the cost of all or some of the options declining over time and may also support delay in implementation of the carbon mitigation strategy until such time as the technologies become more affordable.
- Access to suitable sites – the availability of high quality wind sites will decline over time as wind farms are built. Mitigating this risk would involve early implementation of the carbon mitigation strategy to ensure that an optimum site is available.
- Local factors – the biomass, wind, hydro or solar resource at a selected site may be better or worse than assumed in the strategic estimates. Detailed feasibility studies will identify more accurate efficiency and generation costs.

The consequence of the technology cost varying from that which has been assumed is that, at the time when Centroc are ready to implement the mitigation strategy, opportunities aside from those identified may become preferred or the ranking of the identified options could change. To mitigate this risk, Centroc could undertake market testing, through an Expression of Interest (EOI) process, for supply of wind energy but with opportunity for submission of proposals related to alternative technologies (e.g. solar thermal, biomass) provided these options achieve the same electricity generation, carbon mitigation and TBL outcomes.

This approach would ensure that the most efficient solution is identified even if technology costs vary from assumed. Having completed the Carbon Plus Study, Centroc councils will have a good understanding of the typical costs of renewable energy options available and will be well informed on the relative merits and risks associated with the wind and alternative proposals. Centroc and will therefore be in a solid position to effectively assess EOI responses.

The recommended strategy action to review the viability of hydro-generation at design stage will also serve to reduce the risk that a cost effective opportunity to recover energy from the water security system is missed.

Electricity, fuel and REC prices vary from assumed:

Electricity: Electricity prices have been forecast based on IPART published costs for the current regulatory period and Australian Government commissioned studies. However, the impact of future Australian Government Carbon and renewable energy policies, which are still being formulated and revised, and the uptake of renewable energy generation under the RET scheme are matters that could lead to higher or lower electricity prices in the future. Sensitivity analysis has shown that higher electricity prices support the implementation of the identified recommended strategy, with the performance of all renewable energy and energy efficiency options improving.

Furthermore, an arrangement that delivers fixed price electricity supply (or escalation over time in line with CPI) reduces the Centroc councils' exposure to future electricity price increases associated with electricity used by the Water Security Study infrastructure. If a lower electricity price is assumed (e.g. no carbon price is introduced), wind generation at this stage is still preferred as the mitigation approach for the water security infrastructure operational impacts. However, in this scenario the viability of the potential Centroc council energy from waste (landfill and wastewater) may be impacted.

Transport and fuel prices: Transport and fuel prices can affect the viability of cases involving the freight of fuels (e.g. biomass, crop, wood and animal waste) or cases such as natural gas cogeneration where the fuel must be purchased. The recommended strategy does not include initiatives that will be impacted by increases in transport and fuel prices. However, an open tender process, with alternatives to wind allowed, may see biomass, natural gas cogeneration or waste (crop, wood or animal waste) electricity generation options identified as preferred to wind (e.g. if local optimisation or innovative approaches deliver lower costs than estimated in the Carbon Plus strategic study). In this case a sensitivity assessment on transport and fuel prices will need to be undertaken and careful consideration would also to be given to the allocation of price escalation risk in the electricity supply contract.

REC prices: The performance of the options is not significantly impacted by the assumed price of RECs. The assessment assumed that RECs generated from the wind farm for the water security infrastructure operation electricity would be surrendered by Centroc to deem the electricity "renewable" so the price of RECs does not impact on the performance of the wind (or any of the renewable energy options). RECs associated with any additional electricity generated, beyond that used by Centroc for the water security infrastructure operation, would have a value in the market; however the strategic analysis has not assumed any additional electricity or REC revenue from the wind farm operation. In reality, to achieve economies of scale, the wind farm demand will most likely comprise Centroc's water security demand and additional demand from others (e.g. community, third parties, Centroc councils' general operations) and the impact of the REC price on the arrangements for the additional supply of electricity to these users will need to be considered by the wind farm owner/operator and these customers.

The generation of RECs for the water security infrastructure operation electricity provides some flexibility for Centroc to vary its mitigation approach in future. If Centroc seeks to mitigate the Carbon impacts of the water security scheme (in accordance with the adopted mitigation target), it would surrender the RECs to the Office of the Renewable Energy Regulator (ORER) and the electricity would be deemed "renewable". If, for whatever reason, Centroc decides in future that mitigation is not warranted, then the RECs could be sold into the market place for revenue offsetting in part the wind farm electricity generation costs. The extent of the revenue generated from the sale would be impacted by the future REC price.

Carbon strategy/policy: Government's policy drivers related to Carbon are currently unclear. On the one hand, there are advantages to implementing the Centroc Carbon Plus strategy ahead of time, as later demand arising from the introduction of a Carbon price may increase costs. For example, the demand for wind generated electricity is likely to lead to the sites with a better wind resource (and hence greater electricity generation efficiency and lower generation costs) being taken by others leaving sites with a poorer resource (equating to lower electricity generation efficiency and higher costs) available for supply of the Centroc demand.

However, if the impetus to address carbon declines, then the linkages between Carbon management and water security infrastructure funding may no longer exist and early adoption would not be preferred.

If a Carbon price is not introduced, carbon offset/sequestration projects would be more affordable as a mitigation approach than generation of renewable energy. However recent Australian Government policy announcements would indicate that this scenario is unlikely. The generation of RECs by renewable energy schemes such as wind, solar and biomass provides Centroc with some flexibility to respond to changes in carbon policy as the RECs can be sold in the market to generate revenue and offset the cost of the scheme rather than surrendered to deem the electricity "renewable".

Energy requirement and carbon footprint: The Carbon footprint of the water security infrastructure operation may be higher or lower than forecast due to:

- Electricity requirements for the infrastructure differing from strategic estimates (e.g. detailed design may identify pipe routes that lead to higher or lower pumping requirements);
- Electricity requirements differing from year to year whereas strategy is based on an average annual requirement; and
- Projected water demand and/or energy efficiencies are not achieved.

In addition, balancing the water security electricity demand against the wind (or other renewable energy scheme) supply at each point in time is a key challenge and these "overs and unders" will need to be managed through purchase and sale of electricity from/into the National Electricity Market (NEM). Commercial arrangements will need to specify who is responsible for management of overs and unders. The need to trade in the NEM will create exposure to escalating carbon, electricity and potentially REC prices and the allocation of the risk will need to be carefully considered. The commercial arrangements will need to specify the variability in the need for renewable energy year to year.

Community Attitudes towards Renewable Technology: Community acceptance of the proposed carbon mitigation strategy, in particular, the recommendation of a regional wind farm, was highlighted in the risk assessment process. As contemplated in the TBL analysis of the options, the advantages of this renewable energy technology (and indeed, any other potential solution), need to be balanced against the amenity of the community that lives in the vicinity (although, it is important to note, a particular location is not yet under consideration). This will continue to be an aspect of interest to the community and other stakeholders during the implementation of the plan.

In planning wind farms, noise is often (although there are notable exceptions) the most important factor in determining the distance between wind turbines and sensitive receivers. Therefore, noise assessments play a key role in determining the viability and size of wind farms. Ensuring there is an understanding of this and other aspects of wind farms will be important to successful implementation.

A recent review of environmental noise undertaken by Sonus on behalf of the Clean Energy Council concluded the following (Sonus, 2010):

- The Standards and Guidelines used in Australia and New Zealand to assess the noise from wind farms are stringent in comparison to other International approaches.
- They are also the most contemporary in the World, with recent updates and releases of the main assessment approaches occurring in both late 2009 and early 2010.
- The rate of complaints relating to environmental noise emissions from residents living in the vicinity of operating wind farms is very low.
- There is detailed and extensive research and evidence that indicates that the noise from wind farms developed and operated in accordance with the current Standards and Guidelines will not have any direct adverse health effects.

A study has also recently been undertaken by the NSW government to develop an understanding of the attitude of communities to wind farms and renewable energy across the six Renewable Energy Precincts identified across the state, including the Central Tablelands area. The study concluded (DECCW 2010):

- Over half (59%) of residents of the Precincts named wind power spontaneously as a clean energy source, second only to solar power.
- Almost everyone (97%) in the Precincts, and the rest of regional NSW, had heard about wind farms or wind turbines to generate electricity, and over three quarters (81%) had seen a wind farm or wind turbine (which could be in person or in the media).

- A majority of residents expressed interest in finding out more about aspects of wind farms. The most common issues mentioned were around noise, location of wind farms, impact on the environment and community and effectiveness of power generation.
- Residents widely acknowledged that wind power has lower greenhouse gas emissions than coal or gas and that NSW is well positioned with resources. There was, however, less understanding or greater uncertainty about efficiency and reliability of wind power, and about whether wind power was the cheapest renewable energy source.
- There was also broad acknowledgement that wind farms would benefit the local community and can boost employment and the economy. Consistent with this, there was broad endorsement of more wind farms being built in the local region and of more active involvement of the local councils to encourage wind farms.
- About two thirds (69%) of residents did not perceive any health concerns, while on the issue of safety concerns opinion was more polarised. Residents were also divided in their views on impacts of wind farms on both property values and visual appeal of the area, and on concern about noise. Furthermore, the majority (62%) of residents did not perceive a negative impact on the environment, while opinion was divided on the issue of heritage values.
- The large majority of residents across the Precincts indicated they would support wind farms being built both in NSW (85%) as well as in their local region (80%). Over three quarters (79%) supported wind farms being built 10 kilometres from their residence, and more than half (60%) supported them at 1-2 kilometres.
- Residents opposing wind farms being built 1-2 kilometres from their residence were much more likely than supporters to identify concerns about noise and the impact on the landscape, and much less likely to identify benefits of wind farms such as reducing pollution, and improving the community and economy. Notably, over two thirds (68%) of residents opposing wind farms at 1-2 kilometres still saw an overall benefit of wind farms to the local region.
- The most important drivers of support for wind farms were attitudinal:
    - attitudes towards the economic and community benefits of wind farms;
    - the perceived visual and noise impacts;
    - other concerns about health, safety and heritage values; and
    - perceptions of wind power relating to clean energy and its potential in NSW.
- Proximity to wind farms was also found to be of some importance, while demographic characteristics such as Precinct, gender and age had relatively low influence on level of support.

Raising the level of understanding of wind farm development, management and design with the community and key stakeholders, and further developing an understanding of attitudes towards the recommendation, is an important aspect of implementing the strategy. Therefore, the key mitigation measure identified to manage this risk is the development and deployment of a communications plan as part of the implementation strategy for the recommendations of the Carbon Plus study.

It has also been noted by stakeholders to the development of this study that a community owned wind farm development model, providing not only WSS study electricity requirements but also community electricity demands, may be more readily accepted.

Funding: At this point in time, funding for the carbon management recommendations, and indeed the water security recommendations themselves, has not been secured. This is a significant risk to implementation.

It is anticipated that to enable the achievement of water security in the Centroc region, including the implementation of the recommended carbon management actions to ensure the provision of water security is done minimising the potential impact on climate change, that funding from all three layers of government may be sought. In addition, or as an alternative, private sector funding may also be pursued.

For capital expenditure and investment of public funds above $10 million, strict capital planning and investment processes are in place within Federal agencies such as Infrastructure Australia and within State Treasury guidelines. These processes commence with the preparation of a business case (setting out the basis for the investment decision) which will result in a capital budget allocation (assuming the project is successful in its prioritisation against other competing projects providing services utilising government funds). The business case is the first gateway in a series of gateways to manage the prudent and efficient delivery of the infrastructure to meet defined service needs. Any state or federal funding is likely to require delivery of the project within this overall investment decision making process.

Private sector investment will also require clear and well examined documentation of the business case for the infrastructure. Whilst the technical work undertaken to develop the study recommendations is required to justify the investment decision, the business case would typically also need to:

- Establish affordability, achievability and value for money;
- Develop program or project brief, specifications and timeline;
- Confirm market interest in the project;
- Develop a procurement strategy (in the case of capital spend over $50 million[1], particularly if the proposal is presented as part of the overall Water Security Study Business case, the strategy will need to consider public, private partnerships (PPP)). A commercial risk assessment of options around ownership and equity contributions would need to be completed as part of developing the procurement proposal;
- Documentation of major investment and project level risks and development of management plans;
- Develop an approach to quality management and benefits realisation, including key performance indicators for the project; and
- Develop a stakeholder engagement and management and a change management plan.

The development of this business case, in consultation with key State and Federal agencies is recommended as a key mitigation activity for the risk of a lack of funds to implement the recommendations of this study.

3.2 Questions Arising from the Risk Assessment

For example, some of the mitigation measures identified to address project risks are at odds with one another (e.g. The final form of the Australian Government's Carbon policies are not clear, which would suggest a strategy to delay progressing the Carbon Plus recommendations would be an appropriate risk mitigation measure. However, the demand for renewable energy arising from the Government's Renewable Energy Technology scheme and increasing energy prices is creating competition for the best wind sites and risk mitigation involves early action). The competing mitigation measures give rise to a number of questions that will require Centroc resolution before implementation of the recommended carbon mitigation strategy can proceed.

Package up the Water Security Infrastructure and Carbon Plus projects?

One of the key questions that will need to be contemplated and resolved in implementing the recommendations of the study is whether to pursue the Carbon Plus Study recommendations separately from the Water Security Study recommendations.

[1] A threshold requirement presently set by Infrastructure Australia

The Carbon Plus Study has identified a number of activities that each of the Centroc member councils may wish to pursue in order to manage the carbon footprint of their general purpose business activities. However, the primary focus of this study has been in developing a complementary carbon emissions management strategy to implement as part of the overall program of actions to provide water security for the region. The recommendations of each study combine to form a program of work to provide the region with water security.

It is recommended the recommendations are brought together in an integrated implementation plan in support of the business case to be prepared. This will not prohibit the development of the different components of the overall water security strategy using varied delivery mechanisms, but will allow clarity of the full scope of requirement to obtain endorsement in the investment planning process. It will also not prohibit the development of non-core aspects (i.e. such as the expansion of the regional wind farm concept to include some part, or all, of the general purpose demand of some or all of the member councils) that may make the project as a whole more attractive to private sector investment.

Delay or act early?

Delaying implementation of the Carbon Plus Study recommendations would allow Centroc to consider the implications of the Australian Government Carbon policies on the arrangements for funding the water security infrastructure and the costs of the proposed mitigation strategy. Postponing implementation may also lead to technology developments that reduce the cost of renewable energy generation.

