FINAL DRAFT

CARBON ABATEMENT PLAN

Positioning Manningham City Council for a

clean and resilient energy future in the 21st century

Version Control

Rev#	Date	Details
1.0	4 July 2014	Final Draft to SBS 8 July 2014

TRIM Reference D14/48434

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Abbreviations

Abbrev	Description
1 kW PV	1 kilo Watt photo voltaic system
80W MV	80 Watt Mercury Vapour street lights
25W LED	25 Watt LED lights
A	The priority action will be acted upon in this year(s)
ADV	Unbudgeted – advocate for funds through Business Case submission
AMS	Asset Management Strategy
BAU	Business-as-Usual
BEE	Building Energy Efficiency
CAP	Carbon Abatement Plan
DA	Direct Abatement – Council undertakes direct action to reduce its carbon footprint
DAM	Direct Abatement Measures to 2020
CARES	Clean and Resilient Energy Supply program
CE	Clean Energy
CORE	Resourcing part of core budget
CW	Capital Works Program
EE	Energy Efficiency
EPC	Energy Performance Contracts
FY1819 Review	A review of the CAP to be undertaken in FY18/19
GF	GreenFleet
GP	GreenPower
GOGO	Green Office Green Organisation cross organisational group
GOV	Governance Program
HPS	High Performance Sodium Lamps (shared with Vic Roads – main roads street lighting)
IDA	Indirect Abatement – Council invests in abatement achieved elsewhere either in Australia or overseas
LED	Light Emitting Diode Lighting
MAC	Marginal Abatement Cost
MACC	Marginal Abatement Cost Curve
MAV	Municipal Association of Victoria
NAGA	Northern Alliance for Greenhouse Action – consisting of nine northern LGA's and MEFL
NCOS	National Carbon Offset Standard
NGER	National Greenhouse and Energy Reporting Act (2007)

Abbrev	Description
O	Ongoing
OC&FC	Operational Control and Financial Control
PV	Photo Voltaics
PLEE	Public Lighting Energy Efficiency
REMO	Resilient Mobility program
REC	Renewable Energy Certificate
RET	Renewable Energy Target
SSU	Solar Scale Up program – in association with NAGA
SU	Service Unit
TZNE	Towards Zero Net Emissions
UMG	Utility Management Group
VCS	Voluntary Carbon Standard
ZNE	Zero Net Emissions

Abbrev	Service Unit
ADSS	Aged and Disability Services
BS	Building Services
CM	Communications and Marketing
CP	Community Planning
CS	Corporate Support
CLS	Cultural Services
EEP	Economic and Environmental Planning
EMT	Executive Management Team
EO	Engineering Operations
ETS	Engineering and Technical Services
FIN	Finance
HLL	Health and Local Laws
IT	Information Technology
OD	Organisational Development
PR	Parks and Recreation
PROC	Procurement
SCS	Social and Community Services
STP	Strategic Projects
SP	Statutory Planning

MESSAGE FROM THE CEO

1.0 Overview

Summary

This section provides an introduction to the Carbon Abatement Plan, its strategic context, an overview of how Council proposes to move towards zero net emissions by 2020, the Towards Zero Net Emissions (TZNE[1]) Scenario, through direct and indirect abatement actions, and the strategic framework.

GREENHOUSE GASES 101

There are six greenhouse gases that are considered to be key contributors to global warming.

These are:

1. Carbon dioxide (CO2)
2. Methane (CH4)
3. Nitrous oxide (N2O)
4. Hydrofluorocarbons (HFCs)
5. Perfluorocarbons (PFCs), and
6. Sulfur hexafluoride (SF6)

1.1 Introduction and Strategic Context

This Carbon Abatement Plan (CAP or Plan) outlines a timetable for Council to move towards zero net emissions by 2020 and beyond.

