

Colac Otway Shire

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## Executive summary

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In 2010, Colac Otway Shire Council (the ‘Council’ or the ‘Shire’) set a goal to achieve carbon neutrality by 2016. To support the achievement of this goal the Shire, utilising financial support from the Victorian Sustainability Accord, engaged Arup to develop a Carbon Neutral Options and Cost-Benefit Report (the Report) to inform the next stage of the Council’s revised Carbon Neutral Plan.

The outputs of the Carbon Neutral Options and Cost-Benefit Report include:

- A prioritised list of cost-effective options for reducing emissions from the Council’s corporate operations
- An understanding of the feasibility of emissions reductions targets for the Council’s greenhouse inventory, and
- Options for immediate ‘next steps’ for effective greenhouse action.

The Report and associated analysis provide Council with information which can be used to prioritise potential carbon reduction initiatives which both reduce emissions and are cost effective. This understanding will complement other decision making drivers such as the need for community engagement, social inclusion, environmental quality and responding to stakeholder interests.

The analysis and subsequent recommendations within the Report are based on an initial appreciation of the Council’s 2011-2012 emissions as follows:

- The Council’s total Scope 1 and 2 emissions are approximate 4,300 tCO<sub>2</sub>e.
- A majority of the Council’s Scope 1 and 2 emissions were from diesel and electricity use – combined to be almost 85% of total Council emissions.

In particular:

- The largest emission source was diesel use associated with the Council’s corporate fleet and bulk purchases i.e. diesel for trucks, equipment or on-site generators. This accounts for approximately 75% of all Scope 1 emissions.
- The second largest source of carbon emissions is electricity use associated with Council facilities which accounts for almost 40% of emissions.

Based on an understanding of the Council’s main emission sources as above, the Report identifies initiatives to reduce emissions associated with assets such as buildings, public lighting, corporate fleet, and heavy fleet. The analysis concludes that:

- If all the emissions reduction measures were implemented in 2013, the annual carbon abated would amount to around 1,600 tCO<sub>2</sub>e at 2013.
- If initiatives were implemented to achieve cost neutrality<sup>1</sup> over the 10 year analysis period, around 1,000 tCO<sub>2</sub>e could be reduced. Table ES1 highlights the most cost-effective initiatives. This is around 25% of total Council emissions, or almost 50% of building-related emissions.

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<sup>1</sup> This assumes that initiatives can be funded using energy cost savings from the ‘low hanging fruit’ actions detailed in Section 4.5.

Further reductions above cost-effective initiatives would require additional capital investment. The remaining emissions would amount to around 3,200 tCO<sub>2</sub>e at 2013. If Council chose to purchase carbon offsets instead of implementing more costly emissions reduction initiatives, then this would cost \$72,000 at the current price for Voluntary Carbon Standard offsets of \$22 per tCO<sub>2</sub>e. If all electricity from buildings was offset by the purchase of 100% GreenPower, this would reduce emissions by around 1,700 tCO<sub>2</sub>e and cost approximately \$59,000-60,000 per annum (in additional to normal electricity costs).

Table ES1 Priority initiatives based on cost-benefit analysis

Category	Initiative	Emissions savings at 2013 (tCO <sub>2</sub> e/annum)	Capital cost	Energy cost savings over 10 years (\$ total)
Buildings	Cogeneration	315	\$178,000	\$259,000
	Roof insulation - Large sites	95	\$62,000	\$138,000
	Sensor lighting	104	\$126,000	\$163,000
	Lighting upgrades	175	\$110,000	\$274,000
	Draught proofing - Large sites	39	\$16,000	\$58,000
Heavy Fleet	Purchase B20 Biodiesel fuel	151	\$0	\$235,000
Corporate Fleet	Adopt LPG fuelled vehicles	38	\$75,000	\$526,000
	Electric vehicle trial	32	\$126,000	\$208,000
Public Lighting	T5 Lighting Replacement	26	\$4,000	\$41,000
	32W CFL Lighting Replacement	40	\$9,000	\$62,000
<b>TOTAL</b>		<b>1,015</b>	<b>\$706,000</b>	<b>\$1,964,000</b>

Therefore, in addition to the carbon neutrality target by 2016, the Council could consider setting two emissions reduction targets for: buildings and public lighting; and vehicle use. These targets represent a commitment to avoiding or reducing greenhouse gas emissions before offsets are purchased.

The proposed targets, as informed by the analysis of this Report, are as follows:

- On a cost-neutral basis, the target for total emissions reductions across Council could be around 20% by 2016 on a 2011/12 baseline.  
A more ambitious target could be set, if Council decide to allocate additional investment.
- On a cost-neutral basis, the target for building-related (this includes public lighting) emissions reduction target could be around 50% by 2016 on a 2011/12 baseline.
- A vehicles-related emission reduction target – 10% by 2020 on a 2011/12 baseline.

The next stage of this project is to develop a road map for the Carbon Neutral Plan, which would be an operational plan for Colac Otway Shire Council. By providing financial information, this study assists the development of a robust plan to realise energy cost savings and tackle climate change.

# 1 Introduction

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## 1.1 Project background

In 2010, Colac Otway Shire Council (the ‘Council’ or the ‘Shire’) set a goal to achieve carbon neutrality by 2016. Since then, the Shire has initiated a range of programmes to reduce greenhouse gas emissions from operations including the incorporation of energy efficiency criteria into purchasing, contracts and corporate vehicle fleets.

With support from the Victorian Sustainability Accord, the Shire engaged Arup to develop a Carbon Neutral Options and Cost-Benefit Report which will inform the next stage of the Council’s next Carbon Neutral Plan.

The Plan will provide the council with a strategic direction for achieving its carbon neutral target for corporate operations by 2016.

The project involves the following tasks:

1. A review of the Council’s carbon inventory.
2. Development of a reporting framework in line with the National Greenhouse and Energy Reporting (NGER) Act.
3. Identification and cost-benefit analysis of emissions reduction options.
4. Review of offset opportunities.
5. Development of the Carbon Neutral Colac Otway by 2016: Options and Cost-Benefit Report.
6. Presentation to Councillors and development of an associated ‘road map’.

The outputs of the Carbon Neutral Options and Cost-Benefit Report include:

- A prioritised list of cost-effective options for reducing emissions from the Council’s corporate operations
- An understanding of the feasibility of emissions reductions targets for the Council’s greenhouse inventory, and
- Options for immediate ‘next steps’ for effective greenhouse action.

## 1.2 Assumptions and limitations

This Report has been developed to inform the Shire of the cost and benefits associated with a range of carbon reduction initiatives. It provides a comparison of initiatives which can be implemented over a ten year period.

The analysis is based on general assumptions and data held by Arup. The results should be viewed as high level information and further detailed analysis of any of the options raised in this report should be undertaken prior to implementation. Site specific barriers, opportunities and costs will influence the suitability of implementation of specific initiatives.

Details of the assumptions used for the analysis are outlined in Appendix A. Arup encourages the Shire to view these assumptions as part of this report.

**Data limitations regarding fuel use**

Arup has estimated the usage of fuel based on assorted information provided by Colac Shire Otway Council. These estimations are detailed in Appendix A1.2.

It should be noted that based on Arup's assumptions on number of vehicles and known fuel use (through fleet cards and other data sources), Arup can account for how 54% of the Council's fuel is being used.

Of the remaining 46%, the majority is diesel consumption. Council does not collect data on how purchased bulk diesel is used in heavy fleet, generators and other equipment.

Arup recommends that the Council investigates how more detailed diesel consumption data can be collected in future, as there may be significant fuel and cost savings to be made.

## 2 Methodology

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An overview of the methodology is provided in Figure 1.

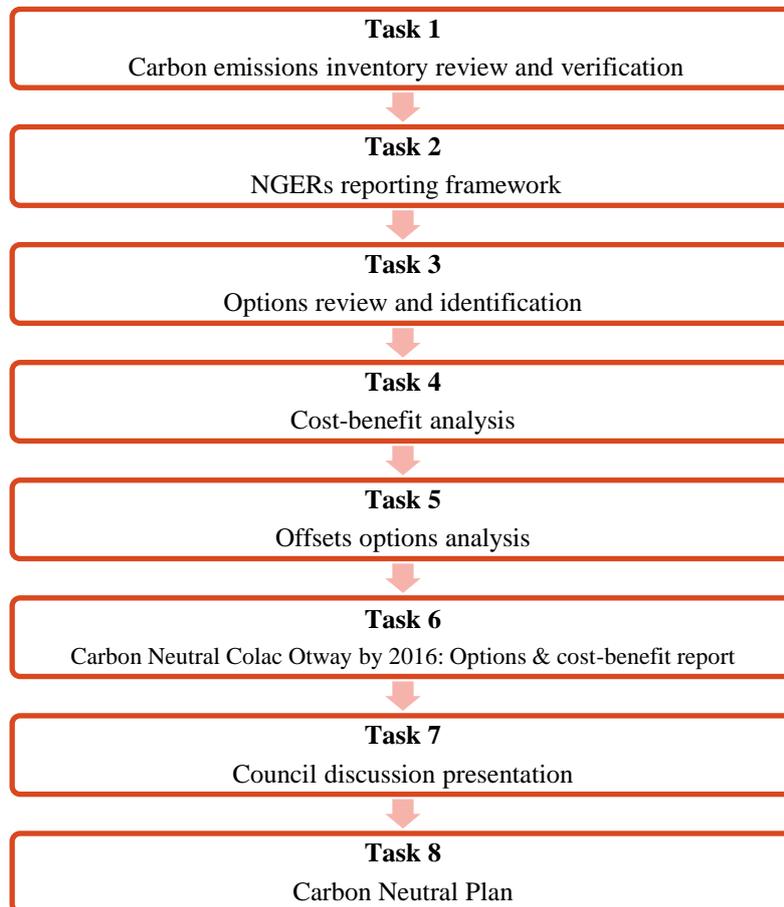


Figure 1 Methodology overview

## 2.1 Task 1: Carbon emissions inventory review and verification

The first stage of analysis was to examine the energy and emissions inventory of the Shire as calculated and reported by Planet Footprint. The purpose of the review was to identify key emission sources which may offer the greatest opportunities for carbon reduction.

A high level data review was also undertaken to confirm the accuracy of the inventory. The report for Task 1 is provided in Appendix B. In summary, the review determined that;

- Total Scope 1 and 2 emissions for 2011-2012 are approximately **4,300 tCO<sub>2</sub>e**; and
- A majority of the Council's Scope 1 and 2 emissions were from diesel and electricity consumption – combined to be approximately 85% of total Council emissions (described in Figure 2).

A summary of the Council's emissions are shown in Table 1. The inventory is based on figures reported by Planet Footprint plus emissions from bulk purchase diesel.

Table 1 Summary of Council carbon emissions

Scope	Emissions source	Greenhouse gas emissions <sup>2</sup> (tCO <sub>2</sub> e)	Approximate energy / fuel usage	Approximate energy cost (2011-2012)
1	Diesel (transport)	1,192	442 kL <sup>2</sup>	\$666,000
	Diesel (bulk purchased)	745 <sup>3</sup>	375 kL	\$375,000
	Mains Gas	322	2,935 GJ	\$27,000
	Unleaded Petrol (transport)	213	90 kL <sup>2</sup>	\$132,000
	LPG (transport)	86	54 kL <sup>2</sup>	\$38,000
	Premium Unleaded (transport)	27	11 kL <sup>2</sup>	\$17,000
	Unleaded with 10% Ethanol	13	8 kL <sup>2</sup>	\$12,000
2	Electricity	1,655	1,333 MWh	\$266,000
<b>1+2</b>	<b>TOTAL</b>	<b>4,252</b>	<b>-</b>	<b>\$1,533,000</b>

Diesel consumption accounts for approximately 75% of all Scope 1 emissions. This diesel consumption is from both corporate vehicle fleet and the Council's

<sup>2</sup> Estimated based on Planet Footprint emissions data, refer to Section 1.2 regarding the consolidation of with transport fuel data

<sup>3</sup> Estimated based on data provided by Council – this was excluded in the Planet Footprint data

bulk purchases. Bulk purchase diesel<sup>4</sup> may be used by trucks, equipment or on-site generators.

The second largest source of emissions is electricity consumption from Council facilities which account for almost 40% of all Scope 1 and 2 emissions.

Based on the assessment above, emissions reduction initiatives have primarily been selected to reduce electricity consumption (from buildings), and diesel consumption (particularly from vehicles and heavy transport).

The remaining 15% of Council emissions are from mains gas, and other transport fuels such as LPG and petrol.

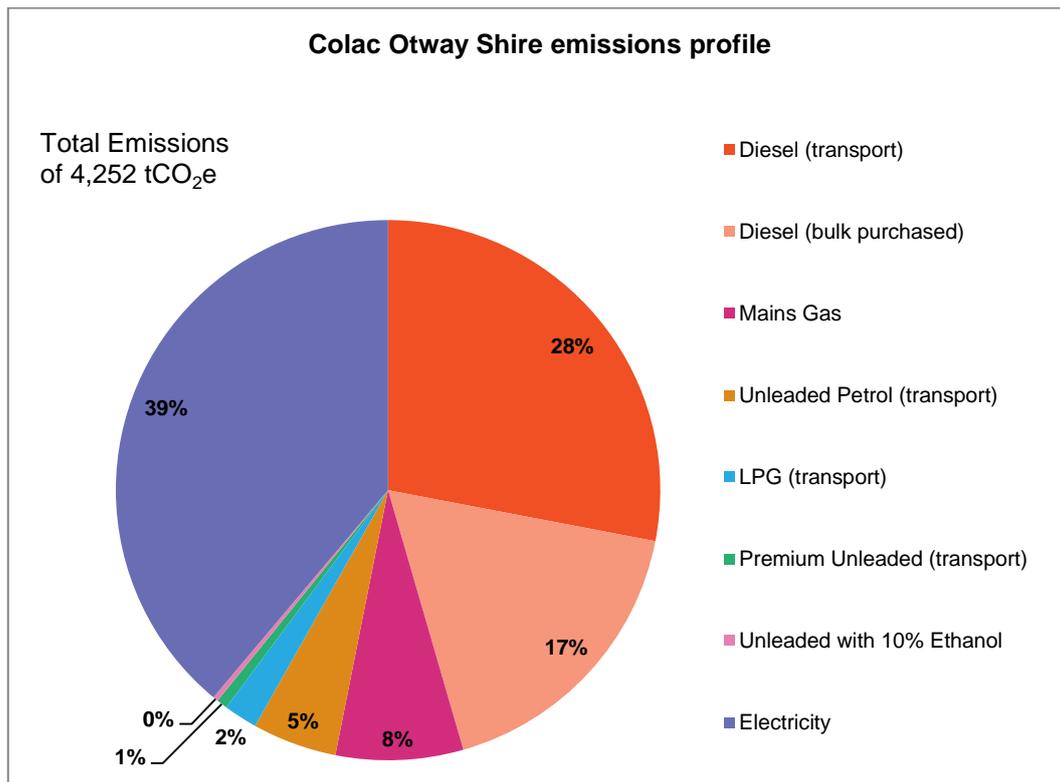


Figure 2 Colac Otway Shire Council – greenhouse gas emissions profile

It should be noted that if Council chose offset its total Scope 1 and 2 carbon emissions ( $\approx 4,300$  tCO<sub>2</sub>e), this would amount to paying approximately \$94,000 per annum in carbon offsets (estimated at \$22 per tCO<sub>2</sub>e).

### Emission Reductions in the Context of Street Lighting

Although emissions from powering streetlights are Scope 3 emissions and not within the scope of this project, they are part of the context for the Council's energy use and emissions. Figure 3 provides a comparison between streetlight emissions and Council Scope 1 and 2 emissions in 2011/12. This is based on Powercor and Energex billing data.

<sup>4</sup> It should be noted that as per Appendix B, Arup's initial review of the inventory showed that diesel used in plant vehicles and equipment were not included, and as such, Arup have manually calculated and added the emissions to the inventory.

Total streetlight emissions are almost 1,900 tCO<sub>2</sub>e, which is equivalent to around 40% of Council’s Scope 1 and 2 emissions.

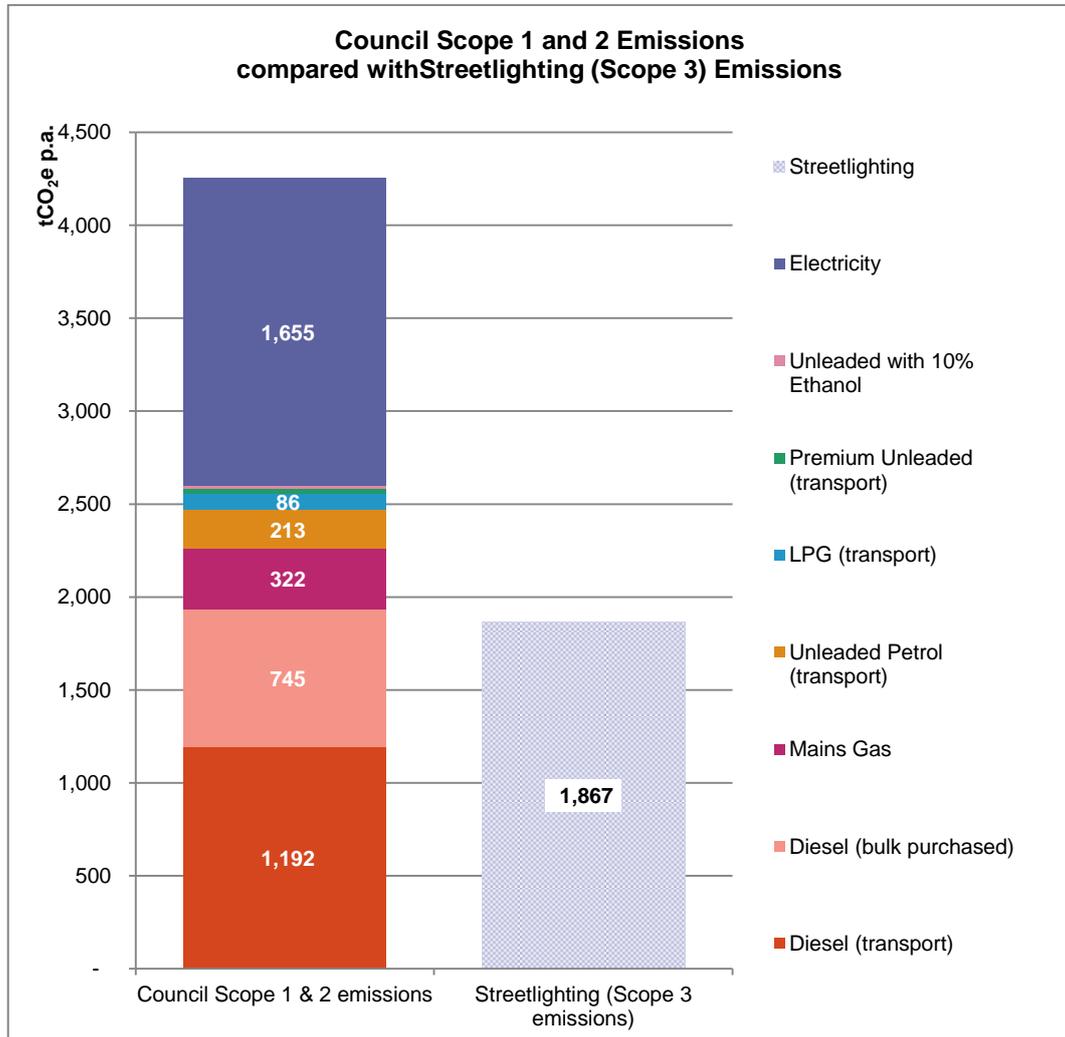


Figure 3 Colac Otway Shire Council breakdown of greenhouse gas emissions

Arup estimates that Council spends around \$1.5 million each year on energy for Scope 1 and 2 emissions. Streetlights are an additional \$84,000, which represents a significant cost. Even though streetlights are Scope 3 emissions, Council has focused on reducing energy for streetlights as part of managing its risk to energy price increases.

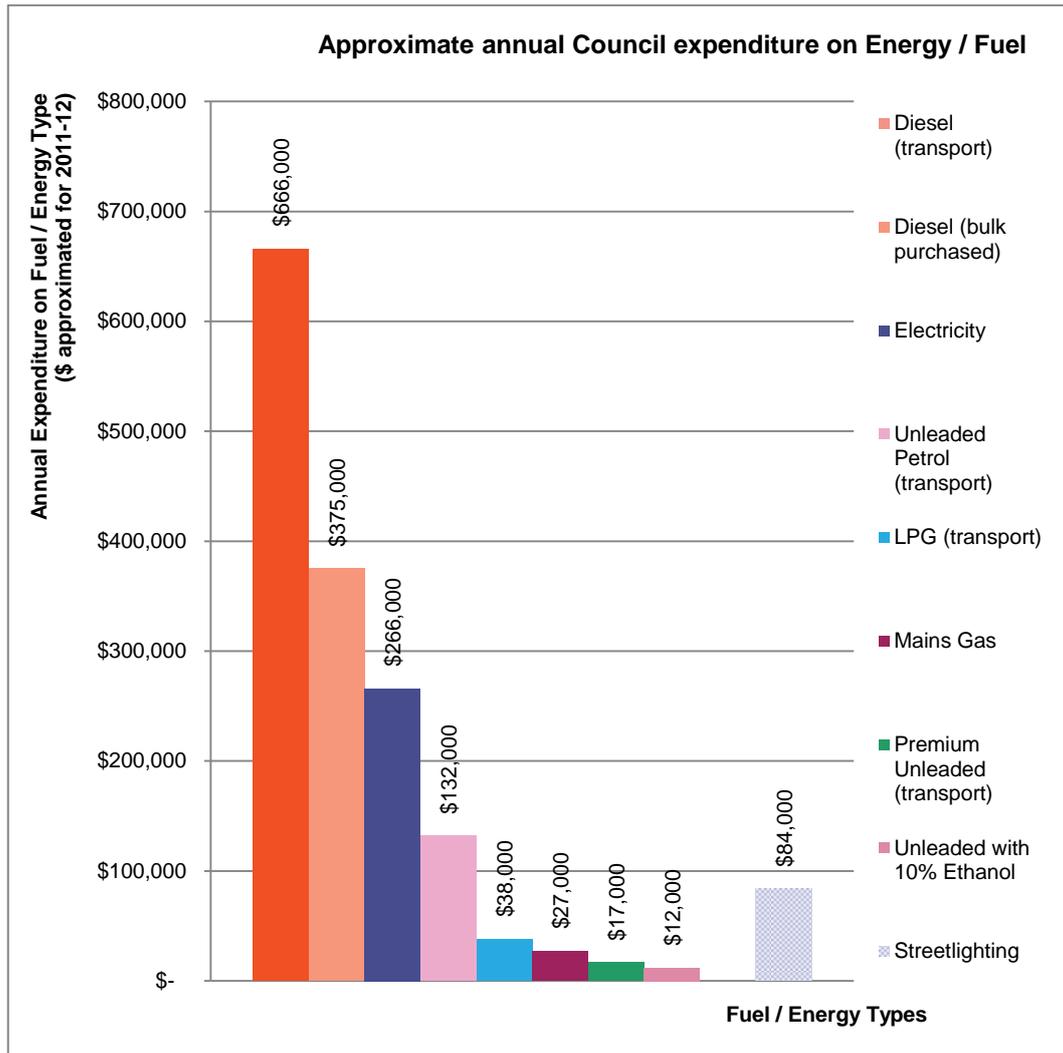


Figure 4 Breakdown of approximate annual Council expenditure on energy and fuel

## 2.2 Task 2: NGER reporting framework

Arup developed a reporting framework for the Shire based on the NGER guidelines. The purpose of this framework is to provide the Council with a template document to adapt and implement as a consistent approach for data collection and reporting.

The reporting framework is provided in Appendix B.

## 2.3 Task 3: Options review and identification

Based on the results of the emission review in Task 1, Arup identified a long list of relevant carbon reduction opportunities across Shire properties.

This list covers both energy demand and supply in the Shire's corporate operations including building retrofit for energy efficiency, the types of fuels used for vehicles, and renewable energy supply. This list also encompasses actions nominated in the Shire's 2012 Community Energy Efficiency Program (CEEP) funding application and recent lighting audits.

Initiatives were identified across the following categories:

- Buildings
- Public lighting
- Corporate fleet, and
- Heavy fleet.

The output of Task 3 is a list of initiatives to be examined as part of the cost-benefit analysis in Task 4.

## 2.4 Task 4: Cost-benefit analysis

Arup undertook a cost-benefit analysis of the initiatives identified in Task 3.

Colac Otway Shire Council's mission is to work in partnership with the community and other organisations to provide:

- Effective leadership, governance and financial accountability
- Affordable and effective services, and
- An advocacy and engagement approach to sustainably grow our community.

The Council considers a range of drivers for making budget decisions such as community engagement, social inclusion, environmental quality and responding to stakeholder interests. The outputs of the analysis provide Council with information which complements this prioritisation process as an understanding of the financial costs and benefits of initiatives that can assist Council to deliver cost-effective services to the community.

For Task 4, Arup calculated the total capital cost and carbon reduction potential of each initiative. The following were key references for these estimates:

- Rawlinsons Construction Cost Guide 2012.
- Facility Management Association of Australia (FMA) guide 2010, *An operational Guide to Sustainable Facilities Management*.
- Direct information from manufacturers of a range of efficient and renewable technologies, and
- The Green Vehicles Guide, accessed online February 2012 at <http://www.greenvehicleguide.gov.au/GVGPUBLICUI/home.aspx>

This data was used to calculate the Net Present Value (NPV – the current value of future cash flows) and cost per tonne of greenhouse gas emissions (\$/tCO<sub>2</sub>e) cost of carbon reduction over the 10 year analysis period.

### Financial parameters and terms

**Weighted average cost of capital** – The rate at which Council can access funding. This study is based on a rate of 7.75% which is a typical commercial interest rate for investment. In this analysis, the rate is used to discount future costs and benefits to present day so that options can be compared to each other.

**Investment time horizon** – The analysis considers costs and benefits over a 10 year investment timeframe, which aligns with the Council's capital works plan.

To provide a common starting point for comparison, the analysis assumes that all identified initiatives are adopted simultaneously adoption by the Shire in Year 1 (nominally 2012) however, it is acknowledged that in reality carbon reduction initiatives will occur in stages over a longer period.