However, delaying implementation will certainly lead to a reduction in the number of high quality wind sites available as a source of renewable electricity, as existing initiatives are sufficient to support development of these facilities. It is also clear that the Australian Government intends to introduce a Carbon price and, although the details of the price mechanism are unclear, it is highly likely that there will be upward pressure on electricity prices and increased demand for carbon offsets arising from future policy, which reinforces the suitability of the recommended strategy actions. These initiatives could also affect the availability of sites for other technology options such as biomass where there are already plans by other generators within the region. There is significant lead time in progressing a wind farm (or other renewable energy source), as will be described in Section 4.4, and a delay in progressing the Carbon Plus strategy recommendations could lead to significant delays in delivering renewable energy to the water security infrastructure requiring the purchase of renewable energy or carbon offsets (possibly at a premium) from the market in the interim.

On balance, it is recommended that Centroc proceed with the implementation of the Carbon Plus strategy at a rate in line with the water security infrastructure project delivery, potentially as part of a consolidated water security program as described above.

Stipulate Wind as the preferred mitigation option?

The Carbon Plus Study has identified that renewable energy sourced from a regional scale wind farm is the preferred mitigation option. However, the risk assessment has identified that various factors could change the relativity in performance of the various options; particularly renewable energy options with TBL scores only marginally lower than wind, such as biomass and some energy from waste solutions.

Undertaking an Expression of Interest (EOI) process that allows proposals for provision of renewable energy not only from a wind farm but also from other renewable energy facilities, would increase the complexity of the tender assessment process. However, this approach would provide an opportunity for proponents of other technologies, who have identified efficiencies that reduce costs (e.g. optimising logistics, technology innovation, synergies with existing initiatives) beyond strategic estimates, to submit their proposals for consideration.

Other technologies considered in the EOI process would need to be of a similar scale to wind; generating a similar quantity of electricity and achieving the same or better Carbon mitigation and TBL outcomes. On balance, it is considered that the benefits that would be achieved by including an open EOI process (that allows other renewable energy technologies to be considered) ahead of a Request for Proposal (RFP) tender process, which limits the technologies to those preferred option identified through the EOI process, has significant benefits.

This two stage process is transparent to proponents and stakeholders, provides all proponents with the opportunity to have their technology considered and ensures the most cost effective approach is selected. On balance it is considered that these benefits outweigh the disbenefit of a more complex tender process. Having completed the Carbon Plus Study, Centroc councils will be well informed on the relative merits and risks associated with the wind and alternative proposals and will therefore be in a solid position to assess tender responses. To assist in the tender process, some guidance will be provided on the estimated costs for alternative energy proposals to breakeven with wind on a TBL basis (see section 4.3.4).

While it is recommended that the tender process would be open to various low emissions and renewable energy technologies (provided they achieve the same energy generation and carbon mitigation outcomes as wind), it is not proposed that the process be opened up to Carbon offset/sequestration schemes. The nature of Carbon offset schemes differs considerably from energy generation schemes and it is considered that the inclusion of Carbon would unduly complicate the EOI/RFP process. Although performing well in the TBL analysis, Carbon sequestration and offset schemes fall consistently behind wind generation in all cases except the case when qualitative TBL scores are ignored. One of the drivers for this is the qualitative score related to Innovation & Leadership which tests, in part, how directly each option addresses the Carbon emissions problem. Offsets were seen as a less direct, and therefore a less secure, method of reducing the Carbon footprint of the water security infrastructure operation. This is consistent with established principles of carbon management (Figure 4), which guide users to consider avoidance, reduction and switching to renewable energy then sequestration and offset schemes, where the strategies can be implemented cost effectively.

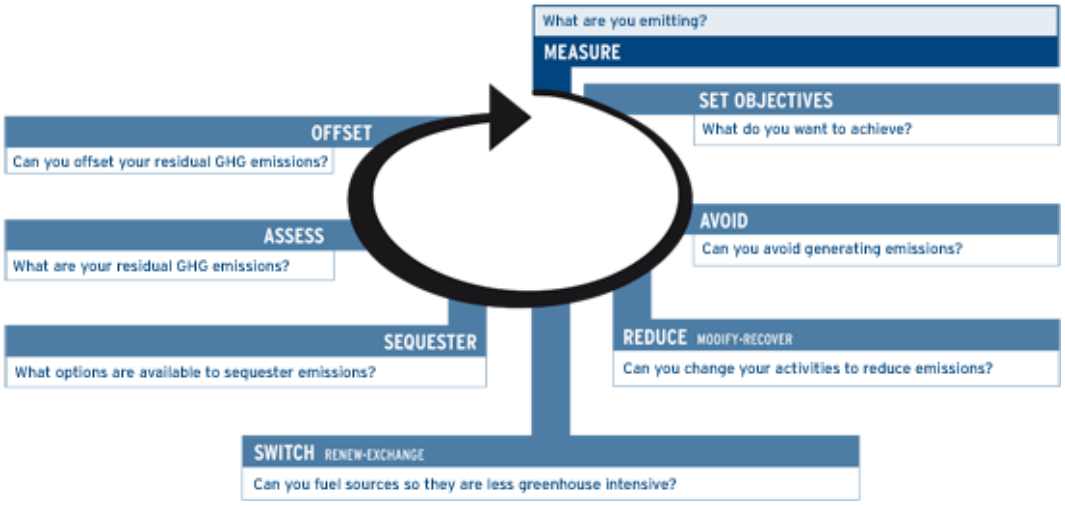

Figure 4: Carbon Management Principles (Vic EPA, 2008)

Further sensitivity testing shows that Carbon sequestration/offsets could become a more attractive option if the offset price were to remain at the current voluntary market level. Given the imperative to reduce Australian emissions to meet global emissions reduction commitments and initiatives such as the Carbon Farmers Initiative that will enable Carbon offsets/credits to be sold into global markets, it is seems unlikely that Carbon offset/sequestration project prices will not rise in future. Lastly, the Carbon offset and sequestration options will not provide protection against future electricity price increases, whereas the renewable energy options do provide protection against this risk.

Procure additional electricity for non WSS electricity demand (e.g. non-WSS water system, Council general and community requirements)?

The risk assessment indicates that balancing the water security electricity demand against the wind (or other renewable energy scheme) supply at each point in time is a key challenge and these “overs and unders” will need to be managed through purchase and sale of electricity from/into the National Electricity Market (NEM). The power supply agreement between Centroc and the generator/operator will need to specify who is responsible for management of overs and unders and who bears the market risk for purchases and sales into the NEM.

Recognising that there will be a high degree of variability in electricity requirements for operation of the water security infrastructure from year to year, there is a potential opportunity to purchase all or part of the Centroc member councils' electricity needs from the renewable energy generator. This would enable Centroc to specify a fixed and variable demand to cater for the water security variability and may lead to an improved proposition for the generator (because there would be a higher base demand for electricity) and hence better commercial conditions for Centroc.

3.3 Recommended Refinements to the Strategy

In general, the recommended mitigation strategy appears robust when the various implementation risks are considered. However, some refinements to the Strategy are recommended to address the key issues described in Section 2.4. The refined Strategy is presented below, with alterations underlined.

- WSS Energy Efficiency: Implement the identified Water Security Study energy efficiency measures (subject to further investigation during the detailed design stage).
- Wind Farm Renewable Energy Production: Establish <u>or partner in</u> a regional scale wind farm to generate the electricity required for operation of the water security system. <u>Undertake market testing to confirm wind as the optimum renewable energy production technology and to identify the preferred delivery model prior to undertaking the renewable energy tender process.</u>
- Hydro-generation: Review the potential for hydro-generation on the water security system during detailed design to confirm costs and energy generation potential.

In addition, it is recommended that Centroc and member councils assess the following energy and carbon initiatives that were shown in this study to be potentially profitable and/or attractive on a TBL basis and which may assist councils to achieve general carbon and energy footprint targets:

- Council Energy Efficiency:
    - Council building energy efficiency schemes
    - Council Street-lighting programs (re-lamping with efficient globes and optimisation of operation)
- Energy from waste (wastewater gas): generation of electricity from wastewater biogas at identified facilities
- Energy from waste (landfill gas): generation of electricity from landfill gas combustion at identified facilities
- <u>Wind Farm Energy Production: expansion of the WSS Wind Farm concept to include production of electricity to meet councils' other water supply and general electricity needs and/or community (residential, commercial and/or industrial) electricity demand.</u>
- Hydro-generation: review of potential for hydro-generation facilities on the existing water supply system
- Tri/Cogeneration: tri or cogeneration plants on council facilities with significant heat/cooling loads
- Carbon sequestration program: partnerships with local landholders to generate sequestration offsets through Carbon sink projects(forestry, environmental plantings and soil carbon) to offset the Centroc councils' other emissions as required.

4 Carbon Plus Implementation Plan

This section sets out the plan for implementing the recommendations of the Centroc Carbon Plus Study.

4.1 WSS Energy Efficiency

In the Water Security Study, assessment of energy requirements for operation of the water security infrastructure was based on typical equipment performance. In Stage 4, the following initiatives were identified to optimise energy efficiency to reduce electricity consumption below typical levels. It is recommended that during the design and procurement of the water security infrastructure, that each of these options be analysed and that those with a payback period of 3 years or less be implemented:

- Optimisation of system hydraulics;
- Optimisation of pump station layout;
- Use of speed control in place of throttling valves;
- Use of three phase motors (standard practice);
- Coating/trimming of impellors;
- Use of plastic pipe where feasible (smoother and less friction loss);
- Maximising pipe diameter;
- Provision of multiple pumps for varying flows (standard practice);
- Alternation of pumps;
- Installation of harmonic filters where possible; and
- Optimisation of power factor correction where possible.

4.2 Hydro-generation Potential

Within the proposed water security supply system there are opportunities to recover energy using hydro-turbines. An analysis of the potential for recovery of energy from the system has identified that hydro opportunities may exist at the locations set out in Table 4.

Table 4: Hydro-generation Potential

Council	Location	Potential Generation MWh p.a.
Central Tablelands Water	Lake Rowlands Dam Augmentation	640
Wellington	Burrendong-Wellington Pipeline – Stage 1	2,400
Wellington	Burrendong-Wellington Pipeline – Stage 2	2,400
Wellington	Burrendong-Wellington Pipeline – Stage 3	2,400
Bathurst	Chifley to Bathurst Pipeline	780
	Total	**8,700**

It is recommended that hydro-generation potential at each of these sites (and any additional sites identified) be assessed during detailed design stages.

4.3 Renewable Energy Procurement

The implementation tasks to progress the renewable energy procurement opportunity, utilising an open RFP process, are shown in Figure 5 and Table 6. Depending on the nature of commercial model selected and various other factors that are described in the following sections, the renewable energy procurement process could take anywhere between 2 and 7.5 years. It should be noted, that as it is recommended that the recommendations of the Carbon Plus Study are pursued in an integrated fashion with the recommendations of the Water Security Study, the procurement approach set out in Figure 5 may be altered as a result of examining options to deliver the entire package of work.

The implementation plan for progressing the renewable energy procurement option is divided into five phases:

- Investment Decision: identification of scope of renewable energy supply, calculation of minimum, peak and average electricity demands and business case development leading to decision as to whether to proceed with proposal;
- Market Testing: market discussions and an Expression of Interest (EOI) process to identify potential partners, to confirm wind as the preferred technology and to identify potential procurement model(s);
- Procurement Decision: procurement options assessment and identification of the preferred delivery model;
- Tender: undertaking a Request for Proposal (RFP) process to select a renewable energy proponent/supplier;
- Implementation: planning and construction of the renewable energy facility (likely to be a wind farm).

Each of these tasks is explained in the following sections.

4.3.1 Investment Decision

The Investment Decision involves steps 1-4 in Figure 5. In step 1, Centroc councils will need to identify whether the generation of electricity is for the water security infrastructure solely or whether purchase of electricity for the remainder of the water supply system or broader council requirements is also of interest. Given the expected annual variability in water security infrastructure operational needs, there would be advantages in identifying a demand profile with a reasonably fixed annual demand and a floating portion comprising the water security infrastructure electricity requirements.

An opportunity also exists to engage the community in the scheme by facilitating uptake of renewable energy from the energy generation facility through an ownership/power purchase agreement.

Once the decision has been made as to the electricity demands that are to be included in the scheme, the next step (step 2 in Figure 5) is to identify the annual, monthly and daily electricity demand profile; maximum, minimum and average demands. Managing the supply and demand profiles of the renewable energy facility and the water security infrastructure will be a key issue to be identified and resolve in contractual negotiations so it is important that the demand profiles are understood at an early stage.

A business case for the generation/procurement of renewable energy would be developed in step 3, either as an independent business case or as a component of a broader water security implementation program. Following preparation and review of the business case (potentially through the Government's Gateways program) a decision will be made as to whether or not to proceed with the investment in renewable energy. It is anticipated that the duration of the investment decision stage would be approximately 6 months.

4.3.2 Market Testing

In step 5, it is proposed that Centroc would enter into pre-tender discussions with renewable energy proponents to identify potential project partners, to develop an understanding of these organisation's commercial drivers, to explore potential delivery models and to ensure the market is aware of Centroc's plans to tender for supply of electricity. The kinds of organisations which might get involved in funding/investing in, owning and operating renewable energy developments include:

- Large (government or recently privatized) energy generators, e.g., Eraring Energy owns the Crookwell and Blayney Wind Farms, Delta Energy are looking at biomass generating opportunities at both Wallerawang and Norah Head.
- Energy Retailers, e.g., Energy Australia and AGL have both moved into generation of renewable energy.
- Private generators, e.g., Macquarie Generation, Marubeni Corporation
- Industrial operators, investing to offset their own needs or to utilize waste products, e.g., CSR and A.J Bush and sons.
- Community based groups.
- Investors/Venture Capital organisations, e.g. Macquarie Bank, Sumitomo Corporation, Cleantech Ventures, Marinya Investments, CHAMP ventures.

A listing of current renewable energy operations in NSW, their energy source and ownership is provided in Appendix 3 as an example of existing ownership structures.

In addition, during the market pre-tender investigation, it is recommended that Centroc have discussions with other organisations that have pursued investment in renewable energy projects and long term power purchase agreements to increase understanding of how these organisations approached the procurement process and structured their contractual arrangements. Some organisations that have already investigated the purchase of renewable energy under long term supply agreements with generators/suppliers are:

- Sydney Water – have a 20 year power purchase agreement (PPA) for the supply of renewable energy for their Desalination Plant from the Capital Wind Farm in NSW.
- Melbourne Water – have entered into a long term agreement for supply of all their electricity needs from a nominated renewable energy source.
- Brisbane City Council - have traditionally purchased green energy from the market but their Renewable Energy Project proposes an alternative, where council commits to a long term Power Purchase Agreement (PPA) for its renewable energy needs from renewable energy facilities in South East Queensland.