Development of the Carbon Abatement Plan is opportune as the field is dynamic and only now does Council have access to sufficient data, abatement costs and information on energy performance contracting and carbon neutrality accreditation programs to be able to develop a comprehensive, fully-informed plan.

The development of the Carbon Abatement Plan demonstrates Council's leadership and progresses the objectives of major Council strategies:

- Generation 2030 Community Plan (2012)
- Climate 2020 Action Plan (2009)
- Securing the Future Adaptation Plan (2012)

In particular, the Plan strengthens Council's capability to achieve the following Climate 2020 targets for its own operations and service delivery:

- Towards zero net emissions by 2020[2]
- 20% more energy efficient by 2020
- 20% de-carbonised energy supply and
- 40% of Council energy requirements generated locally by 2020

1 A complete list of abbreviations can be found on page 3 of this document.

[2] This is an interim goal, subject to the review in FY1819.

1.2 Strategic Framework

The strategic framework of the CAP, summarised in Figure 1, consists of the following key elements.

Vision

"Towards Zero Net Emissions" is the interim vision for the CAP. The CAP vision is subject to the findings of the FY1819[3] Review (refer section 1.3).

Objectives

The CAP objectives are in alignment with the objectives of the overarching Climate 2020 Action Plan (2009) and are defined as follows -

Efficiency	Reduce energy demand – buildings, lighting, appliances, heating, ventilation and air conditioning (HVAC)
Decarbonise	Embrace sustainable local energy generation, GreenPower and green electric vehicles
Leadership	Community and Council leads the way

Carbon Management Process

The key elements of the management process have been identified. More detailed explanation has been provided in section 1.3.

Programs

In order to deliver on the CAP vision and objectives a suite of programs have been developed. Six of these programs will lead to direct abatement and the seventh, Governance, supports effective and co-ordinated decision making and action to deliver integrated outcomes. Further information on these programs is provided in sections 3.0 and 7.0.

Priority Action and Abatement Measures

Each program is described in section 1.3 and consists of:

- Goal(s)
- Targets / Outcomes
- Principles and Considerations
- Priority Actions

The programs are designed to implement the direct abatement measures.

Indirect Abatement and FY1819 Review

Two key outcomes of the Governance program are:

1. to continue to review Council investment into indirect abatement through mechanism such as GreenPower, GreenFleet and offsets
2. to undertake a review in FY1819 (refer section 1.3).

[3] Throughout the CAP, financial years such as FY18/19 are denoted as FY1819, the naming convention necessary to perform an analysis in Excel.

