LOVING
LIVING
KU-RING-GAI
Sustaining Sydney's green heart

Greenhouse Gas Reduction Action Plan

2015 – 2017

Doc distribution	External	**Doc status**	Draft	**File No**	2014/193992
Document owner	Manager Environment and Sustainability	**Contact officer/s**	Manager Environment and Sustainability		
Approval date	June 2015	**Approved by**	General Manager and Directors (GMD)		
Effective date	June 2015	**Review period**	Every 3 years	**Review date**	June 2018

History of approved versions

Version	Effective date	Summary of changes
1	June 2015	Final

Contents

List of figures

List of tables

Background

Climate change science is now clear. “The warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the oceans have acidified, the amounts of snow and ice have diminished, and sea level has risen.” (IPCC, 2014, p2)

“Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century. “(IPCC 2014, p4)

“In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. In many regions, changing precipitation or melting snow and ice are altering hydrological systems, affecting water resources in terms of quantity and quality (medium confidence). Many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions in response to ongoing climate change (high confidence).The negative impacts of climate change on crop yields have been more common than positive impacts (high confidence). Some impacts of ocean acidification on marine organisms have been attributed to human influence (medium confidence). Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability (very high confidence).” (IPCC 2014, p7-8)

“Our future climate will depend on committed warming caused by past anthropogenic emissions, as well as future anthropogenic emissions and natural climate variability.’ (IPCC 2014, p10) “Continued emissions of greenhouse gases and rising rates and magnitudes of warming and other changes in the climate system, accompanied by ocean acidification, increase the risk of severe, pervasive, and in some cases irreversible detrimental impacts. The precise levels of climate change sufficient to trigger abrupt and irreversible change remain uncertain, but the risk associated with crossing such thresholds increases with rising temperature. “(IPCC 2014, p13)

“Limiting climate change will require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.” (IPCC 2014, p8) “Mitigation involves some level of co-benefits and of risks due to adverse side-effects, but these risks do not involve the same possibility of severe, widespread, and irreversible impacts as risks from climate change, increasing the benefits from near-term mitigation efforts.” (IPCC 2014, p17) [1].

Ku-ring-gai Council, as a key asset owner, service provider and decision-maker, has a responsibility to its community to effectively mitigate against and adapt to the impacts of climate change.

Purpose

This Greenhouse Gas (GHG) Reduction Action Plan (2015) supports Council’s Climate Change Policy (2015) by providing a mitigation response to climate change and describing how Council intends to meet its GHG emission reduction target of 20% by 2020, based on 2000 levels. It outlines findings from a review of Council’s reduction targets to date; Council’s current performance against its 2020 GHG emission reduction target; Council’s future predicted GHG emissions based on current levels of activity and investment; future GHG emission scenarios (including resourcing implications); and recommended abatement activities to enable Council to achieve its 2020 reduction target. It also provides an overview of Council’s (2000) baseline emissions and states how progress will be tracked and measured.

[1] A full summary of climate change observations, projections, impacts and risks at a global, national, state and regional level is attached to this Action Plan as *Appendix 1: Climate change: observations, projections, impacts and risks*.

This Action Plan builds on Council's Energy Reduction Strategy (2010) and the progress made to date in reducing Council's energy consumption and GHG emissions through projects funded by Council's Environmental Levy and operational budget. A significant challenge exists for Council in meeting its 2020 GHG emission reduction target in light of predicted population growth and Council's predicted new and replacement assets.

Objectives

This Plan responds to a number of objectives in Council's 2015 Climate Change Policy 2015, namely:

- To reduce Council's greenhouse gas emissions (from Council assets, street lighting and vehicles) to levels consistent with the international goal of limiting global warming to 2˚ C above pre-industrial levels, equating to a reduction in GHG emissions of 20% by 2020, 50% by 2030 and 100% by 2045, based on 2000 levels.
- To limit Council's 2013-2050 emissions to 158,827 tonnes of CO_2 equivalent (CO2-e), in order to achieve Council's greenhouse gas emission reduction targets.

Review of current GHG emission reduction targets

The continuing appropriateness of Council's current GHG emission reduction targets was considered in light of recommended international and Australian targets, and a recent release, by the Climate Change Authority, of a set of recommendations on future emission targets and trajectories for Australia in its report, *Reducing Australia's Greenhouse Gas Emissions – Targets and Progress Review*.

Recommended international targets

In its Fourth Assessment Report (2007), the IPCC analyses the emission reductions required by developed (Annex 1) countries to achieve different atmospheric CO2-e concentration stabilisation levels, as shown in the figure below.

Box 13.7 The range of the difference between emissions in 1990 and emission allowances in 2020/2050 for various GHG concentration levels for Annex I and non-Annex I countries as a group[a]

Scenario category	Region	2020	2050
A-450 ppm CO_2-eq[b]	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO_2-eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO_2-eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

Notes:

[a] The aggregate range is based on multiple approaches to apportion emissions between regions (contraction and convergence, multistage, Triptych and intensity targets, among others). Each approach makes different assumptions about the pathway, specific national efforts and other variables. Additional extreme cases – in which Annex I undertakes all reductions, or non-Annex I undertakes all reductions – are not included. The ranges presented here do not imply political feasibility, nor do the results reflect cost variances.

[b] Only the studies aiming at stabilization at 450 ppm CO_2-eq assume a (temporary) overshoot of about 50 ppm (See Den Elzen and Meinshausen, 2006).

Source: See references listed in first paragraph of Section 13.3.3.3

Figure 1: Targets for different atmospheric CO2-e concentrations (Source: IPCC 2007, p 776)

At the 2009 United Nations Climate Change Conference in Copenhagen it was agreed that holding any temperature increase to below 2˚C above preindustrial levels was needed to prevent 'dangerous' climate change. "Warming above 2˚C increases the likelihood that the world will cross irreversible 'tipping points' in the climate system that results in abrupt, highly disruptive and permanent changes. Two of the most fragile tipping points are believed to be the permanent melting of Arctic summer sea-ice and the Greenland Ice Sheet, which may occur between 1 and 2.5 degrees of global warming (compared with pre-industrial levels)." (Climate Change Authority 2014, p36)

Referring to Figure 1, an atmospheric concentration level of 450 ppm (CO_2e) is consistent with about a 50% chance of limiting warming to 2˚C or less, equating to Annex 1 countries (including Australia) setting greenhouse gas emission reduction targets of 25 – 40% by 2020, based on 1990 levels.

Current Australian targets

Currently, the Australian government has committed to:

- a long-term target to cut its greenhouse gas (GHG) emissions by 80 per cent below 2000 levels by 2050
- reducing its GHG emissions by 5% below 2000 levels by 2020 (unconditionally)
- reducing its GHG emissions by 25% below 2000 levels by 2020 if the world agrees to an ambitious global deal capable of stabilising levels of GHGs in the atmosphere at 450 ppm (parts per million) carbon dioxide equivalent (CO_2-e) or lower
- reducing its GHG emissions by up to 15% below 2000 levels by 2020 if there is a global agreement that falls short of securing atmospheric stabilisation at 450 ppm CO_2-e, but where major developing economies commit to substantially restraining their emissions and advanced economies take on commitments comparable to Australia's

Recommended future emissions targets and trajectories

The Australian Climate Change Authority (CCA) is an independent statutory agency that reports to the Australian Parliament through the Minister responsible for climate change. In February 2014 the CCA released a set of recommendations on future emission targets and trajectories for Australia in its report *Reducing Australia's Greenhouse Gas Emissions – Targets and Progress Review*.

As the magnitude of global temperature increases is not determined by emissions in one year but by the cumulative concentration of emissions in the atmosphere limiting climate risks implies a limit to cumulative greenhouse gas emissions.

Consistent with the objective of limiting cumulative emissions, the IPCC in its Fifth Assessment Report on the Physical Science basis of Climate Change, released in September 2013, quantified a global emissions budget as the key to avoiding global warming beyond 2˚ C. The CCA uses the global emissions budget as a reference point for setting a national budget for Australia. A global emissions budget sets out the total amount of global emissions consistent with the aim of limiting warming to a specific temperature target, within a probability range.

A global emissions budget sets out the total amount of cumulative global emissions consistent with the aim of limiting warming to a specific temperature target, within a probability range. Australia's emissions reduction goals should therefore be considered in the context of a global emissions budget.

The IPCC (2013) refers to a global emissions budget of 1,000 Gt of carbon to provide a likely (greater than 66 per cent) chance of limiting global warming to less than 2˚ C, and notes that about half that budget has already been emitted. In its report, the CCA (2014) uses the global emissions budget estimates developed in a study by Meinshausen et al (2009), which have been widely cited by other scientific studies and used by national and international bodies as a reference for global emissions budgets. The IPCC's estimated emissions budget is consistent with the budgets described in the Meinshausen et al. study used in the CCA review. The two studies, however, use some different assumptions and report in different units, resulting in different budget figures.