Having completed discussions with potential partners and renewable energy customers, Centroc will be able to identify its key requirements and aspects of the renewable energy supply agreement that will need to be resolved through the tender process (step 6). Considerations include:

- Ownership of the RECs generated;
- Management of "overs and unders";
- Nameplating arrangements (e.g. is the facility to be identified as supplying Centroc's water security electricity needs);
- Location and additionality preferences (e.g. is there a preference for the generation facility to be located in the Centroc region and is a new facility preferred over a facility already operating); and
- Allocation of market risk (e.g. fuel, carbon, REC, power prices).

In step 7 an Expression of Interest (EOI) process would be undertaken to identify potential partners, to confirm wind as the preferred technology and to identify potential procurement model(s). It is recommended that the EOI requests proponents put forward their preferred options for provision of renewable energy, detailing carbon mitigation, potential commercial arrangements and cost.

It is expected that the majority of proposals received in response to the tender will involve provision of electricity from a regional wind farm. However, it is also possible that some tenders will involve electricity production from alternative sources and that the costs of these technologies relative to wind may differ for the reasons described in Section 4.3.1.

A TBL assessment approach, similar to that utilised in this study, could be used to allow comparison of the full sustainability impacts if proposals for alternatives to wind generation are received. Table 5 provides generation costs and net present costs for the various technologies considered in this study that would see each technology 'break even' with wind on a TBL basis according to the TBL analysis undertaken in this study if the qualitative indicators (noise, amenity, innovation and leadership) are ignored. The reason that breakeven costs with no qualitative scoring are provided is that views on these qualitative factors are likely to change over the time and the assessment panel can readily assess these at the time the EOI process is run (e.g. emerging technologies may become proven on a commercial scale effecting the innovation & leadership score).

Table 5: Technology Generation Costs to Break Even with Wind TBL Score

Technology	Cost assumed in options assessment ($/MWh)*	Estimated cost to break even with wind ($/MWh)*/**
Wind	80	80
Concentrated Solar	125	80
Solar Thermal	105	80
Biomass combustion***	100	70
Waste (wood, crop)****	95	70

* Includes $10/MWh allowance for management of the wind facility and NEM trading to manage overs and unders. Levelised generation cost over lifetime of facility.

** No qualitative scoring included

*** Includes feedstock cost and freight

**** Includes freight

In reviewing EOIs received from proponents, it will be necessary to ensure that the proposals are comparable or, where this is not the case, that the potential cost of any variations or services not provided by the proponent are factored into the decision making process. The assessment of the EOI responses will need to consider aspects including (many of these will have been considered in preparation of the EOI brief):

- Net Present Cost and Triple Bottom Line performance;
- Electricity generation and Carbon emissions outcomes
- Ownership of Renewable Energy Certificates (RECs) and any other environmental attributes generated – Centroc would need to retain ownership of the RECs and the option of retaining/surrendering or selling at its discretion if it wishes to maintain flexibility to vary its carbon mitigation targets at a later date;
- Management and any penalties associated with over and under supply of electricity due to:
    - Availability of wind, sun, biomass fuel etc.
    - Plant outages.

    - Centroc demand variability.
- Risk allocation associated with outages due to drought and flood (particularly important for biomass schemes), storm and equipment failure;
- Supply and demand matching - is there a fixed and floating electricity supply component and who will bear the risk for any premium/losses paid for spot purchases/sales of electricity in the market?;
- Power pricing proposal – flat, escalated over time or other. In particular, who bears the risk on any future electricity, carbon and REC price increases and decreases?;
- Arrangements for price increases related to REC, carbon, fuel or transport prices as relevant;
- Management of participation/trading in the NEM (e.g. electricity production is sold in the market on 5min intervals);
- Inclusion of "nameplate" rights to a specific renewable electricity facility; and
- Delivery point for the electricity and transmission/distribution charges.

It is recommended that Centroc include energy technology and market experts on the EOI assessment panel and later in the tender process, to provide additional advice on the technical and commercial characteristics of the various proposals.

The market testing steps will allow Centroc to collect the information needed to confirm wind energy as the preferred technology and/or identify any other viable technologies to be included in the scope of the Request for Proposal (RFP) tender process. In addition, the process will allow Centroc to collect information on delivery models acceptable to energy generators/suppliers and relative costs, risks and benefits of these approaches.

4.3.3 Procurement Decision

In the procurement decision stage, information collected in the market testing stage and EoI would be analysed to identify a preferred delivery model as shown in steps 8 – 10 in Figure 5.

Possible delivery models vary from models where Centroc has full equity in the facility, through various partnerships with the private sector to the options where Centroc purchase electricity from a private sector facility or from the market. Example of delivery options include:

- Design and Construct (Centroc operate and maintain);
- Design, Build, Operate, Maintain;
- Public Private Partnership;
- Alliance;
- Privately owned facility with Centroc facilitating aspects of the start up;
- Privately owned facility with no involvement by Centroc in start up; and
- Purchase of green power from the electricity market (note that this option was assessed separately in the TBL analysis conducted in Stage 4 and is not a preferred option).

A comparison of the main types of delivery models is presented in Appendix 4.

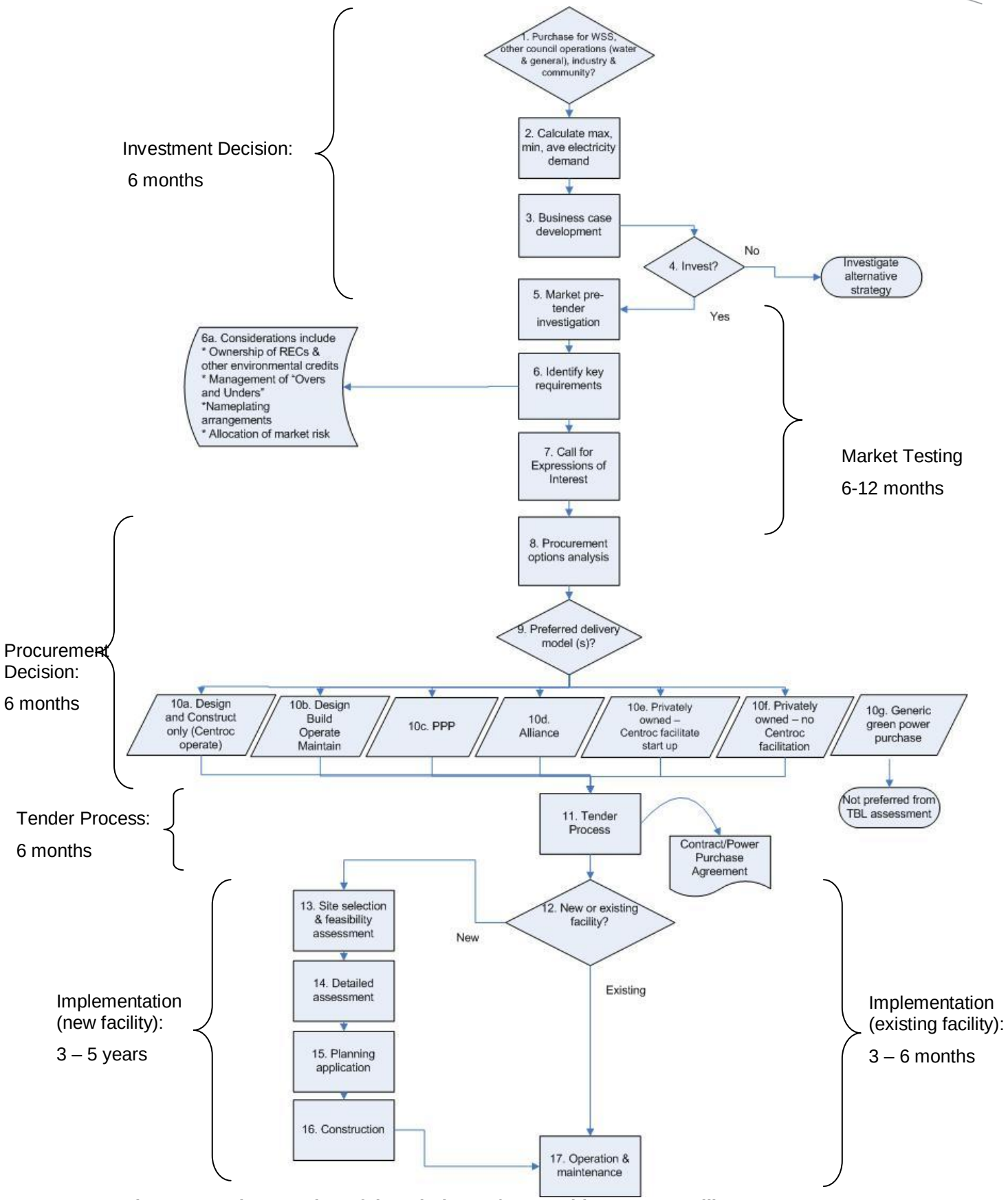

Figure 5: Implementation of the Wind Farm/Renewable Energy Facility

Table 6: Implementation Details of Wind Farm Renewable Energy Facility

Flow Diagram Step	Indicative Timeframes	Indicative Next Studies	Order of Effort[2]	Funding Sources
Step 1	6 months	To decide the extent of purchase, additional studies are not necessarily required. Consultation with the community is likely also to be required.	Operating costs of Council businesses and Centroc	Each council and Centroc
Step 2		An electricity demand study would be required to determine the maximum, minimum and average electricity demand for the extent of purchase determined at the previous step.	$50,000-$100,000	Federal Office of Climate Change through their Greenhouse abatement grants for business possibly
Step 3		Business case development would likely require the following studies: • Cost-benefit analysis; • Value management study; • Governance review; • Project plan: risk management, stakeholder management, change management, scope and schedule • Business case review with funding/government entities	$100,000-$250,000 A business case is also required for the Water Security Study. There may be some cost benefit in doing the case as a whole.	NSW Regional Development Grants Commercialisation Australia grants (50:50) basis for this size3
Step 4		Investment decision process is likely to involve consultation with other levels of government and Centroc Board governance processes	Operating costs of Council businesses and Centroc	Each council and Centroc
Step 5	3-6 months	A market pre-tender investigation would require the following: • A detailed market review study; • Development of a proponent consultation plan; • Implementation of proponent consultation plan; • Key requirements documentation.	$100,000-$250,000	NSW Regional Development Grants3
Step 6				

[2] These order of cost estimates are indicative only. Market testing of the cost of each study would need to be undertaken and it is expected that there would be considerable variability in outcomes. The costs provided in this table should not be relied upon for investment decision-making.

[3] The money that comes from these has to be matched by the proponent and can only be spent on external services. That is there is no in kind allowance and cash needs to be paid to third parties. These grants can be from $50k up to $2m. This source can be for all the following steps but they would need to establish an entity to do it and seed that entity with enough funds to get the matching funding. The entity applying for the grants has to have a business plan and show commercial outcomes coming from the work that is done under the project that the grant is funding. issue here is the work to decide the procurement model has to be done first.

Flow Diagram Step	Indicative Timeframes	Indicative Next Studies	Order of Effort[2]	Funding Sources
Step 7		To deliver the expression of interest step, the following will need to be undertaken: • Pre-EoI review by funding/government entities • EoI documentation preparation • EoI assessment process • EoI support technical services contract	$50,000-$100,000	-
Step 8	6 months	To complete the procurement and tendering process, the following would be required: • Procurement options study; • Procurement decision governance processes;	$50,000-$100,000	-
Step 9				
Step 10				
Step 11	6 – 12 months	To complete the tendering process, the following would be required: • Pre-tender review by funding/government entities • Tender documentation preparation • Tender assessment process • Tender support technical services contract	$100,000-$200,000	-

4.3.4 Tender Process

In this stage Centroc would issue a Request for Proposal (RFP) to the market that limits technology and procurement choices to the preferred options identified in the market testing and procurement decision stages.

As with the EOI stage, it is recommended that Centroc include energy technology and market experts on the RFP tender assessment panel, to provide additional advice on the technical and commercial characteristics of the various proposals.

4.3.5 Implementation

The duration and complexity of the implementation stage of the renewable energy opportunity will differ depending on whether the generation facility is new or existing (step 12). The steps involved in establishing a wind farm (other renewable energy facilities would have similar lead times) include (SEDA, 2002):

- Site selection and feasibility assessment (step 13): including analysis of the wind resource, assessment of technical viability, commercial analysis, review of environmental and cultural constraints, land access;
- Detailed assessment (step 14): detailed design and layout, environmental impact assessment;
- Planning application processes (step 15): comprising environmental impact assessment, planning approvals (including any referrals required under the Environment Protection and Biodiversity Conservation Act), lease agreement;
- Construction (step 16); and
- Commissioning, Operation and Maintenance (step 17).

For new facilities, the duration of the implementation step could range from 1 and 5 years depending on the complexity of the feasibility and planning processes required to establish the plant.

A contract with an existing plant (wind or other) could be in place within a few months (step 18).

As noted earlier, delays in the establishment of a renewable energy facility beyond the water security infrastructure commissioning could be managed through purchase of renewable energy from the market.

4.4 Timeframes and Order of Cost

The WSS Energy Efficiency initiatives will be evaluated and implemented as part of the design and construction of the pipelines, pump stations and treatment plant infrastructure (most of these are planned for 2010-2016).

It will be necessary for the timeframes to progress the wind farm opportunity to follow the implementation of the broader Water Security Study program. Indicative timings for implementing the renewable energy solution are as follows:

- Investment Decision (6 months)
- Market Testing (6 -12 months)
- Procurement Decision (6 months)
- Tender Process (6 months)
- Implementation (3 months – 5 years) – duration will depend on whether the wind farm is a new or existing facility.

As can be seen there is potentially significant lead time (between 2 and 7.5 years) in implementing the strategy. However, implementation of the WSS recommended projects will also occur over many years and implementation of the Carbon Plus recommendations can proceed in parallel.

Note that there is flexibility in the Renewable Energy Procurement process to complete one stage (e.g. pre-planning) and delay progressing subsequent stages if a decision is made that would shorten the duration of the procurement task (e.g. decision to progress a power purchase agreement involving an existing facility).