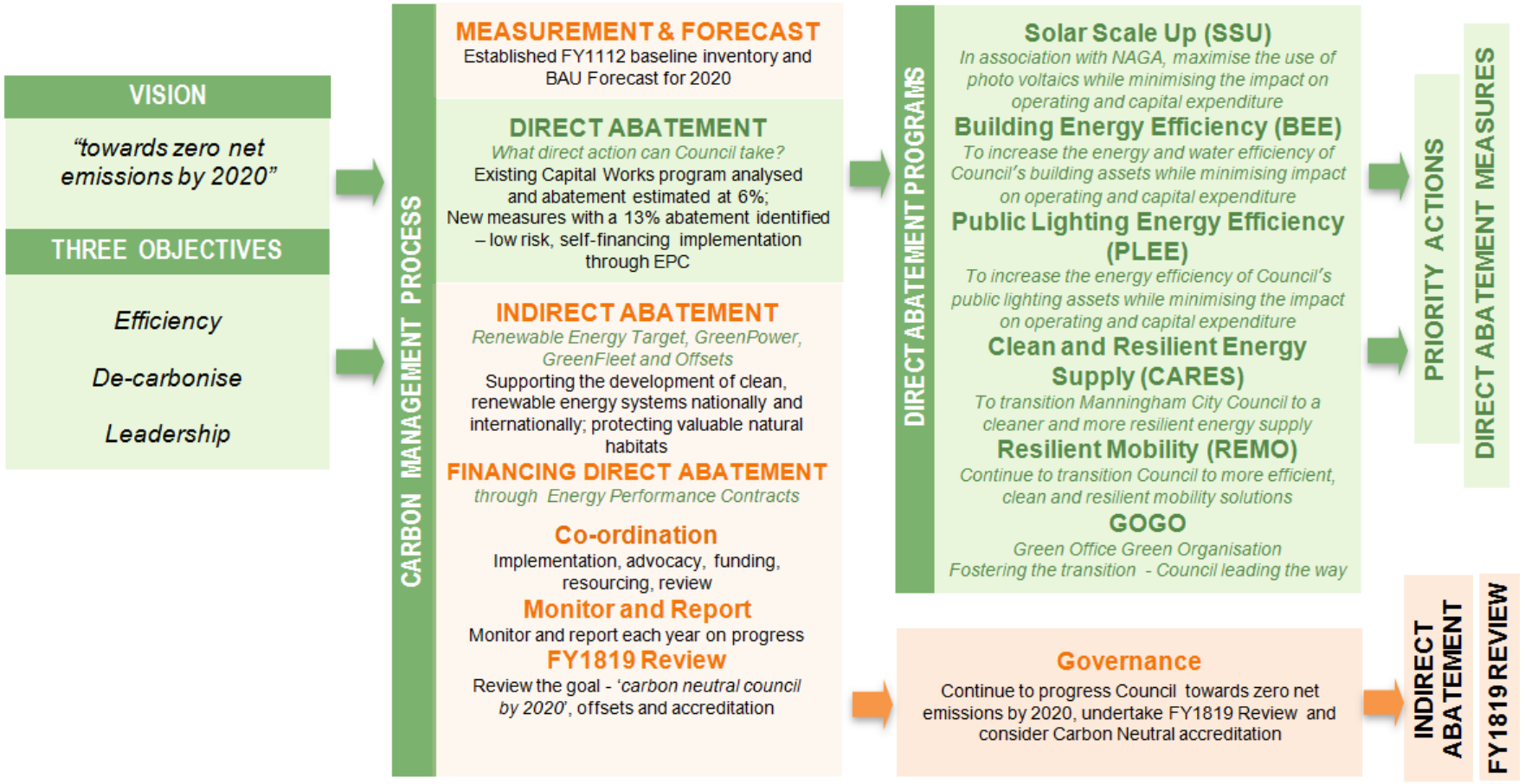

Figure 1 Carbon Abatement Plan Strategic Framework

1.3 CAP Management Process

The CAP Management Process has evolved from the development of the Carbon Abatement Plan. It was based on the MAV Carbon Management Principles (Victorian Local Government Guide to Reducing Emissions - page 4) and the NGERs framework for carbon accounting.