In light of the severe global and national risks projected at temperatures of 2 degrees and above, the CCA (2014) considers that the global emissions budget used as a reference point for setting Australia's national budget should have at least a 67% probability of limiting warming to 2 degrees or less (defined as 'likely'). The global emissions budget used by the CCA (2014) as a reference is therefore 1,700 Gt CO_2-e (Kyoto

multi-gases) for the period 2000–2050, which gives a 67 per cent probability of limiting temperature increases to 2˚C or less (about 35 per cent of this budget has already been used between 2000 and 2012).

Based on a global emissions budget of 1,700 Gt CO_2-e (Kyoto multi-gases) for the period 2000–2050, the CCA (2014) has developed a national recommended emission budget for Australia, described by a set of targets and trajectories, providing a clear course for action (depicted in the figure below):

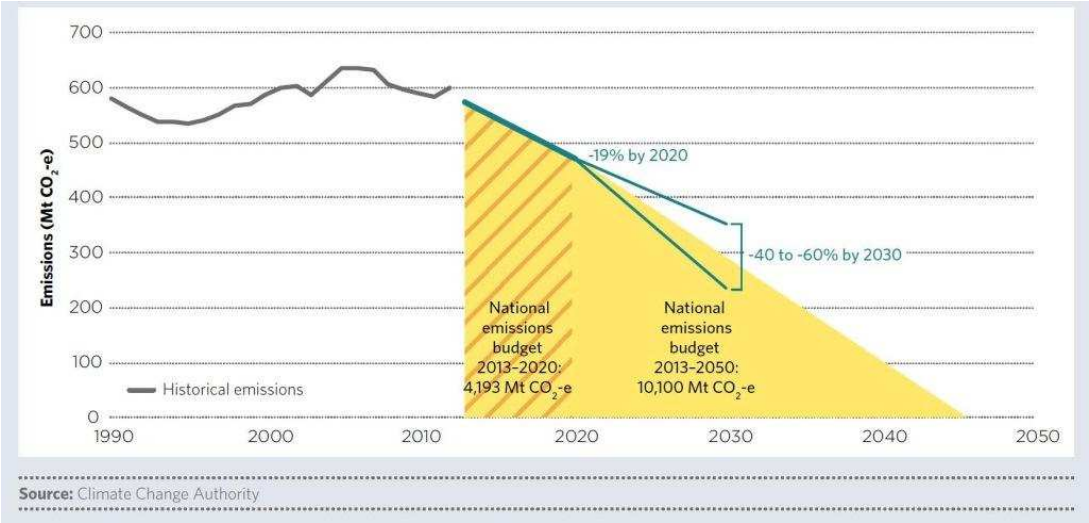


Figure 2: National emissions budget and set of targets and trajectories (Source: CCA 2014, p9)

This equates to:

1. An indicative national trajectory consistent with a 19 per cent reduction in greenhouse gas emissions below 2000 levels by 2020 and an emissions budget of 4,193 Mt CO_2-e for the period 2013–2020.
2. Beyond 2020, guidance for longer term planning and investment, subject to frequent review in light of new information:
    - a trajectory range for emissions reductions of between 40 and 60 per cent below 2000 levels by 2030
    - a national emissions budget for 2013–2050 of 10,100 Mt CO_2-e, (around 1% of the estimated global budget), considered to be Australia's fair share of a global emissions budget

In its report, the CCA (2014) lists the following considerations as being the key factors used when formulating its target and trajectory recommendations:

- What the science tells us
- International action to reduce emissions
- Australia's progress to date in reducing emissions
- Australia's equitable share of emissions
- Economic implications for Australia
- Domestic and international opportunities for emissions reduction

Other key findings in the CCA (2014) report were:

- Australia has a clear national interest in limiting global warming to no more than 2 degrees.
- If emission levels are allowed to warm the planet above 2 degrees, the climate impacts in Australia would be highly disruptive, impose a heavy financial burden and, in many cases, would prove to be beyond Australia's capacity to adapt.
- The cumulative effect of current 2020 emissions reduction pledges falls short of what is required to hold temperature increases below 2 degrees. This suggests all countries, including Australia, will need to do more to help achieve this goal.
- Australia's 2020 targets of 15 or 25 per cent would be broadly comparable with the current actions of other key countries, including major emitters; Australia's trading partners; and neighbours.

- The CCA's analysis of the Government's target conditions show that the conditions for moving beyond 5 per cent have been met. Whether the conditions for 15 per cent have been met are unclear – some elements have been met, others are marginal. The conditions for a 25 per cent target have not been met. While the Authority has taken these conditions into account, it is also required to examine a broader range of considerations.
- Considering a range of measures, Australia's current 5 per cent target is low compared with the targets of other key countries. A stronger 2020 target of 15 or 25 per cent is broadly comparable with other countries' targets, including that of the United States. This is especially the case given Australia's high level of development, relative wealth and governance capacity.

Australia's emissions were broadly the same in 2012 as in 1990, despite a doubling in the size of the economy over this period. This means that the emissions intensity of the economy (emissions per unit of GDP) has halved.

Council emissions budget and set of targets and trajectories

Based on the CCA (2014) target and trajectory recommendations above, that is, Australian emissions from 2013-2050 be constrained to 10,100 Mt CO_2-e using a set of straight lines from 2013-2020 (-19% at 2020), 2020-2030 (-50% at 2030), and 2030-2050 (-100% at 2045), where all percentages are relative to 2000 emission levels, a Council emission profile can be drawn which is congruent with the CCA's budget and targets. By applying the same percentage targets and trajectories to Council's 2000 and 2012 emission levels, Council's 2013-2050 emissions budget is 158,827 t CO_2-e, as depicted in the figure below.

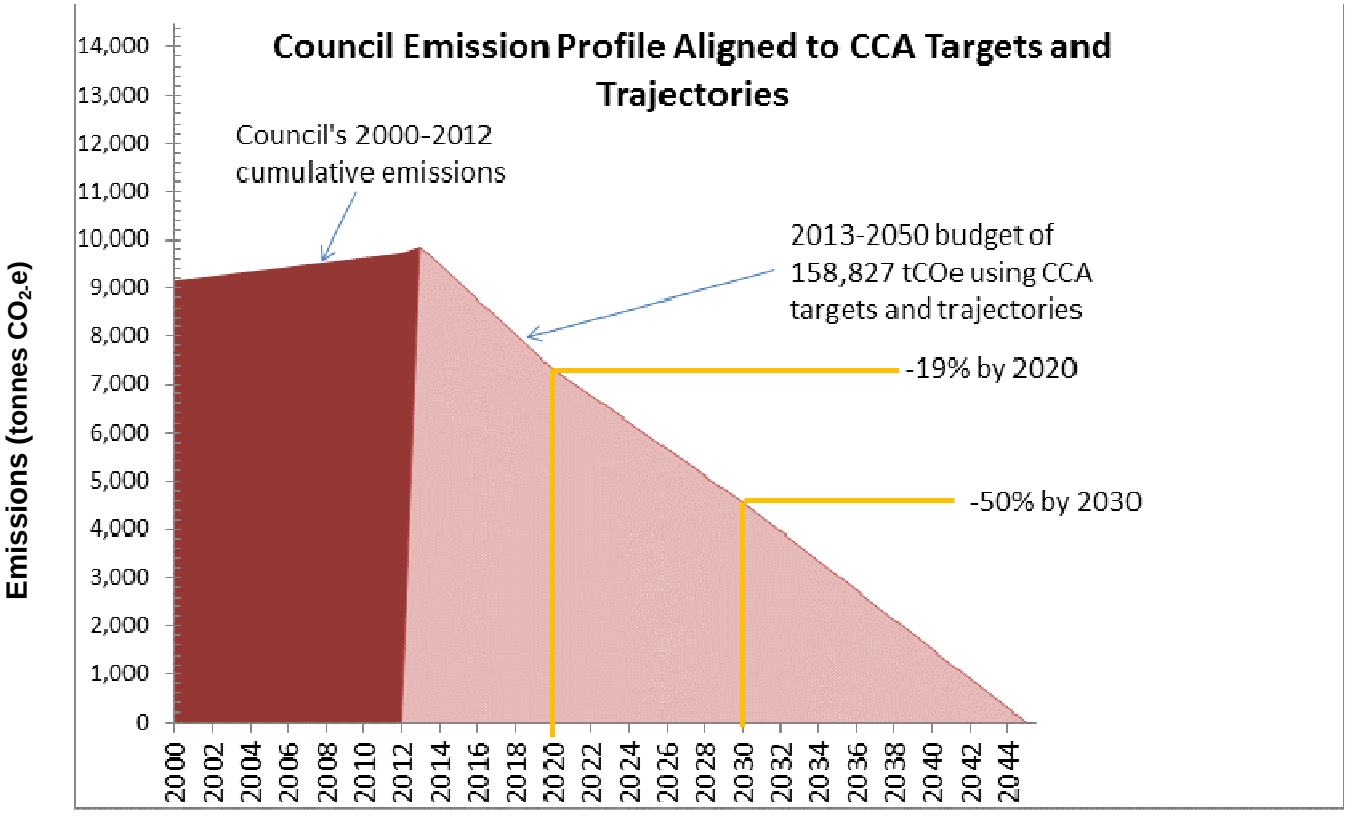


Figure 3: Council emissions budget and set of targets and trajectories

Below are 3 figures illustrating the required emissions profiles (targets and trajectories) under a range of future greenhouse gas emission scenarios (described in detail below) for Council to meet its emissions budget.