Strategic level costs for implementation of the Carbon Plus Strategy are shown in Table 7. The table shows the capital and operating costs assumed in the options assessment for the energy efficiency measures and wind farm. The costs shown for the wind farm facility were derived from literature values and also include an allowance for costs to manage the facility and to undertake the electricity market trading processes to match electricity supply to Centroc needs. The capital cost for the energy efficiency measures has been calculated assuming a 5% saving is achieved and that initiatives with a 3 year payback are implemented. It is important to realise that the costs have been derived for the purposes of option comparison, not project budget development and actual costs could be greater. A high end cost estimate is also provided to reflect the potential scale of this uncertainty. Cost estimation for budgeting purposes would need to be undertaken in conjunction with business case development and tendering.

The costs for implementation of the Wind Farm Renewable Energy Production procurement opportunity are expressed in Table 7 as capital costs for investment in a wind farm and ongoing operating and maintenance costs for the facility and electricity market participation. In reality, Centroc may enter into an agreement that sees a different allocation of cost between capital and operating investment (e.g. a long term power purchase agreement with a wind farm proponent may involve no capital outlay by Centroc, but rather a long term operating expenditure commitment). Levelised generation costs, expressed in $/MWh are therefore provided in Table 7.

The Net Present Cost (NPC) per MWh and per t CO2-e greenhouse gas emissions avoided are also provided in the cost table. These differ from the levelised generation costs for two reasons:

- They are calculated over the WSS study period of 50 years (with additional investment in the wind farm facility at the end of life), whereas levelised generation costs are calculated over the lifetime of the wind facility (assumed 20 years)
- The NPC figures represent the net costs, when power cost savings are included, over the WSS study period of 50 years.

The last column in Table 7 shows the NPC/t CO2-e if RECS generated by the scheme are sold up until the end date of the current Renewable Energy Target program (2030). It is important to note that if RECs generated by the wind farm were to be sold in the market rather than cancelled as required under the National Carbon Offset Standard, then it would no longer be valid to claim that renewable energy was being supplied to the WSS system. While the fact that RECs have a monetary value provides some protection should Centroc decide at a later date that carbon mitigation of the WSS operational emissions is not needed (i.e. it can sell the RECS and generate revenue to offset the cost of the electricity generation), revenue from the sale of RECs cannot be factored in if Centroc wish to claim that the electricity provided is renewable.

Table 7: Indicative Carbon Plus Strategy Costs

Strategy	Indicative Capital Cost $	Indicative Operating & Maintenance Cost $ p.a.*	Indicative Levelised Generation Cost $/MWh*/**	Indicative NPC $/MWh** (over 50 year study period)	Indicative NPC $/t CO2-e** (over 50 year study period)	Indicative NPC $/t CO2-e *** (RECs sold)
WSS Energy Efficiency						
Assumed	$500,000	N/A	N/A	-$75	-$80	N/A
High End Estimate	$700,000	N/A	N/A	-$25	-$30	N/A
Wind Farm (11MW) Renewable Energy Procurement						
Assumed	$30,000,000	$500,000	$80	$20	$25	$5
High End Estimate	$45,000,000	$1,300,000	$130	$65	$70	$50

***** Operating and long run generation costs for the wind farm include an allowance for management of the facility and trading in the electricity market to manage over and under production. Hence the costs are higher than typical literature figures. There is likely to be significant variability in this management cost depending on the procurement model and allocation of risk.

** Levelised generation costs have been shown for comparative purposes. These costs have been calculated over the life of the facility (assumed 20 years in line with typical levelised generation cost calculations) and reflect generation and management costs only. The Net Present Cost (NPC) figures represent the net costs, when power cost savings are included, over the WSS study period of 50 years. Note that it has been assumed that only the energy component of the power cost will be saved and that Centroc would continue to pay network and retail charges at each location (i.e. electricity is still delivered via the network). If a long term power purchase agreement was entered with a flat or CPI escalated $/MWh charge for electricity, then the levelised cost comparision is the net present cost of these operating payments over the contract term.

*** The NPC for the case where Renewable Energy Certificates are sold includes revenue from the sale of RECs up until the end date of the current Renewable Energy Target program (2030). It has been assumed that the RET scheme is not extended beyond 2030 and there is therefore no additional revenue from the sale of RECs after this date. NPC figures are rounded to the nearest $5.

4.5 Communications Strategy

A key element of the implementation of the recommendations of the Carbon Plus Study is the development of a communications strategy.

In January 2011, Centroc, Central West Farming Services, Brand Orange and MWH signed a collaboration agreement to develop and pilot a communications strategy to support the implementation of the recommendations of the Carbon Plus Study.

Successfully implemented adaptation and mitigation strategies, such as the Carbon Plus Study, strengthen communities and promote vibrant economies. However, successful implementation often requires changes in attitudes and behaviours at all levels and across individuals, organisations and economic sectors. A robust change management processes is required to support the desired change.

A key aspect of change management is the development and implementation of an effective communication strategy to bridge gaps in the understanding of the benefits of change. The bridge must be two-way, to allow for the development of a shared understanding of the benefits. In addition, communication may need to be supported with varying degrees of education or capacity building (again, this is not necessarily one-way). The communications strategy will assist the process of change through awareness raising and knowledge building working with CWFS and Brand Orange as well respected and connected groups within the region.

The strategy will target the following key audiences (to be confirmed following a stakeholder analysis to be completed in March 2011):

- General Public;
- Centroc Board;
- Agriculture and Forestry Sector;
- Energy Utilities; and
- Peak Environment Groups and Energy Associations.

The strategy will develop the following:

- Photographic collateral of the region illustrating water and energy;
- Visual design collateral surrounding the defined key objectives and messaging;
- Development and deployment of a survey of the CWFS member base;
- Development of an educational program targeting CWFS members;
- A distribution strategy to provide collateral to target audiences; and
- A detailed budget for the communication strategy.

It is anticipated that the communications strategy will be completed in September 2011, with endorsement proposed for the November 2011 Centroc Board meeting.

4.6 Forecast Mitigation Outcomes

Figure 6 shows the cumulative carbon footprint associated with the WSS infrastructure over the 50 year study period. It can be seen that the WSS Operating and Capital Carbon Footprint totals 1,980,000 t CO2-e over the study period, or 1,680,000 t CO2-e with the demand management program in place. The Operating Footprint totals 1,850,000 t CO2-e, but with the proposed water demand management program in place, the total operating footprint is 1,550,000 t CO-e. The total Scope 1 & 2 Operating Footprint totals 1,200,000 t CO2-e.

Figure 6 shows the contribution made by the WSS Energy Efficiency initiatives (conservatively estimated to deliver 5% savings in energy consumption) and the Renewable Energy Procurement (Wind Farm) option to mitigating the cumulative WSS Scope 1 and 2 operational emissions.

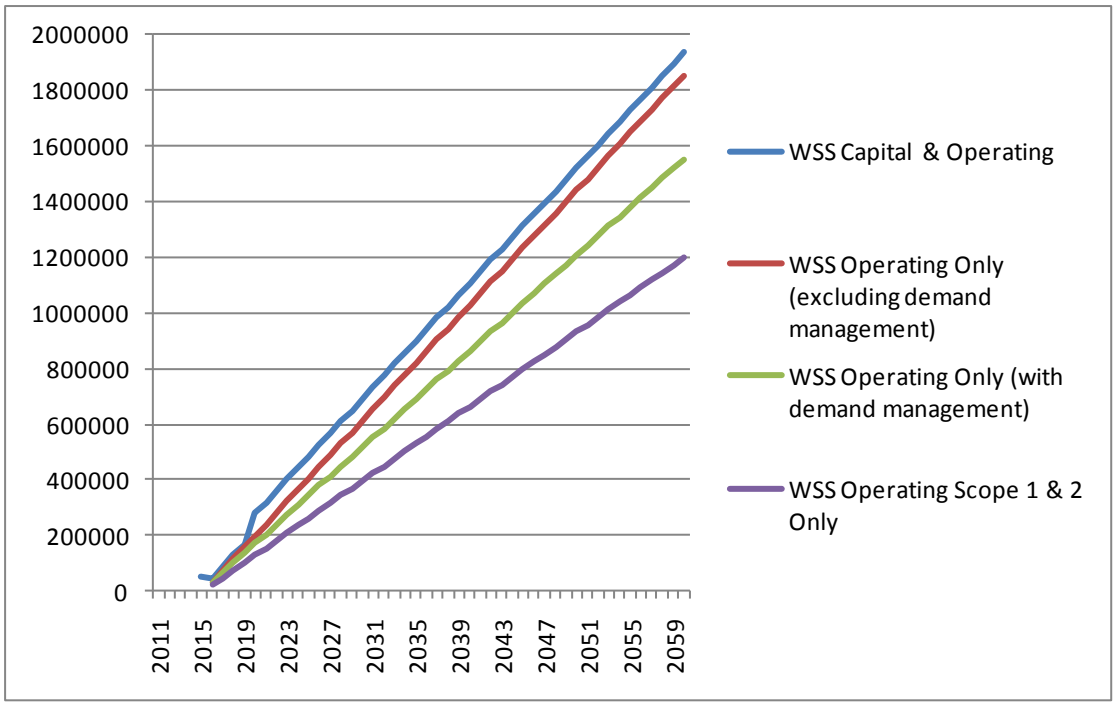

Figure 6: Cumulative WSS Carbon Footprint

Figure 7 shows the contribution made by the WSS Energy Efficiency initiatives (conservatively estimated to deliver 5% savings in energy consumption) and the Wind Farm/Renewable Energy option to mitigating the cumulative WSS Scope 1 and 2 operational emissions. The mitigation outcome of close to 1,200,000 t CO2-e is significant, being equivalent to removing 6,300 cars from the road each year for the 50 year period.

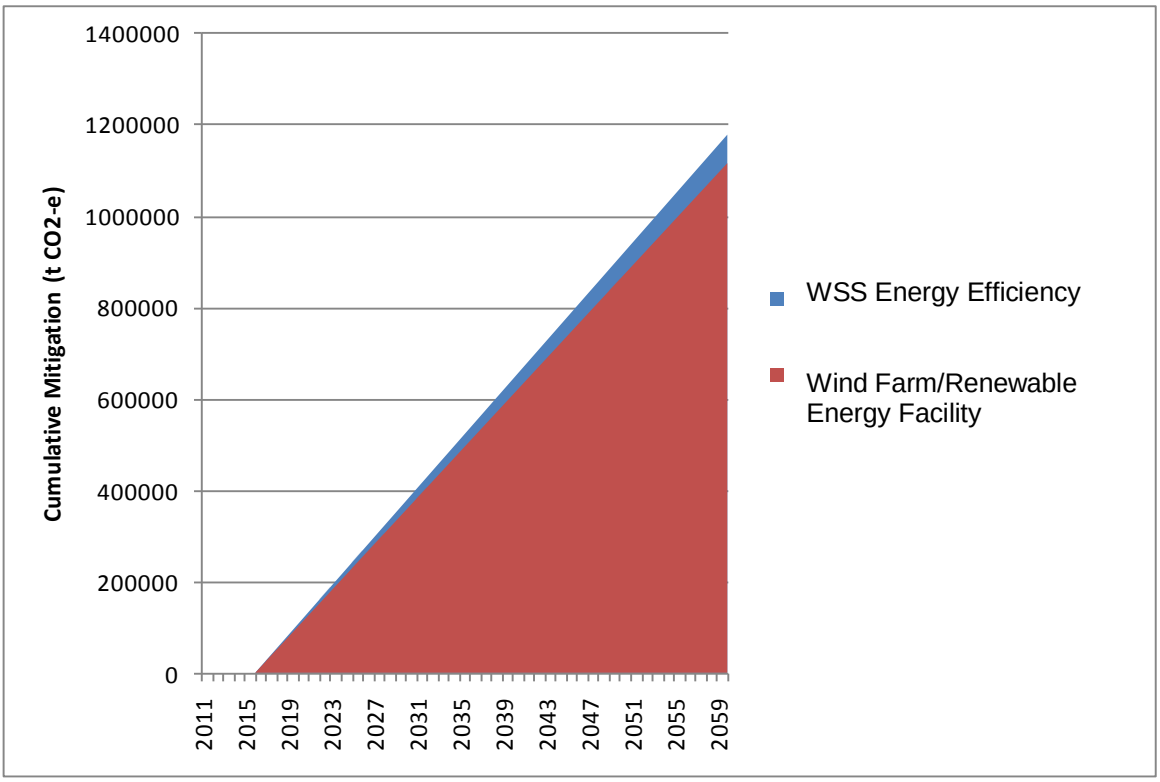

Figure 7: Mitigation of WSS Scope 1 & 2 Operational Emissions

4.7 Monitoring and Evaluation

The monitoring and evaluation requirements related to the water security component of the Carbon Plus Strategy include:

- Monitoring of progress in implementation of the Carbon Plus Strategy in relation to the water security infrastructure projects;
- Monitoring of technology costs in the lead up to the renewable energy tender process;
- Monitoring forecasts of electricity pricing below estimates used in analysis;
- Monitoring and evaluating the effectiveness of WSS energy efficiency initiatives; and
- Monitoring and forecasting water security infrastructure electricity consumption once commissioned.

4.8 Carbon Plus Implementation Plan by LGA

The estimated Scope 1 & 2 Operational footprint and implementation actions for each Centroc council are shown in Table 8. Note, if the recommendation to progress the recommendations of this study in alignment with progress of the Water Security Study is accepted, regional elements of this implementation plan will need to be integrated with the timing and delivery of the water security infrastructure.

Table 8: Implementation Plan by Local Government Area

Council	Region-Wide Strategy Implementation
Centroc	Plan and deliver a market testing and tender process to identify wind energy or alternative renewable energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Bathurst	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley Dam to Bathurst pipeline. During design, review potential for hydro-generation on the Chifley Dam to Bathurst pipeline. Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley Dam to Oberon pipeline. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Blayney	See Central Tablelands Water
Boorowa	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Cabonne	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the bulk water supply storage and water treatment facilities for Cumnock and Yeoval. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Cowra	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Forbes	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Forbes Pipeline via

Council	Region-Wide Strategy Implementation
	Gooloogong (including connection to Parkes). Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Harden	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Lachlan	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the integrated pipeline and storage system for Lake Cargelligo During design, review potential for hydro-generation on the Lachlan River to Lake Cargelligo pipeline. Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the off-stream storage facility at Condobolin. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Lithgow	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Oberon	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Chifley to Oberon pipeline – including liaison with Bathurst Council. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Orange	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Orange Pipeline via Milthorpe. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Parkes	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Rowlands to Parkes Pipeline via Gooloogong. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Upper Lachlan	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Weddin	See Central Tablelands Water.
Wellington	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the Lake Burrendong to Wellington pipeline. During design, review potential for hydro-generation on Stages 1, 2 and 3 of the Burrendong to Wellington pipeline. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.
Young	Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.