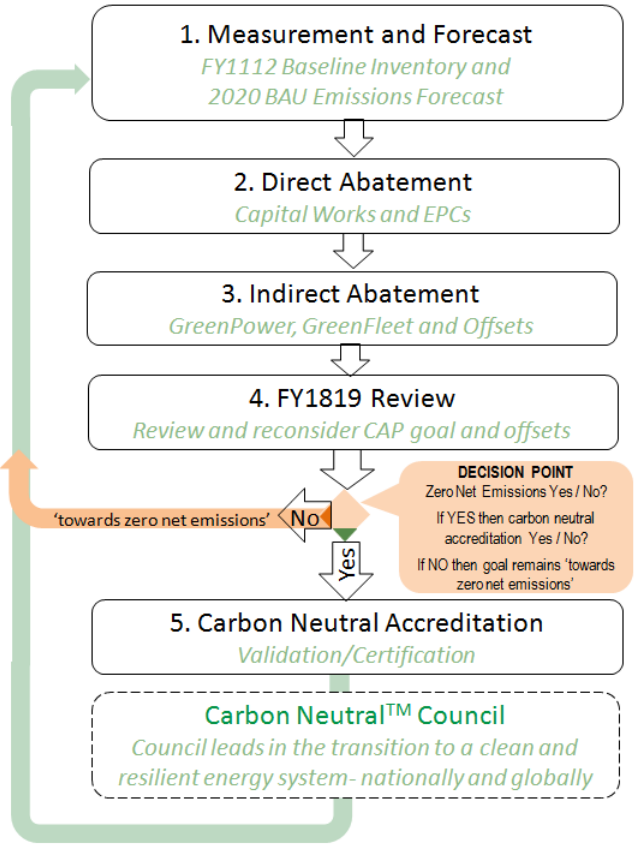

Figure 2 CAP Management Process

Figure 2 depicts the CAP Management Process. The key steps are:

1. Measurement and Forecast: Council's carbon footprint was measured by constructing a greenhouse gas emissions inventory within a defined boundary (refer Appendix D) for FY1112 then estimating the BAU emissions for 2020.
2. Direct Abatement: Measures and associated marginal abatement costs (MACs) were estimated. Some direct abatement (6%) is already funded through the Capital Works program to 2020 while it is anticipated that the remaining 13% will be funded through Energy Performance Contracts (EPCs)
3. Indirect Abatement: Maintaining investment in GreenPower and Greenfleet to achieve 11% of indirect abatement
4. Review FY1819: In FY1819 Council will re-consider the Climate 2020 and CAP 2020 goal of '*a carbon neutral council by 2020*' and the issues associated with offsetting the remaining 70% of emissions. The review will make recommendations on: what the future goal of the CAP and Climate 2020 will be; whether Council will seek Carbon Neutral™ accreditation, and; the level of future investment in offsets and direct abatement action, represented in Figure 2 as the 'Decision Point'.

Decision Point – Zero Net Emissions - Yes/No?

If No, then Climate 2020 and CAP goal becomes 'towards zero net emissions'

If Yes, then next decision is 'Carbon Neutral™ accreditation - Yes/No?'

5. Carbon Neutral™ Accreditation: If decision is a 'Yes', Council will seek certification of Council's carbon neutral claim under the NCOS Carbon Neutral Program.

Formal recognition as a Carbon Neutral™ Council

1.4 Towards Zero Net Emissions (TZNE) by 2020

This Carbon Abatement Plan has considered the various elements involved in achieving the goal '*carbon neutral Council by 2020'* and made the following findings.

- The wording of the CAP goal has been re-considered and initially re-phrased to '*zero net emissions by 2020*' due to issues associated with the use of the term 'carbon neutral', trademarks and accreditation (refer Appendix F).
- Direct abatement measures will contribute an estimated 19% reduction to 2020 Business–as-Usual Emissions Forecast. A further 11% of indirect abatement will be achieved through continued investment in GreenFleet and GreenPower. With two sources of abatement, Council will reduce its overall net emissions by an estimated 30%.
- The remaining 70% would require 'indirect' abatement in the form of offsets.
- Research during the development of the CAP has revealed that if world carbon markets operate effectively, offsets would typically be priced at $20 per tCO2e. At this price, it would not be financially sustainable for Council to purchase indirect abatement in the form of offsets to achieve '*zero net emissions by 202*0'.

Consequently the Plan proposes the following:

1. The CAP goal be revised to '*towards zero net emissions by 2020*' until the FY1819 Review

2. In FY1819 undertake a review to consider:
   - the effectiveness of carbon / offsets markets
   - whether Council should invest in offsets, and if so, the level of investment
   - the level of investment in direct abatement and the mechanisms for securing ongoing finance
   - the achievability or not, of the goal '*zero net emissions by 2020* and if applicable, consider accreditation as a Carbon Neutral™ Council.

The CAP refers to this review as the FY1819 Review.