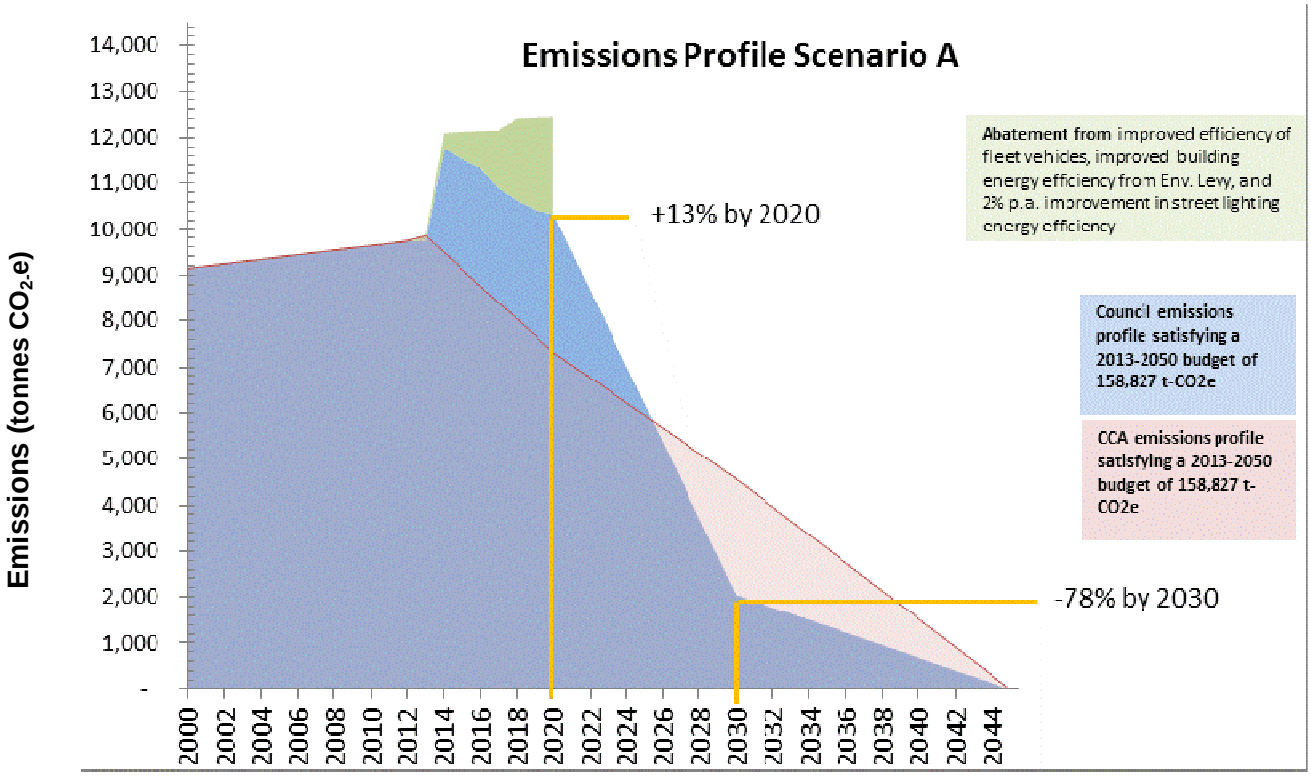


Figure 4: A 13% increase in GHG emissions by 2020 equates to the need for a reduction of 78% by 2030 to meet Council's emissions budget

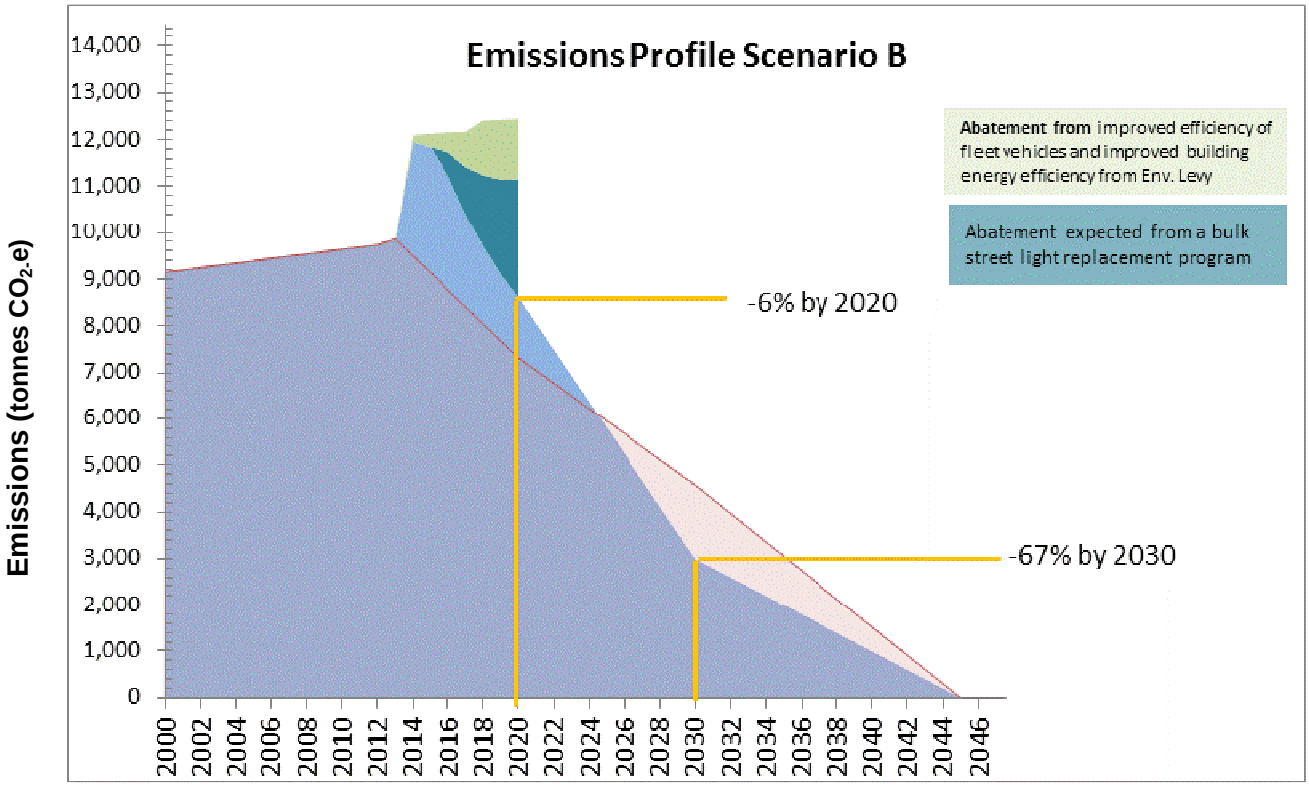


Figure 5: A 6% decrease in GHG emissions by 2020 equates to the need for a reduction of 67% by 2030 to meet Council's emissions budget