Council	Region-Wide Strategy Implementation
Central Tablelands Water	Review opportunities for energy efficiency measures with a payback period of less than 3 years in design and construction of the augmentation of Lake Rowlands and associated pipeline links to Orange, Forbes and Parkes. During design, review potential for hydro-generation on the Lake Rowlands Dam Augmentation. Participate in tender process to identify wind energy generators/providers to partner with the Centroc councils to supply WSS electricity requirements.

5 Progressing General Council Schemes

Although not the key focus of the Carbon Plus study, the Stage 4 investigations have identified a number of opportunities for the Centroc member council's to reduce their carbon footprint and energy consumption for general operations. The steps to implement these opportunities are described below.

5.1 Council Energy Efficiency

Stage 4 identified the opportunity for implementation of energy efficiency schemes for Centroc council facilities and street lighting. Street lighting schemes have been investigated and implemented by other councils (e.g. Hobsons Bay, Blacktown City Council) and various case studies and guidance for both urban and regional areas are available through the ICLEI Sustainable Lighting Toolbox (ICLEI, 2008). Building energy reduction schemes can achieve significant efficiency gains. Some case studies and links to resources are available in the Climate Group, Cashing in on Carbon guidance document (The Climate Group, 2010).

To implement this opportunity it is recommended that:

- Centroc councils compile data on the energy consumption for major buildings, facilities and street lighting and where possible compare consumption against best practice benchmarks (e.g. NABERS Energy Rating benchmark for offices) to identify the level of current performance and the greatest opportunities for energy savings
- Undertake energy efficiency assessments to identify specific opportunities, including modifying user behaviour, equipment, lighting, HVAC systems and the building envelope, to improve efficiencies.
- Undertake a regional street lighting efficiency review, working with other stakeholders (e.g. energy companies, Road Traffic Authority), to investigate:
    - Opportunities to utilise more efficient but effective LED and fluorescent lamps in place of mercury vapour lamps
    - Operational protocols that optimise the time that the lights are operating.
- Audit progress in achieving energy reductions through these initiatives.

5.2 Landfill Biogas for Electricity Generation

An opportunity to utilise biogas from the Bathurst landfill was identified in Stage 4 of this project. The biogas, which is currently captured and flared, would be utilised for electricity generation for onsite, or possible off-site use. Existing examples of landfill biogas facilities exist within Australia (e.g. Mugga Lane Landfill Gas Power Plant and various AGL facilities).

It is recommended that a feasibility assessment be undertaken to evaluate the technical and commercial viability of biogas electricity generation at the Bathurst landfill.

5.3 Wastewater Biogas for Electricity Generation

A review of the Centroc wastewater treatment plants has identified that biogas recovery and electricity generation at two plants, Orange[4] and Lithgow, may be viable with current sludge treatment methods. Examples of wastewater biogas plants in Australia include large facilities such as the North Head plant in Sydney, Melbourne Water's Eastern Treatment Plant and Western Treatment Plant along with smaller facilities such as the Western Water Melton treatment facility and Elanora treatment plant on the Gold Coast.

[4] It is recognised that Orange are currently collecting and utilising biogas for heating; however just under half the total biogas production is flared.

The biogas and electricity estimates for Orange and Lithgow are set out in Table 9.

Table 9: Biogas Production

Location	Estimated Biogas Production m^3/d	Potential Electricity Generation MWh p.a.
Orange	383	364
Lithgow	390	370

It is recommended that a feasibility assessment be undertaken to verify the availability of biogas and viability of gas collection and electricity generation.

5.4 Wind Farm Electricity

There is an opportunity to expand the WSS Wind Farm concept to include production of electricity to meet councils' other water supply and general electricity needs and/or community (residential, commercial and/or industrial) electricity demand.

This option would be attractive to Centroc councils interested in procuring renewable energy to reduce their carbon impact and/or securing a long term fixed price electricity supply to protect against future price rises (if it is considered that electricity prices could be higher than assumed in this study).

Recognising that there will be a high degree of variability in electricity requirements for operation of the water security infrastructure from year to year, the additional base demand from council's other operations may also lead to an improved proposition for the generator (because there would be a higher base demand for electricity) and hence better commercial conditions for Centroc. The ISA modelling conducted in Stage 3 of the Carbon Plus study estimated that Business as Usual (BAU) water supply operations consume some 19,000 MWh p.a. of electricity. Total demand for supply of electricity to both the BAU and WSS infrastructure is therefore approximately 45,000 MWh p.a. (19,000 MWh BAU and 26,000 MWh WSS). [5]

It is recommended that Centroc co-ordinate an investigation to ascertain whether there is interest from Centroc member councils in the opportunity to progress procurement of electricity for other Council and/or community (residential, commercial and/or industrial demands) needs.

5.5 Hydro-generation

Assessment of hydro-generation potential on the existing water supply system was beyond the scope of this study. However, project stakeholders believe there may be potential for mini-hydro facilities on the water supply network. It is recommended that Centroc co-ordinate a review of the existing water supply system to identify whether there are locations with hydro-generation potential above 80 MW as part of the design activities for the WSS.

5.6 Tri/Cogeneration

The Stage 4 study investigated the opportunity for natural gas co-generation or tri-generation where there was a significant energy user that could be co-located with an electricity generation plant. While this opportunity did not score as well on a TBL basis as the regional wind farm, there remains an opportunity for Centroc council's to achieve power cost savings and reduced carbon emissions through installation of cogeneration on council facilities with large electricity and heating and cooling loads, for example heated pool facilities. This study showed that electricity production from smaller co-generation units (e.g. 0.25MW) is relatively expensive but that the costs decline with scale. Larger units (e.g. 1.5MW) produce electricity and heat at a

[5] To meet this additional requirement approximately 8.5MW of additional wind farm capacity would be needed at an additional strategic level capital cost estimate of approximately $25M.

cost competitive with other options but need to be located close to a heating/cooling load for cogeneration to be viable.

To progress this initiative, it is recommended that Centroc first identify facilities with high heating and cooling loads (e.g. pools, large buildings with heating loads in the order of 0.5MW or more) and then undertake a feasibility study to assess the technical and commercial viability of cogeneration on these facilities. The 0.5MW investigation trigger has been selected as a conservative lower end estimate of where cogeneration may be viable in some instances. A 0.5MW cogeneration plant would produce:

- Approximately 1500 MWh of electricity per year; and
- Approximately 7884 GJ of heat (equivalent to 250 kW)

Case studies of similar projects are available for the Macquarie University Library cogeneration facility (Department of Innovation and Industry, 2002), Griffith University Hospital (Institute of Hospital Engineering, 2003) and the UNSW Cancer Research Centre (Cogen Energy, 2009).

During Stage 4, the option of co-location of a tri/cogeneration facility with housing developments was also investigated. Literature sources quote the limits of viability for such a scheme to be approximately 200 homes at medium density (60-80 homes/hectare) (Commission for Architecture and the Built Environment, 2010). It is therefore recommended that the larger councils, Bathurst, Orange and Parkes, review opportunities for tri/cogeneration for any new medium density developments with 200+ houses are proposed.

5.7 Carbon Sequestration

The strategy recommends that Centroc work to develop partnerships to generate carbon sequestration offsets through carbon sink projects(forestry, environmental plantings and soil carbon) to offset Centroc councils' other non-water security related emissions as required. These partnerships could be with any land owner in the region as well as with other commercial operators that are working on developing offsets from bio sequestration. Councils could also consider the use of any excess or public land that they have under their control.

While it is understood that not all Centroc councils will have carbon reduction targets, Centroc can work to identify potential project partners and partnership schemes that could allow councils to participate in sequestration projects in future, if this is each council's preferred mitigation approach, as and when this becomes a priority. In addition, Centroc council's can work with local farmers and landholders to maximise their opportunity to participate in the Australian Government's Carbon Farmers Initiative and to develop an additional revenue stream through the sale of carbon offsets/credits in the international market.

To progress this initiative, Centroc would need to work with the Central West Farming Systems, the Catchment Management Authorities and with Landcare, who have been allocated responsibility for implementation of the Carbon Farmers Initiative, to communicate opportunities for farmers under the Carbon Farmers Initiative and to facilitate carbon sequestration projects.

5.8 Monitoring and Evaluation

The monitoring and evaluation requirements related to the general council component of the Carbon Plus Strategy include:

- Monitoring and evaluating the effectiveness of office energy efficiency initiatives;
- Monitoring progress in assessing the landfill and wastewater biogas opportunities and the tri/cogeneration option and evaluating the effectiveness of these if they are implemented
- Monitoring progress of local landholders in capturing opportunities arising from the Carbon Farmers Initiative and other relevant carbon sequestration schemes;
- Potentially monitoring and forecasting water supply network and general council electricity consumption if these are included in the renewable energy supply agreement.

5.9 Plan to Progress General Council Schemes by LGA

The actions to progress the actions for general council operations are shown in Table 10 for each local government area.

Table 10: Implementation Plan by Local Government Area

Council	Region-Wide Strategy Implementation
Centroc	Co-ordinate Centroc member council consideration of expansion of the WSS Wind Farm concept to include production of electricity to meet councils' other water supply and general electricity needs and/or community (residential, commercial and/or industrial) electricity demand. Work with the Central West Farming Systems, the Catchment Management Authorities and with Landcare groups to communicate opportunities for farmers under the Carbon Farmers Initiative and to facilitate carbon sequestration projects. Identify council facilities within the Centroc region with heating and cooling loads greater than 0.5MW (e.g. pools, large buildings) and undertake a feasibility study to assess the technical and commercial viability of co or tri-generation on these facilities. Initiate regional energy efficiency program to study energy consumption in major Centroc council buildings and facilities to identify priorities for improvements and undertake an assessment to identify specific opportunities to improve efficiency in these facilities. Initiate regional street and public space lighting efficiency program to investigate opportunities for use of more efficient lamps, development of design standards and use of operational protocols to minimise electricity consumption. Undertake a review of the regional water supply system to identify potential for hydro-generation facilities
Bathurst	Investigate the technical and commercial viability of biogas electricity generation at the Bathurst landfill. Review opportunities for tri/cogeneration for any new medium density developments with 200+ houses are proposed. Participate in regional energy efficiency and street lighting efficiency program.
Blayney Boorowa Cabonne Cowra Forbes Harden Lachlan	Participate in regional energy efficiency and street lighting efficiency program. Participate in Centroc investigation of the opportunity to procure additional renewable electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs.
Lithgow	Participate in Centroc investigation of the opportunity to procure additional renewable electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs. Undertake a feasibility assessment to verify the availability of biogas and viability of gas collection and electricity generation at the Lithgow wastewater treatment plant. Participate in regional energy efficiency and street lighting efficiency program.
Oberon	Participate in Centroc investigation of the opportunity to procure additional renewable

Council	Region-Wide Strategy Implementation
	electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs. Participate in regional energy efficiency and street lighting efficiency program.
Orange	Participate in Centroc investigation of the opportunity to procure additional renewable electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs. Undertake a feasibility assessment to verify the availability of biogas and viability of gas collection and electricity generation at the Orange wastewater treatment plant. Review opportunities for tri/cogeneration for any new medium density developments with 200+ houses are proposed. Participate in regional energy efficiency and street lighting efficiency program.
Parkes	Participate in Centroc investigation of the opportunity to procure additional renewable electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs. Review opportunities for tri/cogeneration for any new medium density developments with 200+ houses are proposed. Participate in regional energy efficiency and street lighting efficiency program.
Upper Lachlan Weddin Wellington Young	Participate in Centroc investigation of the opportunity to procure additional renewable electricity for council operations (water supply and/or general operations) from an expanded WSS Wind Farm designed to provide additional electricity beyond the WSS needs. Participate in regional energy efficiency and street lighting efficiency program.

6 Claiming Carbon Neutrality

The National Carbon Offset Standard, which provides a framework for claims of carbon neutrality, does not provide guidance for carbon neutrality of projects. For organisations (such as the Centroc member councils) the standard requires those making claims of Carbon Neutrality to mitigate Scope 1, 2 and some scope 3 operational emissions (business travel, disposal of waste and paper use).

For new products sold to consumers with claims of carbon neutrality, the Standard requires a conventional Life Cycle Assessment process that considers the embedded emissions associated with capital components (effectively the same as ISA Scope 1 and 2+ emissions throughout all production layers).

As the water security infrastructure carbon footprint will become part of the Centroc member councils' overall footprints, it is considered that the guidance on carbon neutrality for an organisation is of the greatest relevance and this supports Centroc's plan to offset Scope 1 & 2 operational emissions (minimal Scope 3 business travel, waste and paper use emissions are anticipated). Options to mitigate emissions throughout all production layers and for capital components will be considered in future if organisational obligations change.

Carbon neutrality commonly refers to a situation where the net emissions associated with an organisation or a product's activities are equal to zero. Achieving a zero emission is usually achieved by firstly reducing the carbon emissions through efficiency drives particularly in the area of energy efficiency and then through the acquisition and cancellation of carbon offsets that meet stringent criteria.

The National Carbon Offset Standard (NCOS) Carbon Neutral Program in Australia allows the Australian operations of organisations or Australian produced products to be certified under the Standard as carbon neutral. It is not clear under the terms of the Standard as to whether a Project or Program such as the Water Security Study and Carbon Plus Study would qualify and meet the absolute requirements of the standard. Centroc, could however, use the process as outlined in the Standard, as a way of demonstrating to the community and stakeholders its carbon efficiency.

Carbon Neutrality Certification is not an exercise to enter into lightly. It requires and ongoing commitment in terms of management and resourcing to be able to maintain and comply with the requirements of the standard in terms of data collection, reporting and third party verification. The main steps in the process are:

1. Measure the carbon footprint of your organisation or product;

2. Monitor and reduce emissions (to the extent possible); and

3. Generate or purchase and cancel sufficient eligible carbon offset units to offset emissions associated with the organisation or product.

Figure 8 below outlines the detail of the process that needs to be followed. It should be noted that this process actually begins after reduction and efficiency measure shave been implemented. More importantly though is that the process also includes the measurement and accounting of all Scope 1, Scope 2 and Scope 3 emissions.