2.0 Measurement and Forecast

Summary

Carbon accounting for the greenhouse intensity of Council's operations and service delivery was undertaken using the NGERs framework. A baseline inventory for the FY1112[4] year was developed. Using this information, forecasts for 2020 carbon emissions were estimated under a business as usual (BAU) scenario.

2.1 Carbon Accounting and NGER Framework

Carbon accounting is a credible approach to the quantification of greenhouse gas emissions. The introduction of the Australian National Greenhouse and Energy Reporting Act 2007 (NGER) and the NGER Determination 2008 provided organisations with a framework and sound algorithms for the measurement of Scope 1, 2 and 3 emissions. For a detailed explanation of Scope 1, 2 and 3 emissions please refer to Appendix D.

The Carbon Abatement Plan is based on the NGERs reporting methodology.

Defining the Boundary of Council's GHG Inventory

The CAP has adopted the greenhouse gas inventory boundary defined by all sites for which Council has Operational and Financial Control (OC&FC).

- Operational Control (OC) refers to the entity which has the greatest responsibility for choosing equipment, building upgrades, installing heating and cooling systems and the implementation of environmental and occupational health and safety policies.
- Financial Control (FC) refers to who pays the utility bills.

Further detailed information on the process used to define the boundary of Council's greenhouse inventory is proved in Appendix D.

[4] Throughout this document financial years will be represented without any abbreviation. For example financial year 2011/2012 is depicted as FY1112.

2.2 Baseline Inventory

Using the NGER framework and through extensive consultation with stakeholders to collate necessary data, the baseline carbon inventory has been developed. Council's carbon emissions for the financial year 2011/2012, referred to as the *FY1112 Baseline Inventory*, have been used to establish a baseline.

The information provided in Table 1 is extracted from Council's FY1112 Baseline Inventory and provides a summary by emission source.

Also included in Table 1 is the BAU 2020 Forecast data that is discussed in detail in the next section.

The baseline includes nearly 100% of Council's building assets, including those for which Council does not pay the utility bills but is considered to have control of the energy performance of the building asset. For example, Aquarena and building types such as sporting pavilions, scout halls, pre-schools and community facilities have been included in the baseline carbon inventory. These community facilities are included in the Plan because energy performance of a building depends on the quality of the design, insulation, efficiency of lighting, equipment, heating and cooling; areas which fall within Council's responsibility.

The baseline carbon inventory shown in Table 1 and Figure 3, a representation of the same information in a pie chart format, clearly identifies electricity (66%) used to power street lighting, buildings and minor lighting as the major contributor to Council's carbon inventory, closely followed by vehicle fuels (14%) used by waste contractors.

Source of Emissions	FY1112 Baseline		BAU 2020 Forecast	
	QTY%	tCO2e	QTY%	tCO2e
Street Lighting	35%	6,297	31%	6,441
Electricity – buildings, minor lighting, EPT*	31%	5,646	36%	7,385
Major Contractor Fuels	14%	2,589	13%	2,707
Natural Gas	8%	1379	9%	1,781
Diesel	5%	883	6%	1,151
Water & Sewerage	2%	285	2%	326
Unleaded Petrol	2%	435	2%	485
Liquid Petroleum Gas	1%	94	1%	122
Corporate Travel – Public Transport, Home Health & Other Business Travel	1%	120	1%	145
Refrigerants	1%	165	1%	180
Paper, Council Waste & Biodiesel	0%	20	0%	20
Biodiesel	0%	-	0%	5
Council Waste	0%	10	0%	11
TOTAL tCO2e	**100%**	**17,931**	**100%**	**20,758**