The analysis also assumes that financial savings through reduced utility bills are realised from 2013 onwards and remain constant each year.

In most cases, operational and maintenance costs have not been included. For example, lighting initiatives include the upfront installation cost per building and no maintenance costs. However, where data is readily available, operational costs are included as documented in Appendix A.

The key findings of Tasks 3 and 4 were presented to Shire councillors in February 2013.

## **2.5 Task 6: Carbon neutral Colac Otway by 2016: Options & cost-benefit report**

The results of Task 1 to 5 have been consolidated in this draft Report which will be revised and finalised following the receipt of Shire comments.

## **2.6 Tasks 7 and 8: Presentation and Carbon Neutral Plan roadmap**

A presentation with Councillors was held on the 27<sup>th</sup> of February 2013. The purpose of the presentation was to communicate key findings and discuss preferred options for the Shire achieving its carbon reduction objectives.

The final task, a Carbon Neutral Plan roadmap, summarises the discussion and implementation plan for the development and delivery of a Carbon Neutral Plan.

### 3 Options review and identification

The following initiatives were examined as part of the cost benefit analysis.

Table 2 List and description of initiatives reviewed

Category	Sub-category	Ref #	Initiative	Description
Buildings	Energy supply	1	Cogeneration	Installation of a 70kWe cogeneration facility in Blue Water Fitness Centre
		2	Solar hot water (Sites with Gas Heating)	Solar hot water panels reduce heating requirements (for gas heating supplement)
		3	Solar hot water (Sites with Electric Heating)	Solar hot water panels reduce heating requirements (for gas heating supplement)
		4	Solar PV - Large sites	Solar PV panels reduce electricity requirements (for lighting and appliances)
		5	Solar PV - Small sites	Solar PV panels reduce electricity requirements (for lighting and appliances)
	Appliances	6	Switch to energy efficient refrigerators	Old refrigerators often use significantly more energy than new, energy efficient alternatives
	Heating, Ventilation and Air Conditioning (HVAC)	7	Gas heating (Split system air-conditioner replacement)	Switch to gas heating rather than air-conditioning for heating. Reduction of refrigerants also. Does not take into account gas connection costs
		8	Mechanical building management system (MBMS) - Large sites	Mechanical building management system (MBMS) can control the operating period and performance of the building service systems
	Building fabric	9	High Performance Glazing (Double-Glazing) - Small sites	High performance glazing reduces energy consumption, lowers heat loss and air leakage and minimizes condensation
		10	High Performance Glazing (Double-Glazing) - Large sites	As above
		11	Wall insulation - Small sites	Upgrading of wall insulation to reduce heating and cooling requirements
		12	Wall insulation - Large sites	As above
		13	Roof insulation - Small sites	Upgrading of roof insulation to reduce heating and cooling requirements
		14	Roof insulation - Large sites	As above

Category	Sub-category	Ref #	Initiative	Description
		15	Highly reflective paint - Large sites	Highly reflective paint is a heat reflective paint, which reflects energy. This reduces requirements for air conditioning within the building
		16	Draught proofing – Large sites	Draught proofing of vents and openings of buildings with seals.
	Lighting	17	Sensor lighting	Sensors may be installed to control when lighting system in certain facilities is turned on, such as meeting spaces
	18	Lighting upgrades	Convert old lighting to more efficient T5 fluorescent lamps	
	19	Photocells	Photocells can be used to turn off electric lighting when daylight is adequate, reducing energy consumption. These can be implemented in combination with a management based approach, which turns off lighting within rooms, when not in use	
Transport	Heavy Fleet	20	Purchase B20 Biodiesel fuel	Biodiesel is a lower carbon intensity option than other commonly used fuels such as LPG. B20 accounts for 20% of the diesel being from biodiesel. B20 is known for only a very minor reduction in engine performance, as opposed to B100.
		21	Hybrid truck replacement	Hybrid trucks are an efficient and sustainable vehicle option
	Corporate Fleet	22	Purchase Ethanol Blend for Petrol Vehicles	Ethanol blends as less emission intensive than petrol
		23	Adopt LPG fuelled vehicles	LPG is a lower emission fuel than standard petrol
		24	Electric vehicle trial	Electric vehicle trials may be undertaken on like vehicles
Public Lighting	Lighting	25	T5 Lighting Replacement	Replacement of 42W CFL's with T5s within toilet blocks
		26	32W CFL Lighting Replacement	Replacements of both 42W and 80W lights with 32W CFLs

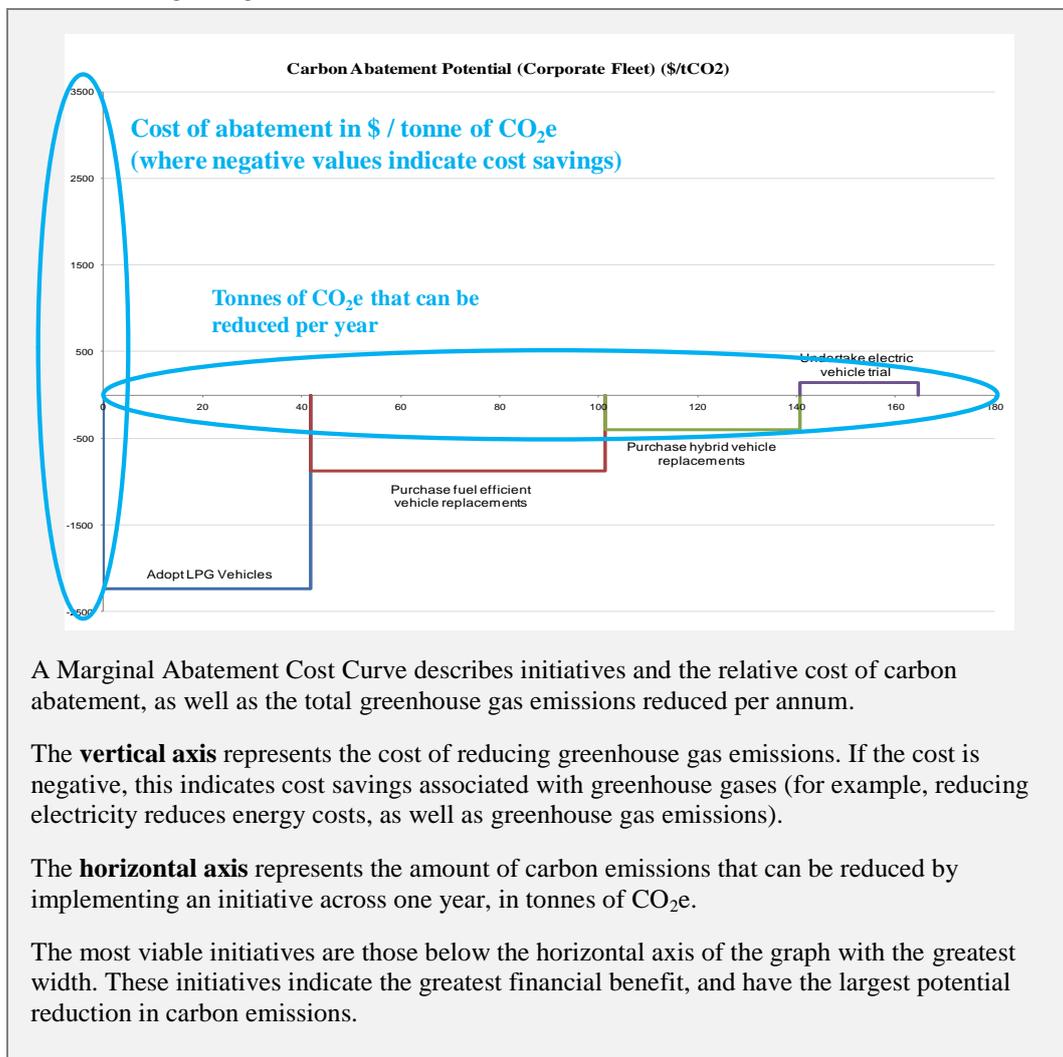
## 4 Cost-benefit analysis

The following section presents the results of the cost-benefit analysis for:

- Buildings
- Corporate fleet
- Heavy fleet, and
- Public lighting initiatives.

The results of the analysis are shown graphically as a Marginal Abatement Cost Curve (MACC). Box 1 provides a short description of how a MACC is interpreted.

### Box 1 Reading Marginal Abatement Cost Curves



## 4.1 All initiatives

The costs and benefits of each initiative are summarised in Table 3 and Figure 5.

Figure 5 also shows the equivalent additional cost for Green Power (additional to normal electricity rates).

Table 3 Summary results table for all initiatives

#	Initiative	Annual emissions savings (tCO <sub>2</sub> e/ annum in 2013)	Capital cost	Total NPV (\$ over 10 years)	Cost per abatement (\$/tCO <sub>2</sub> e)
1	Cogeneration	315	\$178,000	-\$81,000	-\$30
2	Solar hot water (Sites with Gas Heating)	16	\$288,000	\$279,000	\$1,993
3	Solar hot water (Sites with Electric Heating)	18	\$100,000	\$71,000	\$451
4	Solar PV - Large sites	102	\$366,000	\$207,000	\$237
5	Solar PV - Small sites	84	\$304,000	\$172,000	\$237
6	Switch to energy efficient refrigerators	3	\$61,000	\$57,000	\$2,292
7	Gas heating (Split system air-conditioner replacement)	41	\$82,000	\$32,000	\$97
8	Mechanical building management system (MBMS) - Large sites	28	\$24,000	\$23,000	\$99
9	High Performance Glazing (Double-Glazing) - Small sites	5	\$385,000	\$378,000	\$8,744
10	High Performance Glazing (Double-Glazing) - Large sites	24	\$97,000	\$61,000	\$298
11	Wall insulation - Small sites	9	\$93,000	\$80,000	\$1,034
12	Wall insulation - Large sites	43	\$75,000	\$7,000	\$20
13	Roof insulation - Small sites	16	\$52,000	\$28,000	\$205
14	Roof insulation - Large sites	95	\$62,000	-\$76,000	-\$92
15	Highly reflective paint - Large sites	28	\$185,000	\$141,000	\$577

#	Initiative	Annual emissions savings (tCO <sub>2</sub> e/ annum in 2013)	Capital cost	Total NPV (\$ over 10 years)	Cost per abatement (\$/tCO <sub>2</sub> e)
16	Sensor lighting	104	\$126,000	-\$37,000	-\$41
17	Lighting upgrades	175	\$110,000	-\$164,000	-\$109
18	Photocells	35	\$488,000	\$433,000	\$1,451
19	Draught proofing - Large sites	39	\$16,000	-\$42,000	-\$125
<b>Buildings (above initiatives) Sub-Total<sup>5</sup></b>		<b>1,180</b>	<b>\$3,092,000</b>	<b>\$1,721,000</b>	<b>-</b>
20	Purchase B20 Biodiesel fuel	151	\$0	-\$235,000	-\$173
21	Hybrid truck replacement	57	\$183,000	\$58,000	\$113
22	Purchase Ethanol Blend for Petrol Vehicles	37	\$0	\$162,000	\$485
23	Adopt LPG fuelled vehicles	38	\$75,000	-\$451,000	-\$1,323
24	Electric vehicle trial	32	\$126,000	-\$82,000	-\$285
<b>Fleet (above initiatives) Sub-Total<sup>5</sup></b>		<b>315</b>	<b>\$384,000</b>	<b>-\$548,000</b>	<b>-</b>
25	T5 Lighting Replacement	26	\$4,000	-\$37,000	-\$156
26	32W CFL Lighting Replacement	40	\$9,000	-\$53,000	-\$148
<b>Public Lighting (above initiatives) Sub-Total<sup>5</sup></b>		<b>66</b>	<b>\$13,000</b>	<b>-\$90,000</b>	<b>-</b>
<b>TOTAL</b>		<b>1,561</b>	<b>\$3,489,000</b>	<b>\$1,083,000</b>	<b>-</b>

<sup>5</sup> It should be noted that the sub-totals identified are hypothetical in nature, i.e. they will not account for the cumulative savings (carbon, energy and respective financial savings) of combined initiatives. This is due to the initiatives being investigated in an isolated manner and as independent initiatives, rather than a set of initiatives.

In summary:

- If **all** emissions reduction initiatives listed were implemented in 2013, the total carbon abated would amount to almost 1,600 tCO<sub>2</sub>e in the first year.<sup>6</sup>
- If all **building-related** emissions reduction initiatives were implemented, the total carbon abated would amount to around 1,200 tCO<sub>2</sub>e, which is equivalent to almost 30% of the Council's total Scope 1 and 2 emissions.
- If all **fleet-related** emissions reduction initiatives were implemented, the total carbon abated would amount to 315 tCO<sub>2</sub>e.

The initiatives with negative NPV for investment over a 10 year period are considered 'low hanging fruit' i.e. initiatives that pay back of upfront costs through savings in energy expenditure. Such initiatives should be the first priority for investment and implementation.

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<sup>6</sup> The modelling as removed the purchase of ethanol blends for petrol vehicles to avoid duplications with the purchase of LPG vehicles.

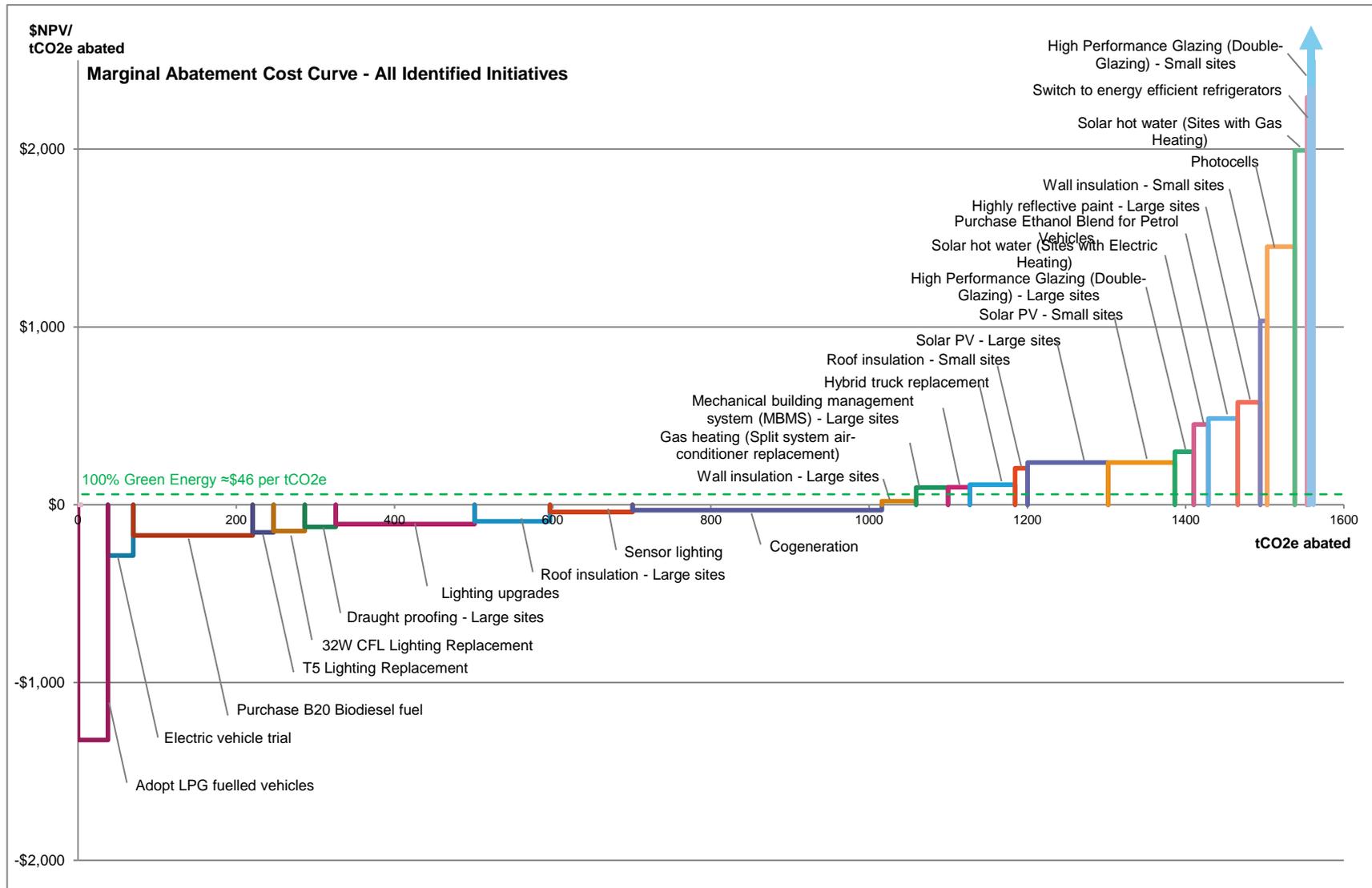


Figure 5 Carbon abatement potential (\$/tCO<sub>2</sub>e) - All

## 4.2 Buildings

The emissions reduction opportunities in the Shire's building portfolio were analysed separately for small and large sites.

Large sites include the following building assets:

- The Bluewater Fitness Centre
- COPACC Rae St Offices, and
- COPACC Theatre.

Small sites include the following building assets:

- Administrative Offices
- Animal Control
- Clubrooms
- Community Early Childhood and Maternal Health
- Older People Services
- Saleyards
- Sheds / garages
- Shelters
- Transfer Stations
- Tourist Information Centres, and
- Work Depot.

The use of two building category sizes reflects differences in energy demands, consumption profiles and suitability of particular initiatives. All asset types, as listed in both the Shire's electricity records and building asset register, have been captured within these two categories.

The results of the MACC analysis are shown in Figure 6. Of particular note is the potential initiative to introduce cogeneration infrastructure within the Bluewater Fitness Centre which may provide 30% of the total annual emission reductions.

Initiatives that were identified as having overall benefit (i.e. negative NPV) are:

- Cogeneration
- Draught proofing (for large sites)
- Lighting upgrades
- Roof insulation (for large sites), and
- Sensor lighting.

A number of initiatives reduce the consumption of gas, particularly for space heating. These include roof insulation (small sites), replacement of split system air conditioning with gas heating, solar hot water (sites with gas heating) and the introduction of a mechanical building management system on large sites.

It must be noted however that because of the relatively low cost of gas, these initiatives are less favourable in terms of financial costs and carbon benefit.

## Growth

Three major building developments are planned for the Shire over the short term:

- A \$10 million redevelopment of the Bluewater Fitness Centre
- Redevelopment of a hardware store into a community facility, and
- Expansion of the Council offices at Rae St.

These developments will have a significant impact on the Council's emissions and in turn, the ability to meet its carbon neutral target by 2016. Electricity and gas consumption in particular are likely to increase.

In light of this projected growth, Arup encourages the Shire to develop stringent energy efficient design and operation policies to ensure realisation of a low carbon development.

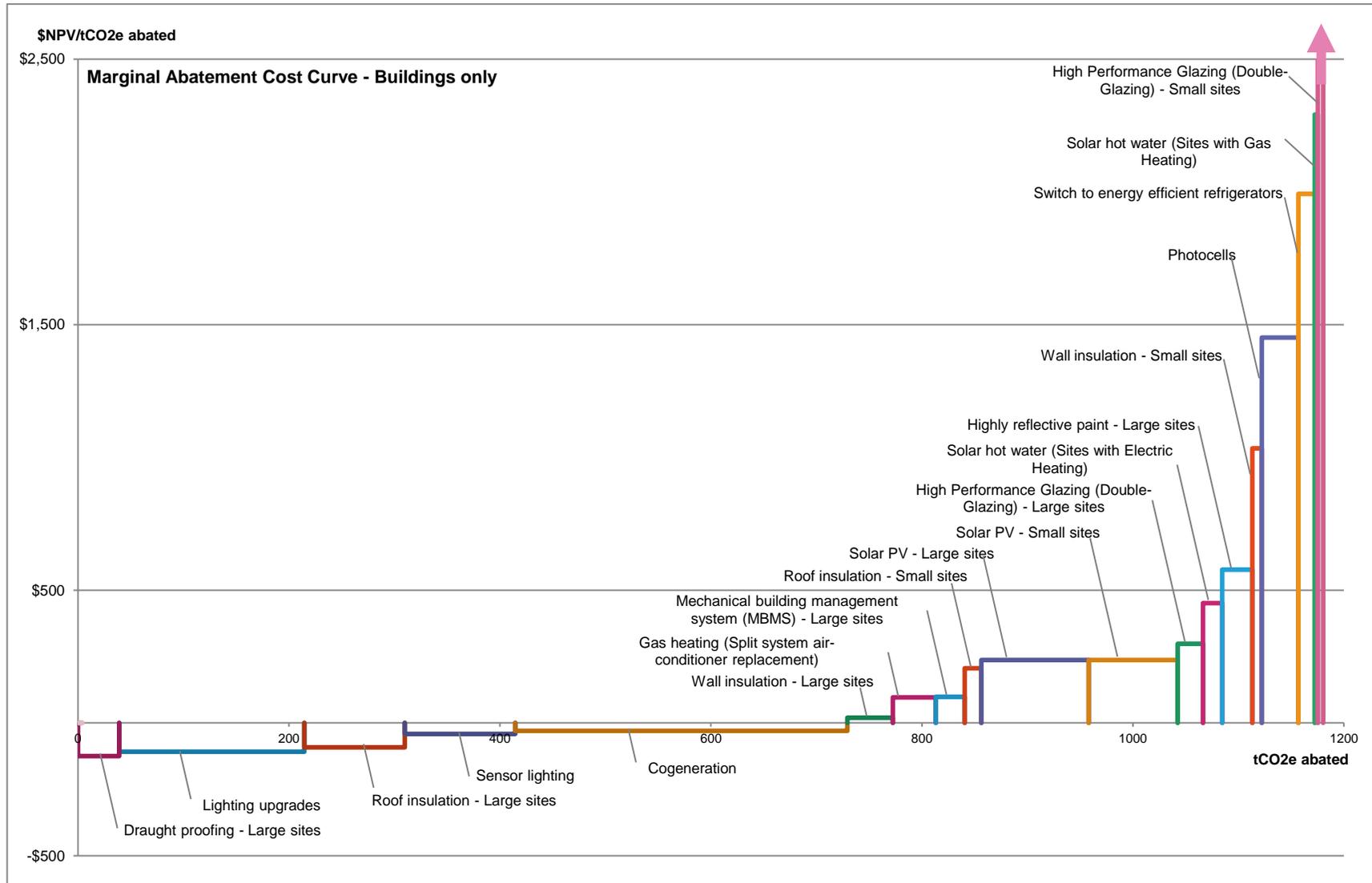


Figure 6 Carbon abatement potential (\$/tCO<sub>2</sub>e) – Buildings

### 4.3 Fleet vehicles

The Shire's transport fleet was separated into two categories: corporate fleet and heavy fleet. This categorisation reflects differences in vehicle types and use. Table 4 includes examples of vehicle types in these categories.

A full list of the captured vehicles has been included as part of the assumptions listed in Appendix A.

Table 4 Example vehicle types by fleet category

Fleet category	Example vehicles
Corporate Fleet	Subaru Liberty sedan Toyota Aurion Ford Falcon wagon Holden Rodeo
Heavy Fleet	5 metre truck 2t truck Grader Sweet sweeper

#### Corporate fleet

The emissions reduction potential of corporate fleet initiatives is shown in Figure 7. Three initiatives were examined:

- The adoption of LPG vehicles
- Electric vehicle trials, and
- The purchase of ethanol blends for use within petrol vehicles.

These are anticipated to reduce approximately 107 tCO<sub>2</sub>e per annum representing around 3% of the Shire's transport related emissions.<sup>7</sup>

As shown in Figure 7, the most financially viable option is the adoption of LPG vehicles to replace petrol fuelled vehicles. The range of commercially available LPG vehicles allows the replacement to be cost competitive with its petrol comparisons.

Noticeable emission reductions can be achieved with the introduction of electric vehicles as a replacement of 'like' vehicles such as the Volkswagen and Toyota Corolla hatchbacks. Importantly, the cost savings associated with these vehicles allow the capital cost to be paid back over the ten year period.

The purchase of ethanol blended fuel has a cost impost. This is due to minimal emission savings and increases in the cost of fuel, as well as a potential reduction in fuel efficiency (fuel efficiency is reduced by 20% with this option).

<sup>7</sup> This considers the Shire's 2011/12 carbon footprint, as reported by Planet Footprint. Bulk biodiesel purchases have been included for completeness.

## Heavy fleet

The opportunities for emissions reductions from heavy fleet vehicles across the Shire's operations was limited due to the need to ensure replacement options are able to carry out 'like' functions. Smaller, more energy efficient vehicles such as hybrids were therefore generally not applicable, as they would not be able to undertake the same function.

With this in mind, the following initiatives were examined:

- The use of B20 biodiesel fuel, and
- The replacement of applicable trucks with hybrid trucks.

The results are shown in Figure 7. The introduction of B100 has the potential to provide annual carbon reductions however, the reduced fuel efficiency and the fuel availability regionally, makes it an impractical option.

B20, however, has minimal impact on fuel efficiency, and may be more readily available, even in regional areas.

Hybrid truck replacements are relevant for some light trucks. This analysis considers the replacement of 50% of light trucks with a hybrid option. While this would reduce emissions, the high capital cost makes it an expensive option, even over the ten year period.