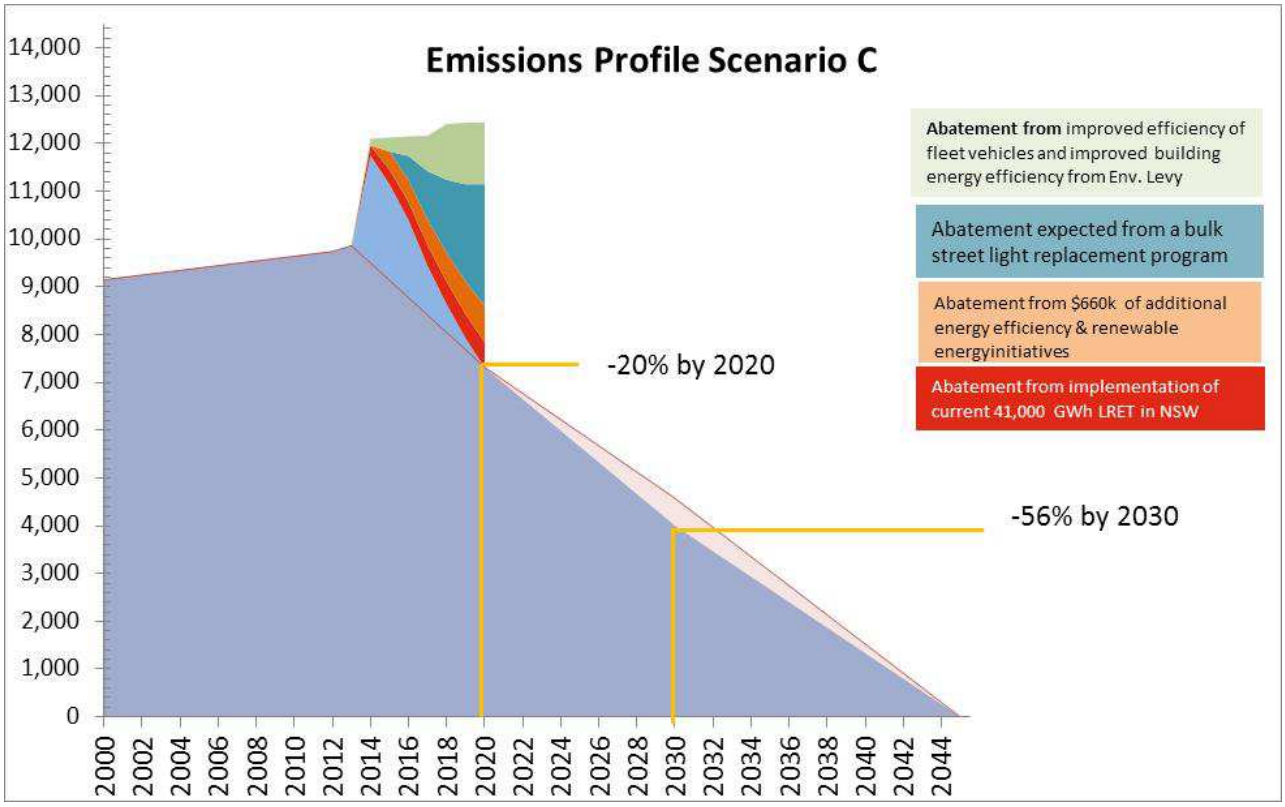


Figure 6: A 20% decrease in GHG emissions by 2020 equates to the need for a reduction of 56% by 2030 to meet Council's emissions budget

Under the scenario in Figure 6, Council would also be more able to accelerate 2020-2050 emissions abatement, if for example, future reviews of the national budget against global progress and the latest science led to a lowering of the CCA's current 2013-2050 national budget.

Based on the information presented above, Council's current GHG emission reduction target of 20% by 2020 based on 2000 levels remains appropriate. Council's current 2050 emissions reduction target of 90% should be revised to be 100% by 2045. An interim reduction target of 50% by 2030 should also be introduced.

Performance against current GHG emission reduction target

Council's performance against its current GHG emissions reduction target of 20% by 2020 based on 2000 levels was subject to a recent analysis by Ironbark Sustainability, in consultation with Council staff.

Council's 2000 baseline emissions (electricity from fixed assets, electricity from street lighting and vehicles) were determined through the Greenhouse Gas Abatement Tool, developed through the ICLEI Oceania Cities of Climate Protection program. As this tool is no longer available, the National Greenhouse and Energy Reporting (NGER) framework was utiised, operating under the *National Greenhouse and Energy Reporting Act 2007* to develop a whole-of-Council greenhouse gas emissions profile for 2011-2012 and to enable Council to measure progress against its 2020 reduction target.

Under the NGER framework, emissions are categorised into three scopes:

- Scope 1: direct emissions
- Scope 2: direct emissions from the purchase of electricity
- Scope 3: all other indirect emissions

The NGER reporting system encompasses all scope 1 and scope 2 emissions but does not include scope 3 emissions since one organisation's scope 3 emissions (for example, municipal waste) would be another organisation's scope 1 emissions (for example, landfill emissions from a waste facility). Ku-ring-gai Council is under the reportable corporate threshold and has no reporting obligations under the NGER framework.

Based on the NGER framework, Table 1 below looks at the various activities conducted by Council, their scope, whether they should be reported and the priority and timeline for including them in Council's GHG emissions profile.

Activity	Scope	Report	Priority	Term
Electricity	2	Yes if pay bills/have operational control	High	Short
Grid-sourced gas	1	Yes if pay bills/have operational control	High	Short
LPG	1	Yes if pay bills/have operational control	Medium	Short
Transport fuel	1	Yes	High	Short
Refrigerants	1	No	Medium	Medium
Oils and lubricants	1	No	Medium	Medium
Water	3	Yes	High	Short
Waste	3	If data available	High	Short
Paper	3	If data available	High	Short
Upstream emissions	3	Yes	High	Short
Flights	3	If data available	High	Short
Other supply chain	3	No	Low	Long
Contractor emissions	3	No	Low	Long

Table 1: Council activities, scope and reporting

The National Greenhouse Accounts (NGA) issued by the Federal Department of Climate Change and Energy Efficiency includes emission factors for all fuels, grid-sourced gas, electricity and waste. Emissions factors for paper and water were sourced from Victoria's Environmental Protection Agency's Greenhouse Inventory Management Plan.

Council's 2011-2012 GHG emissions profile was calculated accordingly and is presented in Table 2 below:

Emissions source	CO2-e(tonnes)	Proportion (%)
Direct Emissions (scope 1)		
Diesel Oil in Vehicles	1,009.05 *	10.06
Ethanol in Vehicles	0.12 *	0.00
Gasoline in Vehicles	170.02 *	1.69
LPG in Vehicles	18.80 *	0.19
Liquefied Petroleum Gas	2.97	0.03
Grid-sourced gas	71.31	0.71
Total Scope 1	**1272.27**	**12.68**
Indirect Emissions (scope 2)		
Electricity (fixed assets)	2,826.90 *	28.20
Total Scope 2	**2,826.90**	**28.20**
Optional Emissions (scope 3)		
Electricity (Street Lighting)	4,267.35 *	42.50
0% - 49% Recycled Paper Usage	5.89	0.06
50% - 74% Recycled Paper Usage	0.60	0.01
75% - 100% Recycled Paper Usage	9.59	0.10
Diesel Oil in Vehicles Indirect Emissions	76.58*	0.76
Electricity Indirect Emissions (buildings and street lighting)	1,354.90*	13.51
Ethanol in Vehicles Indirect Emissions	0.00	0.00
Gasoline in Vehicles Indirect Emissions	13.49*	0.13
LPG in Vehicles Indirect Emissions	1.51*	0.02
Landfill Waste	13.80	0.14

Emissions source	CO2-e(tonnes)	Proportion (%)
Liquefied Petroleum Gas Indirect Emissions	0.19	0.00
Grid-sourced gas Indirect Emissions	19.71	0.20
Paper Recycling Waste	0.00	0.00
Potable Water	169.69	1.69
Total Scope 3	**5933.30**	**59.12**
SCOPE 1+2+3	**10032.47**	**100**

Table 2: GHG emissions inventory (2011/12)

Using this profile, Council extracted the data (marked with a *) that aligns with the 2000 baseline data (electricity from Council assets, electricity from street lighting and vehicles) to measure progress against its 2020 reduction target. This data represents 97% of the emissions that Council can currently measure.

Council's 2012 GHG emissions

This analysis revealed that with current levels of activity and investment, Council's greenhouse gas emissions (electricity from fixed assets, electricity from street lighting and vehicles) has increased by 6% in 2012, compared to 2000 levels, as shown in the table below. Despite the above, there has been a recent downward trend in fixed assets and street lighting emissions.

	1999/2000	2011/12	
	Tonnes CO2-e		% change 2012
Fixed assets	2926	3367	15%
Fixed assets target	2340	2340	
Street lighting	4664	5082	9%
Street lighting target	3732	3732	
Vehicles	1,559	1290	-17%
Vehicles target	1,247	1,247	
Total	**9,149**	**9,739**	**6%**
Total Target	**7,319**	**7,319**	

Table 3: Comparison of Council's emissions in 2011-2012 against its 2020 target

A breakdown of Council's 2011-2012 emissions by emission type (fixed assets, street lighting and vehicles) is depicted in the figure below. This demonstrates that over half of Council's emissions are from street lighting.

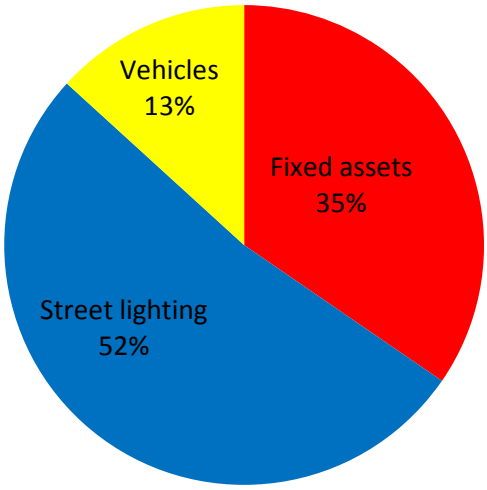


Figure 7: Breakdown of emissions by fixed assets / street lighting / vehicles (2011/12)

Council's 2014 GHG emissions

Following the analysis by Ironbark Sustainability, Council's emissions between 2000 and 2014 were also calculated and are presented below.