The certification process requires biennial reporting and remains in force for a period of five years at which time the process for certification has to be completed from first principals again.

One of the principles on which the NCOS is based is that project must provide abatement that is additional to that which would occur if the project did not go ahead. Accordingly, RECs generated by a renewable energy scheme need to be surrendered if the electricity is to be deemed emissions free. If the RECs are sold into the market they would typically be purchased and surrendered by an organization with a compliance obligation under the RET scheme – this is not additional as had Centroc not produced and sold the RECs the organization would have had to meet its compliance obligation by purchasing RECs from another renewable energy scheme. No additional renewable energy is produced if Centroc's RECs are sold into the market to meet an existing demand for renewable energy under the RET.

The NCOS recognizes the voluntary surrender of RECs as a valid approach to deeming electricity consumption renewable:

"The purchase of GreenPower™ and the voluntary cancellation of Renewable Energy Certificates (RECs) generated by accredited GreenPower™ generators (GreenPower™-eligible RECs) is considered to be equivalent to the direct use of renewable energy. On that basis, GreenPower™ and voluntary cancellation of GreenPower™-eligible RECs are treated as a zero-emissions electricity source in a product's LCA or an organisation's GHG Inventory. "

In summary, it is important to note that if RECs generated by the wind farm were to be sold in the market rather than cancelled as required under the NCOS, then it would no longer be valid to claim that renewable energy was being supplied to the WSS system. While the fact that RECs have a monetary value provides some protection should Centroc decide at a later date that carbon mitigation of the WSS operational emissions is not needed (i.e. it can sell the RECS and generate revenue to offset the cost of the electricity generation), revenue from the sale of RECs cannot be factored in if Centroc wish to claim that the electricity provided is renewable.

Complete details of the Standard and its requirements can be found at http://www.climatechange.gov.au/government/initiatives/australian-carbon-trust/ncos-carbon-neutral-program.aspx

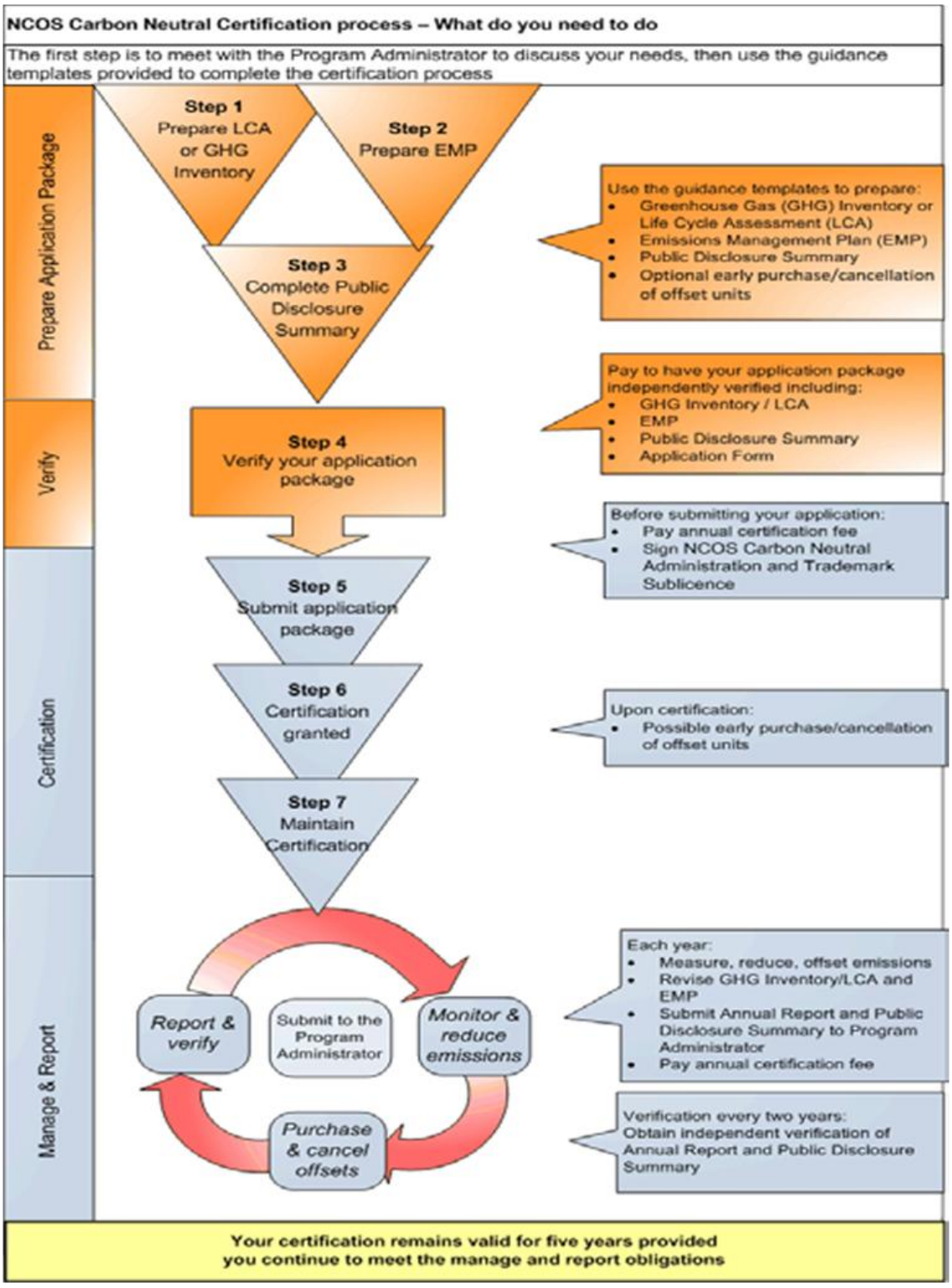

Figure 8: NCOS Carbon Neutral Certification Process

7 Funding Opportunities

Under a commercial model whereby Centroc councils have some level of ownership in the renewable energy facility or are facilitating a privately owned scheme, there are opportunities for grant and other Government funding to be secured. Other Centroc council schemes, for example regional carbon sequestration programs, may also be eligible for funding. In addition, while Centroc itself may not be eligible to apply for some of these grants, its partners and stakeholders may meet eligibility criteria. A summary of the most relevant and available grant and funding opportunities is provided in Table 11.

Table 11: Grants and Funding Opportunities

Grant/Assistance Scheme	Features	Value	Contact	Comment
STATE SCHEMES				
Regional Business Development Scheme Building the Country	This package complements existing programs designed to support regional communities. It has been developed in response to consultation in rural areas as part of the State Plan and The Rural and Regional taskforce. These programs will deliver new infrastructure and upgraded community facilities. This fund provides $52m over 5 years supporting infrastructure required for business establishment, expansion or relocation in regional NSW. Applications for assistance can be accepted where infrastructure requirements are preventing a specific business investment decision occurring. The application process involves two-stages: expression of interest followed by suitable projects being invited to submit a detailed application for assessment.	-	Gordana Mirkova on (02) 9338 6635	Web site: http://www.business.nsw.gov.au/assistance-and-support/grants/regional-communities/building-the-country
Regional Business Employment fund	The Regional Business Employment Fund (RBEF) aims to encourage business growth and genuine new employment creation. The Fund aims to offset business costs including payroll tax, to assist businesses create employment through establishment or expansion of operations in regional NSW. The RBEF aims to encourage small to medium businesses to create new employment opportunities, establish or expand their operations, diversify and strengthen their business. Financial assistance will be available to eligible businesses to offset costs impeding the establishment or expansion of operations, where new employment will result. Subject to employment and other milestones being met, assistance will be targeted to offset the costs associated with employment growth. Assistance may be in the form of payroll tax rebates; and/or direct grants; and/or other business cost offsets (for example, initial capital costs, costs of pursuing diversification or other growth opportunities). The level of assistance offered for a project will take into account direct new employment generated, value of payroll tax being paid and the skill level of new jobs. Small to medium sized businesses in regional NSW are eligible to apply for the Regional Business Employment Fund.	-	NSW Industry and Investment Orange 02 63608400	Web site : http://www.business.nsw.gov.au/assistance-and-support/grants/regional-programs/regional-business-employment-fund

Enterprising Regions Program	This program assists community/regional development organisations undertake planning activities and implement projects which have broad based local support and the potential to generate economic benefits. Applications for assistance must be submitted by a sponsoring organisation such as: • local councils • incorporated associations including business, industry and community organisations • regional development organisations including Regional Development Australia committees. Applicants must demonstrate: • broad support from stakeholders such as the business and wider community for the project, eg by providing letters of support from the local council/s and organisations such as local business or industry groups and tourism organisations and/or • the project is aligned with a local, regional or industry plan eg Regional Business Growth Plans • the potential economic benefits of the project • that project funding will be matched by organisations outside of I&I NSW. This program is designed to "kick-start" local projects to benefit the broader region rather than being of specific benefit to a single enterprise.	-	NSW Industry and Investment Orange 02 63608400	Web site: http://www.business.nsw.gov.au/assistance-and-support/grants/regional-communities/enterprising-regions-program
FEDERAL SCHEMES				
Caring for our Country Program	Caring for our Country is the Government's new natural resource management program. Caring for our Country is designed as an integrated package with one clear goal, a business approach to investment, clearly articulated outcomes and priorities and improved accountability. The scheme commenced on 1 July 2008 and will integrate delivery of the Commonwealth's existing natural resource management programs, the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality, the National Landcare Program, the Environmental Stewardship Program and the Working on Country Indigenous land and environmental program.	-	Australian Government Land and Coasts Phone: 1800 552 008	Web site: http://www.nrm.gov.au/funding/index.html

Commercialisation Australia	Commercialisation Australia is a competitive, merit based assistance program that assists Australia's talented researchers, entrepreneurs and innovative companies to commercialise their ideas. It is the Australian Government 's primary source of support for commercialisation, offering a range of tailored assistance measures including: specialist advice and services, financial support to engage experienced executives and grants for proof of concept and early stage commercialisation activities. Successful applicants are assigned a Case Manager to help guide them through the commercialisation process and facilitate access to experienced Volunteer Business Mentors. Applications are considered on an ongoing basis	Up to $2m	Department of Innovation, Industry, Science and Research Phone: 13 22 56	Web site: http://www.commercialisationaustralia.gov.au/Pages/Home.aspx
Building Farm Businesses	The Australian Government, in partnership with the Western Australian Government, is conducting a pilot of drought reform measures in part of Western Australia. Building Farm Businesses is a program under the drought pilot. The program provides grants to assist eligible farm businesses to manage and prepare for the impacts of drought, reduced water availability and a changing climate. Under Building Farm Businesses, grants of up to $60,000 are available, to be paid in instalments over four years from 1 July 2010 to 30 June 2014. There are two separate grants available under this program. Farm Business Adaptation Grants—up to $40,000 to help farmers implement eligible activities identified in their strategic plan to better manage and prepare for drought, reduced water and a changing climate. Landcare Adaptation Grants—up to $20,000 to implement eligible activities identified in their strategic plan with a natural resource management focus. These activities will have a broader public benefit and be consistent with state and national natural resource management priorities. To be eligible for the grants, farmers must have also completed the Farm Planning program under the drought pilot.	$60k	13 23 16	Web Site: http://www.daff.gov.au/agriculture-food/drought-pilot/building-farm-businesses

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Appendix 1 – Other Sustainability Impacts

Table 12: Improving Other Sustainability Impacts

Group	Application	Technology	Mitigation Category	Assessment
Green concrete	Use in place of traditional concrete	Recycled aggregate content concrete	Avoidance. Use of more sustainable material to reduce embedded sustainability impacts.	Concrete product that uses recycled material could be used in place of the aggregate in the concrete saving on quarrying of raw materials and associated energy consumption and biodiversity issues. This product is commonly used in Australia and has been adopted by large concrete manufacturers such as Boral. This is good environmental practice if recycled aggregates are available close by. However, if recycled aggregates have to be transported long distances for use, this may result in the overall environmental impacts of the green concrete being greater than standard concrete produced with new aggregates sourced locally. It is considered unlikely that this option will be beneficial unless it can be identified that there is a ready source of recycled material available in close proximity to Lake Rowlands. If shortlisted at the opportunities workshop, an assessment will be conducted on the likely availability of recycled aggregate and impacts of any haulage involved in transporting the material to site.
	Use in place of traditional concrete	Concrete manufactured with flyash	Avoidance. Use of more sustainable material to reduce embedded carbon/energy impacts.	Fly ash can be used as a partial replacement for Portland cement. However, the sustainability forecasts already assume approximately 50% cement replacement with fly ash (typical ration for similar projects) and no further savings are expected.
	Use in place of traditional concrete	Concrete manufactured using geopolymer cement	Avoidance. Use of more sustainable material to reduce embedded carbon/energy impacts.	Concrete product that is produced with an alternative, geopolymer cement (the active ingredient in concrete) could be used instead of the standard Portland cement. Geopolymer cement can be manufactured with much lower greenhouse gas emissions. However, it is likely that local constructors will be reluctant to utilise the materials as it is more difficult to demonstrate compliance with Australian regulations which are based on traditional cements.
Biodiversity and land	Biodiversity credit purchase	Market based biodiversity credit	Land use offset. Offset project belongs to another party.	• Full offset of land use impacts possible
		Generation (and retirement)of biodiversity credits to offset water security land use on surplus council land	Land use offset. Council owned or facilitated scheme.	• Limited by availability of suitable land. If this option is shortlisted an estimate of potential extent will be made based on nominal land area
Labour	Maximising regional	N/A	Substitution. Opportunities to utilise	Opportunities exist to maximise local employment arising from the water security projects

Group	Application	Technology	Mitigation Category	Assessment
	employment		regional people either directly in the water security projects or in other sectors which supply goods or services to the projects or people working on the projects.	through strategies such as: • Maximising sourcing of materials and services associated with the project in the region. • Recruiting construction staff locally (where possible) • Recruiting staff and sourcing materials and services from neighbouring areas (or as close as possible to the region the project is in) if resources are not available in the project region. • Consider workforce requirements effect on local community (e.g. in some small towns may exhaust workforce and impact on other businesses) • Identifying skills needs and gaps ahead of time and providing targeted employment training and skills development for local employees • Maximising involvement of local small businesses by identifying small businesses present in the area and scoping their capability in relation to the project • Emphasise benefits of local employment in minimising work travel time and accommodation costs • Use potential publicity about the project to promote region (e.g. for tourism purposes) • Provision of strong communication/information/advertising on local employment opportunities to ensure maximum uptake by local people • Form partnerships with local businesses (and potentially also schools to help with education/training) • Consideration of local employment intentions in contracts