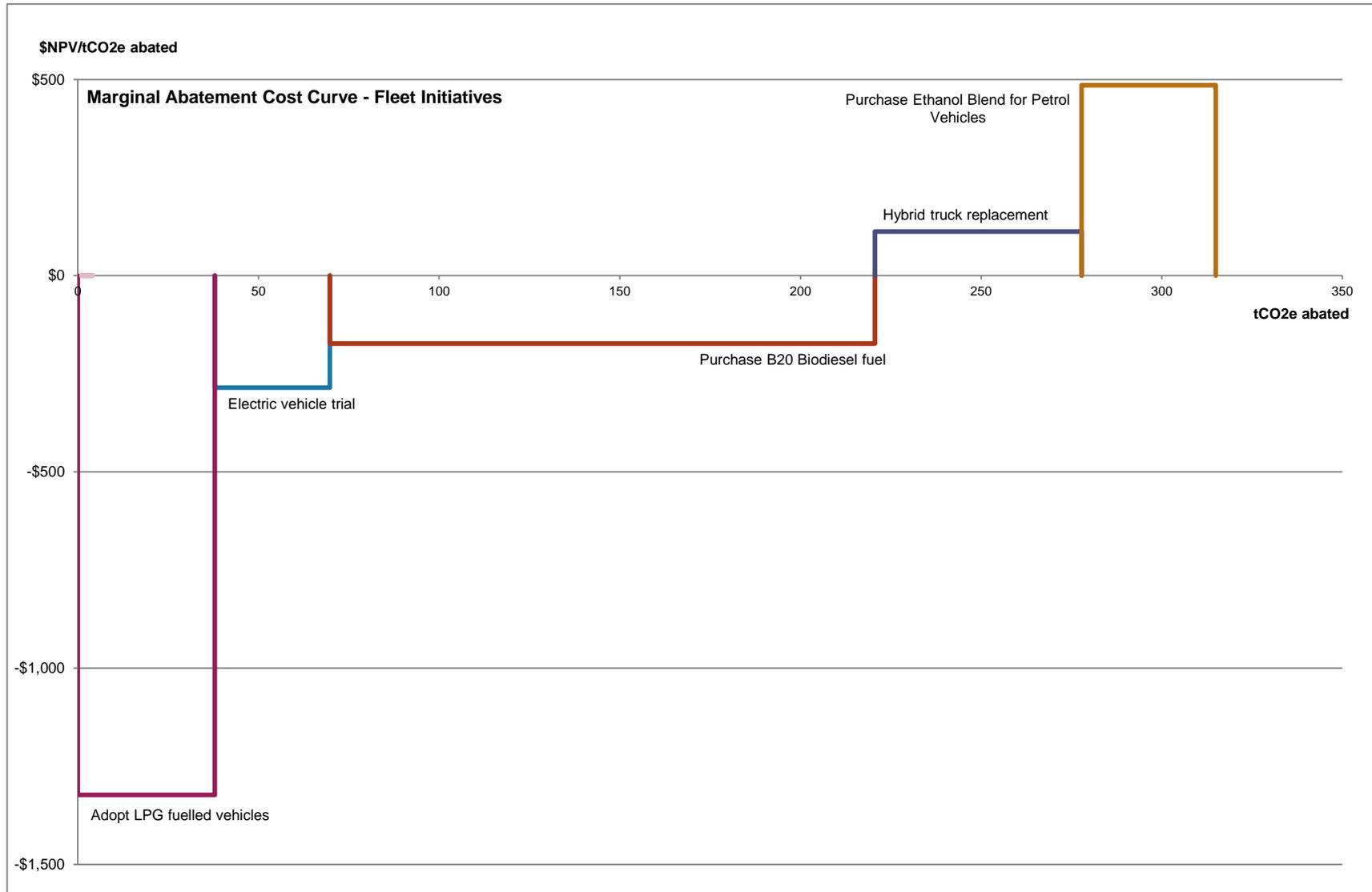


Figure 7 Carbon abatement potential (\$/tCO<sub>2</sub>e) – Corporate and Heavy Fleet

## 4.4 Public lighting

Public lighting includes lighting associated with car parks, reserves and public toilets. As shown in Figure 8, two initiatives were considered:

- Replacement of 42 W fluorescent lights in public toilets with T5 lights, and
- Replacement of both public and reserve lighting (80 W) with 32 W fluorescent lights.

Both initiatives are presented as having cost savings over the ten year period, with replacement technology being readily and relatively cheaply available. Applying both of these initiatives would reduce emissions by approximately 66 tCO<sub>2</sub>e each year.

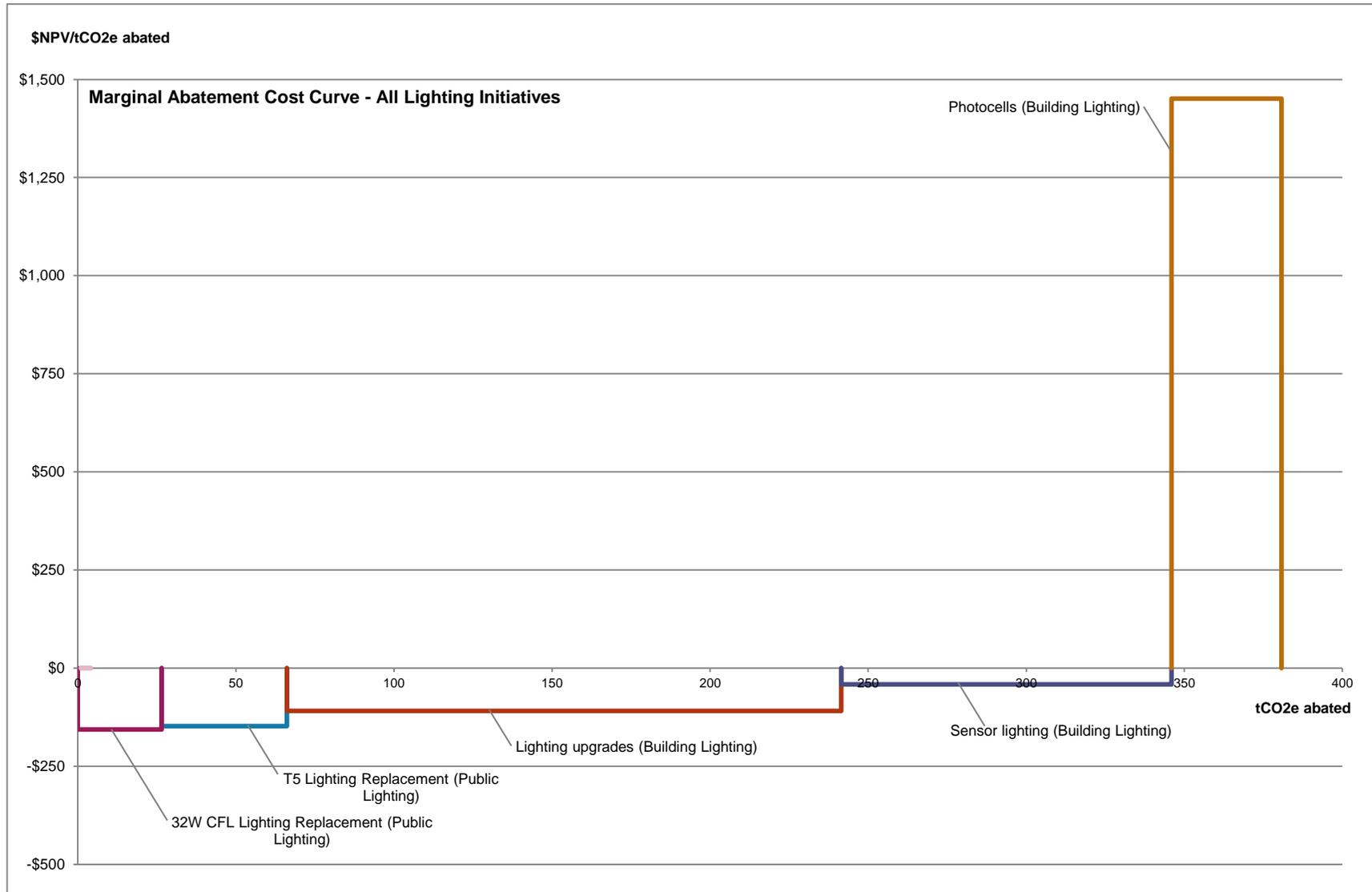


Figure 8 Carbon abatement potential (\$/tCO<sub>2</sub>e) – Lighting (public lighting and in buildings)

## 4.5 Recommended initiatives

Based on the cost-benefit analysis, Arup recommend that the initiatives in Table 5 are prioritised by Council.

Together, these are anticipated to reduce emissions by around 1,000 tCO<sub>2</sub>e per annum, representing approximately a 25% reduction on the Shire's 2011/12 carbon footprint.

Table 5 Priority initiatives based on cost-benefit analysis

Sub-category	Initiative	Average emissions savings (tCO <sub>2</sub> e/annum)	Capital cost	Savings over 10 years (\$ total)
Buildings	Cogeneration	315	\$178,000	-\$259,000
	Roof insulation - Large sites	95	\$62,000	-\$138,000
	Sensor lighting	104	\$126,000	-\$163,000
	Lighting upgrades	175	\$110,000	-\$274,000
	Draught proofing - Large sites	39	\$16,000	-\$58,000
	<b>Sub-total</b>	<b>728</b>	<b>\$492,000</b>	<b>-\$892,000</b>
Fleet (heavy and corporate)	Purchase B20 Biodiesel fuel	151	\$0	-\$235,000
	Adopt LPG fuelled vehicles	38	\$75,000	-\$526,000
	Electric vehicle trial	32	\$126,000	-\$208,000
	<b>Sub-total</b>	<b>221</b>	<b>\$201,000</b>	<b>-\$969,000</b>
Public Lighting	T5 Lighting Replacement	26	\$4,000	-\$41,000
	32W CFL Lighting Replacement	40	\$9,000	-\$62,000
	<b>Sub-total</b>	<b>66</b>	<b>\$13,000</b>	<b>-\$103,000</b>
<b>TOTAL</b>		<b>1,015</b>	<b>\$706,000</b>	<b>-\$1,964,000</b>

In addition, a number of initiatives which have a small positive NPV (small cost) may be considered in conjunction with those items listed in Table 5.

These include:

- Roof insulation (for small sites in particular)
- Gas heating (for sites with split-system air conditioners)
- Hybrid truck replacements, and
- Solar PV (small and large sites).

The Shire may also consider the uptake of initiatives for non-financial reasons such as ease of implementation, community expectations or because it provides a visible showcases of the Council's sustainability vision.

An implementation plan will help to ensure the long-term process of emissions reduction is planned, resourced and monitored.

## 5 Possible carbon reduction target

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Arup analysed a sequenced combination of emissions reduction initiatives in order to understand how far emissions could be reduced before the purchase of carbon offsets to achieve carbon neutrality.

The sequence was:

1. Initial investment is made for all financially beneficial initiatives (cumulative \$NPV < \$0)
2. Once initiatives in Step 1 were implemented, invest in reasonable cash negative initiatives (cumulative \$NPV < \$100)
3. Once initiatives in Step 1 and 2 were implemented, investment in all initiatives (cumulative \$NPV > \$100).

The results of the analysis are shown in Figure 9 and Figure 10.

Theoretically, if initiatives were implemented to achieve cost neutrality<sup>8</sup> over the ten year analysis period, around 1,000 tCO<sub>2</sub>e could be reduced each year. This is almost 25% of total Council emissions, or around 50% of building-related Council emissions.

Further reductions would require additional capital investment. The remaining emissions would be approximately 3,400 tCO<sub>2</sub>e.

If, instead of implementing the more costly emissions reduction initiatives, the Council chose to purchase carbon offsets, then at the current price for Voluntary Carbon Standard offsets (\$22 per tCO<sub>2</sub>e) this would be \$66,000 each year.

If all electricity from buildings was offset by the purchase of GreenPower, this would reduce emissions by around 1,700 tCO<sub>2</sub>e each year; a cost of approximately \$59,000-60,000 per annum (at \$44 per MWh for GreenPower, as quoted by AGL Business Services for Colac large sites on 13 January 2013) which is in addition to standard electricity costs. Further discussion of offset options is provided in Section 6.

Regarding transport-related emissions, only a 7% reduction (of total Council emissions) is possible through the uptake of the initiatives analysed in this Report. Further reductions may be achieved by Shire behavioural mechanisms such as:

- Driver training for fuel efficiency – Programmes such as Safe and Fuel Efficient Driving (SAFED) have shown fuel savings of up to 10%.
- Vehicle maintenance – Simple measures like keeping tyres correctly inflated can save more than 3% in fuel.
- Careful consideration of what transport is deemed ‘necessary’ and whether downgrading of vehicles to more fuel efficient, low emission vehicles is possible given use patterns.

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<sup>8</sup> This assumes that initiatives can be funded using energy cost savings from the ‘low hanging fruit’ actions detailed in Section 4.5.

More than 50% of the Council's emissions are associated with fuel used in corporate and heavy fleet and plant. This reflects the nature of the Council's operations as a major regional municipality. In contrast, typically most emissions from smaller metropolitan councils come from buildings. Therefore, it may be useful to set an emissions reduction target separately for stationary emissions (building and public lighting) and fleet.

On the basis of the above discussion, a possible suite of targets are:

- Existing target – Carbon neutral by 2016.
- Cost-neutral target for total emissions reductions across Council – 20% by 2016 on a 2011/12 baseline.
- Building-related (this includes public lighting) emissions reduction target – 50% by 2016 on a 2011/12 baseline.
- Vehicles-related emission reduction target – 10% by 2020 on a 2011/12 baseline.

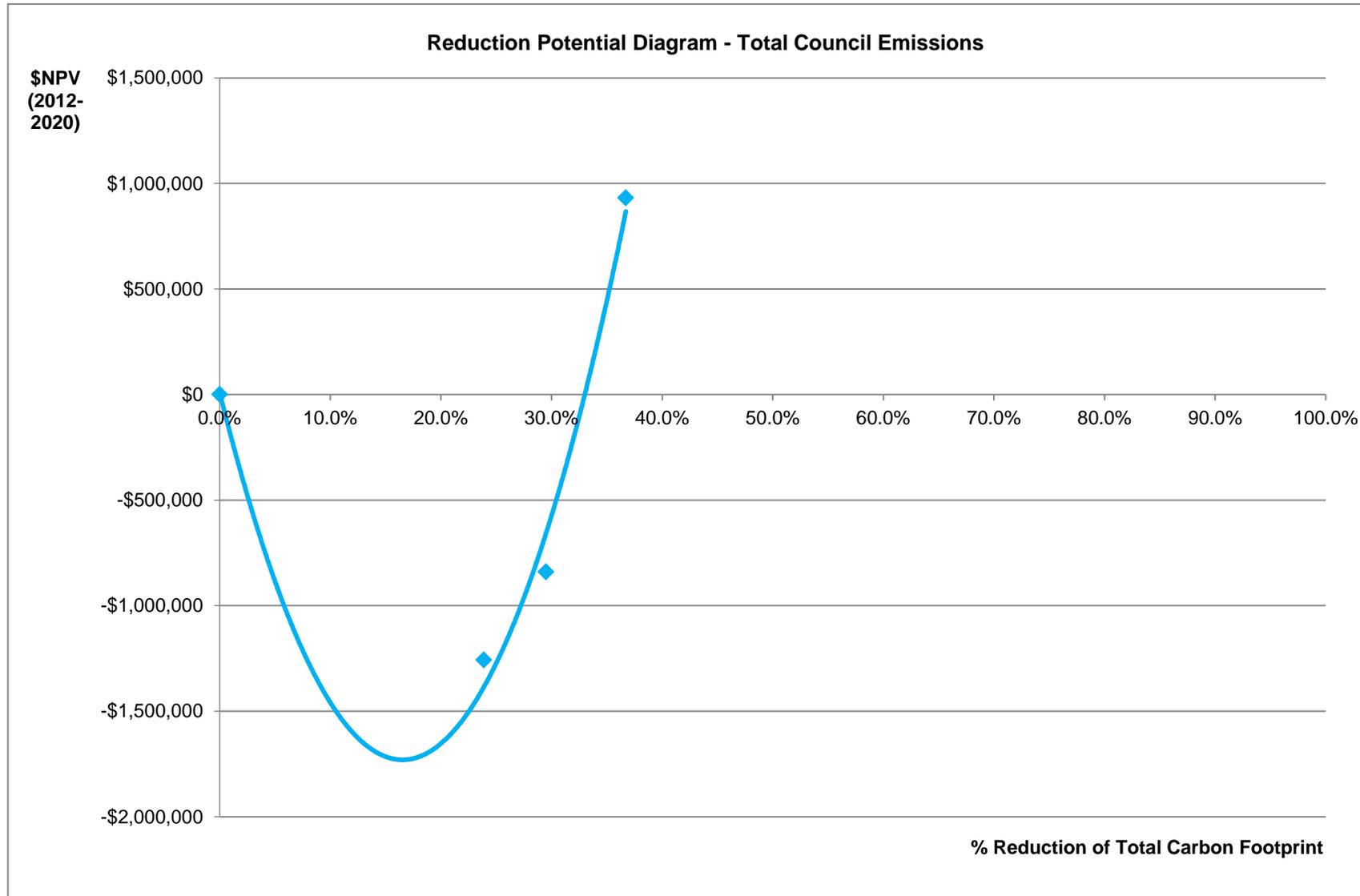


Figure 9 Carbon abatement potential – All initiatives

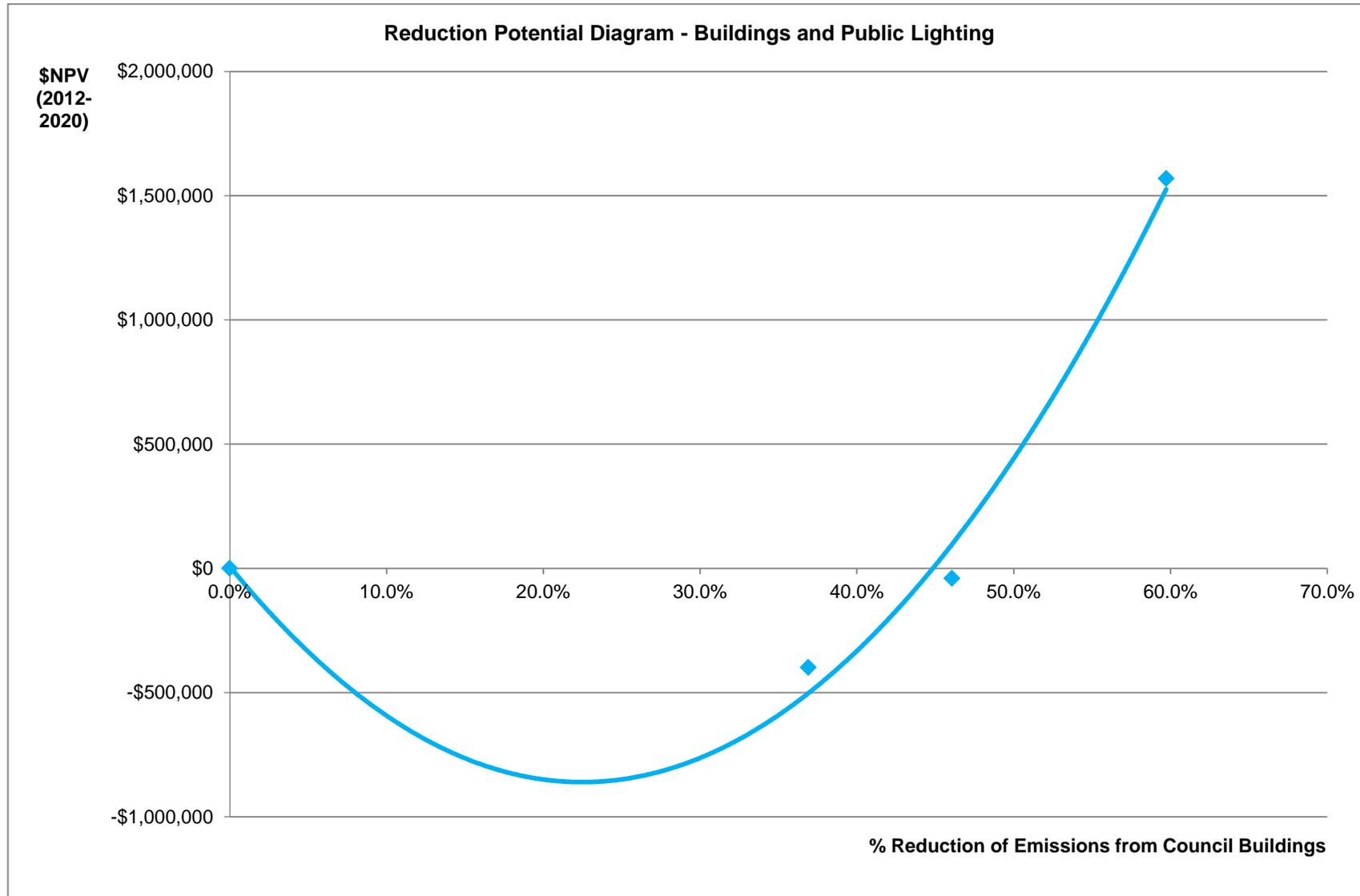


Figure 10 Carbon abatement – Buildings and public lighting

## 6 Options for carbon offsets

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### 6.1 Introduction to carbon offsetting

In order to achieve the 2016 target of carbon neutrality, residual emissions will need to be ‘offset’. This section provides an overview of carbon offsets and the issues for Council to consider before procuring any carbon offsets.

Carbon offsets are projects which compensate for emissions at one source by either investing in emissions avoidance elsewhere or removing carbon from the atmosphere. Common projects include renewable energy generation and reforestation.

Offset units (measured in tCO<sub>2</sub>e) are generated when organisations either undertake an emissions sequestration or avoidance project that is additional to their normal activities in order to compensate for emissions elsewhere. Organisations can also purchase offsets through another party.

Offsets may be traded between organisations through various markets. These markets have increasingly been established by various bodies as an economic-based approach to alleviating the growth of national and international emissions.

### 6.2 Types of offsets

The carbon market consists of a *compliance* and *voluntary* market. The compliance market comprises emitters who are legally required to reduce their emission levels. Compliant offsets are recognised by the Kyoto Protocol, which is the international legislation for emissions targets for countries.

The voluntary market consists only of organisations that voluntarily elect to participate in order to achieve emissions reduction targets or carbon neutrality. Organisations may voluntarily choose to purchase either Kyoto compliant or non-Kyoto compliant offsets.

Colac Otway Shire Council is not required to participate in any carbon market and is electing to participate on a voluntarily basis. Therefore the Council is able to purchase units within both the voluntary and compliance markets.

The National Carbon Offset Standard (NCOS) provides guidance for organisations which are participating in the carbon offset market on a voluntary basis. Published in 2010 the Standard specifies a list of voluntary and compliance generated units which are considered to be authentic and can be reliably procured by organisations.

Recognising this, key carbon offset markets have been separated into NCOS and non-NCOS recognised markets / units (Figure 11).

Participation in any of these approaches has implications for the type of credits purchased, as well as the nature of the offset project.

The selection of a final offset will depend on Council's preference in relation to:

- Locality.
- Project type.
- Project co-benefits.
- Cost, and
- Reputation implications.

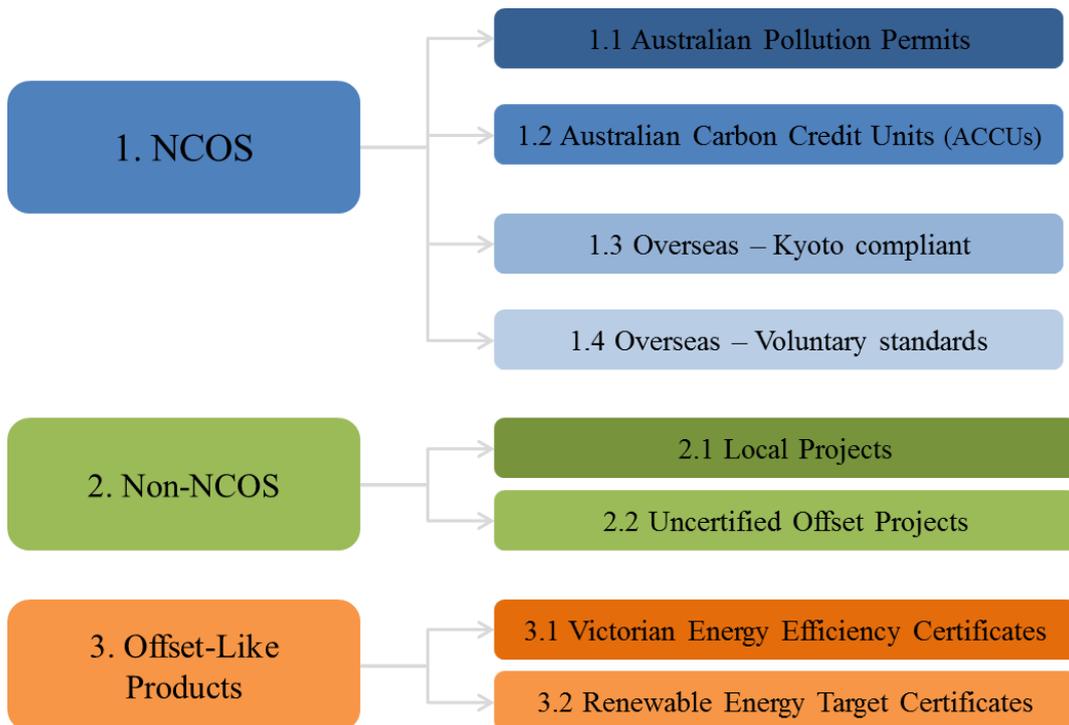


Figure 11 Available offset markets

## 6.3 NCOS markets

The National Carbon Offset Standard is the central framework for the procurement of offsets by organisations, such as Colac Otway Shire, which are not legally required to purchase offsets but wish to participate on a voluntary basis (often for reasons of achieving carbon neutrality).

The Standard recognises a number of units which are generated on both domestic and international markets. These NCOS recognised units are discussed below.

### 6.3.1 Australian pollution permits

In July 2011 the Federal Government released its plan for transitioning Australia towards a low carbon economy. The plan, known as The Clean Energy Future, establishes a range of programmes to support this goal.

The carbon price is one of the central elements of the Clean Energy Future plan and was established with the purpose of placing a price on greenhouse gas (GHG) emissions. The basic premise is that the largest polluters in Australia are required to buy a carbon pollution credit for every tonne of greenhouse gas they emit. This will create incentives for these organisations to reduce their exposure to the price through the adoption of energy efficiency, avoidance and switching to greener forms of energy.

The carbon price will be initially introduced as a fixed price scheme (with units issued by the Clean Energy Regulator at \$23 per tCO<sub>2</sub>e from 1 July 2012), before transitioning to a flexible price period from 2015 onwards.

Council is not required to buy pollution permits but may choose to do so to reduce the supply of permits for those organisations that are legally required to under the Carbon Price Mechanism.

#### Summary – Australian Pollution Permits

**Targeted market:** Australia's largest polluters who are legally required to 'surrender' pollution credits for their greenhouse gas emissions.

**Current price:** The permits will be initially introduced with a fixed price of \$23 / tCO<sub>2</sub>e.

**Why buy?** To reduce the availability of pollution credits from organisations captured under the carbon price, thereby encouraging these polluters to either pay more for each carbon permit or invest in emissions reduction initiatives.