Electricity emissions from fixed assets

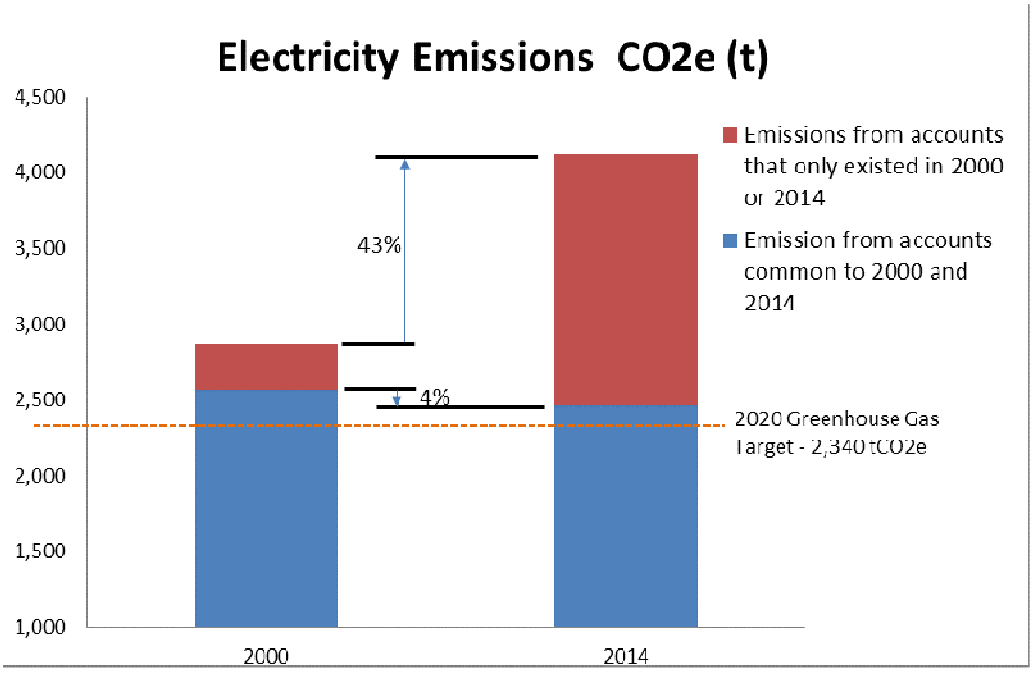


Figure 8: Council's electricity emissions from fixed assets 2000-2014

Greenhouse gas emissions from fixed assets decreased by 4% between 1999/2000 and 2013/2014 for common accounts, due to energy efficiency measures and alternative energy projects implemented across Council. However, when incorporating the emissions from new electricity accounts added between 2000 and 2014, Council's emissions from fixed assets were 43% higher in 2014 than they were in 2000.

Street lighting emissions

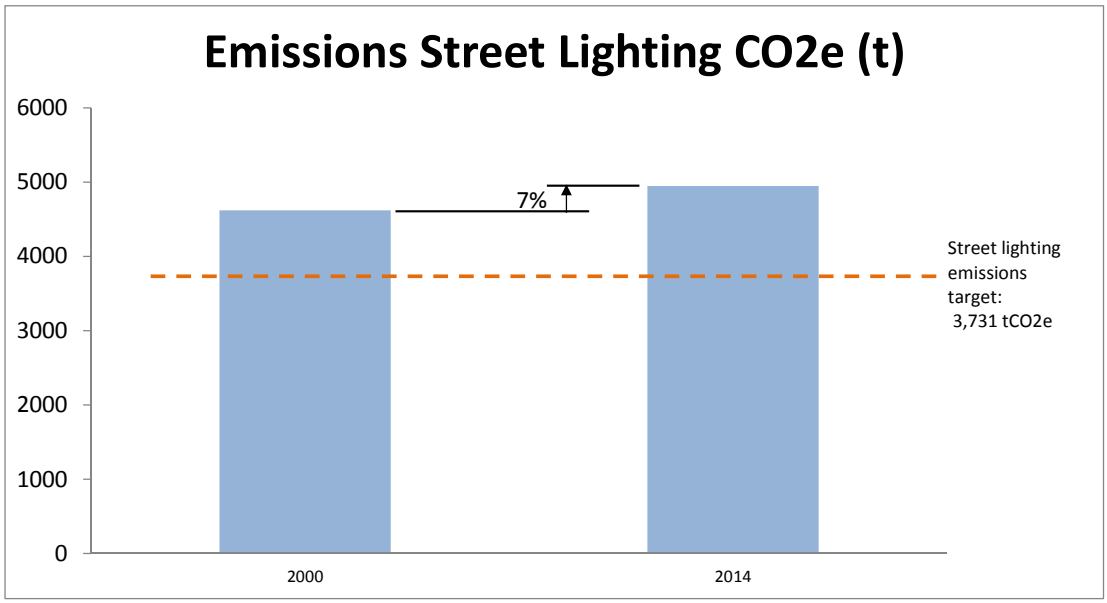


Figure 9: Council's electricity emissions from street lighting 2010-2014

Council emissions for street lighting have increased by 7% between 2000 and 2014. Emissions include Scope 2 and Scope 3 emissions.

Fleet emissions

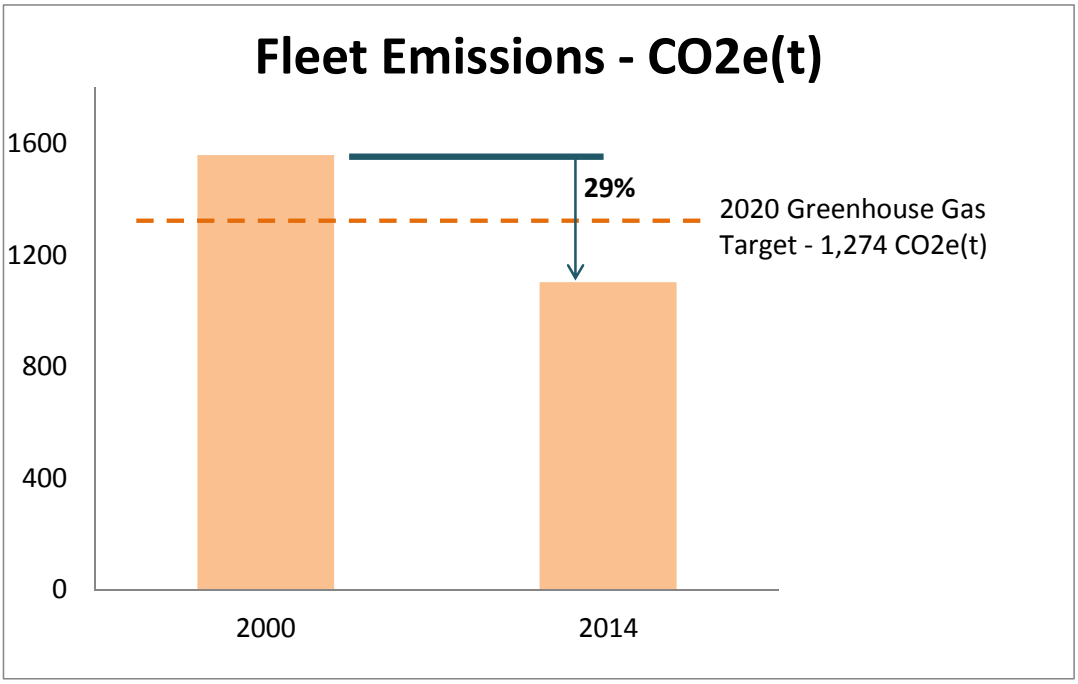
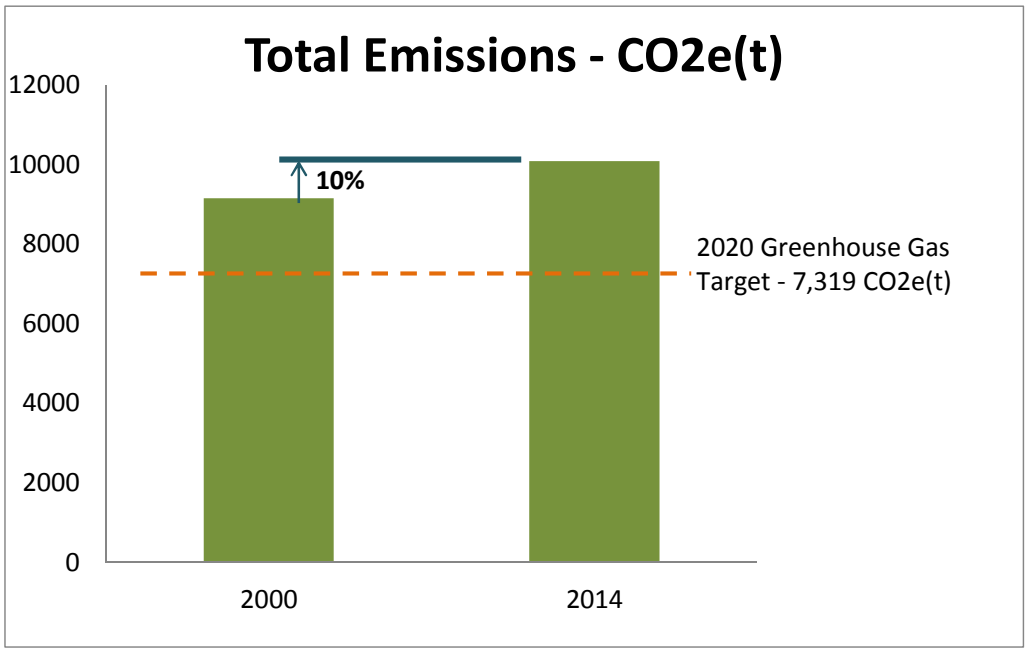


Figure 10: Council's fleet emissions 2000-2014

Council has reduced greenhouse gas emissions from our fleet by 29% since 2000.