Appendix 2 – Risk Assessment

Table 13: Consequence Scoring Criteria

Consequence						
Impact		**1**	**2**	**3**	**4**	**5**
		Insignificant	**Minor**	**Moderate**	**Major**	**Extreme**
Criteria	**Reputational**	Community unconcerned	Concern from pockets in local community	Localised community concern	Widespread community concern	Widespread community concern
		No media exposure	No media exposure	Local media coverage – short term	Local media coverage - ongoing	National media coverage
		-	-	Govt/ LGA concern – short term and readily addressed	Govt/ LGA concern	Loss of Govt/ LGA support
	Financial	Insignificant cost increase	<25% cost increase	25% cost increase	25-50% cost increase	>50% cost increase
	Environmental	No damage or cosmetic and reversible damage	Minimal and reversible damage requiring only short term remediation.	Localised environmental impacts, reversible with long term treatment	Widespread damage, reversible with long term treatment	Widespread irreversible damage
		Carbon mitigation within 80% of estimate	Carbon mitigation within 60-70% of estimate	Carbon mitigation within 50% of estimate	Carbon mitigation within 30-40 % of estimate	Carbon mitigation within 20% of estimate
	Social	Minimal impact	Short term impact on amenity	Ongoing impact on amenity - localised	Illness requiring medical treatment.	Loss of life or permanent disability
					Ongoing widespread impact on amenity	

Table 14: Likelihood Scoring Criteria

	Risk Probability Ranking	
Ranking	**Probability of Risk Event**	
5	Almost Certain	80–99%
4	Likely	60–79%
3	Possible	40–59%
2	Unlikely	20–39%
1	Rare	1–19%

Table 15: Risk Allocation

		Insignificant	Minor	Moderate	Major	Extreme
		1	2	3	4	5
Almost Certain	5	5	10	15	5	25
Likely	4	4	8	12	16	20
Possible	3	3	6	9	12	15
Unlikely	2	2	4	6	8	10
Rare	1	1	2	3	4	5
		High Risk		Medium Risk		Low Risk

Table 16: Carbon Plus Strategy Risk Assessment

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Strategy Drivers	1. The driver around carbon becomes a higher priority for funding entities.	The mitigation target may not be high enough. It may become necessary to take action faster. The cost of mitigating carbon may increase before Centroc implement the strategy.	3	3	9	Implement strategy recommendations earlier than required (stay ahead of the game) provided this can be done in a flexible/reversible manner (see below)	2	2	4
Strategy Drivers	2. Drivers for the carbon strategy (the priority of carbon management in gaining funding for the water security study) may change	The implementation of the recommendations is not needed to support funding of the WSS. Implementation of the carbon strategy in this case may be seen by the community as wasteful/unnecessary.	3	3	9	Wait until the carbon management and funding linkages become clear. Continue to implement those aspects that make sense to do anyway and/or implement in a manner that is flexible/reversible/adaptable (e.g. Retain option to sell RECs if carbon mitigation is not required).	2	2	4
Assumptions	3. Electricity prices (higher or lower than forecast)	If electricity prices increase, the performance of the recommended strategy vs alternatives improves. If electricity prices decrease (e.g. there is no carbon price introduced), economics of the proposed mitigation scheme deteriorate. While a regional wind farm remains the preferred mitigation approach in the scenario where no carbon price is introduced and electricity price increases are moderate, the relative TBL performance of the carbon sequestration projects improves to close almost breakeven with wind.	3	4	12	Wind opportunity remains preferred option when sensitivity case with no carbon price is evaluated. Electricity price escalation assumptions are considered conservative. Ongoing monitoring of projected electricity pricing.	3	3	9

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Assumptions	4. Transport and fuel prices (higher or lower than forecast)	Economics of the energy generation from biomass and waste (crop, forestry and animal waste) cases and cogeneration cases will change as these cases are sensitive to the freight and biomass/waste/natural gas fuel price assumptions.	3	3	9	Biomass and options involving waste import are not currently in the suite of recommended mitigation options. An open RFP process may see biomass, cogen or waste (crop, forestry or animal waste) electricity generation options identified as preferred to wind (e.g. if local optimisation or innovative approaches deliver lower costs than estimated in the Carbon Plus strategic study). In this case a sensitivity assessment on transport and fuel prices will need to be undertaken and careful consideration would also need to be given to the allocation of price escalation risk in the electricity supply contract.	3	2	6
Assumptions	5. Technology costs, if the relatively becomes inconsistent (absolute will change). Might happen due to local synergies or efficiencies, innovation and technology improvements etc.	If relativity of costs differs from that assumed (e.g. due to technology developments, local optimisation or innovation) an option not currently identified may be preferred on a TBL basis. If there was a breakthrough in any of the technologies not currently included in the top 5 preferred options, then these opportunities may be missed.	3	4	12	Undertake an open EOI/RFP process (i.e. without specifying technology) to ensure than most efficient solution is identified.	1	3	3

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Assumptions	6. REC price (higher or lower than forecast)	If REC price is lower than assumed, purchase of green energy from the market is less costly but review of this scenario has identified that purchase of green energy still remains a less preferred option. With a lower REC price it may become more difficult for renewable energy schemes (e.g. Wind, solar or biomass projects) to proceed as revenue for any electricity generated in excess of Centroc requirements will decline and proponents will therefore be less likely to invest. Also, if Centroc decides to sell its RECs (i.e. no longer seeks to mitigate carbon) then revenue generated will be less than anticipated.	3	2	6	Monitor REC forecasts. Increasing demand for renewable energy facility output (e.g. By partnering with community, purchasing all council electricity needs) may increase viability of investment for proponents. Undertake sensitivity analysis of impact if Centroc decides to sell RECs rather than retaining to deem WSS electricity 'renewable'.	3	2	6
Assumptions	7. Carbon price (higher or lower than forecast)	If the carbon price goes down, carbon offsets may become a more attractive option (occurs if price for offsets remains at the current voluntary market level and no escalation in carbon price occurs) (See also risk related to electricity price assumptions described under risk 3.) Depending on renewable energy supply contract conditions, if carbon price increases, Centroc may be exposed to higher electricity prices for spot purchases of electricity to manage supply/demand matching.	3	2	6	Wait until Government's Carbon Policy becomes clear. Ensure allocation of risk on Carbon price is clearly articulated in electricity supply contracts and undertake sensitivity assessment on the carbon price when evaluating the contract/tender. Note that a long term agreement for generation/purchase of power from a renewable energy facility will protect Centroc from increases in the Carbon price compared to the do nothing scenario.	3	2	6
Assumptions	8. Footprint is higher or lower than forecast. (Footprint is based on the strategic level WSS and this may change)	May commit to more or less electricity that required. In addition, strategy has been based on average annual electricity requirements, while electricity requirement will vary year to year.	5	4	20	Commercial arrangements need to be able to deal with variability in the need for renewable energy year to year. Decision to be made to purchase all of council electricity needs or only what is required for operation of the WSS system - opportunity for a fixed and variable (base and peaking model).	3	3	9

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Recommendations - wind	9. Community resistance	Localised community objection to renewable energy facility.	3	3	9	Appropriate siting, education and potential community involvement (e.g. Share in output from facility)	2	3	6
Recommendations - wind	10. Availability of the site /resource	Available sites under heavy competition.	3	2	6	Implement strategy recommendations earlier than required (stay ahead of the game) provided this can be done in a flexible/reversible manner (see Risk 2 and Risk 7).	2	2	4
Recommendations - wind	11. Scale	Appears to be a demand of a scale for wind, but needs to be tested.	3	2	6	If required, add the rest of council's operations (see the footprint discussion) or alternatively partner with community or other to increase demand	2	2	4
Recommendations - wind	12. Technology cost going down (efficiency improvements, economy of scale)	Costs are likely to go down over time (although constraints on suitable sites for wind may move those costs up as poorer sites lead to lower generating efficiency). Delaying investment may lead to a more cost effective solution.	4	3	12	Mitigation would be to delay investment for as long as possible (subject to considerations of Risks 1 and 10 above). Wind site efficiency has a marked impact on generation cost and this may outweigh technology cost consideration. The issues can therefore not be considered in isolation.	3	3	9
Recommendations - wind	13. Wind Farm approval process	Wind Farms can have a long and tedious approvals process.	3	2	6	The approval process for wind is well documented and understood. There have been a number of other wind farm applications in the Centroc region in the past that can be used as a guide. There are wind farm developments underway in the region.	2	2	4
Recommendations - wind	14. Changing wind patterns due to climate change	May result in diminished/more variable wind availability to produce electricity	2	4	8	Take into account available modelling of climate change impacts prior to site selection	1	4	4
Recommendations - biomass	15. Cost of the biomass fuel and transport, carbon, RECs goes up	Changes the relative costs of this source. Might be more difficult to lock in a long term contract.	4	3	12	Biomass not currently in the suite of recommended mitigation options. An open RFP process may see biomass electricity generation options identified as preferred to wind (e.g. if local optimisation or innovative approaches deliver lower costs than estimated in the Carbon Plus strategic study). In this scenario it would be important to understand how risk is assigned and to undertake a sensitivity assessment during tender assessment to understand the potential impact. Locate biomass/waste plant close to fuel source. See Risk 4 above.	3	2	6

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Recommendations - biomass	16. Community resistance	Localised community objection (competition for viable prime agricultural land).	3	2	6	Biomass not currently in the suite of recommended mitigation options. An open RFP process may see biomass electricity generation options identified as preferred to wind (e.g. if local optimisation or innovative approaches deliver lower costs than estimated in the Carbon Plus strategic study). In this scenario, appropriate siting, education and involvement will mitigate risk.	2	2	4
Recommendations - biomass	17. Availability of the site /resource	Competition for viable prime agricultural land and for biomass resources (e.g. the existing Delta biomass project creates competition for biomass resource - Delta demand of 350,000ha of Malee).	2	2	4	Biomass not currently in the suite of recommended mitigation options. An open RFP process may see biomass electricity generation options identified as preferred to wind (e.g. if local optimisation or innovative approaches deliver lower costs than estimated in the Carbon Plus strategic study). In this scenario, mitigation approach would be through early implementation. Note that Centroc region is 75,000 km2 and significant agricultural area so potential for biomass production is considerable.	2	2	4
Recommendations - Council building energy efficiency	18. Using council opportunities to offset the WSS when it may need to be used at a later date to offset other council activities.	When general council activities need to be mitigated, less options are available. Difficulty communicating strategy to communities if cause and mitigation solution are not related.	3	2	6	Implement a more direct option (particularly given that WSS energy efficiency measures are virtually break even on a TBL basis with the council building/energy efficiency options), or formally transfer to a legal entity	2	2	4
Recommendations - Council building energy efficiency	19.Verification/auditing requirements	Implementation of these measures will require council to annually verify that reductions have been achieved to verify savings have been achieved. Difficulty achieving consistency between councils and will add costs if verification is required.	3	2	6	Regular audits using accredited auditors. Consistent auditors utilised across all Centroc councils. Implement recommendation without seeking to make claim of "offsetting WSS energy use"	3	1	3
Recommendations - Council building energy efficiency	20. The efficiencies anticipated are not achieved	Anticipated electricity savings are not achieved and no impact on council footprint.	3	2	6	Research and implement 'tried and true' measures to improve energy efficiency. Monitor energy requirements during design and after commissioning.	2	2	4

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Recommendations - WSS infrastructure energy efficiency	21. The efficiencies anticipated are not achieved or greater efficiencies are achieved	Greater or lower purchase of electricity required.	3	2	6	Increase purchase of renewable energy - ensure some flexibility in supply contracts to do so. Monitor energy requirements during design and after commissioning.	3	2	6
Recommendations - VCOS and carbon neutral	22. The standard does not deal with projects	If project is deemed to be a "product" rather than an "organisation" then potential loss of credibility if carbon neutrality claim is perceived to be incorrect.	3	3	9	WSS emissions will contribute to organisational footprint so project aligns more closely to organisational than product emissions. Avoid use of 'neutral' claims in communications	2	2	4
Recommendations - landfill gas	23. Estimates of gas generation is quite uncertain	Estimates of potential electricity generation are overstated or understated.	4	2	8	Landfill gas generation not required in recommended suite of actions to offset Scope 1 and 2 WSS operational emissions. Potential exists that options is put forward if an open EOI/RFP is used. In this case, or if Centroc choose to implement option outside WSS mitigation requirements, further detailed investigations by relevant Centroc councils of current and future biogas availability will be required	4	1	4
Recommendation - hydro	24. Opportunity cost of building WSS without using hydro resource	Loss of viable and cost effective resource.	3	2	6	Continue examining hydro through design of WSS when costs are better defined. Produce table of prices where alternatives 'break even" to wind TBL.	1	2	2
Implementation - commercial models	25. Scale of the demand is not sufficient for the private sector	Can only implement using Centroc entities or might alter the nature of the options (i.e. co-gen).	3	2	6	Reliant on Centroc funds and interest. Bring in the rest of council's energy consumption, community demand or other partners. Run open EOI/RFP tender process to enable various technologies to be considered Produce table of prices where alternatives 'break even" to wind TBL.	2	2	4
Implementation - commercial models	26. Risk transfer and the impact on price	Too great an allocation of risk to the private sector drives up price, changing viability and strategic option.	3	3	9	Smoothing out variability of Centroc demand (i.e. fixed and float) by including other electricity requirements. Measures to transfer less risk or remove the risk.	2	2	4
Implementation - grants	27. Grant funding not available	Affordability of the recommendations altered.	4	1	4	Early and broad reaching assessment of funding opportunities. Analysis does not assume any external funding or incentives	3	1	3
Implementation - timing	28. Delay in implementation of Carbon mitigation strategy (compared to WSS implementation)	No carbon management in place at time WSS is commissioned.	3	3	9	Buy green electricity or carbon offsets as a transition measure.	2	2	4
Implementation - timing	29. Carbon mitigation strategy implemented ahead of WSS implementation	Carbon management in place when not needed.	3	3	9	Sell RECs into the market. Sell electricity into market. Utilise electricity for general council requirements	2	3	6