Table 1 FY1112 Baseline Inventory and BAU 2020 Forecast

* EPT Extraction, Production and Transmission

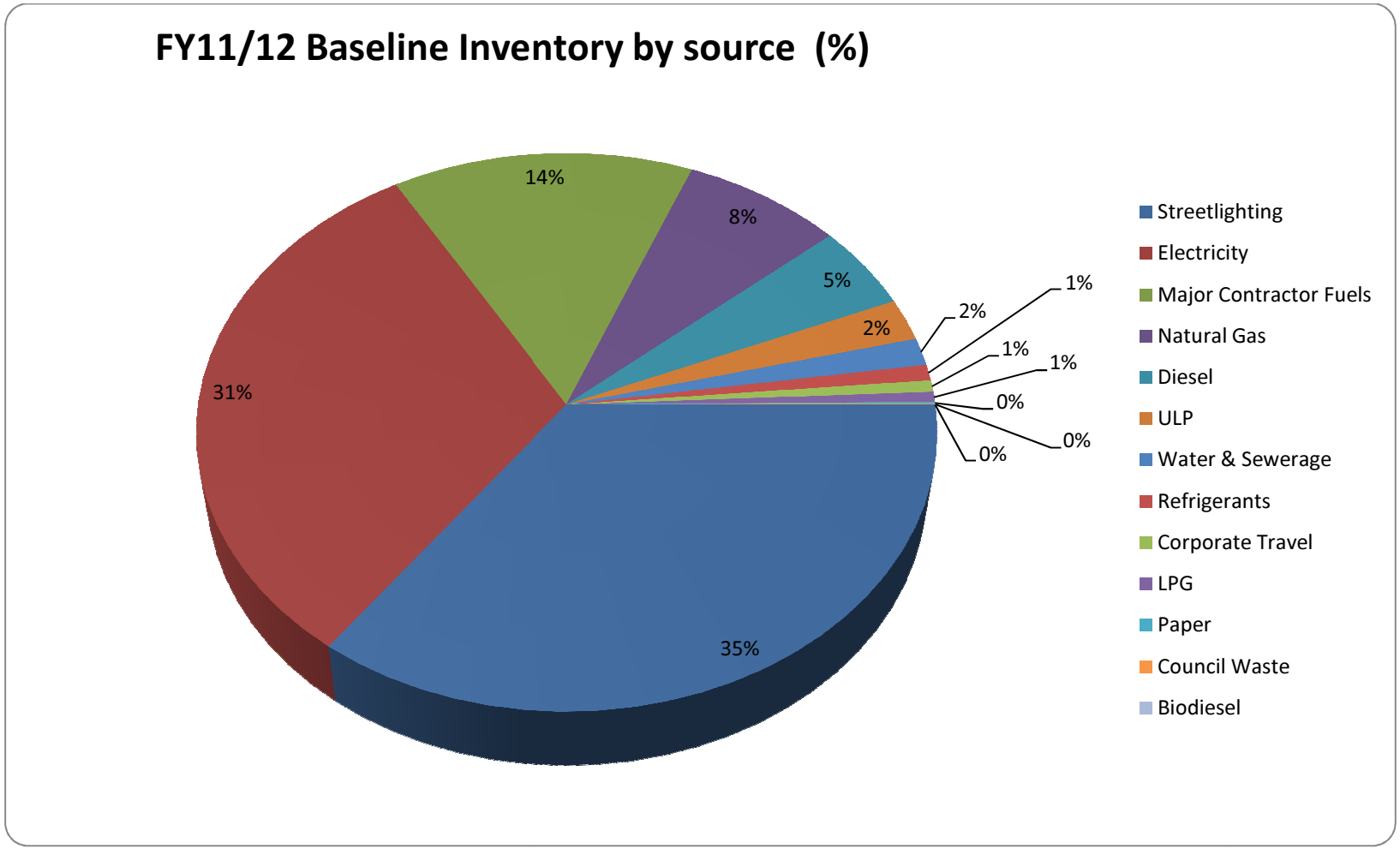

Figure 3 FY1112 Baseline Inventory by Source (%)

2.3 BAU Carbon Forecast for 2020

The Business-As-Usual (BAU) emissions forecast to 2020, as depicted in the last column of Table 1 and Figure 4, shows the projected increase of Manningham City Council's greenhouse gas emissions up to FY1920 (represents FY2019/2020), if no further measures are implemented. In the Plan this is referred to as the *BAU 2020 Forecast.*

The percentage increases in the emission sources have been deduced from Council's planned activities for each financial year and developed in close consultation with stakeholders from Manningham City Council.