**Process for procuring:** Purchase through third party carbon broker or offset provider.

### 6.3.2 Australian Carbon Credit Units (ACCUs)

The Carbon Farming Initiative (CFI) is the recognised domestic carbon offset and credit scheme that was established by the Clean Energy Future plan, alongside the carbon price.

Under the CFI, only projects undertaken as part of an approved methodology are eligible for participation. The units, known as Australian Carbon Credit Units (ACCUS), generate both Kyoto compliant and non-Kyoto compliant offsets units (Table 6) i.e. units which can contribute towards Australia's national target.

Table 6 Carbon projects categories under the Carbon Farming Initiative (CFI)

Offset Type	Compliance Market	Voluntary Market
Carbon Sequestration	<p><b>Forestry</b></p> <p>Reforestation</p> <p>Avoided deforestation of land that was forested on 31 December 1989</p> <p><b>Land Management</b></p> <p>Human induced regeneration of native vegetation on land that was forest on 31 December 1989 and has since been converted to a non-forest land use</p>	<p><b>Land Management</b></p> <p>Application of biochar to soil</p> <p>Restoration of wetlands</p> <p>Non-forest revegetation</p> <p>Native vegetation protection (non-forest)</p> <p>Human induced regeneration of native vegetation on non-deforestation land</p>
Emissions Avoidance	<p><b>Land Management</b></p> <p>Capture and combustion of methane from livestock manure</p> <p>Savanna fire management</p> <p>Reduced enteric fermentation in livestock</p> <p>Nitrification inhibitors to manure or fertilisers</p> <p><b>Waste</b></p> <p>Capture and combustion of methane from legacy waste at landfills</p> <p>Legacy waste diversion from landfill.</p>	<p><b>Land Management</b></p> <p>Introduced or feral animal management</p>

Council may elect to purchase either carbon price pollution units, or units generated through the CFI. Council (or businesses and households within Colac Otway Shire) may also become a producer of CFI credits, although the process of certification can be onerous.

**Summary – ACCUs**

**Targeted market:** Corporations liable under the Carbon Price Mechanism, who can buy Kyoto-compliant ACCUs to offset up to 5% of their liability during the fixed price period (2012-2015), except landfills, which can use ACCUs to offset up to 100% of their liabilities. Non-Kyoto ACCUs are targeted at individuals or organisations who are voluntarily offsetting emissions.

**Current price:** Unknown (to commence in 2015)

**Why buy?** To participate in Australian based projects recognised as high quality offsets.

**Process for procuring:** Purchase through carbon broker or offset provider.

**6.3.3 Overseas – compliance units**

There are a number of credits available within overseas compliance markets. This market captures the creation and trade of units which are generated by countries seeking to meet their emissions reduction obligations under the Kyoto Protocol.

Both the Clean Development Mechanism (CDM) and Joint Implementation (JI) Scheme are administered under the compliance market and applied between countries. Units (known as Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs)) purchased through these schemes contribute towards realising Australia's national targets.

**Summary – Overseas Kyoto compliant units**

**Targeted market:** Annex I countries (generally 'developed' nations) seeking to reduce greenhouse gas emissions in order to meet Kyoto emission reduction units.

**Current price:** \$17-37 tCO<sub>2</sub>e (CERs)<sup>9</sup>

**Why buy?** To purchase high quality offsets that are certified to contribute to the low carbon development of other countries.

**Process for procuring:** Purchase through a third party offset provider or broker.

**6.3.4 Overseas – voluntary units**

Two voluntary overseas standards are recognised by the NCOS:

- The Voluntary Carbon Standard, and
- The Gold Standard.

The Voluntary Carbon Standard is an international standard which is widely used for projects issuing credits onto the voluntary market. The Standard recognises projects which feature approved methodologies within a wide range of areas including energy generation, energy distribution, mining, agriculture, forestry and land use.

<sup>9</sup> Carbon Association Australasia Limited, Offset Market Prices, accessed online September 2012 at [http://www.caaltd.org/registry\\_offsetmarketprice.aspx](http://www.caaltd.org/registry_offsetmarketprice.aspx)

The Gold Standard accredits projects which not only reduce emissions but importantly are also underpinned by social co-benefits. Offsets units generated under the scheme stem from energy efficiency and renewable energy based projects. Due to the strong co-benefits of Gold Standard projects, these units are typically more expensive than those recognised under the Voluntary Carbon Standard.

#### Summary – Overseas Voluntary Standards

**Targeted market:** Organisations who are participating in the carbon market on a voluntary basis.

**Current price:** \$6-18 per tCO<sub>2</sub>e (VCS); >\$20 (GS)<sup>10</sup>

**Why buy?** Low cost of VCS units, or the strong social co-benefits of GS units, which may be preferred by stakeholders.

**Process for procuring:** Purchase through a third party offset provider or broker.

## 6.4 Non-NCOS markets

The following section provides a brief overview of the offset projects / markets which are not recognised under the NCOS.

Council is encouraged to assess any projects within these markets against each of the offset integrity principles established by NCOS: additional, permanent, measureable, transparent, avoidance, auditable and registered<sup>11</sup>.

### 6.4.1 Local projects in Colac Otway Shire

Council may elect to establish its own locally based projects. Projects would likely be focused on energy efficiency, renewable energy and/or land management.

These projects are considered to be non-NCOS compliant as they do not generate approved units i.e. they are not accredited under the voluntary or compliance standards and/or are undertaken without an approved CFI methodology however, Council may value the local benefits of own projects.

#### Summary – Colac Otway Shire local projects

**Targeted market:** Organisations who would like a local based project, and are not required to participate within the compliance market.

**Current price:** Not applicable.

**Why buy?** To generate a locally based carbon offset.

**Process for procuring:** Identify and establish an offset project for the community.

<sup>10</sup> Ibid.

<sup>11</sup> Department of Climate Change and Energy Efficiency (2012) National Carbon Offset Standard (Version 2), accessed online September 2012 at <http://www.climatechange.gov.au/ncos>.

## 6.4.2 Uncertified projects

There are a number of offset projects available which are not certified or accredited to an approved standard. Colac Otway Shire is encouraged to avoid these projects, as the integrity of the offset unit is unknown.

Council should seek evidence of standard accreditation for any offset projects to avoid these project types.

### Summary – Uncertified projects

**Targeted market:** Organisations seeking a cheap and unverified project.

**Current price:** Not available.

**Why buy?** Colac Otway Shire is encouraged to not consider buying these project types.

**Process for procuring:** Purchase through a third party offset provider or broker.

## 6.4.3 GreenPower

GreenPower is a voluntary renewable energy offset scheme run by the ACT, NSW, SA, QLD and VIC governments. The purpose of the scheme is to ensure consumers are able to purchase renewably sourced electricity from their providers which meet stringent environmental standards.

Eligible GreenPower sources include solar power, wind, biomass, wave and tidal power. The cost of purchasing this electricity is invested into the renewable energy sector<sup>12</sup>, contributing to improve renewable facilities and lower costs.

Council may purchase Green Power to offset residual emissions. In these instances Green Power is essentially treated as a zero emission source.

With increasing investment and customer purchasing it is understood that the cost of these offsets will reduce over time.

### Summary – GreenPower

**Targeted market:** Retail market within Australia.

**Current price:** \$44 per MWh<sup>13</sup> or \$46.15 - \$62.50 per tonne of CO2 offset<sup>14</sup>

**Why buy?** To support growth and investment in renewable energy sources.

**Process for procuring:** Contact a GreenPower provider listed on the GreenPower website (<http://www.greenpower.gov.au/Business/How-To-Switch/>)

<sup>12</sup> What is GreenPower, accessed online September 2012 at <http://www.greenpower.gov.au/About-Us/What-Is-GreenPower/>

<sup>13</sup> AGL Business Services (January 2013), communication to Colac Otway Shire regarding electricity prices for large sites

<sup>14</sup> QLD Water Commission, SEQ Desalination Sitting Study: Greenhouse Gas Assessment, Appendix J, p. J10, accessed online at: <http://www.qwc.qld.gov.au>

## 6.5 Offset-like products

There are a number of Australian State and Federal schemes which have been established to facilitate growth within the energy efficiency and renewable energy industries.

Participation in these schemes through the procurement of relevant certificates can be used by Council to reduce overall emissions in Victoria and Australia however, these are not considered ‘offsets’ by NCOS.

### 6.5.1 Victorian Energy Efficiency Certificates (VEECs)

Established in 2009, the Victorian Energy Efficiency Target is a Victorian government initiative originally designed to encourage energy efficient improvements within households and facilitate growth and employment within energy efficient businesses.

Under the scheme energy retailers are required to purchase energy efficiency certificates; each representing 1 tonne reduction in greenhouse gas emissions. These certificates, known as VEECs (Victorian Energy Efficiency Certificates) are created when activities such as the upgrading of refrigerators or introduction of standby power are undertaken.

Council may elect to purchase these certificates by registering a VEET account, or alternatively buying the VEECs through a third person provider. Prices may vary significantly as VEECs are traded within an open market. *Green Energy Trading* lists the price as being \$19 per VEEC for all VEECs in September 2012.<sup>15</sup>

#### Summary –Victorian Energy Efficiency Certificates (VEECs)

**Targeted market:** Energy retailers.

**Current price:** \$19

**Why buy?** To limit the availability of VEECs for energy retailers; thereby increasing the cost of these certificates and increasing the required implementation of activities.

**Process for procuring:** Register for a VEET account, or through a third person provider.

<sup>15</sup> Green Energy Trading, accessed at: <http://www.greenenergytrading.com.au/certificates/todays-pricing>

## 6.5.2 Renewable Energy Certificates (RECs)

Established by the Federal Government, the Renewable Energy Target consists of two types of tradable certificates:

- Small-scale technology certificates (STCs), and
- Large-scale generation certification (LGTs).

STCs are generated through the installation of a range of 'green' forms of energy including small generation units such as small solar photovoltaic panels, wind and hydro systems<sup>16</sup>.

The cost of these is higher than other local energy efficiency units at around \$30 per STC (as quoted in September 2012)<sup>17</sup>.

The LGCs are generated when renewable energy power stations produce renewable energy above a particular business-as-usual baseline. The scheme captures energy options such as solar, wind, ocean, tidal and landfill gas. The certificates are currently priced around \$33 per LGC.<sup>18</sup>

Both of these schemes have been developed to encourage the growth of renewable energy within Australia. Whilst only electricity retailers are legislatively obliged to participate, Council may also elect to purchase these certificates as a means of supporting the growth of renewable energy within the market.

### Summary – Renewable Energy Certificates (RECs)

**Targeted market:** Electricity retailers.

**Current price:** \$33 (LGC); \$30 (STC).

**Why buy?** To support the growth of renewable energy and reduce.

**Process for procuring:** Establish a REC Registry or through a third party offset broker.

<sup>16</sup> Clean Energy Regulator, Renewable Energy Target, accessed online September 2012 as <http://ret.cleanenergyregulator.gov.au/For-Industry/Renewable-Energy-Power-Stations/Creating---Selling-LGCs/creating-selling-lgcs>

<sup>17</sup> Green Energy Trading, accessed at: <http://www.greenenergytrading.com.au/certificates/todays-pricing>

<sup>18</sup> Green Energy Trading, accessed at: <http://www.greenenergytrading.com.au/certificates/todays-pricing>

## 6.6 Summary of offset projects

If Council does participate in the purchase of offsets, it is recommended that the final offset project be selected based on a set of principles pre-agreed by Council. For example, the City of Melbourne identified the following principles to guide the eventual selection of their offset project:

- Compliance with NCOS Carbon Neutral Standard.
- Social responsibility.
- Timeliness.
- Certainty in emission reductions.
- Transparency in what we do.
- Cost effectiveness.
- Leadership by example.
- Biodiversity, and
- Transparency of suppliers.

These principles may be developed in consultation with community and other stakeholders.

A summary of each of the offset units discussed in the section above is provided below for consideration. Council will need to examine these further as part of any process to procure offsets units.

Table 7 Summary of offset types and their characteristics

Project Type	Location			Project Type			Benefit			Quality		Cost	
	Colac Otway Shire	Aust	OS	Avoid	Sequester	Renewable	Emission reductions	Biodiversity	Social	NCOS	Non-NCOS	High <sup>19</sup>	Low <sup>20</sup>
Australian Pollution Permits		✓		✓			✓			✓		✓	
Australian Carbon Credit Units		✓		✓	✓		✓			✓		✓	✓
Overseas – compliance units			✓		✓	✓	✓	✓		✓			✓
Overseas – Voluntary units			✓	✓	✓	✓	✓	✓	✓	✓			
Local projects	✓			✓			✓				✓		✓
Uncertified Projects	✓	✓	✓	✓	✓	✓	✓				✓		✓
Green Power		✓				✓	✓				✓	✓	
Victorian Energy Efficiency Certificates	✓	✓		✓			✓				✓		✓
Renewable Energy Certificates		✓				✓	✓				✓	✓	

<sup>19</sup> Permits are typically greater than \$20 / tCO<sub>2</sub>.

<sup>20</sup> Permits are typically less than \$20 / tCO<sub>2</sub>.

## 7 Carbon neutral plan roadmap options

Arup worked with the Council to develop three possible options (combinations of reduction initiatives) for the Carbon Neutral Plan. The preferred option will form the basis for the final Roadmap report. The options investigated are:

- **Option 1** - Offset total emissions from 2016, no investment in emissions reduction initiatives.
- **Option 2** – Implement viable emissions reduction initiatives (15% carbon emissions reduction by 2016).
- **Option 3** – Implement all initiatives with a 10-year payback (almost 25% carbon emissions reduction by 2016).

The initiatives included in each Option have shown in Table 8.

Table 8 Initiatives included in each Option

Option 1	Option 2	Option 3
None	Roof insulation - Large sites	
	Highly reflective paint - Large sites	
	Sensor lighting	
	Lighting upgrades	
	Photocells	
	Draught proofing - Large sites	
	Purchase B100 Biodiesel fuel	
	Purchase B20 Biodiesel fuel	
	Hybrid truck replacement	
	Purchase Ethanol Blend for Petrol Vehicles	
	Adopt LPG fuelled vehicles	
	Electric vehicle trial	
	T5 Lighting Replacement	
	32W CFL Lighting Replacement	
		Cogeneration
	Electric vehicle trial	

To compare the three roadmap Options, Arup consolidated the outputs of the analysis in Section 4 to summarise the capital and operational costs, energy cost savings and emissions reduction potential. These are shown in Table 9 and Table 10.

Figure 12 shows that:

- Option 1 does not break even, as the ongoing purchase of offsets do not lead to any energy cost savings
- Option 2 could break even four years after implementing all initiatives. That is, upfront investment would be recovered through energy cost savings.
- Option 3 could break even five years after implementing all initiatives. However, Option 3 requires a significantly higher capital investment than Option 2.

On this basis, Option 2 is the preferred balance of capital investment and operational savings.

The three roadmap Options have been prepared for the Council project team's consideration. These options can be modified to reflect different timelines (e.g. to 2020) and the inclusion/exclusion of different emissions reduction initiatives. The Options will be presented to Councillors on 27 February 2013 in order to seek endorsement for a preferred Option.

Table 9 Costs of roadmap Options per year (2013-2022)

Option	Costs (\$ p.a.)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Purchase of energy / fuel (operational expenditure)	\$1,664,941	\$1,741,799	\$1,831,384	\$1,924,316	\$2,004,402	\$2,092,600	\$2,182,245	\$2,271,972	\$2,381,348	\$2,475,555
	Implementing initiatives / purchase offsets (capital expenditure)	\$0	\$0	\$0	\$99,273	\$101,259	\$103,284	\$105,350	\$107,457	\$109,606	\$111,798
2	Purchase of energy / fuel (operational expenditure)	\$1,607,846	\$1,646,469	\$1,692,750	\$1,779,395	\$1,857,846	\$1,943,294	\$2,030,770	\$2,119,396	\$2,223,451	\$2,317,659
	Implementing initiatives / purchase offsets (capital expenditure)	\$134,178	\$134,178	\$134,178	\$84,548	\$86,534	\$88,559	\$90,624	\$92,731	\$94,881	\$97,073
3	Purchase of energy / fuel (operational expenditure)	\$1,607,510	\$1,622,944	\$1,642,888	\$1,725,606	\$1,803,307	\$1,887,597	\$1,974,037	\$2,062,200	\$2,163,283	\$2,257,490
	Implementing initiatives / purchase offsets (capital expenditure)	\$235,636	\$235,636	\$235,636	\$83,228	\$85,214	\$87,239	\$89,304	\$91,411	\$93,561	\$95,753

Table 10 Summary of roadmap Options

Option	Cost of Council Energy / Fuel (\$ over 10 years)	Total Cost of Carbon Abatement / Offsets			Total Council Energy Savings (\$ over 10 years)	Carbon Emission Reductions from Abatement Measures (at 2016)
		Carbon Abatement Measures (\$ over 10 years)	Carbon Offset Purchases (\$ over 10 years)	Total Costs (\$ over 10 years)		
1	\$20,571,000	\$0	\$738,000	\$738,000	\$0	0 tCO <sub>2</sub> e
2	\$19,219,000	\$403,000	\$635,000	\$1,037,000	\$1,352,000	670 tCO <sub>2</sub> e
3	\$18,747,000	\$707,000	\$626,000	\$1,333,000	\$1,824,000	1,016 tCO <sub>2</sub> e

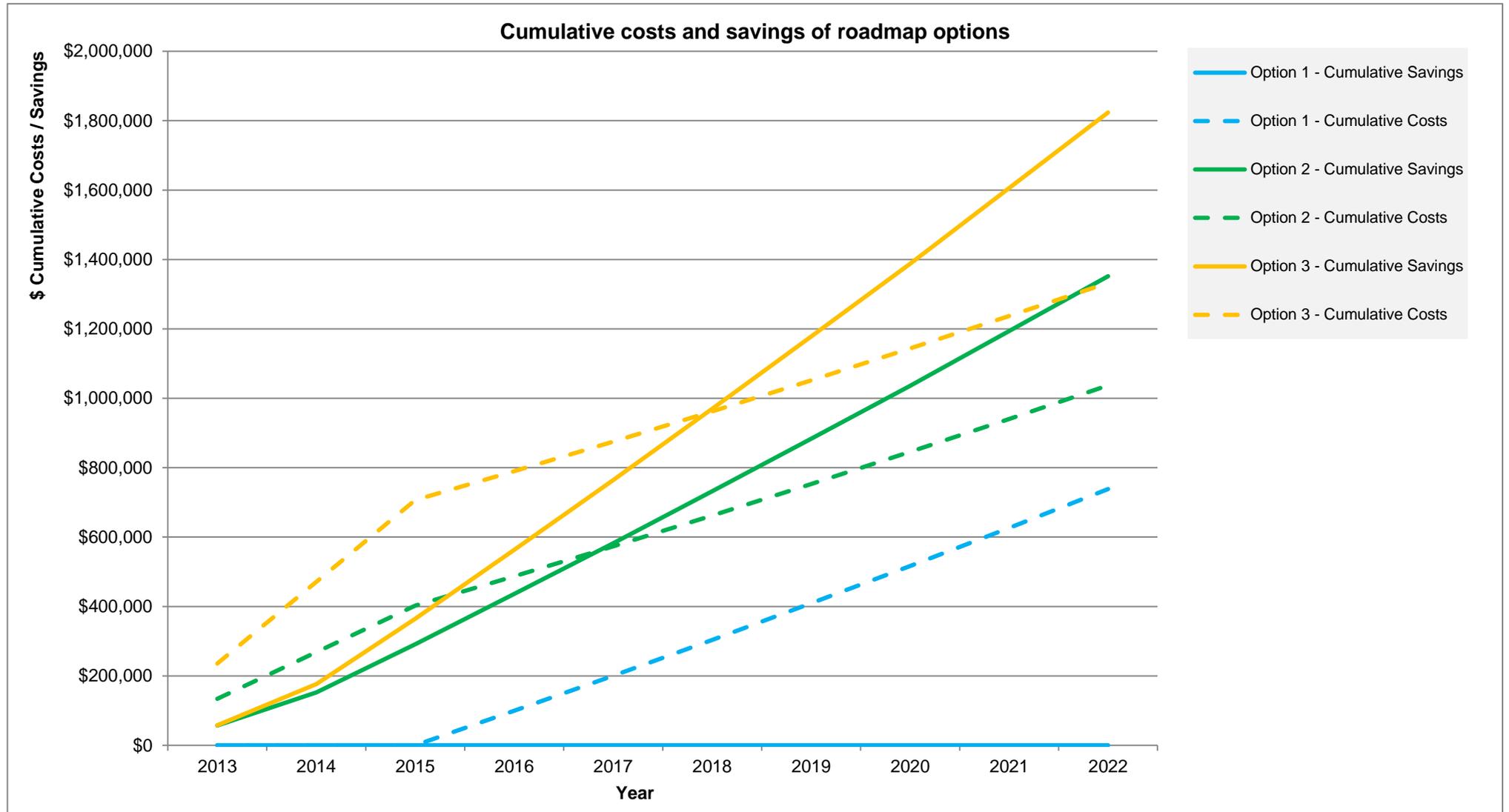


Figure 12 Cumulative costs and savings of roadmap options for Council

## 8 Conclusions

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### 8.1 Recommended emissions reduction initiatives

On the basis of financial costs and benefits, this study has identified viable initiatives that could reduce emissions by almost 25%. Over 10 years, these initiatives would save more in energy costs than their upfront cost. The initiatives include cogeneration energy supply at Bluewater, roof insulation (for large sites), LPG vehicles, building lighting upgrades and the upgrade of public lighting to T5 lights.

### 8.2 Setting targets

The Council has set a carbon neutrality target however, in addition the Council may consider setting an emissions reduction target for buildings and public lighting; and vehicle use. These targets represent a commitment to avoiding or reducing greenhouse gas emissions before offsets are purchased.

The recommended targets based on the analysis of the Report are:

- On a cost-neutral basis, the target for total emissions reductions across Council could be around 20% by 2016 on a 2011/12 baseline.  
A more ambitious target could be set, if Council decide to allocate additional investment.
- On a cost-neutral basis, the target for building-related (this includes public lighting) emissions reduction target could be around 50% by 2016 on a 2011/12 baseline.
- A vehicles-related emission reduction target – 10% by 2020 on a 2011/12 baseline.

### 8.3 Preferred roadmap options

Three approaches to combining emissions reduction initiatives have been outlined in this report. Option 2 represents a balanced approach to upfront capital expenditure and ongoing emissions reductions and energy cost savings.

### 8.4 Next steps

The next stage of this project is to develop a roadmap for the Carbon Neutral Plan which would be an operational plan for Colac Otway Shire Council. The roadmap will identify immediate priorities for managing implementation. These could include:

- Baseline report – A report with Colac Otway Shire Council's agreed baseline emissions inventory for 2011/12, taking into account bulk diesel purchases.
- Data management system – Implementation of the NGER reporting framework developed in Task 1 including briefing external providers (Planet Footprint) and utilities (Origin, AGL).

- Review of diesel use – A focused review to identify the major users of diesel and opportunities to increase efficiency of diesel use.
- Carbon management training – A training session (half or full day) for Councillors, Council executives and officers to understand the carbon management, implications of the carbon price, and their role in implementing emission reductions. This could be modelled after the successful training sessions offered by the Municipal Association of Victoria in 2012.
- Offset consultation and policy – Development of an offsets policy.
- Feasibility of local offset projects – Investigate the opportunities, potential costs, benefits and partnerships for local land management or energy efficiency projects.
- Sustainable vehicle and plant review – Given the significance of vehicle-related emissions, a focused review and plan for efficient use of corporate transport and heavy plant may be of value.
- A design guideline for new developments – The Council has the opportunity to develop its significant new buildings in a sustainable way. A robust set of design guidelines will ensure that cost-effective and visible demonstrations of the Council’s sustainability commitments are incorporated.

The Council takes into account a range of benefits to determine its programme in the coming years. The financial analysis of carbon reduction actions is a useful input into Council’s decision making. Ultimately, Council will make decisions to serve the interests of the Colac Otway Shire community.

This study shows that reducing greenhouse gas emissions and saving costs are compatible and a whole-of-Council issue. Putting energy efficiency and renewable energy programs in place protects Council from future increases in electricity costs and fluctuations in fuel prices.

The development of a Carbon Neutral Plan is an opportunity for Council departments to work towards the same goals.

## **Appendix A**

### Analysis assumptions

## A1 Data assumptions

The following assumptions page details the source of information and the methodology undertaken to estimate building and its energy usage, fleet and its fuel usage, and public lighting and its electricity usage.

### A1.1 Buildings details and energy usage

A number of documents (described below) were received to compile assumptions regarding the current council buildings and energy usage.

Table 11 Document reference – Buildings

Ref.	Document Ref. Name	Source	Applicable to	Ref. Year	Relevant Data
B1	Attachment_L2_Baseline_energy_consumption_summary_2010_11.xlsx	AGL	COPACC	2010-2011	Gas and electricity
B2	Powercor.xlsx	Powercor	Public lighting	2010-2013	Invoice
B3	CLC_Invoice_Detail_Electricity_Jul_Sep_2012_20121125(1).xls	Planet Footprint	Council buildings	2012	Property detail, electricity
B4	BUILDING REGISTER.xlsx	Council	Council buildings	N/A	Building area, age
B5	Electricity 1112.xls	Unknown	Council buildings	2011-2012	Electricity
B6	CLC_Invoice_Detail_Mains_Gas_Jul_Sep_2012_20121201(1).xls	Planet Footprint	Council buildings	2012	Property detail, gas
B7	Elgas 1112.xls	Unknown	Assorted	2011-2012	Bottled gas
B8	Rae St offices - energy report - planet footprint.pdf	Planet Footprint	COPACC	2012-2013	Electricity, gas
B9	Electricity 1213.xls	Unknown	Council buildings	2012-2013	Electricity
B10	Elgas 1213.xls	Unknown	Assorted	2012-2013	Bottled gas

To undertake the options analysis for council buildings, Arup estimated the energy end-use across all buildings using the following methodology:

1. Summarise and gather the information from document B4, B5 and B6 to link electricity and gas usage with known council buildings. This also included linking buildings with known building area (or footprint)
2. Summarise known council buildings into building types (such as council offices, sheds, clubrooms, etc). Consolidate information to determine average building type, regarding building area, electricity and gas usage.
3. Apply Arup estimates of energy demand by end-use to each type of building, i.e. lighting, hot-water, heating and cooling.
4. Compare estimates with known data on building energy-use.