Total emissions



* Emissions include electricity for Council assets, electricity for street lighting, and fleet fuel. Reporting period is for the 12 months April to March.

Figure 11: Council's total emissions 2000-2014

Council's overall GHG emissions have increased by 10% between 2000 and 2014.

Council's predicted future GHG emissions

The Ironbark Sustainability analysis revealed that with current levels of activity and investment, Council's GHG emissions (from electricity from fixed assets, street lighting and vehicles) are predicted to be 13% higher in 2020 based on 2000 levels, as shown in the table below.

	Emissions 1999/2000 (tonnes CO2-e)	**Emissions 2011/12** (tonnes CO2-e)	**Emissions 2019/20** (tonnes CO2-e)	**% change 2012**	**% change 2020**	**Notes**	**% change 2020 with (current) RET** [2]
Fixed assets	**2,925**	**3,367**	**4,874**	**15.1%**	**66.6%** [1]	Incorporating predicted population growth, new and replacement assets and current Environmental Levy and grant funding	**53.3%**
Fixed assets target	2,340	2,340	2,340				

Street lighting 2%	**4,664**	**5,082**	**4,269**	**9.0%**	**-8.5%**	Incorporating current anticipated street light energy consumption improvements of 2% per year [as part of the Street Light Improvement (SLI) program	**-15.8%**
Street lighting bulk changeover	**4,664**	**5,082**	**2,541**	**9.0%**	**-45.5%**	Incorporating predicted street light energy consumption improvements with a bulk change over, based on programs implemented to date, and a 3-year planning period and 5 year implementation period	**-49.9%**
Street lighting target	3,731	3,731	3,731				
Vehicles	**1,559**	**1,290**	**1,186**	**-17.3%**	**-23.9%**	Predicted improvements of 1% per year, based on documented historic trends provided by the Australian Government and the Federal Chamber of Automotive Industries	**-23.9%**
Vehicles target	1,247	1,247	1,247				
TOTAL (with street lighting 2%)	**9,149**	**9,739**	**10,330**	**6.4%**	**12.9%**	Incorporating predicted population growth, new and replacement assets, Levy and grant funding impacts, a 2% per year decrease in street lighting emissions and a 1% per year decrease in vehicle emissions	**4.9%**

TOTAL (with street lighting bulk changeover)	**9,149**	**9,739**	**8,602**	**6.4%**	**-6.0%**	Incorporating predicted population growth, new and replacement assets, Levy and grant funding impacts, a bulk changeover of street lighting and a 1% per year decrease in vehicle emissions	**-12.5%**
Total Target	7,319	7,319	7,319				

Table 4: Council's predicted GHG emissions with current levels of activity and investment

[1] The main contributing factors to this are the new Administration Offices (assuming a 4 star NABERS rating) and the West Pymble leisure / aquatic centre development. As a decision was made in April 2015 to postpone relocation to 828 Pacific Highway the emissions for this building will vary to those calculated as part of this analysis – this change will be reflected in the next review of Council's predicted GHG emissions.

[2] If the increase in renewable energy is shared equally across all states (based on a renewable energy target of 20% by 2020), the estimated impact on the NSW grid would be a reduction in emissions from electricity by approximately 8%.

Future GHG emission scenarios

Council's predicted GHG emissions in 2020 under a number of different scenarios were examined to determine the most appropriate and cost effective level of abatement activity and investment required in order for Council to meet its current 2020 GHG emission reduction target.

The underlying assumptions behind the calculation of Council's emission scenarios are provided below:

- **Population increase** – Council provided estimates for population growth based on the Resource for Aging Population Planning 2.0 tool developed by LGNSW (seehttp://www.lgnsw.org.au/policy/ageing). Ironbark Sustainability estimated the impact of population increases for different asset types and the overall contribution given the percentage of total emissions each asset type is responsible and applied this across Council's portfolio of assets.

- **Environmental Levy and grant funding** – the impact of energy saving measures implemented through Environmental Levy and grant funding were estimated using typical cost-benefit figures for existing technologies and the expected cost-benefit figures for emerging technologies such as open-space LED lighting.

- **New and replaced assets** – new assets were identified using the long term financial plan (LTFP). Energy consumption for these assets was provided by the Council officers responsible for the new assets and was based on the typical energy consumption and emissions of similar existing assets.

- **Average vehicle efficiency per year** – a 1% improvement per year in vehicle energy efficiency was presumed based on guidance from Ironbark Sustainability. It is based on an average 10% improvement in vehicle emissions intensity from 2002 to 2012 reported by The Australian Government and the Federal Chamber of Automotive.

- **Street lighting efficiency improvements** - the Street Lighting Improvement program (SLI program) coordinator advised that in the absence of any bulk street lighting upgrades, the expected annual improvement in energy efficiency of Ausgrid street lights is 1% to 2% per annum. These are energy efficiency improvements expected as the Ausgrid maintenance program replaces existing luminaires with more energy efficient LED lighting. An estimate on the energy savings expected from bulk street lighting upgrades was provided by Ironbark Sustainability based on their experience of energy savings achieved in numerous bulk street lighting upgrades in Victoria.

For full details of the emission scenarios calculations see the *Ku-ring-gai Greenhouse Inventory and Target – Final Report.*

These emission scenarios are presented in the table below:

Scenario	Emissions 1999/2000 (tonnes CO2-e)	Emissions 2011/12 (tonnes CO2-e)	Emissions 2019/20 (tonnes CO2-e)	% change 2020	Cumulative Electricity cost (2013-2027)* * Does not account for new or disposed assets past 2020	Scenario conditions	Extra investment required to meet 2020 emission reduction target	NPV[1] of total costs (capital + electricity) (2013-2027)* * Does not account for new or disposed assets past 2020
Baseline Scenario	9,149	9,739	10,330	13%	$66,053,239	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Efficiency improvements for street lighting of 2% per year NO FURTHER INVESTMENT REQUIRED BY COUNCIL	$4,989,000	$47,602,322
Scenario 1	9,149	9,739	8,602	-6%	$56,607,558	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Bulk street light changeover	$2,126,000	$42,872,214

Scenario	Emissions 1999/2000 (tonnes CO2-e)	Emissions 2011/12 (tonnes CO2-e)	Emissions 2019/20 (tonnes CO2-e)	% change 2020	Cumulative Electricity cost (2013-2027)* * Does not account for new or disposed assets past 2020	Scenario conditions	Extra investment required to meet 2020 emission reduction target	NPV[1] of total costs (capital + electricity) (2013-2027)* * Does not account for new or disposed assets past 2020
Scenario 1A	9,149	9,739	8,009	-12%	$56,607,558	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Bulk street light changeover - Impacts of current Renewable Energy Target (RET) - 20% by 2020	$1,234,000	$42,872,214
Scenario 2	9149	9739	9738	6%	$62,847,271	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Efficiency improvements for street lighting of 2% per year - Re-investment of savings from actions undertaken through Environmental Levy and grant funding ($660,269) [1]	$4,008,000	$45,660,911

Scenario	Emissions 1999/2000 (tonnes CO2-e)	Emissions 2011/12 (tonnes CO2-e)	Emissions 2019/20 (tonnes CO2-e)	% change 2020	Cumulative Electricity cost (2013-2027)* * Does not account for new or disposed assets past 2020	Scenario conditions	Extra investment required to meet 2020 emission reduction target	NPV[1] of total costs (capital + electricity) (2013-2027)* * Does not account for new or disposed assets past 2020
Scenario 2A	9149	9739	9054	-1%	$62,847,271	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Efficiency improvements for street lighting of 2% per year - Re-investment of savings from actions undertaken through Environmental Levy and grant funding ($660,269) - Impacts of current Renewable Energy Target (RET) - 20% by 2020	$3,741,000	$45,660,911
Scenario 3	9149	9739	8010	-12%	$53,548,743	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Re-investment of savings from actions undertaken through Environmental Levy and grant funding ($660,269) - Bulk street light changeover	$1,786,000	$41,041,186