Strategy Component/Element	Risk	Consequence	Unmitigated Likelihood	Unmitigated Consequence	Unmitigated Risk Score	Mitigation Measure	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk Score
Implementation - timing	30. Delays in the WSS being implemented	If significant time delays, then the carbon plus study loses relevance.	3	3	9	Package WSS infrastructure and Carbon Plus project as one program will reduce likelihood of delay. Study assumptions can be updated as required.	3	1	3
Implementation - budget	31. No budget for the strategy	Capital investment in wind farm is not possible.	3	4	12	Engage State and Federal Government to fund carbon mitigation from general purpose funds. Various procurement approaches, including option to enter into a long term power purchase arrangement with a wind generator and incur ongoing operating cost rather than up front capital investment. Sell RECs if mitigation targets are not required in future.	2	3	6
Implementation - community resistance	32. Willingness to pay, acceptance of the study as a whole	Councils unable to implement the recommendations.	3	4	12	Communications strategy, including establishing linkages between ability to fund the WSS infrastructure and carbon mitigation strategy and progressing WSS and Carbon Plus aspects as a program of works. Sell RECs if mitigation targets are not required in future.	2	3	6
Implementation - EoI	33. Comparison of options from the EoI (if open to various technologies), gives incomparable or conflicting information	May implement an option that doesn't have all the risks included and costed.	3	4	12	Checklist of tender considerations to be developed as part of implementation planning. Pre tender discussions with tender proponents to inform development of tender documentation. Seek technical input/expertise in tender selection process.	3	2	6
Implementation – Carbon Plus Strategy	34. Involvement in renewable energy generation industry not seen as core business of a water utility	Increased pressure to reform local government involvement in water supply.	2	4	8	To proactively promote the Carbon Plus Strategy as consistent with the priorities and processes large, effective and efficient utilities are presently undertaking (e.g. Sydney Water and Melbourne Water)	2	2	4

Appendix 3 – Renewable Energy Operations in NSW

Table 17: Listing of Renewable Energy Operations in NSW, Energy Source and Ownership

Name	Owned	Keycode	Status
Adjungbilly	CBD Energy	Wind	Proposed
Anembo	Macquarie Generation	Wind	Proposed
Bannister	Marubeni Corporation	Wind	Proposed
Ben Lomond	AGL Energy Ltd	Wind	Proposed
Berambed Weir	NSW Govt	Water	Proposed
Berridale	Epuron Pty Ltd (was Taurus Energy Pty Ltd)	Wind	Proposed
Black Springs	Hickory Hill Wind Energy Pty Ltd/Wind Corporation	Wind	Proposed
Blacktown	Australian Greenhouse Office	Solar	Proposed
Blayney Wind Farm	Eraring Energy	Wind	Existing
Boco Rock	Wind Prospect	Wind	Proposed
Bodangora	Infigen Energy	Wind	Proposed
Box Hill	AGL Energy Ltd	Wind	Proposed
Brogo	Delta Electricity	Water	Proposed
Bulahdelah	Forest Products Ass/National Power - Biomass (wood waste) cogeneration)	Other	Proposed
Buronga	Enviromission Ltd	Solar	Proposed
Capital Wind Farm	Infigen	Wind	Existing
Carmodies Hill	Pacific Hydro	Wind	Proposed
Cataract Dam	NSW Government	Water	Proposed
Chifley	NSW Govt	Water	Proposed
Clarrie Hall	NSW Govt	Water	Proposed
Cochrane (Brown Mountain)	NSW Govt	Water	Proposed
Conroys Gap	Epuron Pty Ltd (was Taurus Energy Pty Ltd)	Wind	Proposed
Cordeaux Dam (Mini-Hydro)	NSW Government	Water	Existing
Crookwell Wind Farm	Eraring Energy	Wind	Existing
Crookwell 2	Union Fenosa Wind Australia	Wind	Proposed
Crookwell Plateau	ANZ Infrastructure Services Ltd	Wind	Proposed
Deniliquin (Biomass Plant)	Stanwell Corporation	Other	Proposed (shelved)
Denman	Geodynamics (Hot Rocks)	Other	Proposed
Eden	South East Fibre Exports (SEFE) - Biomass (wood waste) cogeneration)	Other	Proposed
Edwards Escape	Pacific Hydro	Water	Proposed
Euston Weir	NSW Govt	Water	Proposed
Evandale	Epuron Pty Ltd (was Taurus Energy Pty Ltd)	Wind	Proposed
Flyers Creek	Infigen Energy	Wind	Proposed
Glen Innes	Infigen Energy	Wind	Proposed
Glennies Creek	Delta Electricity	Water	Proposed
Gogeldrie Weir	NSW Govt	Water	Proposed
Goulburn District	ActewAGL	Wind	Proposed
Grafton (Biomass Plant)	Big River Timber (Wood Waste)	Other	Existing
Gullen Range	Epuron Pty Ltd	Wind	Proposed

Name	Owned	Keycode	Status
Gunning	Acciona Energy	Wind	Existing
Gurrundah	Marubeni Corporation	Wind	Proposed
Hampton Park Wind Farm	Hampton Wind Park Company	Wind	Existing
Harwood	NSW Sugar Milling Co-op/Delta Electricity	Bagasse	Existing
Hay Weir	NSW Govt	Water	Proposed
Jindabyne - solar	Jindabyne Community	Solar	Proposed
Kensington	University of New South Wales	Solar	Proposed
Kyoto Energy Park	Pamada	Wind	Proposed
Lake Cargelligo	Lloyd Energy Systems	Solar	Existing
Liverpool Range	Macquarie Generation	Wind	Proposed
Lord Howe Island	SEDA	Wind	Proposed
Lostock	Delta Electricity	Water	Existing
Mangrove Creek	NSW Govt	Water	Proposed
Maude Weir	NSW Govt	Water	Proposed
Merrylands	Waste Disposal Authority	Landfill methane	Existing (not currently operating)
Molonglo Ridge	EHN (Oceania) Pty Ltd	Wind	Proposed
Mount Spring	ActewAGL	Wind	Proposed
Mt Oxley	Babcock&Brown and National Power	Wind	Proposed
Murrurundi	GHG and GREP	Wind	Proposed
Nepean Dam	NSW Government	Water	Proposed
Paling Yards	Union Fenosa Wind Australia	Wind	Proposed
Pindari Hydro	NSW Govt	Water	Existing
Redbank Weir	NSW Govt	Water	Proposed
Riverstone	A.j.Bush&Sons (Biogas)	Other	Proposed
Sapphire	Wind Prospect Pty Ltd	Wind	Proposed
Shannons Flat	CBD Energy Ltd	Wind	Proposed
Singleton Solar Farm	Energy Australia	Solar	Existing
South Moruya	Forest Products Ass/National Power - Biomass (wood	Other	Proposed
Split Rock	NSW Govt	Water	Proposed
Stevens Weir	NSW Govt	Water	Proposed
Tallowa Dam	NSW Government	Water	Proposed
Taralga	RES Ltd	Wind	Proposed
The Wharf	Sydney Theatre Company	Solar	Existing
Torrumbarry	NSW Govt	Water	Proposed
Whytes Gully	Energy Developments Ltd	Other	Existing
Windamere	Delta Electricity	Water	Proposed
Woodlawn 2	Infigen Energy Ltd	Wind	Existing
Woronora Dam	NSW Government	Water	Proposed
Yamba (Clarence River)	Atlantis Resource Corporation (Aquanator)	Water	Proposed
Yanco Weir	NSW Govt	Water	Proposed
Yass Project	Epuron Pty Ltd	Wind	Proposed
Young	Burrangong Meat Processors	Other	Proposed

Appendix 4 – Delivery Models

The Infrastructure Australia, National Public Private Partnership Guidelines describe the procurement options analysis process and considerations for various delivery models:

Investment Decision

A business case is used to set out the justification for the government investment decision in the provision of infrastructure to deliver services. This decision should be taken in relation to all other competing interests for government funding priority (i.e. in relation to the entirety of the capital program identified to deliver upon government service provision objectives) in order not to distort the prioritisation. The approval of the business case results in a capital budget allocation for the project. At this point, the most efficient delivery model should be considered in the procurement decision. Although the decisions are separate, the assessment can be undertaken in parallel.

Procurement decision

A delivery model is a system used to for organising and financing design, construction, operation and maintenance services for infrastructure by entering into legal agreements.

Selection of a delivery model is based on an assessment of the best balance the control of project cost and risk against achieving project objectives and outcomes. The key issue to be resolved is which project delivery model provides the best value for money in meeting the government's service objectives. This is determined by undertaking a Procurement Options Analysis.

The options analysis is a multi-criteria assessment of the available delivery models against a set of evaluation criteria. Infrastructure Australia notes the following criteria as relevant for consideration in model selection:

- Operational Flexibility: The extent to which the Government retains flexibility in terms of the operational profile.
- Risk Management: The extent to which the option incentives effectively and efficiently to manage and reduce risks, thereby minimising the whole-of-life cost to the government.
- Time to Deliver Project: The extent to which the option is able to support achieving an operational supply by the required timeframe.
- Market Interest: The extent to which the option assists in maximising market interest amongst the appropriate players with the relevant skills, expertise and capacity to deliver the project.
- Value for Money: The extent to which the option assists in maximising the government's value-for-money from implementing the project.
- Budget Certainty: The extent to which the option assists in providing earlier budget certainty to the government.
- Flexibility (Future Scope Changes): The extent to which the option assists the government in managing and implementing changes to the functional requirements of the project over time.
- Stakeholder Management: The extent to which the option assists the government in managing stakeholders through the delivery of the project.

Drawing on the guidelines produced by Infrastructure Australia, Table 18 summarises the broad categories of delivery model, including their advantages, disadvantages and approach to risk allocation.

Table 18: Delivery Model Characterisation (Source: Adapted from Infrastructure Australia, 2008)

Delivery Model	Description	Advantages	Disadvantages	Risk Allocation
PPP Models	Privately funded. A service contract between the public and private sectors where the Government pays the private sector to deliver infrastructure and related services over the long term. The private provider will build the facility and operate or maintain it to specified standards over a long period. The private provider usually finances the project. The government is a purchaser of asset-based services that are paid for according to performance. National guidelines suggest consideration where: • Total capital value exceeding $50 million • Project has a complex risk profile • Innovation is required	• Full integration of life-cycle responsibilities • Greater transfer of risk to private sector • Innovation promoted • Cost certainty • Maintenance standard certainty • Efficiency • Performance standards in place	• Success relies on well-defined functional and service specifications • Bid phase can be resource intensive/expensive • Design changes may require contract negotiations • The ability to make a variation needs to be addressed in the contract • Requires skills in financial and technical assessment, tendering and management in the government entity • Need to educate stakeholders who are not familiar with approach	In general, Centroc would be responsible the following activities and their risks for: • Scope and specification • Site availability and access • Demand assessment (some private) • Change in specification • Competition The private sector entity would be responsible for: • Site condition • Design • Construction risks • Construction cost escalation • Supplier risk • Operating cost escalation • Maintenance • Operating performance (including REC ownership and under and overs, NEM participation) • Obsolescence • Industrial relations Shared risks include: • Interface management • Change in legislation • Land acquisition • Environmental approvals • Planning approvals

Delivery Model	Description	Advantages	Disadvantages	Risk Allocation
Competitive Alliance	Government funded. Government collaboration with non-owner party (ies) to share the delivery of the construction phase of the project. Delivery risks are shared by the alliance participants and the contract and other structures are based on 'no-fault, no-blame', 'best for project' and unanimous decision-making principles. Alliance culture is critical and hence, selection of the right participants is crucial. Non-owner parties have an open-book requirement to be reimbursed their direct project costs and corporate project overheads. Key performance indicators designed to achieve specific cost, schedule, environmental, safety and other requirements are set and a pain-gain model applied to all parties based on performance against KPIs.	• Shared responsibility for design • Flexibility to modify design during construction • Incentivised to achieve performance parameters • Adversarial dispute costs eliminated • Can deliver complex projects with uncertain risks • Promotes innovation • Integration of phases promotes efficiency • Stakeholder issues management improved • Early contractor involvement • Skill enhancement for personnel • Assists in attracting greater number of tenders for complex projects	• Less tender price competition and certainty about value for money • Requires genuine openness and collaboration, relationship management key • On-going input of senior staff • High cost of establishment and maintenance of relationships • Government bears cost risk and other unspecified risks • Overall design and fit-for purpose risk is with government • Recourse in event of catastrophic failure is limited • Lack of focus on lifecycle costs	In general, Centroc would be responsible the following activities and their risks for: • Scope and specification • Site availability and access • Site condition • Land acquisition • Environmental approvals • Planning approvals • Demand assessment • Change in specification • Obsolescence • Competition • Interface management • Change in legislation • Industrial relations Shared risks include: • Design • Construction risks • Construction cost escalation • Supplier risk • Operating cost escalation • Maintenance • Operating performance
Design, Build, Own and Maintain	Government funded. Government funded. Government prepares a design brief outlining functional and key user requirements. Government seeks tenders for completion of detailed design. Private entity completes design and construction and operates and maintains the infrastructure.	See design and construct	See design and construct	In general, Centroc would be responsible the following activities and their risks for: • Scope and specification • Site availability and access • Site condition • Land acquisition • Environmental approvals

Delivery Model	Description	Advantages	Disadvantages	Risk Allocation
				• Planning approvals • Design • Construction risks • Demand assessment • Change in specification • Obsolescence • Competition • Change in legislation • Industrial relations The private sector entity would be responsible for: • Construction cost escalation • Supplier risk • Operating cost escalation • Maintenance • Operating performance Shared risks include: • Interface management
Design and construct	Government funded. Government prepares a design brief outlining functional and key user requirements. Government seeks tenders for completion of detailed design. Private entity completes design and construction.	• Single point of accountability for design and construction. • Administrative efficiency • Ability to fast track • Contractor can contribute construction experience to the design • Contractor warrants design • Lump sum for design and construction	• Limited input by contractor into early design • Longer tender period needed to allow assessment of design risk • Principal may pay a premium for transfer of design risk • Lack of focus on lifecycle costs • Government retains whole of life asset risk • Government may be liable for cost and time overruns	In general, Centroc would be responsible the following activities and their risks for: • Scope and specification • Site availability and access • Site condition • Land acquisition • Environmental approvals • Planning approvals • Design • Construction risks • Demand assessment • Operating performance and cost escalation • Maintenance • Change in specification • Obsolescence • Competition

Delivery Model	Description	Advantages	Disadvantages	Risk Allocation
				• Interface management • Change in legislation • Industrial relations The private sector entity would be responsible for: • Construction cost escalation • Supplier risk