Table 12 below provides the breakdown of building energy use by the consolidation of known data and information received. This was compared with the estimated energy use (by building type and end-use) by Arup as described in Table 15.

Table 12 Colac Otway Shire buildings – asset summary

Facility <sup>21</sup>	Classification	Size (m2 / height)	kWh 2011/12 <sup>22</sup>	% of total	kWh 2011/12 <sup>23</sup>	Total elec to be used (kWh 2011/12).	Total gas (MJ) 2011 / 1224
Council Offices	Council Offices	1,295	185,957	15.77%	-	185,957	25,713
Blue Water Fitness Centre	Blue Water Fitness	1,677	332,106	28.16%	332,111	332,111	2,788,882
Telco Hut Great Ocean Rd Lavers Hill	Sheds / Garages	-	459	0.04%	-	459	-
Radio Transmitter Cosworks	NA	-	-	0.00%	-	-	-
Traffic Control Unit	NA	-	-	0.00%	-	-	-
COPACC	COPACC	2,734	421,980	35.78%	-	421,980	58,349
Sculpture Park	Administrative Office	-	2,957	0.25%	-	2,957	-
Colac Central Reserve Hockey Clubrooms	Clubrooms	162	1,865	0.16%	-	1,865	2,164
Tiger Lane Navigation Aid Skenes Creek	NA	-	-	0.00%	-	-	-
Municipal Pound	Animal control	200	10,310	0.87%	-	10,310	-
Colac Maternal & Child Health Centre	Early Childhood and Maternal Health	147	6,980	0.59%	-	6,980	-
Radio Repeater Tuxion Rd Apollo Bay	NA	-	3,230	0.27%	-	3,230	-

<sup>21</sup> As listed in Electricity 1112.xls sheet. Lights have been removed and are covered in public lighting section

<sup>22</sup> As cited in 'Electricity 1112.xls', as provided by Colac Otway Shire

<sup>23</sup> As listed by Planet Footprint Carbon Footprint Report, for top four energy consuming sites.

<sup>24</sup> Sourced from Planet Footprint invoice data

Facility <sup>21</sup>	Classification	Size (m2 / height)	kWh 2011/12 <sup>22</sup>	% of total	kWh 2011/12 <sup>23</sup>	Total elec to be used (kWh 2011/12).	Total gas (MJ) 2011 / 1224
Great Ocean Road Visitor Information Centre	Tourist Information Centre	248	15,090	1.28%	-	15,090	-
Pound Rd Depot Ellminyt	Sheds / Garages	498	48,060	4.08%	34,853	34,853	-
Beeac Depot	Work Depot	-	-	0.00%	-	-	-
105 Gellibrand Street SP&D and CRLC	Administrative Office	610	16,390	1.39%	-	16,390	32,486
Beech Forest Public Hall	Community House	-	5,561	0.47%	-	5,561	-
Beech Forest - Radio Tower	Not classified	14	1,656	0.14%	-	1,656	-
Beech Forest Rd Depot	Shelter	234	411	0.03%	-	411	-
Site Hut Organics Facility Alvie Transfer Station	Transfer Stations	-	1,270	0.11%	-	1,270	-
Breakwater Road Apollo Bay	Administrative Office	33	16,630	1.41%	-	16,630	-
Botanic Gardens Workshop	Work Depot	70	4,090	0.35%	-	4,090	-
Kanyana Senior Citizens Club	Older people services	308	13,270	1.13%	-	13,270	-
Eastern Reserve Clubrooms	Clubrooms	408	6,520	0.55%	-	6,520	-
Gellibrand Depot	Work Depot	226	6,360	0.54%	-	6,360	-
Cressy Maternal & Child Health	Early Childhood and Maternal Health	-	510	0.04%	-	510	-
Irrewarra Airfield	Administrative Office	54	2,820	0.24%	-	2,820	-
Navigation Aid Skenes Creek		-	660	0.06%	-	660	-
Irrewarra Saleyards	Saleyard	281	32,390	2.75%	26,064	26,064	-
Great Ocean Road Visitor Information Centre	Tourist Information Centre	248	4,764	0.40%	-	4,764	-

Facility <sup>21</sup>	Classification	Size (m2 / height)	kWh 2011/12 <sup>22</sup>	% of total	kWh 2011/12 <sup>23</sup>	Total elec to be used (kWh 2011/12).	Total gas (MJ) 2011 / 1224
Colac Visitor Information Centre	Tourist Information Centre	147	17,680	1.50%	-	17,680	-
Harbour Depot Breakwater Road Apollo Bay	Work depot	300	9,660	0.82%	-	9,660	-
Cororooke Maternal & Child Health Centre	Sheds / Garages	25	580	0.05%	-	580	-
Shire Office Nelson Street Apollo Bay	Council Offices	804	17,880	1.52%	-	17,880	-
Birds Track Wye River TV Tower	Sheds / Garages	-	4,214	0.36%	-	4,214	-
Cororooke Maternal & Child Health Centre	Early Childhood and Maternal Health	260	1,560	0.13%	-	1,560	-
Apollo Bay Transfer Station	Transfer Stations	15	4,975	0.42%	-	4,975	-
Youth club	Clubrooms	729.28	0	0.00%	-	-	3,139
Kanyana	Older People Services	308	0	0.00%	-	-	9,691

The difference between the estimates by Arup and the known consolidated data is shown in Table 13.

Table 13 Comparison of consolidated energy usage and estimated energy usage in buildings

	Consolidated energy usage (Table 14)	Estimated energy usage (Table 11)	Difference
Total Electricity (MWh p.a.)	1,315	1,344	2%
Total Gas (GJ p.a.)	2,885	2,926	1%

Table 14 Building energy use breakdown (from consolidated received data)

Building class	Building type	No. of buildings	Building		Electricity		Gas	
			Tot. estimated wall Length (m)	Average building footprint (m <sup>2</sup> )	Average building usage (kWh per building p.a.)	Total usage (kWh p.a.)	Average building usage (MJ per building p.a.)	Total usage (MJ p.a.)
<b>Buildings with Gas and Electricity</b>								
Large site	Blue Water Fitness	1	270	4,550	332,111	332,111	2,788,882	2,788,882
Large site	COPACC	1	209	2,734	421,980	421,980	58,349	58,349
Large site	Council Offices	1	144	1,295	101,919	101,919	25,713	25,713
Small site	Administrative Office	1	99	610	9,725	9,725	32,486	32,486
Small site	Clubrooms	1	83	433	2,795	8,385	2,651	2,651
Small site	Older People Services	1	70	308	6,635	13,270	9,691	9,691
<b>Buildings with Only Electricity</b>								
Large site	Council Offices	1	144	1,295	101,919	101,919		
Small site	Administrative Office	3	26	44	9,725	29,175		
Small site	Animal Control	1	57	200	10,310	10,310		
Small site	Clubrooms	2	83	433	2,795	5,590		
Small site	Community House	1	57	204	3,017	3,017		

Building class	Building type	No. of buildings	Building		Electricity		Gas	
			Tot. estimated wall Length (m)	Average building footprint (m <sup>2</sup> )	Average building usage (kWh per building p.a.)	Total usage (kWh p.a.)	Average building usage (MJ per building p.a.)	Total usage (MJ p.a.)
Small site	Early Childhood and Maternal Health	3	57	204	4,103	12,308		
Small site	Saleyard	1	67	281	26,064	26,064		
Small site	Sheds / garages	4	65	262	10,027	40,107		
Small site	Shelter	1	61	234	411	411		
Small site	Tourist Information Centre	3	59	214	12,511	37,534		
Small site	Transfer Stations	2	15	15	3,123	6,245		
Small site	Work Depot	3	56	199	6,703	20,110		

Table 15 Building energy use breakdown (from Arup estimates)

Building class	Building type	No. of Buildings	Energy usage assumption	Existing building equipment assumption	kWh/m <sup>2</sup>				MJ/m <sup>2</sup>	MWh p.a.	GJ p.a.
					Air conditioner	Lighting	Hot water	Other appliances			
<b>Buildings with Gas and Electricity</b>											
Large site	Blue Water Fitness	1	Energy usage of "Office", based on operating hours as per website, with remaining gas requirements (other than office hot water requirements) being for pool heating	Centralised HVAC, centralised gas heating = COP of 0.80, chiller COP of 2.55, gas hot water COP of 0.80	38	57	-	-	613	431	2,789
Large site	COPACC	1	Energy usage of "Office", based on 7 days a week, avg. 10 hours a day (to account for after-hours usage)	Centralised HVAC, heating = COP of 1, chiller COP of 2.55, gas hot water COP of 0.80 applies to 50% of site	30	46	-	57	20	438	54.8
Large site	Council Offices	1	Energy usage of "Office", based on 5 days a week, avg. 9 hours a day	Split system air-con with COP of 3 for heat and cooling, assumes gas hot water COP of 0.80	22	29	2	37	26	115	33.4
Small site	Administrative Office	1	Energy usage of "Office", based on 5 days a week, 8 hours a day	Split system air-con with COP of 3 for heat and cooling, assume gas hot water system with a COP of 0.80, assume heating is as per an office on 50% of site	2	6	-	8	62	9.6	37.6

Building class	Building type	No. of Buildings	Energy usage assumption	Existing building equipment assumption	kWh/m <sup>2</sup>				MJ/m <sup>2</sup>	MWh p.a.	GJ p.a.
					Air conditioner	Lighting	Hot water	Other appliances	Gas required	Est. total elec usage	Est. total gas usage
Small site	Clubrooms	1	Energy usage of "Residential", based on 5 days a week, 5 hours a day for elec equipment, 1 hour a day for heating elements	Split system air-con with COP of 3 for heat and cooling, assume gas hot water system with a COP of 0.80, assume hot water is as per an office	1	3	-	5	8	4.6	3.4
Small site	Older People Services	1	Energy usage of "Residential", based on 5 days, 9 hours	Split system air-con with COP of 3 for cooling and heating, assume gas hot water system with a COP of 0.80, hot water is based on a commercial office	9	6	2	9	26	7.4	7.9
<b>Buildings with Only Electricity</b>											
Large site	Council Offices	1	Energy usage of "Office", based on 5 days a week, 9 hours a day	Centralised HVAC, centralised electric space heating = COP of 1.0, chiller COP of 2.55, electric hot water COP of 1.0	22	29	6	37		122	
Small site	Administrative Office	3	Energy usage of "Office", based on 5 days a week, 9 hours a day	Centralised HVAC, centralised electric space heating = COP of 1.0, chiller COP of 2.55, electric hot water COP of 1.0	22	29	6	37		12.3	
Small site	Animal Control	1	Energy usage of "Residential", based on 6 days a week, 9 hours a day	Split system air-con with COP of 3 for heat and cooling, assume elec hot water system with a COP of 1, assume hot water is as per an office	10	8	19	11		9.6	

Building class	Building type	No. of Buildings	Energy usage assumption	Existing building equipment assumption	kWh/m <sup>2</sup>				MJ/m <sup>2</sup>	MWh p.a.	GJ p.a.
					Air conditioner	Lighting	Hot water	Other appliances			
Small site	Clubrooms	2	Energy usage of "Residential", based on 5 days a week, 5 hours a day for elec equipment, 1 hour a day for heating elements	Split system air-con with COP of 3 for heat and cooling, assume elec hot water system with a COP of 0.80, assume hot water is as per an office	5	3	2	5		13.7	
Small site	Community House	1	Energy usage of "Residential", based on 6 days a week, 10 hours a day	Split system air-con with COP of 3 for heat and cooling, assume elec hot water system with a COP of 1, assume hot water is as per an office	11	8	21	13		10.8	
Small site	Early Childhood and Maternal Health	3	Energy usage of "Residential", based on 5 days a week, 5 hours a day	Split system air-con with COP of 3 for heat and cooling, assume elec hot water system with a COP of 1, assume hot water is as per an office	5	3	9	5		13.5	
Small site	Saleyard	1	Energy usage of 1 day a week	Assume lighting only	-	13	-	-		3.7	
Small site	Sheds / garages	4	Lights only, bottom-up calc	Assuming T12 34W lights, operation is 365 days a year, 10 hours a day, yearly usage is 155kWh, per light, is on average 22 lights per workshop	-	68	-	-		70.8	

Building class	Building type	No. of Buildings	Energy usage assumption	Existing building equipment assumption	kWh/m <sup>2</sup>				MJ/m <sup>2</sup>	MWh p.a.	GJ p.a.
					Air conditioner	Lighting	Hot water	Other appliances	Gas required	Est. total elec usage	Est. total gas usage
Small site	Shelter	1	Lights only, bottom-up calc	(assuming T12 34W lights, operation is 365 days a year, 10 hours a day, yearly usage is 155kWh, per light, is on average 22 lights per workshop)	-	2	-	-		0.4	
Small site	Tourist Information Centre	3	Energy usage of "Office", based on 5 days a week, 8 hours a day	Centralised HVAC, centralised electric space heating = COP of 1.0, chiller COP of 2.55, electric hot water COP of 1.0	20	26	5	33		53.9	
Small site	Transfer Stations	2	Energy usage of "Residential", based on 5 days a week, 10 hours a day	Split system air-con with COP of 3 for cooling, assume gas hot water system with a COP of 0.80, hot water is 33% of residential, assume gas heating	9	7	17	10		1.4	
Small site	Work Depot	3	Energy usage of "Residential", based on 5 days a week, 10 hours a day	Split system air-con with COP of 3 for cooling, assume gas hot water system with a COP of 0.80, hot water is 33% of residential, assume gas heating	9	7	17	10		26,351	

## A1.2 Fleet details and fuel usage

A number of documents were received to compile assumptions regarding the current corporate and fleet composition and fuel usage. These documents and their relevant details are described in the following table.

Table 16 Document reference – Fleet

Ref.	Document ref. name	Applicable to	Ref. year	Relevant data
F1	AIP_Annual_TGP_Data.xls	Bulk Diesel	2011	Bulk diesel cost at gate
F2	BP Fuel Data 1011.xls	Assorted Fuel Usage	2010-2011	Fuel (l), fuel type
F3	BP Fuel Data 1112.xls	Assorted Fuel Usage	2011-2012	Fuel (l), fuel type
F4	Caltex1011.XLSX	Assorted Fuel Usage	2010-2011	Fuel (l), fuel type, vehicle registration, odometer reading
F5	Caltex1112.XLSX	Assorted Fuel Usage	2011-2012	Fuel (l), fuel type, vehicle registration, odometer reading
F6	Colac Otway Light Vehicle Fleet Review 2010.xlsx	Corporate Fleet, Private Vehicle Use	2010	Vehicle models, vehicle registration, total kilometre travelled
F7	Custom Fleet 1011.xlsx	Assorted Fuel Usage	2010-2011	Fuel (l), fuel type, vehicle registration, odometer reading
F8	Custom Fleet 1112.xlsx	Assorted Fuel Usage	2011-2012	Fuel (l), fuel type, vehicle registration, odometer reading
F9	Custom Fleet 1213.xlsx	Assorted Fuel Usage	2012-2013	Fuel (l), fuel type, vehicle registration, odometer reading
F10	Heavy Fleet.xlsx	Heavy Fleet	-	Vehicle models, vehicle registration
F11	Heavy Plant.xls	Heavy Fleet (plant equipment)	-	Vehicle models, vehicle registration (and/or ID)
F12	Information for Dora Nov 2012.xlsx	Corporate Fleet	-	Vehicle models, vehicle registration, estimated fuel consumption
F13	RE Annual Fuel Costs query for ABS survey - Bulk Diesel Purchases.msg	Bulk Diesel	2011	Bulk Diesel cost
F14	RE Annual Fuel Costs query for ABS survey - Fuel cards.msg	Assorted Fuel	2011	Assorted fuel amounts from fleet cards (LPG, Diesel, ULP)
F15	Transport fuel info - Planet Footprint.pdf	All	2012-2013	Fuel consumption (LPG, Diesel, ULP)

## Corporate fleet

Corporate fleet fuel usage was calculated as follows:

1. Obtain the breakdown of vehicles and annual kilometres travelled from document F6.
2. Apply estimate fuel consumptions as stated in document F12 or if no information was available, the appropriate fuel consumption from the Green Vehicle Guide ([www.greenvehicleguide.gov.au](http://www.greenvehicleguide.gov.au)).

The table below provides the breakdown of corporate fleet fuel usage.

Table 17 Corporate fleet breakdown

Vehicle	Fuel type	Annual km's	Assumed fuel consumption (l/100km)	Total fuel consumption (l)
Toyota Carolla hatch	P	31,931	7.4	2,363
VW Golf hatch diesel - silver	D	55,278	5.6	3,096
Subaru Liberty sedan - silver	P	49,859	8.4	4,188
Subaru Forester - gold	P	56,951	10	5,695
Subaru Forester - silver	P	70,291	10	7,029
Mazda 6 wagon - red	P	38,187	8.7	3,322
Mazda 6 wagon - red	P	56,507	8.7	4,916
Toyota Aurion - silver	P	21,137	9.9	2,093
Toyota Aurion - silver	P	41,135	9.9	4,072
Toyota Aurion - liquid metal	P	22,397	9.9	2,217
Toyota Aurion - caribbean blue	P	33,952	9.9	3,361
Toyota Aurion - red	P	17,204	9.9	1,703
Holden Omega Sportswagon ULP - nitrate	P	69,578	9.3	6,471
Holden Omega sedan LPG - red	LPG	30,520	13	3,968
Holden Omega sedan LPG - red	LPG	53,669	13	6,977
Ford Falcon sedan LPG - lightning strike	LPG	25,126	15	3,769
Ford Falcon wagon LPG - silver	LPG	51,136	15	7,670
Ford Falcon wagon LPG - silver	LPG	29,224	15	4,384
Ford Falcon wagon LPG - silver	LPG	19,202	15	2,880
Ford Falcon XT wagon LPG - blue	LPG	51,279	15	7,692
Ford Falcon sedan LPG - silver	LPG	27,645	15	4,147
Ford Fairmont sedan LPG - silver	LPG	85,117	15	12,768
Subaru Liberty sedan - blue	P	46,701	10.9	5,090
Holden Calais V - silver	P	32,877	10	3,288
Mitsubishi Outlander AWD - Red	P	48,194	9.3	4,482
Toyota RAV 4	P	45,001	9.6	4,320

Vehicle	Fuel type	Annual km's	Assumed fuel consumption (l/100km)	Total fuel consumption (l)
Nissan X-Trail - white	D	32,951	8.1	2,669
Holden Captiva SX	D	40,350	9.3	3,753
Ford Falcon BA LPG ute, DS tray - white	LPG	44,550	12	5,346
Toyota Hilux Crew Cab diesel - white	D	34,789	8.3	2,887
Ford Ranger 4x4 dual cab white	D	23,394	9.2	2,152
Ford Ranger dual cab diesel - white	D	31,196	9.2	2,870
Ford Ranger 4x4 dual cab silver	D	38,669	9.2	3,558
Ford Ranger 4x4 dual cab - white	D	37,438	9.2	3,444
Ford Ranger dual cab 4X4 - white	D	42,884	9.2	3,945
Ford Ranger dual cab 4X4 - white	D	26,104	9.2	2,402
Mitsubishi Triton 4X4 dual cab diesel white	D	37,341	8.1	3,025
Holden Rodeo tray - white	D	19,476	8.4	1,636
Holden Rodeo tray - white	D	21,245	8.4	1,785
Holden Rodeo 4X4 dual cab-white	D	41,126	8.4	3,455
Holden Rodeo	D	10,532	8.4	885
Holden Rodeo dual cab - white	D	15,219	8.4	1,278
Holden Rodeo dual cab-white	D	44,009	8.4	3,697
Toyota Commuter bus - white	D	25,355	11.6	2,941
Toyota HiAce Van - white	D	32,055	11.6	3,718
Holden Shuttle – white*	D	na	-	-
Ford Transit – white*	D	na	-	-
Iveco Daily van*	D	na	-	-
VW Jetta sedan ULP - silver	P	42,903	7.7	3,304
Holden Astra CDXi wagon - gold	P	42,228	10.8	4,561
Holden Astra Diesel hatch auto	D	35,266	10.8	3,809
Holden Astra Wagon - silver	P	11,128	10.8	1,202
Holden Astra hatch	P	37,821	10.8	4,085
Hino Crew Cab	D	4,207	6.4	269
Nissan Patrol DX T/diesel	D	4,716	9.9	467

\* As no data was available, it was assumed that the fuel consumption would be negligible for the analysis, and therefore not accounted for.

## Heavy fleet

Heavy fleet fuel usage was calculated as follows:

1. Obtain the breakdown of vehicles and registration numbers from document F10.
2. Sort document F8 by the odometer reading and date, and fill in any missing data to obtain annual kilometres travelled by vehicle registration number.
3. Estimate the average annual kilometres travelled by a vehicle class, based on the information sorted from document F8.
4. Estimate the fuel consumption of a vehicle class, based on the information sorted from document F8 and average annual kilometres travelled.
5. Estimate total fuel use based on total annual kilometres travelled by a vehicle class, and the estimated fuel consumption of a vehicle.
6. As there is no detail regarding the fuel consumption of mowers, Arup have assumed a fuel efficiency and utilisation rate of 24.3 litres/hr and for 3 hours a week for a full year.

The table below provides the breakdown of heavy fleet fuel usage.

Table 18 Heavy fleet breakdown

Vehicle type	Total no.	Estimated average km travelled per vehicle	Estimated total km travelled	Estimated fuel (diesel only) Consumption	Estimated fuel usage (l)
2.5T TRUCK	2	9,245	18,490	17.24 l / 100km	3,188
2T TRUCK	9	17,479	157,306	17.24 l / 100km	27,122
5 METRE TRUCK	2	20,263	40,525	17.24 l / 100km	6,987
9 METRE TRUCK	6	77,394	464,365	35.71 l / 100km	165,845
BACKHOE	4	8,047	32,188	35.71 l / 100km	11,496
EPV/CHERRY PICKER	1	6,809	6,809	17.24 l / 100km	1,174
FLOCON	2	23,857	47,714	35.71 l / 100km	17,041
FRONT END LOADER	1	8,047	8,047	35.71 l / 100km	2,874
GRADERS	5	7,176	35,880	35.71 l / 100km	12,814
OUT FRONT MOWER	3	-	-	24.3 l / hr	11,373
RIDE ON MOWER	5	-	-	24.3 l / hr	18,955
ROLLER	8	-	-		-
SIDE SHIFT MOWER	2	-	-	24.3 l / hr	7,582
STEALTH MOWERS	2	-	-	24.3 l / hr	7,582
TRACTOR	6	-	-	25.4 l / hr	23,774

## Unaccounted fuel

From the estimation methodologies for Corporate and Heavy Fleet stated above, and as per the data derived in Table 17 and Table 18, there appears to be a gap in fuel consumption that cannot be accounted for. This gap may be due to the use of bulk diesel has been detailed below.

Table 19 Fuel accounted for

Fuel type	Fuel usage <sup>25</sup> (kl)	Estimated fuel consumption (from Table 7 and 8) (kl)	Fuel unaccounted For (kl)
Bulk Diesel	349	318 (Heavy) 58 (Corporate)	415
Diesel	442		
Petrol (and premium)	101	78	31
E10	8		
LPG	54	60	- *
<b>Total</b>	<b>954</b>	<b>514</b>	<b>440</b>

\*As fuel consumption was estimated based on total kilometres travelled by vehicle class, there is a possibility of over-estimating and under-estimating fuel usage. An overestimation of 10% for LPG was deemed appropriate.

### A1.3 Public lighting and electricity usage

Public lighting, for the purposes of this assessment, was determined as the lights within public toilets and reserves (or parks).

To determine the potential energy efficiency options for public lighting, Arup applied the following methodology to determine the baseline number of lights in public lighting:

1. Determine the sites from document B5 which are related to public lighting.
2. High-level detail regarding the breakdown of sites into those that are; toilet lights only, toilet and BBQ, and reserves / car parks, including an estimation of number of lights in each facility. This information was assisted by the email sent by Dora Novak 12<sup>th</sup> December 2012.
3. Apply assumption regarding bulb type and usage. Information is from Arup assumptions and Ironbark (2012) Street Lighting Bulk Replacement Program Business Case.

The following table provides a breakdown of total electricity use from each toilet, park or reserve.

<sup>25</sup> Total fuel usage by type was determined from the emissions profile, reverse calculating fuel consumption using the appropriate emission factors.

Table 20 Public lighting electricity usage by facility

Facility description	Electricity usage (kWh)
<b>Toilet Lights only</b>	
Barwon Downs Toilet	350
Lavers Hill Public Toilet	2,550
Lake Foreshore Toilets	1,414
Toilet Block Great Ocean Road	2,020
Lavers Hill Public Toilet	5,650
Cressy Toilets	-
Murray St East Public Toilet	180
Toilet Block Great Ocean Road Apollo Bay	420
Beeac Public Toilets	230
Kawarren Toilets	-
Beech Forest Rd Toilets	1,607
<b>Toilet and BBQ (to account for toilets only)</b>	
Botanical Gardens Colac	1,130
Colac Memorial Square Toilets and BBQ	11,874
Beeac Park Playground	1,160
Birregurra Park	790
6-7 Sears Court Colac Playground BBQ	64
<b>Reserves / Car Parking</b>	
29 Bromfield St Carpark	7,260
Memorial Square Rotunda	820
Eastern Reserve Netball Association	3,870
Groundsman's Shed - Central Reserve	280
87 Bromfield St Carpark	3,706
Public Lighting Main St Beeac	920

The following table indicates the assumed number of lights and associated electricity usage that is currently owned and operated by the Council.

Table 21 Breakdown of public lighting lights and electricity usage

Facility Description	BaU Light Fittings	Usage (hrs per day)	Lumen	Watts (lamp only)	Total Watts (lamp and ballast)	kWh annual per lamp	No. of fittings
Toilets lighting	Incandescent lamp (GLS)	24	2,800	42	50	442	48
Reserve / Car Park lighting	80W Metal-halide	12	3,800	80	96	418	56
BBQ facilities <sup>26</sup>	3.6kW BBQ	-	-	-	-	455	4

<sup>26</sup> Assumes 4 sites have BBQs operating at 25% of full capacity, equivalent to 455kWh p.a. (Refer to 3.6kW model, [http://www.christieparksafe.com.au/downloads/ccq\\_brochure.pdf](http://www.christieparksafe.com.au/downloads/ccq_brochure.pdf))

## A2 Options calculation assumptions

The following set of tables provides the key assumptions for each emissions reduction initiative analysed.