Scenario	Emissions 1999/2000 (tonnes CO2-e)	Emissions 2011/12 (tonnes CO2-e)	Emissions 2019/20 (tonnes CO2-e)	% change 2020	Cumulative Electricity cost (2013-2027)* * Does not account for new or disposed assets past 2020	Scenario conditions	Extra investment required to meet 2020 emission reduction target	NPV[1] of total costs (capital + electricity) (2013-2027)* * Does not account for new or disposed assets past 2020
Scenario 3A	9149	9739	7417	-19%	$53,548,743	This takes into account: - Population increase - New and replacement assets - Environmental Levy and grant funding - Average vehicle efficiency improvements of 1% per year - Re-investment of savings from actions undertaken through Environmental Levy and grant funding ($660,269) - Bulk street light changeover - Impacts of current Renewable Energy Target (RET) - 20% by 2020	$162,000	$41,041,186
2020 Target	7,319	7,319	7,319					

[1] 2013-2027(15 years) and 4.6% discount rate

Table 5: Future GHG emission scenarios

Re-investment of savings from Environmental Levy and grant funding	2014	2015	2016	2017	2018	2019	2020	TOTAL
Investment timeline	$688,251	$262,175	$175,000	$435,000	$435,000	$85,000	-	$2,080,426
Total savings from actions	-	$23,076	$45,325	$66,560	$124,850	$192,318	$208,139	$660,269
Emission reductions from reinvesting savings (tonnes CO2-e)	-	14	39	52	99	183	205	592

Table 6: Reinvestment of savings from Environmental Levy and grant funding energy projects

Note: $ calculations are based on the average savings and costs from the energy audits conducted at Council facilities (in 2013) and are based on a 7 year payback period (so 1/7 of savings could potentially be re-invested). The financial savings made from recommendations implemented in 2014/15 are ongoing and will therefore also be accrued in the years following. Hence, savings for actions implemented in previous years are incorporated into this calculation.

Table 5 shows the abatement activities / investment / conditions, cumulative electricity costs, extra investment in mitigation activities required for Council to meet its 2020 greenhouse gas emission reduction target and NPV of total costs under these different scenarios, compared to the baseline scenario (no further action required by Council), to determine the most appropriate and cost effective GHG emission reduction pathway for Council to adopt.

Based on this analysis, it is recommended that Council adopts Scenario 3 / 3A as its GHG emission reduction pathway.

With current activity and levels of investment (the baseline scenario), it is predicted that Council's GHG emissions (from electricity from fixed assets, street lighting and vehicles) will be 13% higher in 2020 based on 2000 levels. Under this scenario cumulative electricity costs are $66,053,239 for the period 2013-2027, an additional $4,989,000 of investment in mitigation activities would be required for Council to meet its 2020 GHG emission reduction target, and the NPV of total costs for the period 2013-2027 is $47,602,322.

Adopting Scenario 3 /3A will require the additional abatement activities of:

- Re-investment of savings from actions undertaken through Environmental Levy and grant funding ($660,269)
- Bulk street light changeover
- $1,786,000 of additional investment (with no Renewable Energy Target) to meet 2020 GHG reduction target
- $162,000 of additional investment (if there is no reduction in the Large Scale Renewable Energy Target) to meet 2020 GHG reduction target

Under Scenario 3 Council's greenhouse gas emissions (from electricity from fixed assets, street lighting and vehicles) are predicted to be 12% lower in 2020 based on 2000 levels. Under this scenario cumulative electricity costs are $53,548,743 for the period 2013-2027, an additional $1,786,000 of investment in mitigation activities would be required for Council to meet its GHG reduction target and the NPV of total costs for the period 2013-2027 is $41,041,186.

Under Scenario 3A Council's greenhouse gas emissions (from electricity from fixed assets, street lighting and vehicles) are predicted to be 19% lower in 2020 based on 2000 levels. Under this scenario cumulative electricity costs are $53,548,743 for the period 2013-2027, an additional $162,000 of investment in mitigation activities would be required for Council to meet its GHG reduction target and the NPV of total costs for the period 2013-2027 is $41,041,186.

The ongoing fate of the Renewable Energy Target is crucial in determining whether Council will be required to proceed over future years with the 3 or 3A Scenario.

Based on the NPV of total costs for both Scenario 3 and Scenario 3A, Council will spend $6,561,136 less in the period 2013-2027 compared to the Baseline Scenario. Cumulative electricity costs for the period 2013-2027 will also be $12,504,496 less under the Scenario 3 and Scenario 3A conditions compared to the Baseline Scenario.

Recommended abatement activities

To achieve Council's 2020 GHG emission reduction target, Council will implement a number of actions across the areas of buildings and facilities, open space, street lighting, fleet and staff engagement and education.

Actions to reduce greenhouse gas emissions in other areas (for instance, waste), which constitute the other 3% of Council's GHG emission profile, are not covered by this Greenhouse Gas Reduction Action Plan and have been identified in Council's Corporate Sustainability Action Plan 2015.

Street lighting

Streetlights contributed to 52% of Council's greenhouse gas emissions in 2012, compared to 53% in 2000. Between 2000 and 2012 emissions from street lights increased by 9% and based on current levels of activity and investment (Baseline Scenario on page 16) will be 9% lower in 2020 than in 2000. An accelerated street lighting upgrade to more energy efficient street lighting has the potential to reduce street lighting emissions by a further 37%, to 46%, by 2020 (excluding the impacts of the Large Scale Renewable Energy Target).

Buildings and facilities

Council's buildings and facilities contributed to 35% of Council's GHG emission in 2012, compared to 32% in 2000. Between 2000 and 2012 emissions from buildings and facilities increased by 15% and based on current levels of activity and investment (Baseline Scenario on page 16) will be 67% higher in 2020 (based on 2000 levels).

In March 2013, Ironbark Sustainability conducted Level 1 and 2 (AS 3598) audits and Engeneous 5 star sustainability ratings at 15 of Council's key facilities, to identify current ESD performance and opportunities for reducing energy and water consumption. A series of efficiency measures, totalling $992,120 were identified through these audits, which has the potential to deliver up to a 51.2% reduction in greenhouse gas emissions at these facilities (see Appendix A). An annual works program, utilising Environmental Levy and operational funds and re-invested savings, will facilitate the ongoing implementation of priority works identified in this audit and ongoing audits / investigations of a similar nature, to reduce energy consumption, energy costs and GHG emissions.

Fleet

Council's fleet contributed to13% of Council's greenhouse gas emission in 2012, compared to 15% in 2000. Between 2000 and 2012 emissions from fleet decreased by 17% and based on current levels of activity and investment (Baseline Scenario on page 16) will be 24% lower in 2020 (based on 2000 levels). Actions to reduce GHG emissions from Council's fleet also have the benefit of improving fleet operational efficiency (reducing fuel consumption) and reducing operating costs.

Project financial criteria

Mitigation actions will be prioritised based on their ability to provide the best rate of return (or payback periods) as well as GHG emission reductions.

Most of the modelling for projected abatement is based on projects that have a payback period of around 7 years. This means that over the life of an average capital project (with a life span of 10-20 years), the cost of abatement is negative and will save Council money over that life time. However, not all projects will meet the 7 year payback criteria, and in such cases the cost of abatement threshold ($/tCO2e) for approved projects is the cost of purchasing 100% Green Power (based on Green Power costs at the time of the project – currently

$42/tCO2 to $50/tCO2e in 2015). Projects with the cheapest cost of abatement and the greatest net abatement should be prioritised first.

At times there may be technologies with a cost of abatement that are higher than Council's threshold, but where the cost of abatement is expected to eventually decrease to below the threshold level. In such cases there may be a case for implementing a demonstration project in anticipation of the technology meeting Council's financial criteria in the coming years.

Summary of abatement activities

A summary of the recommended abatement activities to meet the conditions of Scenario 3 / 3A are provided in Table 7, in order for Council to achieve its GHG emission reduction target of 20% by 2020 based on 2000 levels whilst achieving significant operational savings.