### A2.1 Building options

Table 22 Building options – key cost and reduction potential assumptions

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
Switch to energy efficient refrigerators	\$1,799	per unit	Electrolux ETE4200SC 420L Top Mount Fridge, Old 5 star, New 3.5 star rating, Harvey Norman	16%	Electricity usage per building	Electricity usage as per model of fridge <sup>29</sup>	75%	34	units (assumes one for all office buildings and 3 for large sites)
Gas heating (Split system air-conditioner replacement)	\$1,222	per unit	Rinnai Energysaver® 309FT Space Heater Console, 2.9kW Output	95%	Electricity reduction, replaced with Gas	Assume standard efficiencies of gas heaters.	75%		
Mechanical building	\$3	m2	Building Guide and Arup internal	20%	Reduction in gas heating	FMA (2011) <i>An Operational Guide to Sustainable Facilities</i>	100%	8579	m <sup>2</sup> (large sites only)

<sup>27</sup> Note that for these options, OPEX costs have been assumed to be negligible.

<sup>28</sup> This is assumed by Arup as the percentage of assets in which an option is likely to be applicable to.

<sup>29</sup> [http://www.electrolux.com.au/LocalFiles/Australia\\_NewZealand\\_English/Brochures/EBRO\\_EFRI\\_Sep10.pdf](http://www.electrolux.com.au/LocalFiles/Australia_NewZealand_English/Brochures/EBRO_EFRI_Sep10.pdf)

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
management system (MBMS) - Large sites			estimate (capital cost)	20%	Reduction in electricity for heating and/or cooling	<i>Management</i>			
High Performance Glazing (Double-Glazing) - Small sites	\$360	per sqm	Double-glazing retrofit unit, \$217 per sqm toughened glass, \$143/sqm average installation cost <sup>30</sup>	14%	Reduction in gas heating	Australian Greenhouse Office (2000) <i>Energy Research for the Building Code of Australia</i> , based on 1991 houses, assumes 14% reduction in GHG, from Regulations + double glazing	75%	1070	m <sup>2</sup> (assumes window to floor ratio of 21.5% for Melbourne)
				14%	Reduction in electricity for heating and/or cooling		75%		
High Performance Glazing (Double-Glazing) - Large sites <sup>31</sup>	\$360	per sqm	Double-glazing retrofit unit, \$217 per sqm toughened glass, \$143/sqm average installation cost <sup>30</sup>	14%	Reduction in gas heating	Australian Greenhouse Office (2000) <i>Energy Research for the Building Code of Australia</i> , based on 1991 houses, assumes 14% reduction in GHG, from Regulations + double glazing	75%	268	m <sup>2</sup> (all window area, assuming 30% of wall)
				14%	Reduction in electricity for heating and/or cooling		75%	358	m <sup>2</sup> (all window area, assuming 50% of wall)
Wall insulation - Small sites	\$19	per sqm	Fully installed cost, ICANZ (2012) The	25%	Reduction in gas heating	ICANZ (2011) <i>The Value of Insulation based Residential</i>	75%	4979	m <sup>2</sup> (of floor area, as per cost)

<sup>30</sup> <http://www.refitnsave.org.au/products/swwindows/167-double-glazing-retrofit-units>

<sup>31</sup> Excludes Blue Water Fitness due to building façade being largely glazing

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
			Value of Insulation based Residential Energy Savings Measures, Table 54	25%	Reduction in electricity for heating and/or cooling	<i>Energy Savings Measures</i> , Table 29 (assumes no insulation). Improvement of low VIC detached 2.2 NatHERS stars to 3.2 stars.  Assumes climate zone as Tullamarine = max energy 418MJ/sqm, compared to 315MJ/sqm = 25% reduction in heating.	75%		
Wall insulation - Large sites <sup>31</sup>	\$19	per sqm	Fully installed cost, ICANZ (2012) <i>The Value of Insulation based Residential Energy Savings Measures</i> , Table 54	28%	Reduction in gas heating	ICANZ (2011) <i>The Value of Insulation based Residential Energy Savings Measures</i> , Table 30 (assumes no insulation) semi-detached. Improvement of low VIC semi-detached 3.1 NatHERS stars to 4.3 stars.  Assumes climate zone as Tullamarine = max energy 324MJ/sqm, compared to 233MJ/sqm = 28% reduction in heating.	75%	3993	m <sup>2</sup> (of floor area, as per cost)
				28%	Reduction in electricity for heating and/or cooling		75%		
Roof insulation - Small sites	\$10	per sqm	Fully installed cost, ICANZ (2012) <i>The</i>	44%	Reduction in gas heating	ICANZ (2011) <i>The Value of Insulation based Residential</i>	75%	4979	m <sup>2</sup> (assume all roof area)

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
			Value of Insulation based Residential Energy Savings Measures, Table 54	44%	Reduction in electricity for heating and/or cooling	<i>Energy Savings Measures</i> , Table 27 (assumes no insulation). Improvement from average VIC 1.3 NatHERS stars to 3.2 stars. Assume climate zone as Tullamarine = max energy 564.7MJ/sqm, compared to .315MJ/sqm = 44% reduction in heating.	75%		
Roof insulation - Large sites	\$10	per sqm	Fully retrofit cost, ICANZ (2012) <i>The Value of Insulation based Residential Energy Savings Measures</i> , Table 54	27%	Reduction in gas heating	ICANZ (2011) <i>The Value of Insulation based Residential Energy Savings Measures</i> , Table 28 (assumes sub-par insulation). Improvement from assumed (semi-detached) VIC 3.5 NatHERS stars to 4 stars. Assume climate zone as Tullamarine = max energy 328MJ/sqm, compared to 244MJ/sqm = 27% reduction in heating.	75%	6434	m <sup>2</sup> (assume all roof area)
				27%	Reduction in electricity for heating and/or cooling				

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
Highly reflective paint - Large sites	\$25	per sqm	SkyCool Paint, used in previous project	30%	Reduction in cooling load	Bell, J, Smith, G (2000) <i>Advanced Roof Coatings: Materials and their Applications</i> , Queensland University, University Technology Sydney.	75%	7406	m <sup>2</sup> of roof
Sensor lighting	\$1,000	per building	Installation cost <sup>32</sup> , Per light - Arup lighting group estimates drawing on data provided by Elecraft	20%	Reduction in electricity	NEMA (2001) <i>Demand Reduction and Energy Savings using Occupancy Sensors</i>	75%	24	installations (assuming 1 every building)
	\$70	per light						1464	lights (assuming T12 34W lights as a base-case, yearly usage is 295kWh for an office, per light)
Lighting upgrades	\$1,000	per building	Installation cost <sup>32</sup> , Per light - Average of range (\$49 - \$69) for single tube 18W T8 Fluorescent luminaire. (Rawlinsons)	34%	Reduction in electricity	US EPA (1998) <i>How to Buy Energy-Efficient Fluorescent Tube Lamps</i> , and <a href="http://www.ecospecifier.com.au/knowledge-green/technical-guides/technical-guide-5-high-performance-fluorescent-lighting.aspx">http://www.ecospecifier.com.au/knowledge-green/technical-guides/technical-guide-5-high-performance-fluorescent-lighting.aspx</a>	75%	24	installations (assuming 1 every building)
	\$59	per light						1464	lights (assuming T12 34W lights as a base-case, yearly usage is 295kWh for an office, per light)

<sup>32</sup> [http://www.renovationplanning.com.au/display\\_story.php?story\\_key=364](http://www.renovationplanning.com.au/display_story.php?story_key=364)

Emissions reduction initiative	CAPEX <sup>27</sup>	Units	Costing reference	% Reduction in energy	Reduction applicability	Reference	Adoption rate <sup>28</sup>	Initiatives applied	
								Total no.	Per units
Photocells	\$1,000	per building	Installation cost <sup>32</sup> , per light - <sup>33</sup>	20%	Reduction in electricity	NEMA (2001) <i>Demand Reduction and Energy Savings using Occupancy Sensors</i>	25%	488	sensors (assuming T12 34W lights as a base-case, yearly usage is 295kWh for an office, per light)
Draught proofing - large sites	\$3	per sqm	DP Cost Breakdown.pdf, as part of email from Colac. Assumes \$8665 for 3100 sqm Civic Centre building for Moreland City Council	60%	Reduction in gas heating	ecoMaster (2012), <i>Case Study: Moreland Civic Centre, Energy Consumption Plummets for Local Council Civic Centre</i> , refer to email from Dora Novak, 5 <sup>th</sup> February 2013	75%	7,406	m <sup>2</sup> (of building area)
				27%	Reduction in electricity for heating and/or cooling				

<sup>33</sup> <http://www.lightingillusions.com.au/shop/35/253/360-degree-flush-mount-sensor>

Table 23 Energy supply options – key cost and reduction potential assumptions

Building energy supply initiative	CAPEX	Unit	OPEX (p.a.)	Unit	Assumed % adoption	Number of units proposed	Assumption of proposed units	Energy generation (or consumption)
Cogeneration	\$138,375	total	\$4,738	total p.a.	100%	1 unit at Blue Water Fitness	Based on one 70kWe unit, running 50% of the time.	1,092 GJ (surplus gas required) 306,600 kWh (electricity supplied)
Solar hot water (Sites with Gas Heating)	\$773	per m <sup>2</sup>	Assumed negligible		75%	372m <sup>2</sup>	Total solar collector area across portfolio, assuming that 5% of possible roof is covered	303 GJ (gas saved)
Solar hot water (Sites with Electric Heating)	\$773	per m <sup>2</sup>	Assumed negligible		50%	129m <sup>2</sup>	Total solar collector area across portfolio, assuming that 5% of possible roof is covered	15,000 kWh (supplied for heating)
Solar PV - Large sites	\$741	per m <sup>2</sup>	Assumed negligible		50%	494 m <sup>2</sup>	Total solar collector area across portfolio, assuming that 10% of possible roof is covered	84,000 kWh elec supplied
	\$690	per m <sup>2</sup>	Assumed negligible			56 inverter units	Assumes sized to max power output, i.e. 1100W per unit	
Solar PV - Small sites	\$741	per m <sup>2</sup>	Assumed negligible		50%	410 m <sup>2</sup>	Total solar collector area across portfolio, assuming that 10% of possible roof is covered	69,800 kWh elec supplied
	\$690	per m <sup>2</sup>	Assumed negligible			47 units	Assumes sized to max power output, i.e. 1100W per unit	

## Regarding the analysis of cogeneration

The following methodology was undertaken to estimate the size of a cogeneration unit appropriate for Blue Water Fitness Centre:

1. From gas bills, estimate the average peak gas usage based on the average daily consumption during the December to February period. This amounts to 436MJ.
2. Estimate the average heat demand by assuming a boiler efficiency of 80%. This amounts to 349MJ.
3. Estimate the size of the cogeneration plant, and apply costing and assumptions from the following:

Cogeneration Engine	Electrical Output (kWe)	Heat output (kW)	Fuel input (LHV)	\$CAPEX / kWe	\$OPEX p.a. / kWe
Urban Energy Cento T100	100	140	282	\$ 1,528	\$ 66.50
Design and Project Management Services (Arup assumption)	-	-	-	\$40,000 (total)	-

Size (Output)	Heat Transfer Efficiency	CAPEX \$/kWoutput	OPEX \$/kW output
Average (60-170kW) Heat Exchanger (Arup data)	80%	\$123	\$2.10

4. Assume that the plant is operated during peak hours (12 hour period, or 50% of the year).
5. To calculate the additional cost of gas and the savings from electricity, as the analysis is specific to Blue Water Fitness Centre, the following rates were used:
  - a. For electricity, 12.44c/kWh (based on the average of total charges divided by the total electricity consumption from 2011-2012)
  - b. For gas, \$8.96 per GJ (based on the average of total charges divided by the total gas consumption from 2011-2012)

## A2.2 Fleet options

Table 24 Fleet (corporate and heavy) options – cost and reduction potential assumptions

Emissions reduction initiative	Applicable to	Difference in Fuel Usage	CAPEX	OPEX	References
Purchase ethanol blend petrol	Corporate fleet, only ULP vehicles	Assumes 15% more usage for using E10	None required	Fuel savings from \$1.44 per l (ULP) compared to \$1.42 per l (E10)	Fuel price from RACV <sup>34</sup> , average 2011-2012 historical fuel prices of ULP and E10. Applying mark-up due to regional prices.
Adopt LPG fuelled vehicles	Corporate fleet, non-LPG vehicles	Assumes 20% loss in performance (i.e. 20% more fuel usage per kilometre)	\$3750 per vehicle for LPG conversion	Fuel savings from \$1.44 per l (ULP) compared to \$0.69 per l (LPG)	CAPEX from RACQ <sup>35</sup> Fuel price from RACV <sup>34</sup>
Electric vehicle trial	Corporate fleet, replacement of current hatchbacks only, with Mitsubishi i-MiEV	No fuel usage, electricity consumption at 135Wh/km	Price difference between standard car replacement and i-MiEV (\$54,000)	No fuel usage, electricity cost at 22.33c per kWh	Green Vehicle Guide, Mitsubishi i-MiEV for electricity consumption
Purchase B20 biodiesel fuel	Heavy fleet, for all movers, small and large trucks.	Assumes 3% loss in performance <sup>36</sup>	None required	Fuel savings from \$1.46 per l (Diesel) compared to \$1.40 for B20.	B20 price from National Biodiesel Ltd <sup>37</sup>

<sup>34</sup> ULP:

[www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+\\_+information/fuel/petrol+prices/Unleaded/historical+unleaded+petrol+prices](http://www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+_+information/fuel/petrol+prices/Unleaded/historical+unleaded+petrol+prices)

E10:

[www.racv.com.au/wps/wcm/connect/internet/primary/my+car/advice+\\_+information/fuel/petrol+prices/e10/historical+e10+prices](http://www.racv.com.au/wps/wcm/connect/internet/primary/my+car/advice+_+information/fuel/petrol+prices/e10/historical+e10+prices)

Diesel:

[www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+\\_+information/fuel/petrol+prices/Diesel/historical+diesel+fuel+prices](http://www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+_+information/fuel/petrol+prices/Diesel/historical+diesel+fuel+prices)

Regional fuel price:

[www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+\\_+information/fuel/petrol+prices/regional+fuel+prices](http://www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+_+information/fuel/petrol+prices/regional+fuel+prices)

<sup>35</sup> RACQ (2012) LP Gas, refer to

[www.racv.com.au/motoring/cars/car+advice/car+fact+sheets/lp+gas](http://www.racv.com.au/motoring/cars/car+advice/car+fact+sheets/lp+gas)

<sup>36</sup> John Deere (2012) Biodiesel FAQs,

[www.deere.com/wps/dcom/en\\_US/industry/engines\\_and\\_drivetrain/learn\\_more/biodiesel\\_faqs/biodiesel\\_faqs.page?](http://www.deere.com/wps/dcom/en_US/industry/engines_and_drivetrain/learn_more/biodiesel_faqs/biodiesel_faqs.page?)

<b>Emissions reduction initiative</b>	<b>Applicable to</b>	<b>Difference in Fuel Usage</b>	<b>CAPEX</b>	<b>OPEX</b>	<b>References</b>
Hybrid truck replacement	Heavy fleet, assume applicable to 50% of small trucks only	Assumes 39% fuel saving. <sup>38</sup>	Additional cost of Hino Hybrid (full price at \$60,500)	Fuel price at \$1.46 per l (Diesel)	Fuel price from RACV <sup>34</sup>

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<sup>37</sup> National Biodiesel Ltd (2013) Daily Terminal Gate Price (TGP) Advice, refer to [www.natbiogroup.com/default.asp?id=161](http://www.natbiogroup.com/default.asp?id=161)

<sup>38</sup> Hino (2012) Hino Hybrid, Australia's First Hybrid Truck, refer to [www.scifleet.com.au/literature\\_47964/Hino\\_Hybrid\\_Brochure](http://www.scifleet.com.au/literature_47964/Hino_Hybrid_Brochure)

## A2.3 Public lighting options

All public lighting options assume a runtime of 11.94 hours per day, 365 days a year.

Table 25 Public lighting options – cost and reduction potential assumptions

Emissions reduction initiative	Applicable to	Rated power		Lumens requirement		No. of lights		Electricity		CAPEX	
		BaU (W/light)	Option (W/light)	BaU (lumens / light)	Option (lumens / light)	BaU	Option (to meet lumens)	BaU (kWh total)	Option (kWh total)	(\$/light)	Reference
T5 Replacements of CFLs	Toilets (CFL)	42W	14W	1,800	1,100	48	96	27,619	5,730	\$86	Includes fittings, lamp and installation. From Rawlinsons Construction Guide, p559.
32W CFL Lighting Replacement	Toilets (CFL)	42W	14W	1,800	2,400	48	48	27,619	3,501	\$86	
	Reserves / car parking (MH)	80W	14W	3,800	2,400	56	112	16,856	8,228	\$86	

## **Appendix B**

### **Review of NGER inventory and reporting framework**

Colac Otway Shire

**Development of a carbon neutral  
plan**

Review of NGER inventory and  
reporting framework

227626-00

Issue | 18 February 2013

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 227626-00

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# Document Verification

<b>Job title</b>		Development of a carbon neutral plan		<b>Job number</b>	
				227626-00	
<b>Document title</b>		Review of NGER inventory and reporting framework		<b>File reference</b>	
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			Prepared by	Checked by	Approved by
		Name	Joan Ko	Joan Ko	James Selth
		Signature			
		<b>Filename</b>			
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		Name			
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# 1 Introduction

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Arup has been engaged by Colac Otway Shire Council to support the development of a carbon neutral plan by identifying options for reducing emissions and analysing the financial costs and benefits of each option. The results of Arup's work will inform a carbon neutral plan, which will provide Council with a strategic direction for achieving its carbon neutral target for corporate operations by 2016.

Arup's engagement involves a number of tasks:

1. A review of the council's NGER inventory.
2. Development of a reporting framework in line with the National Greenhouse and Energy Reporting (NGER) Act.
3. Identification of carbon abatement options.
4. A cost benefit analysis of these options.
5. An analysis of offset opportunities.
6. Development of the *Carbon neutral options and cost-benefit report*.
7. Presentation to Councillors, and
8. Development of a 'road map' forward.

This report represents the completion of the first two tasks in the project: the greenhouse inventory review and development of a NGER reporting framework.

## 2 Review of NGER inventory

---

### 2.1 Introduction to the National Greenhouse and Energy Reporting System

Arup reviewed the Shire's greenhouse inventory to confirm consistency with the requirements of the NGER Act. The NGER Act sets out reporting requirements for Australian organisations in relation to the production and consumption of energy and greenhouse gas emissions.

Organisations captured within reporting thresholds established by the Department of Climate Change and Energy Efficiency (DCCEE) are required to report their annual energy consumption / production and carbon emissions.

Local government authorities are typically not required to report under the NGER Act as they are not considered to be 'constitutional corporations'. However, changes to the NGER Act brought about by the Clean Energy Plan mean that some councils that own or manage landfills that emit 25ktCO<sub>2</sub>-e or more are required to report.

Whilst Arup appreciates the Shire does not currently operate any landfills, aligning the corporate inventory with NGER is considered best practice and provides consistency between the Shire's data and other organisations, thereby allowing comparison.

### 2.2 Data received

The review of both the scope and calculation of the Shire's greenhouse inventory was undertaken using the following data provided by the Shire:

- Colac Otway Shire, 'Organisational Footprint – Greenhouse: to end of financial Quarter 4, 2011-12' (received 19 September).
- Carbon Neutral Plan Inception Meeting Minutes Notes (13 November 2012) (revised with Shire comments on 16 November 2012).
- Building Register.xlsx (received 15 November 2012).
- Baseline energy consumption summary 2010/11.xlsx (received 15 November 2012).
- Energy Audit Colac Otway Shire Council COPACC (May 2011) (received 19 November 2012).
- Service reports with utility data from Planet Footprint (retrieved on 22 November 2012).
- Emissions Detail Data from Planet Footprint (received 14 December 2012).

## 2.3 Review against NGER reporting scope

Arup understands that the Shire's NGER inventory is provided as part of the Planet Footprint utility tracking service. The inventory is reported on a quarterly basis.

Previously, emissions were presented by Planet Footprint in line with the Cities for Climate Protection (CCP) programme. Following a recent request by the Shire, the reports are now provided in the NGER reporting framework.

A comparison of the treatment of source emissions is shown in Table 1 below.

Table 1 Comparison of ICLEI and NGER reporting requirements

Source	Captured?	
	ICLEI CCP	NGER (scope 1 and 2)
Electricity	✓	✓
Street lighting	✓	✗
Fleet	✓	✓
Gas	✓	✓
Public lighting	✓	✓
Waste	✓	✗

The NGER Act requires both direct and indirect emissions which are under the control of the organisation to be reported. To avoid double counting these are referred to as scope 1 and 2 emissions, as described in Figure 1.

**Scope 1 emissions:** emissions which directly arise as a result of the operation of an organisation.

**Scope 2 emissions:** emissions which generated off-site, but as a direct result of the organisations activities. The purchase of electricity, heat or steam is a typical example of scope 2 emissions. Here the organisation typically has less control and thereby ability to influence carbon abatement.

Figure 1 Scope 1 and 2 definitions

Reporting of Scope 3 indirect emissions such as paper use, business travel and waste disposal is optional.

Table 2 summarises typical Scope 1 and 2 emissions sources from local government. It identifies whether or not the particular activity has been captured in the greenhouse gas inventory (September 2012) reviewed by Arup.

In some instances, the activity may not be relevant to the Shire (shown as 'NA' Table 2). The 'Review findings' column identifies actions to complete the inventory. The 'Council response' column shows how these issues have been resolved.

Based on the data provided by Council, Arup is able to complete the inventory for the purposes of this project.

Table 2 Emission sources by NGER Scope

Scope	Emission source by activity	Reported?	Arup review findings	Council response
1	Open and closed landfills operated or managed by Council	Yes. Emissions from waste to landfill are reported as scope 1.	Future revision of the NGER inventory should remove landfill.	Planet Footprint (PF) instructed to remove landfill from inventory. No further action required.
1	Waste water treatment plants operated or managed by Council	NA	NA – none in the operational control of the Shire.	NA
1	Fuel used in transport depots	Yes.	None required.	NA
1	Council fleet (pool vehicles and salary packaged vehicles)	Yes. Diesel, Unleaded Petrol, LPG, Unleaded (10% Ethanol)	None required.	NA
1	Heavy vehicles	No.	Revise NGER inventory to include diesel used.	Council will forward bulk diesel data to PF for future inventories. For this project, Arup will add emissions from diesel into the inventory.
1	Quarries operated or managed by Council	NA	NA – none in the operational control of the Shire.	NA
1	Refrigerant gas and SF <sub>6</sub>	No.	Refrigerant gas data collection is not required although the Shire may wish to collect this data for completeness.	NA
1	Gas for heating and cooking	Yes. Mains gas No. Bottled gas	Revise NGER inventory to include bottled gas used.	PF instructed to add in bottled gas. No further action required.
2	Metered public lighting	Yes.	None required.	NA
2	Purchased electricity	Yes.	Confirm that NGER inventory electricity accounts data is consistent with the Building Register.	Council and Arup have agreed to verify only the top three buildings, which are responsible for the vast majority of emissions.
2	Council pumps and irrigation	Yes.	None required.	NA
2	Waste transfer stations	Yes.	None required.	NA

Scope	Emission source by activity	Reported?	Arup review findings	Council response
2	Wholly owned companies	Not applicable.	None required.	NA
3	Waste disposal	No.	NA – not currently in the scope of the inventory.	NA
3	Street lighting	Yes.	None required.	NA
3	Paper consumption	No.	NA – not currently in the scope of the inventory.	NA
3	Employee travel	No.	NA – not currently in the scope of the inventory.	NA
3	Business travel	No, unless captured in council fleet.	NA – not currently in the scope of the inventory.	NA
Energy generation	Electricity from diesel generators	NA	NA – The Shire does not need to report energy generation unless the generating unit has the capacity to produce 0.5 MW or more of electricity and generates more than 100,000 kilowatt hours.	NA

## Council facilities

Arup assumes that all facilities reported in the NGER inventory are under the Shire's operational control. Arup understands that the Shire currently considers that a facility is in its control where it pays the electricity bills. The Shire recognises that in some cases, the payment of bills would not meet the NGER operational control criteria. Examples of known issues include:

- Energy use of the cinema business in Rae Street Colac Otway Performing Arts and Cultural Centre (COPACC) – currently paid by the Shire but under the control of Colac Cinema.
- Energy use in the main library – currently part-paid by the Shire but in the control of the Corangamite Regional Library Corporation.
- Central Reserve.

As the Shire transitions toward NGER reporting, Arup recommends in future that Council undertake a systematic review of operational control for each facility.

## Diesel consumption

Arup's initial review of the inventory showed that diesel used in plant vehicles and equipment were not included. This is a significant source of emissions.

Council has provided diesel data to Arup. For this project, Arup will manually calculate and add the emissions to the inventory.

## Lighting

Emissions associated with metered public lighting are classified as Scope 2 emissions. Public lighting typically includes lighting of car parks, toilets and public reserves. It is differentiated from street lighting, which is typically under the operational control of electricity distributors.

Whilst organisations are usually encouraged to separate emissions by sources, lighting and building energy consumption are typically reported as a combined figure by energy retailers.

Arup understands that the bills received by the Shire include public lighting. As described in the 'Council facilities' section above, if the Council pays for the bills, then it is likely within the its operational control.

## Gas

Mains gas is currently reported within the NGER inventory. Arup understands that bottled gas is also used in some of the facilities (including the Apollo Bay office and Maternal & Child Health Centre).

Following Arup's initial review of the inventory, it has now been updated to include the use of bottled gas.

## Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>)

Some hydrofluorocarbons (HFCs) used in air conditioning and refrigeration units are covered by the NGER Act. The Shire currently does not report these and is not required to, as NGER only requires certain industry sectors to report.

These sectors are:

- Food product manufacturing (ANZSIC classification, Subdivision 11)
- Beverage and tobacco product manufacturing (ANZSIC classification, Subdivision 12)
- Retail trade (ANZSIC classification, Division G)
- Warehousing and storage services (ANZSIC classification number 530)
- Wholesale trade (ANZSIC classification, Division F)
- Rental, hiring and real estate services (ANZSIC classification, Division L)

For completeness, the Shire may wish to collect data on refrigerant gases. The gases covered by NGER are:

- HFC-23
- HFC-227ea
- HFC-43-10-mee
- HFC-143a
- HFC-134a
- HFC-236fa
- HFC-125

HFC-22, a gas which is commonly used in air conditioning, does not have to be reported. Arup notes that R22 was reported for a number of sites examined as part of the CarbonetiX Energy Audit.

In addition to hydrofluorocarbons, sulphur hexafluoride (SF<sub>6</sub>) is reportable as Scope 1 for all industry sectors. The Shire should confirm that no SF<sub>6</sub> is used, typically in gas insulated switch gear and circuit breaker applications.

## Landfill

Scope 1 waste emissions arising from landfills are required to be reported for any open and closed landfills which were / are being managed by Council. Closed landfills that did not receive any waste after 2008 are excluded from reporting obligations.

The Shire currently reports a minor source of emissions from landfill which was closed prior to 2008 as a Scope 1. Following Arup's initial review, landfill emissions have now been removed from the inventory.

## Council pumps and irrigation

Arup understands that the Shire's existing pumps are used on sporting fields only and that energy used as part of the pumps are included in the bills of the relevant facilities.

## 2.4 Calculation review

This section summarises Arup's calculation check for selected large buildings emissions sources to ensure no errors of transcription or calculation. The results of this review are summarised in Table 3. The purpose of this review is to understand the accuracy of the existing inventory.

### Energy calculations

Arup undertook spot reviews of the electricity and gas energy consumption data for the Shire.

#### Electricity

Utilising the Finance department invoicing data provided by Planet Footprint, Arup re-calculated the total electricity usage (kWh) consumed by the three largest buildings by energy use in 2011/12 to compare with the totals reported by Planet Footprint. This identified no errors in calculation.

Arup also compared the data records provided by the Shire's Finance department with those utilised by Planet Footprint. The review identified very minor differences in the energy totals.

The reason for these slight differences is not obvious from the data, however, it is likely that this level of accuracy is acceptable for NGER reporting.

#### Gas

Arup recalculated the gas consumption of both the Civic Hall and Bluewater Fitness Centre. Utilising the invoicing data provided by Planet Footprint identified discrepancies in consumption of less than 5%. This is likely due to the use of estimated gas consumption for a number of months where data was not available.

The discrepancy was greater (14%) when Arup used gas consumption figures identified within the gas bills. This may suggest a breakdown in data accuracy between Finance and Planet Footprint.

### Emissions calculations – initial review

Arup's initial review showed that the emissions calculated by Planet Footprint were higher than those calculated by Arup using the NGER emissions factors for 2011/12.

NGER reporting requires the use of emissions factors listed in *The National Greenhouse and Energy Reporting (Measurement) Determination 2008*. This Regulation is updated each year with new emissions factors. The *National Greenhouse Account Factors* (NGA factors) do not apply and have no standing in relation to reporting under the NGER legislation.

The NGER emissions factors for electricity are based on Scope 1 and 2. The NGA factors include Scope 1 and 2, and also an additional Scope 3 related to emissions from transmission losses in electricity distribution. The Full Fuel Cycle factors for electricity are the sum of Scope 1, 2 and 3 emissions.

Planet Footprint appeared to be using the Full Fuel Cycle emissions factors from 2009. Planet Footprint states that it is possible to request reports to use Scope 1 and 2 (NGER compliant) emissions factors.

Arup recommended that Council request that Planet Footprint reports the NGER compliant emissions factors separately from Scope 3 emissions for electricity.

Table 3 Check calculation of selected significant emissions sources 2011/12 - Electricity

	1. Energy consumed (kWh) As quoted by Planet Footprint	2. Energy consumed (kWh) As calculated by Arup from invoices received by Planet Footprint	3. Energy consumed (kWh) As calculated by Arup from Finance recorded data	4. % Difference Between Planet (1) and Arup (2) calculations	5. Emissions (tCO <sub>2</sub> -e) As calculated by Planet Footprint	6. Emissions (tCO <sub>2</sub> -e) As calculated by Arup	7. % difference Between Planet and Arup calculations
<b>Rae Street Offices</b>							
Cinema 2 (2 - 6 Rae St Colac)	108,158	108,158	<i>Not available</i>	0%	148	131	12%
Shire Offices & COPACC (2 - 6 Rae St Colac)	579,752	579,752	579,749	0%	789	701	11%
<b>Bluewater Fitness Centre</b>	332,111	332,110	332,106	0%	451	402	11%

Table 4 Check calculation of selected significant emissions sources 2011/12 - Gas

	1. Energy consumed (MJ) As quoted by Planet Footprint	2. Energy consumed (MJ) As calculated by Arup from invoices received by Planet Footprint	3. Energy consumed (MJ) As calculated by Arup from gas bills provided by Finance	4. % Difference Between Planet (1) and Arup (2) calculations	5. Emissions (tCO <sub>2</sub> -e) As calculated by Planet Footprint	6. Emissions (tCO <sub>2</sub> -e) As calculated by Arup	7. % Difference Between Planet (5) and Arup calculations (6)
<b>Civic Hall</b>	5,951,465	5,649,514	6,460,090	-5%	329	305	-7%
<b>Bluewater Fitness Centre</b>	38,172	37,396	<i>Not available</i>	-2%	2.1	1.9	-7%

## Emissions calculations – second review

In response to Council's request, on 14 December 2012, Planet Footprint provided additional information in the form of the *Emissions Detailed Data* Excel spreadsheet.

Planet Footprint provides multiple emissions and energy reports to the Shire. Some of these reports appear to conflict. Arup identified the following discrepancies.

### Emissions detailed data excel spreadsheet versus NGER report

The emissions factor in the *Emissions Detailed Data* Excel spreadsheet is correct for 2011/12. The total of the electricity from Emissions Detailed Data Excel spreadsheet does not match the total provided in Planet Footprint's NGER report.

Using the *Emissions Detailed Data* sheet as the basis for the Council's greenhouse inventory would overcome the problem identified in Arup's initial emissions calculation review above.

### Organisation Footprint – Energy report

On the Planet Footprint website, there is an additional report called *Organisation footprint - Energy*, which is up to date for the current 2012/13 financial year. This report also has 2011/12 emissions in it, however the total is different to that reported in the NGER report and different to the *Emissions Detailed Data* Excel spreadsheet.

This energy report appears to be using an emissions factor of 1.33 kgCO<sub>2</sub>/kWh. This appears to be the full cycle factor from 2007 (i.e. it include Scope 3 emissions).

Planet Footprint's website states:

'On the Greenhouse Report we use the so called 'Full Fuel Cycle emissions factors' wherever available. These are the best factors to use for your 'Corporate and Social Responsibility' reporting, and will be consistent with adding issues such as Air Travel, Corporate Waste and Employee Commuting.

'If you need to report for NGER, you can ask us for an additional dataset that uses only the basic Scope 1 and 2 emissions factors. as required by NGER.

'To explain briefly, stationary energy and fleet emissions can be calculated in two ways. The first just counts the direct emissions from burning the fuel. The other, called the Full Fuel Cycle, adds indirect factors such as the emissions created in mining, transporting and processing the fuel.'

Source:

<http://www.planetfootprint.com.au/subscribers/support/Policies/Reporting-Greenhouse-Gas-Emissions-for-Local-Gover> (viewed 13 December 2012)

## Finance data electricity invoice details

Our review of the data quality for Task 2 was based on Finance's invoice spreadsheet. This data appears to have been used for the Planet Footprint facility reports. The emissions within the facility reports are based on an emissions factor of 1.37 kgCO<sub>2</sub>e/kWh. This may be the full cycle factor from 2009.

## Way forward

On the basis of the data reviewed, Arup believes that a complete and consistent inventory can be assembled for this project. Arup will use its calculations based on the Finance electricity and gas invoice data, vehicle fuel and bulk diesel purchases.

In future, it may be possible to use the Planet Footprint *Emissions Detailed Data* spreadsheet for annual reporting, provided that Colac Otway Shire supplies bulk diesel data to Planet Footprint.

Arup recommends that the Council discusses with Planet Footprint the discrepancies between the reports including different emissions totals for 2011/12.

## 3 Framework for reporting in line with NGER

---

### 3.1 Overview

The Council's specification for this project requested that Arup 'provide a clear framework for recording and reporting carbon emissions (in line with National Greenhouse and Energy Reporting (NGER) Guidelines)'.

This section provides a template for an internal data collection and emissions reporting procedure. The purpose of this procedure is to ensure conformance with the NGER Act, which requires corporations to record both their decision making processes and details of the processes adopted to collect data and calculate their GHG emissions.

The Council can adapt the framework for its organisation and provide training to staff members involved in collecting and analysing data. As internal procedures develop, the Environment Manager can complete the fields shown in square brackets.

The following sections are written as an internal procedure.

### 3.2 Introduction to reporting greenhouse gas emissions

This procedure outlines Colac Otway Shire's process for reporting greenhouse gas emission in line with the National Greenhouse and Energy Reporting (NGER) guidelines. The procedure has been structured as follows:

- Section 3.3 provides a summary of emission sources being reported by the Shire.
- Section 3.4 provides an overview of the data collection processes for each of the relevant sources
- Section 3.5 identifies how emissions are calculated, and
- Section 3.6 provides an overview of the monitoring methods managed by the Shire's Environment Manager.

It is the responsibility of the Environment Manager to ensure this Framework is kept up to date. The Framework will be located electronically at [*insert location*].

### 3.3 Colac Otway Shire activities

[Insert information around structure of Council, list of subsidiaries, ownership structure, contractors, joint venture agreements. This can reference the filing or intranet location of this information. Note the key assets – COPACC, Bluewater Fitness Centre].

### 3.4 Emission sources

The following emission sources are recorded by the Shire.

- Electricity used in buildings, public lighting and street lighting
- Mains and bottled gas
- Diesel, unleaded petrol, liquefied petroleum gas, unleaded (10% ethanol) petrol for vehicles and plant, and
- Closed landfills.

These sources account for scope 1 and 2 emissions for the Colac Otway Shire.

Only those facilities identified as being under the control and management of the council have been included within the NGER inventory.

The Shire has undertaken a review of operational control of its facilities. The decisions to include or exclude facilities from the Shire's reporting boundary are documented in [insert filing/intranet location].

### 3.5 Data collection process

#### Electricity, mains gas and bottled gas

**Overview:** Data for electricity, mains gas and bottled gas is received as quarterly invoices by the Finance Manager. Separate invoices are received for:

- Electricity and mains gas for each building (AGL)
- Bottled gas for selected buildings (AGL)
- Public lighting (Origin Energy), and
- Electricity for metered street lighting (AGL).

The data is automatically provided to Planet Footprint (<http://www.planetfootprint.com.au/>), which is contracted to manage greenhouse gas inventory data.

The username and password for the Planet Footprint account is held by the Environment Manager. The Shire's key contact at Planet Footprint is [insert name and contact details].

Energy data for Bluewater Fitness Centre is not captured by this process. The Finance Manager is responsible for requesting data from the energy retailer each month, then emailing this information to Planet Footprint

**Responsibility:** The Finance Manager is responsible for ensuring all invoices are collected from relevant energy retailers. The Finance Officer and Planet Footprint will work together should any anomalies be identified.

**Time Period:** Monthly.

## Vehicle fuel consumption

**Overview:** Petrol and LPG consumption data is captured through fuel cards used by staff for salary packaged vehicles and pool vehicles

Data for diesel used by plant (e.g. road graders) is collected via bulk fuel purchase invoices.

**Responsibility:** The Finance Manager is responsible for collecting fuel data from fuel providers on a monthly basis. The Finance Manager then emails the data to Planet Footprint. The Finance Manager and Planet Footprint work together should any anomalies be identified.

**Time Period:** Monthly.

## Closed landfills

**Overview:** Emissions from closed landfills are not within the scope of reporting.

**Responsibility:** Not applicable.

**Time Period:** Not applicable.

## 3.6 Calculation of emissions

**Overview:** The Council's corporate emissions are calculated by Planet Footprint. Planet Footprint obtains energy and fuel use data directly from the Council's energy retailers and the Finance Manager.

In overview, Planet Footprint:

- Adjusts invoice data to allocate energy use to the quarterly reporting dates.
- Fills in any data gaps and resolves anomalies.
- Calculates emissions on a facility basis. In all cases, Method 1 is used (refer to the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines for details).
- Aggregates facilities to report on a quarterly basis.
- Reports total corporate emission on an annual financial year basis.

An annual report can be downloaded on the Planet Footprint website. The report summarises greenhouse gas emissions and carbon mitigation initiatives adopted by the Council.

**Responsibility:** The Environment Manager is responsible for managing the Planet Footprint service contract and reviewing regular reports. The Environment Manager circulates a summary of performance to the Sustainability Working Group.

**Time Period:** Quarterly.

### 3.7 Monitoring and review

**Overview:** The Environment Manager reviews quarterly NGER inventory reports for:

- Completeness
- Accuracy
- Trends, and
- Opportunities for emissions mitigation measures.

Data and reporting reviews are undertaken annually. Errors are documented by email to Planet Footprint. Copies of the email and resulting corrective actions are stored at *[insert filing location]*.

The Environment Manager may commission third party reviews of calculations and reports.

**Responsibility:** The Environment Manager is responsible for providing internal review and commissioning any third party reviews.

**Time Period:** Annually.

## 4 Conclusions

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This Report documents the outcomes of Arup's review of Colac Otway Shire's corporate greenhouse inventory review, and provides a framework for reporting corporate greenhouse gas emissions. These are the first two tasks of Arup's services to support the development of the Council's carbon neutral plan.

The review of the NGER inventory identified the following changes:

- the removal of waste emissions,
- inclusion of bottled gas and bulk diesel.

Arup's calculation review identified that reports available to Colac Otway Shire show a number of different figures for 2011/12 greenhouse gas emissions. For the purposes of this project, Arup has developed an inventory based on invoicing data provided to Planet Footprint. The revised inventory that will be reported in the *Carbon neutral options and cost-benefit report*, which is Task 6 of this project. The revised inventory will provide an appropriate level of accuracy for the identification of strategic carbon reduction actions.

Finally, this Report provides a template procedure for the collection and analysis of emissions data. This framework is a resource for Council to in future demonstrate its alignment with the NGER guidelines.

## **Appendix C**

**Council workshop presentation**

# Development of a Carbon Neutral Plan

Colac Otway Shire



# Introduction

1. Introduction: Colac Otway Shire Council, Environment Team
2. Inventory and Offset Options: Arup
3. Options for Reaching Carbon Neutrality: Colac Otway Shire Council, Environment Team

# Supporting the Development of a Carbon Neutral Plan

Colac Otway Shire

# Why plan for reducing emissions?

leadership

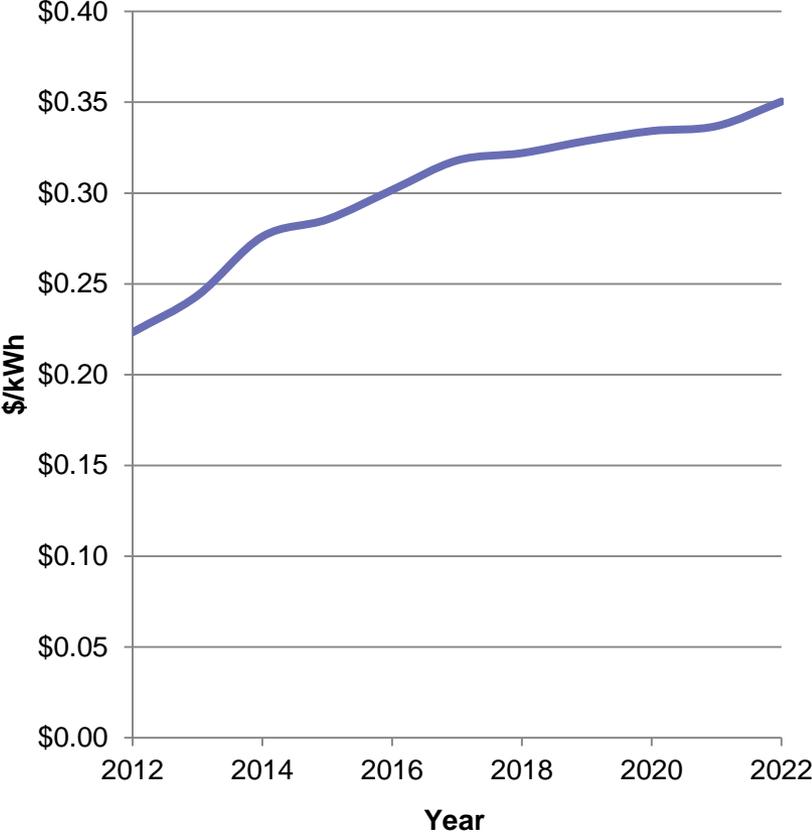
cost savings

risk  
management

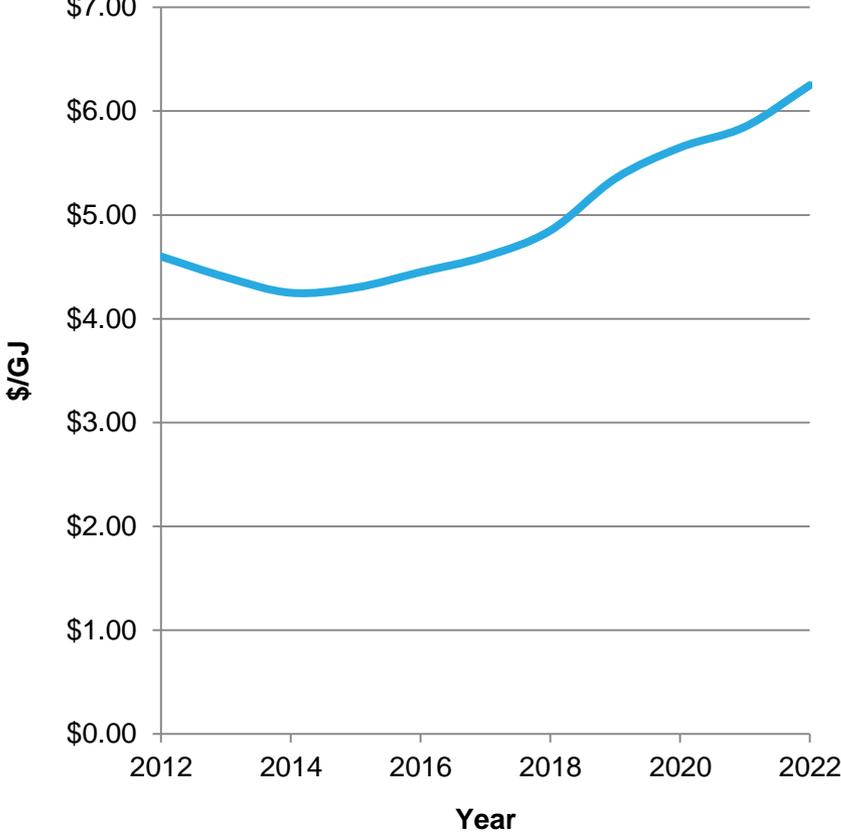
regulation

# Energy Price Rises

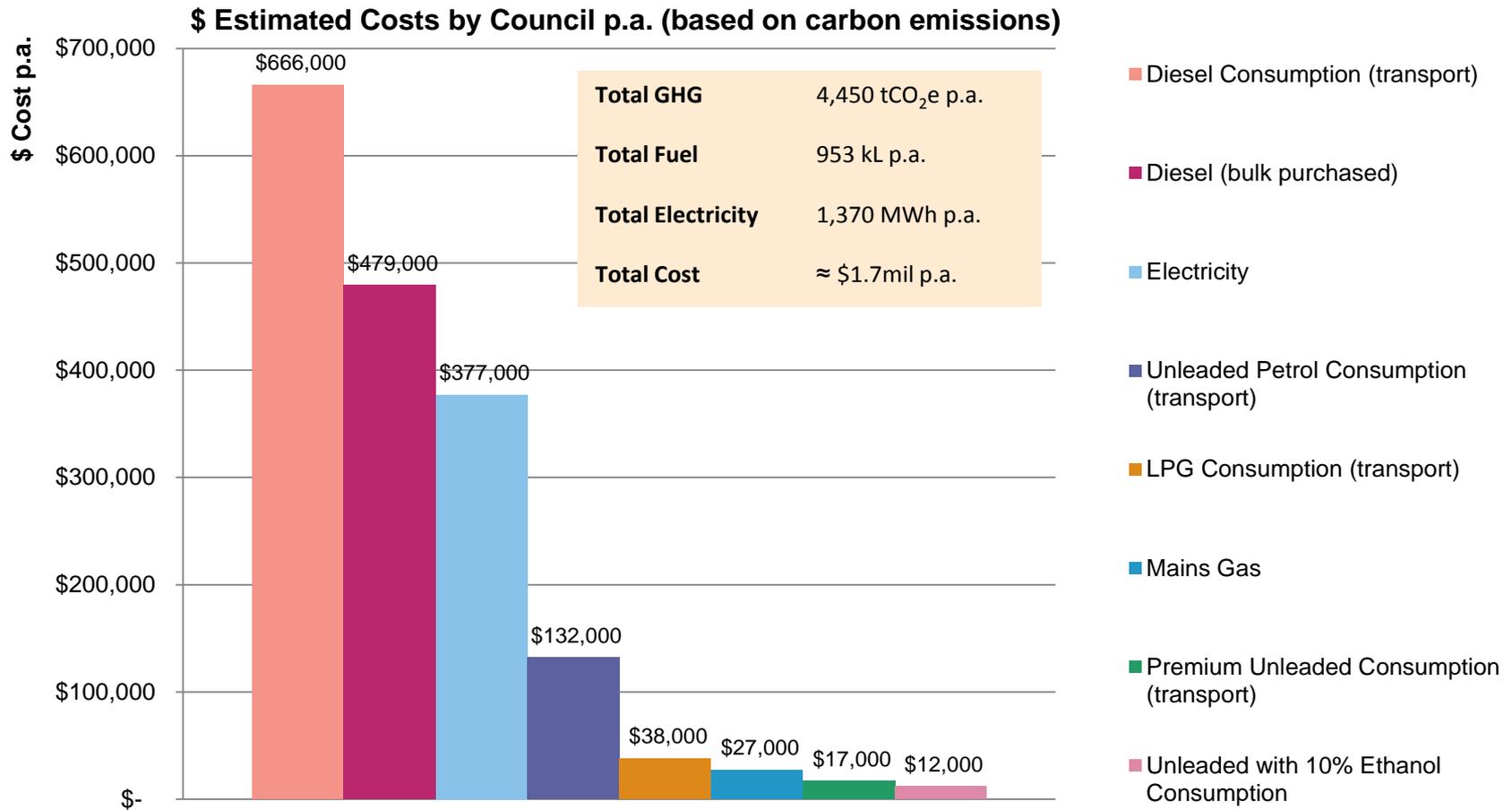
### Projected Electricity Prices



### Projected Gas Prices



# Greenhouse inventory 2011/12 (tCO<sub>2</sub>e)



# Building Portfolio

## Large sites includes:

- The Bluewater Fitness Centre
- COPACC Rae St Offices
- COPACC Theatre

(3 sites identified)



## Small sites includes:

- Administrative Offices
- Animal Control
- Clubrooms
- Community Early Childhood and Maternal Health
- Older People Services
- Saleyards
- Sheds / garages
- Shelters
- Transfer Stations
- Tourist Information Centres
- Work Depot

(28 sites identified)

# Transport

## Heavy transport includes:

- Mower (18)
- Small Truck (18)
- Large Truck (9)



## Corporate Fleet includes:

- Utilities (18 Diesel, 1 LPG)
- Sedan / Wagon (18 Petrol, 9 LPG)
- Hatchbacks (2 Diesel, 2 Petrol)
- Vans (5 Diesel)

(55 in total)