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Street lighting					
Bulk replacement of street lighting	Continue to participate in the SSROC Street Lighting Improvement Program and work with the Program Manager and participating councils to accelerate upgrades to more energy efficient street lighting.	√	√	√	Engineering Operations Environment and Sustainability
Open space					
Outdoor lighting upgrades and installations	Implement outdoor lighting energy efficiency program. Prioritise investment into park lighting (new technology such as LED is more likely to be available for sports field applications in later years).		√	√	Open Space Operations Strategic Projects Environment and Sustainability
Performance standards for outdoor lighting	Develop minimum performance standards for new and replacement open space lighting installations.		√		Open Space Operations Strategic Projects Environment and Sustainability

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Local centre upgrades	Incorporate energy efficiency measures into local centre upgrades	√	√	√	Urban and Heritage Planning Projects - Operations Environment and Sustainability
Neighbourhood centre upgrades	Incorporate energy efficiency measures into neighbourhood centre upgrades	√	√	√	Urban and Heritage Planning Projects - Operations Environment and Sustainability
Maintenance of water reuse systems	Monitoring and maintenance of Council's water reuse systems	√	√	√	Open Space Operations
Buildings and facilities					
Asset maintenance and renewal	Implement priority energy and water efficiency measures at Council's key facilities through an annual works program Prioritise energy management / energy efficiency measures at 828 Pacific Highway and the Ku-ring-gai Aquatic and Leisure Centre.	√	√	√	Engineering Operations Environment and Sustainability Integrate Planning, Property and Assets Community and Recreation Services

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Energy and water audits	Continue to periodically conduct energy and water audits of key facilities, to facilitate Council's energy and water efficiency programs.	√	√	√	Environment and Sustainability Engineering Operations
Renewable energy projects	Conduct a feasibility study to identify the potential of - • commercial scale solar PV with no storage (assets with: high daytime use; medium to large roof space) • solar with storage (assets with: high net usage across day and night; medium to large roof space) Implement priority / feasible solar projects as part of Council's energy management program Work collaboratively with NSROC partner councils on developing a Regional Renewable Energy Master Plan	√	√	√	Environment and Sustainability Engineering Operations

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Large scale renewable energy target (RET)	Continue to advocate for RET policy settings that continue to support the uptake of small, medium and large solar PV systems, as well as storage systems	√	√	√	Environment and Sustainability
Asset management	Update Council's asset creation procedure to explicitly include energy and emissions as part of the life cycle costs. For commissioned assets, Council's sustainability reporting and data management system should enable emissions budgeting and accounting at the asset level. Accounting for emissions of planned assets will require projections of average annual energy consumption from the design to be converted to emissions projections. Investigate carbon budget constraints for assets in line with Council's emissions budget.	√	√	√	Integrated Planning, Property and Assets Environment and Sustainability

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Reinvest cost savings from energy efficiency projects	Reinvest cost savings from energy efficiency projects funded through the Environmental Levy funding into further energy efficiency projects. Reflect the savings achieved as a budget expenditure item in Council's long term financial plan and asset management plan.	√	√	√	Finance Environment and Sustainability
'Green' loans / financing / grants	Investigate the feasibility of using finance / low interest loans to implement cash-flow neutral projects. Apply for grants for renewable energy / energy efficiency projects as they become available.		√	√	Finance Environment and Sustainability
Building performance standards	Develop sustainability and climate resilience building performance standards for Council buildings and facilities, which includes standards for energy efficiency.	√	√	√	Environment and Sustainability Engineering Operations Integrated Planning, Property and Assets Community and Recreation Services

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Energy performance contracts	Re-investigate the use of Energy Performance Contracts (EPC) to deliver specified emission reductions. Management fees would see greater payback periods but the risk is borne by the energy contractor.		√		Environment and Sustainability Finance
Sub-meters	Utilise sub-metering to monitor energy use		√	√	Environment and Sustainability Engineering Operations
Fleet					
Driver training	Investigate the delivery of a driver training program for Operations staff that specialises in driving techniques that improve fuel economy and vehicle performance.		√		Operations People and Culture
Lease back vehicles	Investigate incentives to encourage the use of lower emission private use lease back vehicles Incorporate the Green Vehicle Guide star rating on Council's lease back vehicle selection form		√	√	Environment and Sustainability Open Space Operations People and Culture

		Implementation timeframe			
Abatement activity	**Details**	**2015**	**2016**	**2017**	**Responsible section(s)**
Operational and small plant vehicles	Continue to convert to lower emission operational and small plant vehicles	√	√	√	
Energy procurement					
Electricity tender criteria	Participate in tendering for electricity to ensure tender service level criteria meet Council's needs	√	√	√	Environment and Sustainability Procurement Engineering Operations
Staff education and engagement					
Staff initiatives and behaviour change	Implement actions from the Corporate Sustainability Action Plan 2015 that contribute to a reduction in Council's energy use and greenhouse gas emissions	√	√	√	All directorates

Table 7: Abatement activities to achieve Council's GHG emissions reduction target

Monitoring and reporting

Council will monitor and report against its GHG Reduction Action Plan as follows:

Item	Details	Timeframe
GHG Reduction Action Plan	Reviewed by Environment and Sustainability team	Every 2 years
2020 GHG reduction target	Monitored through Council's sustainability data management and reporting (Envizi) system and reported against Council's Delivery Program and Operational Plan / in Council's Annual Report	Quarterly / Annually
Mitigation activities in GHG Reduction Action Plan	Key reported against Council's Delivery Program and Operational Plan / in Council's Annual Report	Quarterly / Annually
Impact of mitigation activities	Monitored through Council's sustainability data management and reporting (Envizi) system and reported against Council's Delivery Program and Operational Plan / in Council's Annual Report	Quarterly / Annually

Table 8: Monitoring and reporting against GHG Reduction Action Plan

References

Climate Change Authority (2014) *Reducing Australia's greenhouse gas emissions - Targets and Progress Review: Final Report*

Intergovernmental Panel on Climate Change (2007) *Climate Change 2007: Mitigation of Climate Change*, *Working Group III contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.

Intergovernmental Panel on Climate Change (2014) *Climate Change 2014 Synthesis Report: Summary for Policy Makers*, *Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Meinshausen, M, Meinshausen, N, Hare, W, Raper, S, Frieler, K, Knutti, R, Frame, D & Allen, M (2009) *Greenhouse-gas emission targets for limiting global warming to 2 °C'*, Nature, vol. 458, pp. 1,158–63.

Appendix

Potential energy and water efficiency measures at Council's key facilities *

3.4.2 Potential for Energy & Water Reduction and Sustainability Rating

Table 8: Audit Results

Site name	% Elec consumption of all sites audited	% water consumption of all sites audited	Est. Annual Greenhouse Savings (kg CO2e)	Est. Annual Water Savings (L)	Est. Annual savings ($)	Total Est. Cost of Actions ($)	Simple payback (years)	Original Rating	Potential Rating	% reduction of the site's GHG (%)	% reduction of the site's water (%)
Gordon Library	46%	15.7%	238,257	82,125	$34,989	$146,054	4.2	1.3	3.7	50.2%	5.6%
Marian Street Theatre	5%	8.4%	19,310	1,128,920	$5,952	$45,293	7.6	1.0	3.5	34.7%	142.9%
Turramurra Library	10%	1.9%	18,255	139,179	$3,453	$36,321	10.5	1.4	3.4	20.7%	80.0%
Bancroft Art Centre	6%	3.5%	44,392	275,203	$11,624	$72,806	6.3	1.2	3.6	66.4%	84.2%
East Roseville Community Centre	3%	3.3%	19,955	251,433	$5,705	$127,838	22.4	0.9	3.6	74.1%	81.9%
Ku-ring-gai Town Hall	3%	5.8%	14,100	436,872	$4,150	$35,154	8.5	1.4	3.4	42.1%	80.2%
Lindfield Library	4%	1.4%	25,743	81,220	$7,299	$69,511	9.5	1.6	3.4	66.0%	62.0%
Old School Building	4%	0.6%	31,606	47,814	$6,118	$59,193	9.7	1.5	3.5	69.4%	81.0%
St Ives Community Groups	3%	1.9%	30,204	112,220	$8,640	$105,268	12.2	1.6	3.8	96.5%	62.0%
St Ives Community Hall (Village Green)	3%	12.8%	14,685	888,055	$5,816	$55,433	9.5	1.4	3.5	50.4%	73.8%
St Ives Library	5%	0.3%	18,159	6,000	$3,590	$32,608	9.1	1.9	3.4	37.0%	24.0%
Thomas Carlyle Child Care Centre	5%	6.0%	26,341	417,573	$7,708	$58,035	7.5	1.2	3.9	47.9%	74.7%
Turramurra Senior Citizens Centre	0%	6.7%	5,311	555,529	$2,637	$53,752	20.4	1.4	3.8	110.3%	88.5%
West Lindfield Community Centre	2%	3.5%	14,612	183,120	$4,368	$53,446	12.2	1.5	3.3	69.3%	56.0%
West Pymble Community Centre Hall	1%	28.1%	5,969	1,328,544	$4,059	$41,411	10.2	1.5	3.2	65.3%	50.4%
TOTAL			**526,900**	**5,933,806**	**$116,109**	**$992,120**	**8.5**	**1.4**	**3.5**	**51.2%**	**63.4%**

* It should be noted that it is difficult to portray the accumlated savings of all recommendations, as the cost and savings for each recommendation is calculated on a stand-alone basis, based on a building's current infrastructure. This is why some water and greenhouse gas savings outlined for certain sites equates to a 100%+ reduction.