# Identified Options

Energy supply

HVAC

Building fabric

Lighting

Heavy fleet

Corporate fleet

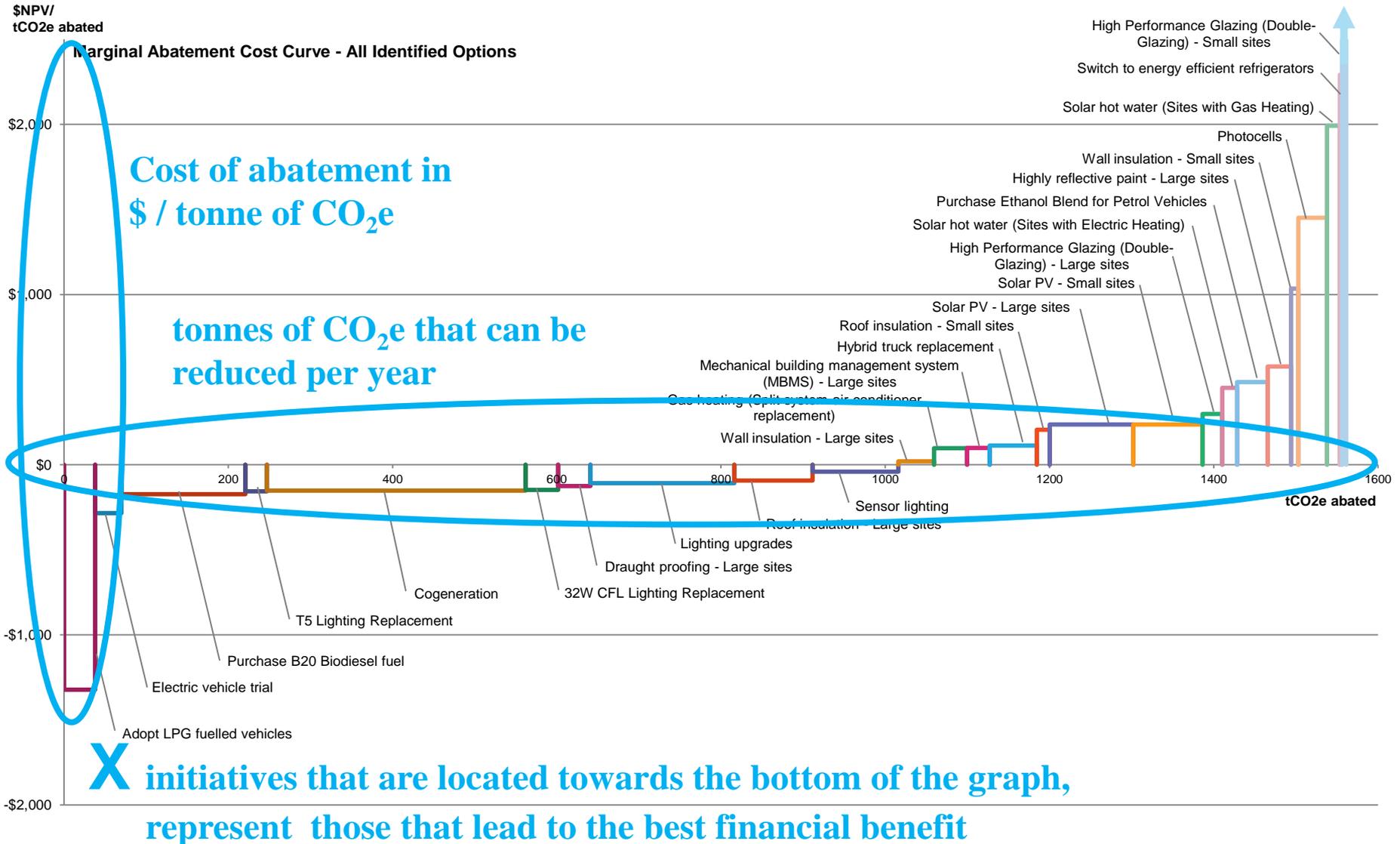
Public lighting



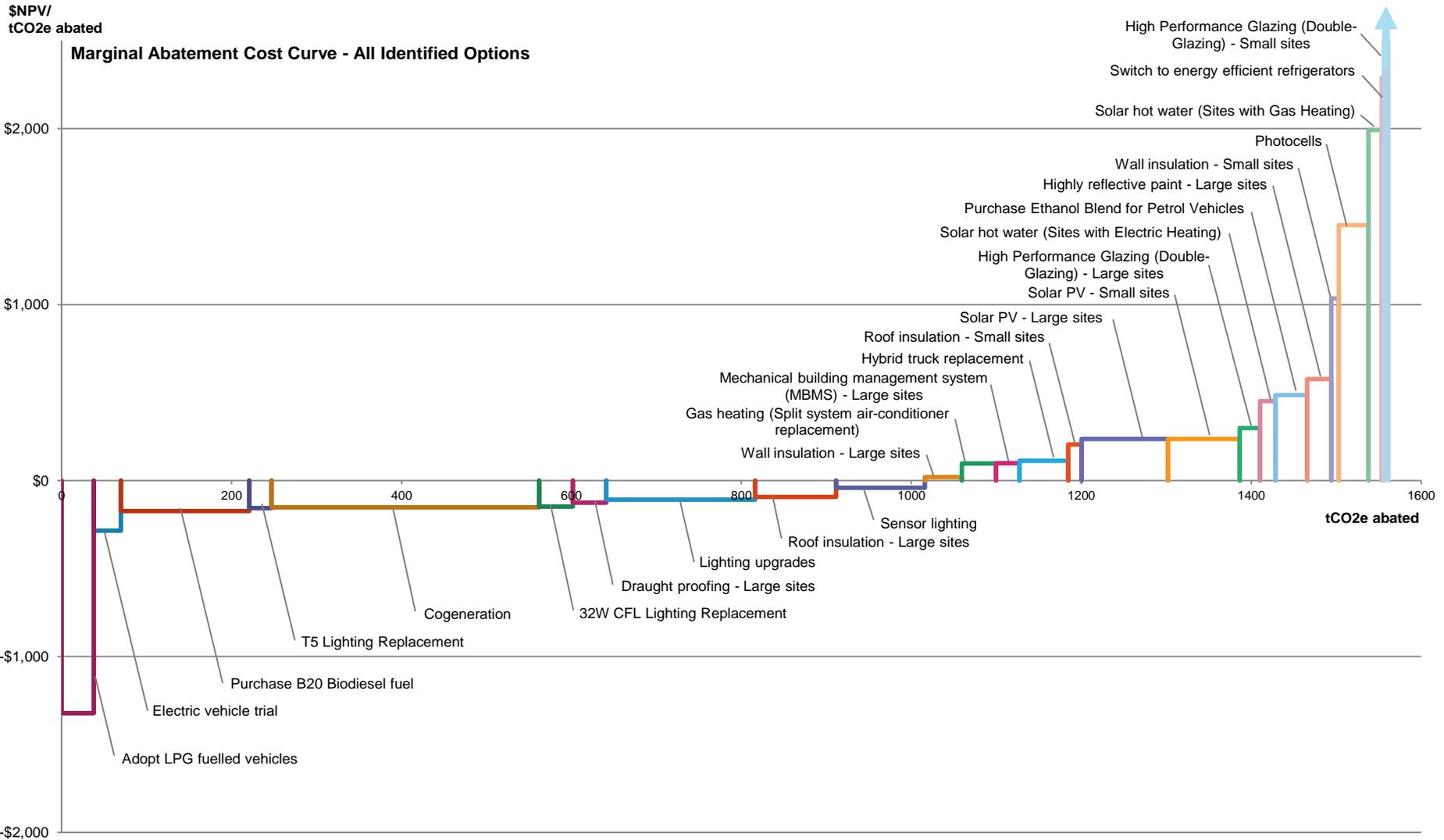
# Analysis Findings

Options Identification and Cost-Benefit Analysis of Carbon Reduction Initiatives

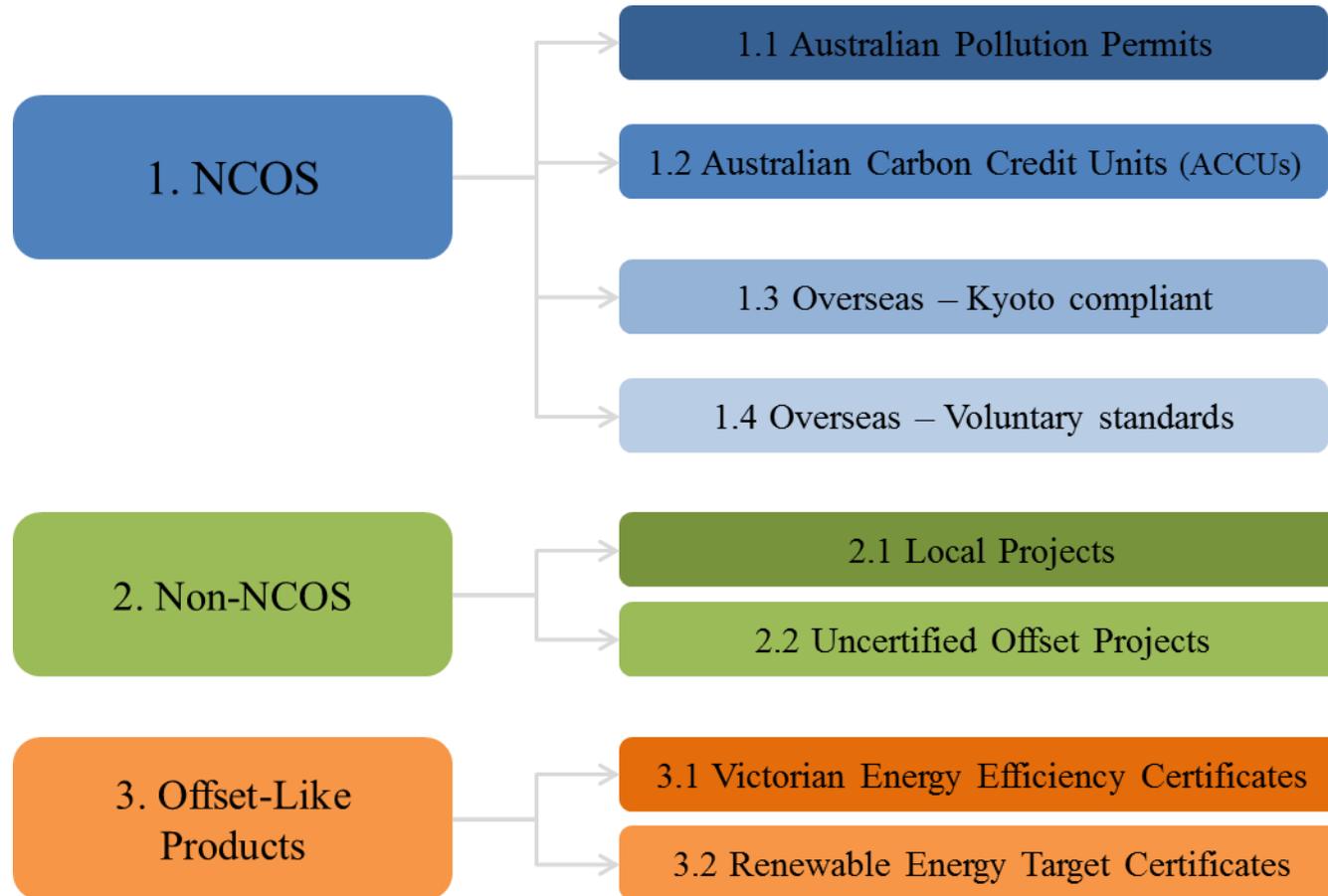
# Interpreting Marginal Abatement Cost Curves



# MACC – All Options



# Available Offset Options



# Available Offsets

Project Type	Location			Project Type			Benefit			Quality		Cost	
	Colac Otway Shire	Australia	Overseas	Avoid	Sequestration	Renewables	Emission reductions	Biodiversity	Social	NCOS	Non-NCOS	High <sup>1</sup>	Low <sup>2</sup>
Australian Pollution Permits		✓		✓			✓			✓		✓	
Australian Carbon Credit Units		✓		✓	✓		✓			✓		✓	✓
Overseas – compliance units			✓		✓	✓	✓	✓		✓			✓
Overseas – Voluntary units			✓	✓	✓	✓	✓	✓	✓	✓			
Local projects	✓			✓			✓				✓		✓
Uncertified Projects	✓	✓	✓	✓	✓	✓	✓				✓		✓
Green Power		✓				✓	✓				✓	✓	
Victorian Energy Efficiency Certificates	✓	✓		✓			✓				✓		✓
Renewable Energy Certificates		✓				✓	✓				✓	✓	

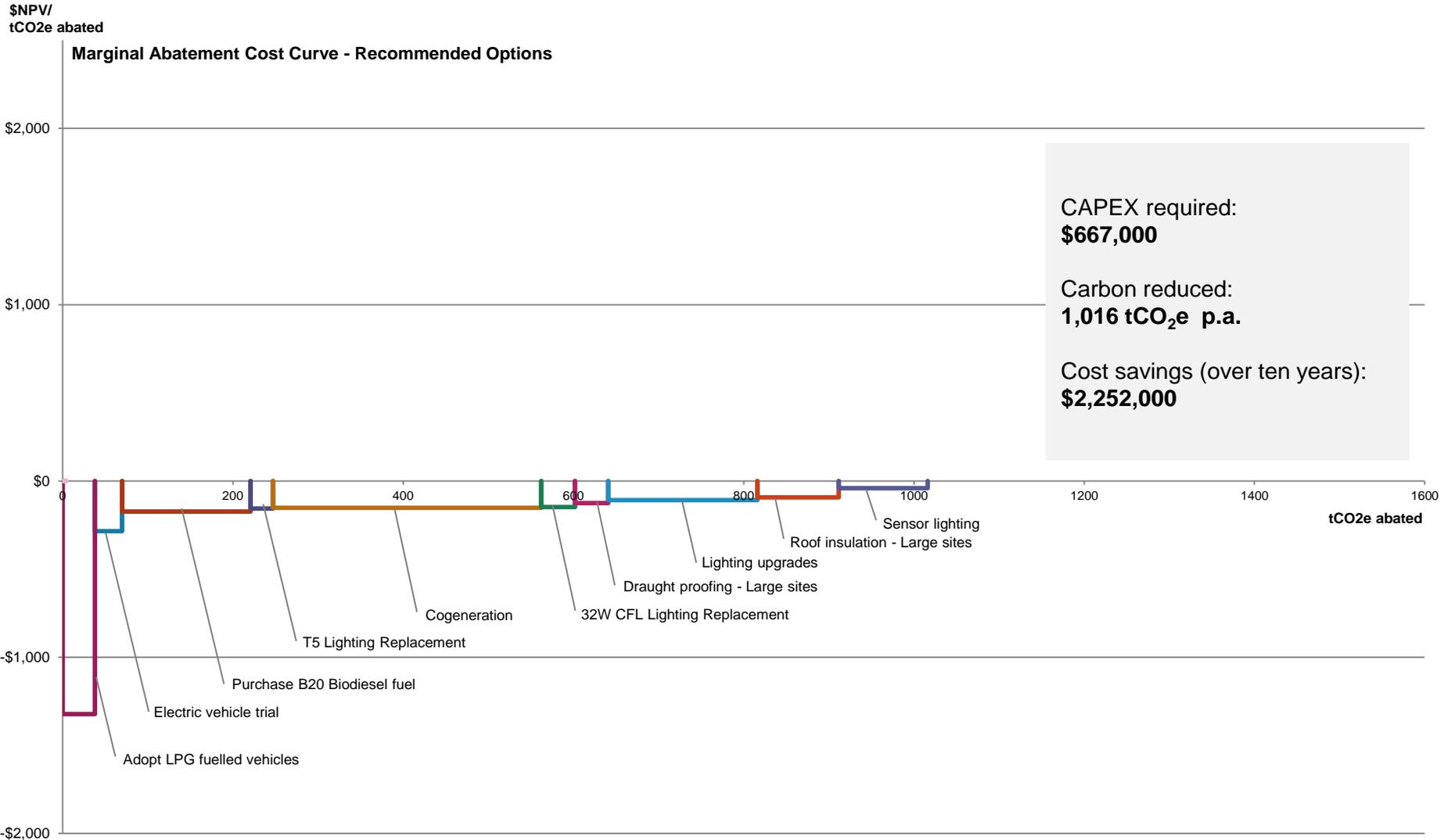
<sup>[1]</sup> Permits are typically greater than \$20 / tCO<sub>2</sub>.

<sup>[2]</sup> Permits are typically less than \$20 / tCO<sub>2</sub>.

# Recommendations

Options Identification and Cost-Benefit Analysis of Carbon Reduction Initiatives

# MACC – Options that Payback within 10 Years



# Setting Targets

On the basis of the analysis, a possible suite of targets are:

- Existing target – **Carbon neutral by 2016**
- Emissions reduction target – **20% by 2016** on a 2011/12 baseline

# Options for Reaching Carbon Neutrality

Colac Otway Shire



# A Roadmap of Options to Carbon Neutrality

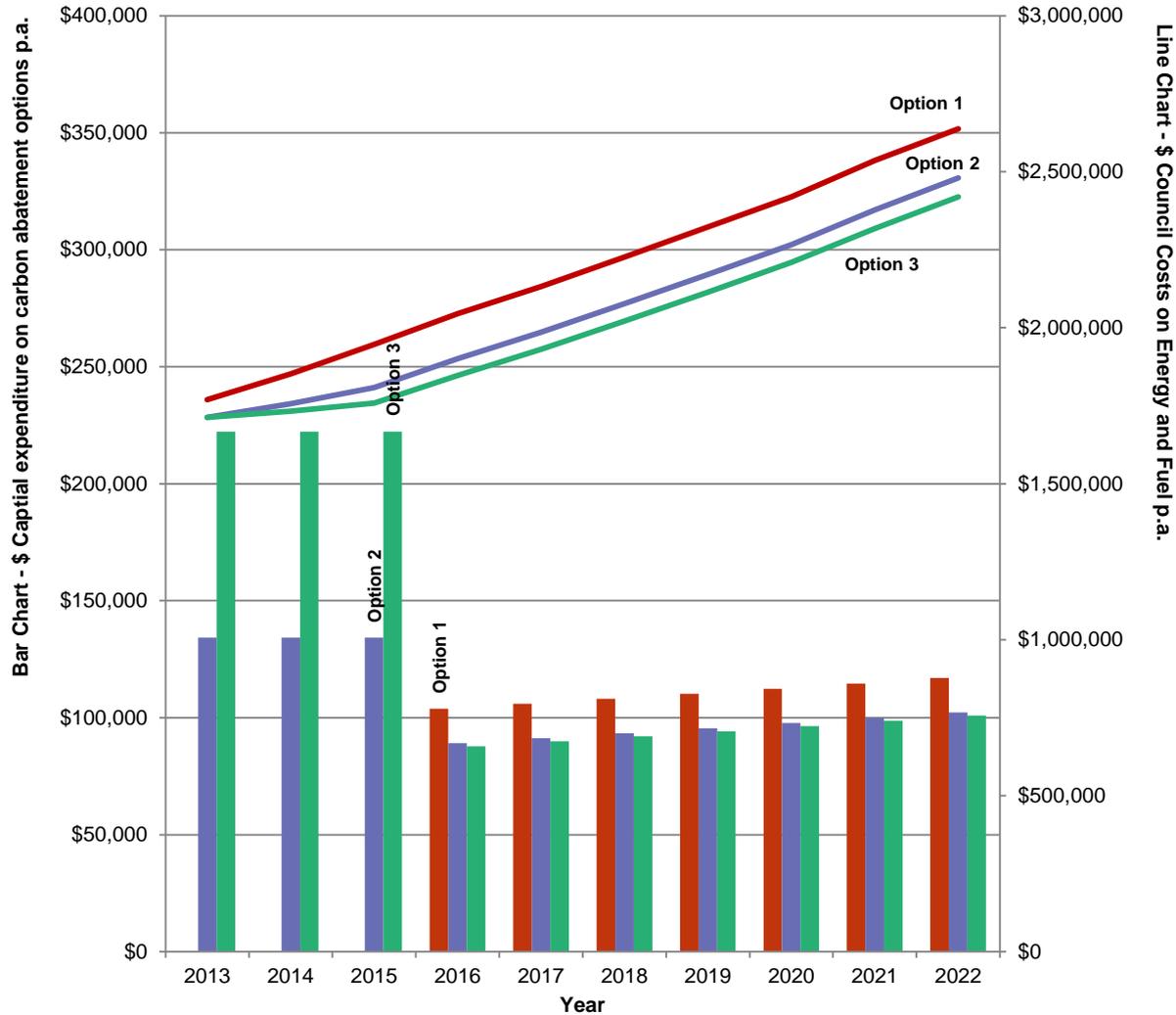
Arup and Colac Otway Shire Council have determined three potential options for a Roadmap to Carbon Neutrality from 2016 onwards.

These options are as follows:

- Option 1.** Offset total emissions from 2016, no investment in abatement measures
- Option 2.** Implement viable abatement measures  
(15% carbon emissions reduction by 2016)
- Option 3.** Implement all measures with a 10-year payback  
(23% carbon emissions reduction by 2020)



# A Comparison of Roadmap Options



**Legend**

**Bar chart:**  
Capital expenditure on carbon abatement options or offsets (\$ p.a.)

**Line chart:**  
Council costs on energy and fuel (\$ p.a.)

**Findings**

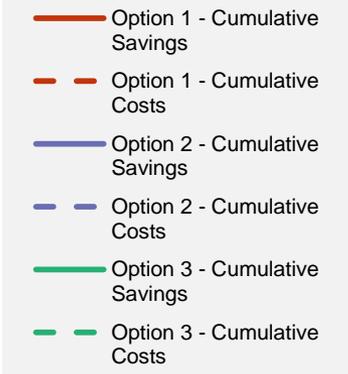
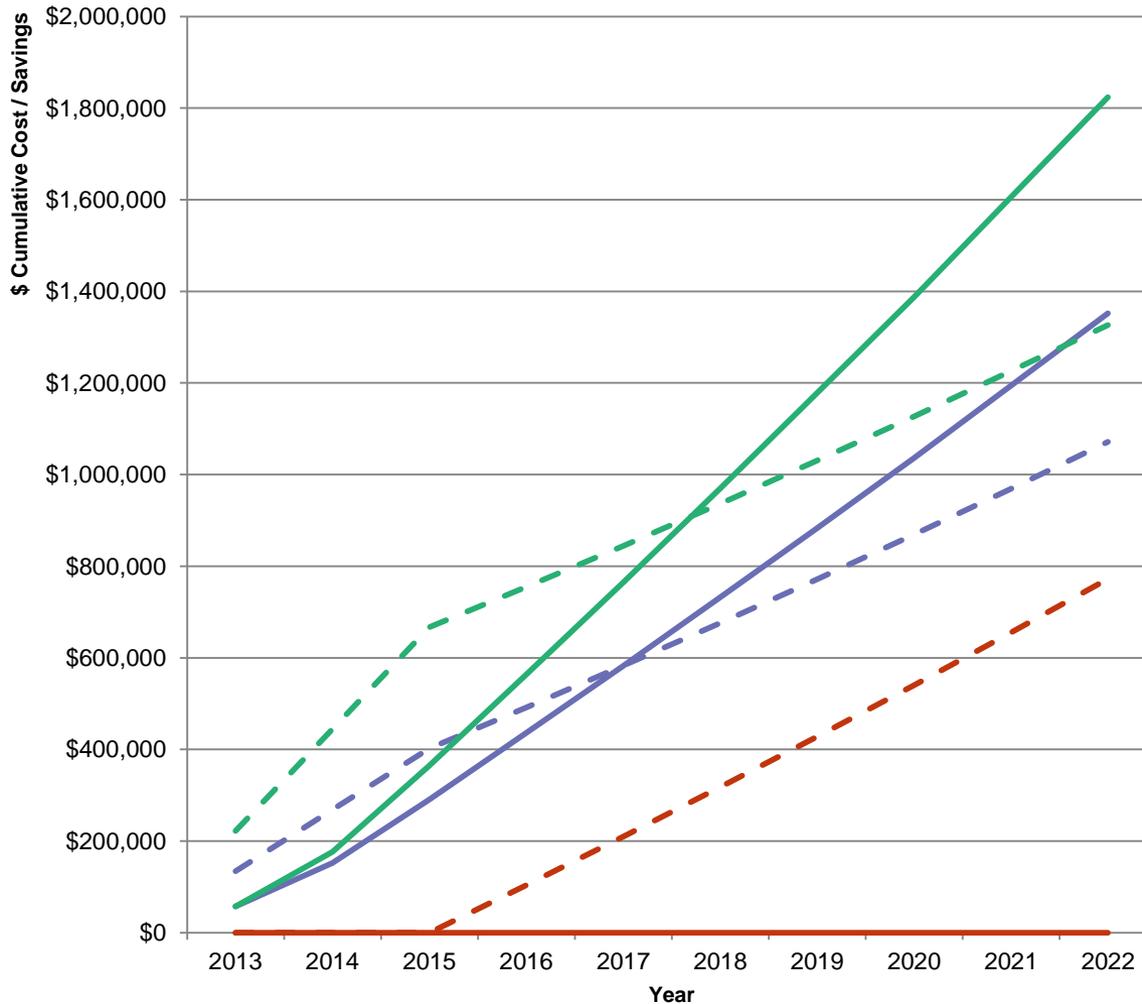
Option 1 presents no capital investment for the first three years, but is more exposed to rising energy and fuel costs in the future.

Option 2 presents the most viable option, by reducing energy and fuel costs over the long-term.

Option 3 presents higher capital costs in the first-three years, but provides minimal improvement compared to Option 2.



# Cumulative Costs vs. Savings



## Findings

Option 1 shows no energy or fuel \$ savings over the next ten years.

Option 2 presents cost savings that will recover the expenditure made in the first three years.

Option 3 presents cost savings that will recover the expenditure made but across a longer period. This option will also require higher initial capital costs.

# A Comparison of Roadmap Options

	Cost of Council Energy / Fuel (\$ over 10 years)	Total Cost of Carbon Abatement / Offsets			Total Council Energy Savings (\$ over 10 years)	Carbon Emission Reductions from Abatement Measures (at 2016)
		Carbon Abatement Measures (\$ over 10 years)	Carbon Offset Purchases (\$ over 10 years)	Total Costs (\$ over 10 years)		
<b>Option 1:</b> Offset total emissions from 2016, no investment in abatement measures	\$21,887,000	\$0	\$772,000	<b>\$772,000</b>	<b>\$0</b>	0 tCO <sub>2</sub> e
<b>Option 2:</b> Implement viable abatement measures (15% carbon emissions reduction by 2016)	\$20,535,000	\$403,000	\$669,000	<b>\$1,071,000</b>	<b>\$1,352,000</b>	670 tCO <sub>2</sub> e
<b>Option 3:</b> Implement all measures with a 10-year payback (23% carbon emissions reduction by 2016)	\$20,063,000	\$667,000	\$660,000	<b>\$1,327,000</b>	<b>\$1,824,000</b>	730 tCO <sub>2</sub> e



# Further Opportunities

There is an opportunity to further Option 2 with additional benefits.

This could involve the extension of the carbon neutral target to 2020, allowing for:

- longer capital investment upfront, and
- time to assess the feasibility of a local project in carbon forestry options

# Extending Carbon Neutral Target to 2020

If Option 2 were adopted, and the carbon neutral target to 2020 were extended, investment of abatement measures could be spread out over a longer period of time.

	Cost of Council Energy / Fuel (\$ over 10 years)	Total Cost of Carbon Abatement / Offsets			Total Council Energy Savings (\$ over 10 years)	Carbon Emission Reductions from Abatement Measures (at 2016)
		Carbon Abatement Measures (\$ over 10 years)	Carbon Offset Purchases (\$ over 10 years)	Total Costs (\$ over 10 years)		
<b>Option 2a:</b> Implement viable abatement measures (15% carbon emissions reduction by 2016)	\$20,535,000	\$403,000	\$669,000	<b>\$1,071,000</b>	<b>\$1,352,000</b>	670 tCO <sub>2</sub> e
<b>Option 2b:</b> Implement viable abatement measures (15% carbon emissions reduction <b>by 2020</b> )	\$20,772,000	\$403,000	\$300,000	<b>\$702,000</b>	<b>\$1,115,000</b>	670 tCO <sub>2</sub> e

# Potential Feasibility of Local Project in Carbon Forestry

A simple costing for a local project in carbon forestry may include the following:

- 1 ha of mixed native forest revegetation (1,500 plants)  
*= 268 tonnes of tCO<sub>2</sub>e sequestered on average*
- Council's unavoidable emissions annually of 3500 tCO<sub>2</sub>e  
*= 13.1 ha of revegetation p.a.*
- Cost of establishment (approx. \$3000 per ha of revegetation)  
*= \$47,200 (incl. 20% administration costs, not incl. cost of land purchase if required)*