As shown in Figure 4, there is a general linear increase in emission sources from FY1112 to FY1920. The consumption of paper is the only emission source that does not increase over time up to FY1920.

Consideration of Table 1 reveals an anticipated 67% of overall BAU 2020 emissions can be attributed to electricity used to power Council buildings, streetlights and other public lighting. In addition, the estimate for emissions associated with contractor fuels expended during the collection of municipal waste (Major Contractor Fuels) amounts to 13% of overall emissions.

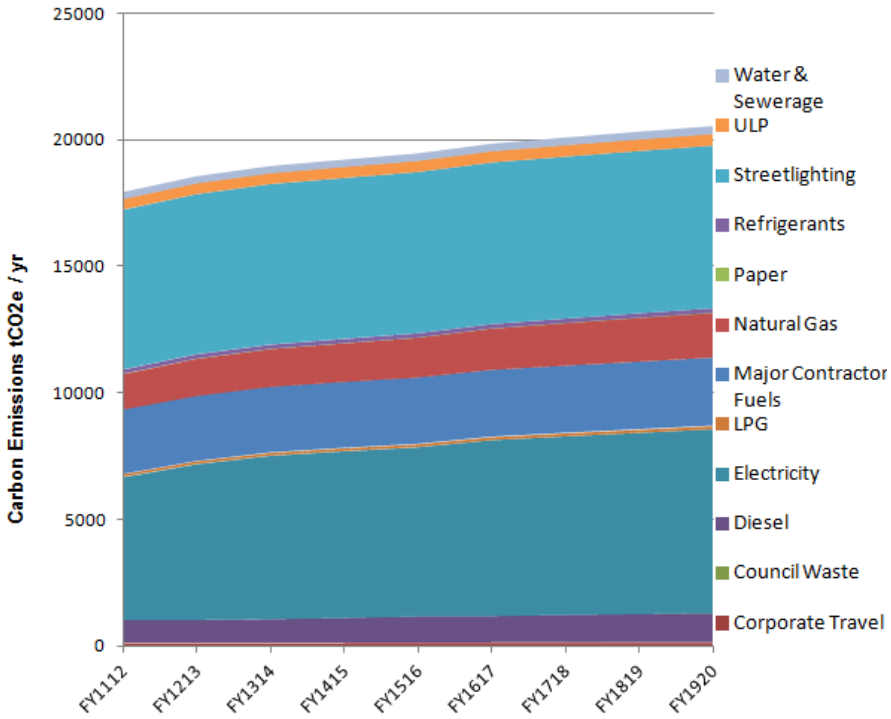

Figure 4 BAU Carbon Forecast to 2020

Figure 4 above is a graphical representation of the projected increase in the Council's greenhouse gas emissions in the absence of greenhouse gas reduction measures.

3.0 Direct Abatement

Summary

This section outlines how Council can reduce its carbon footprint through its own direct action. It outlines six Programs and their associated Priority Actions which are aimed at driving the direct abatement goal of 19% by 2020.

3.1 What is Direct Abatement?

'Direct Abatement' refers to those actions (measures) which Council undertakes to reduce the emissions arising from its own operations and service delivery. A range of direct abatement measures has been identified (refer Appendix B. Direct Abatement Measures (DAM) to 2020).

Further analysis has identified those measures which will result in zero net budget impact to implement (refer section *4.0 Financing Direct Abatement*).

3.2 Programs AND Priority Actions

An assessment of Council's assets and operations, in conjunction with consultation of key stakeholders and operations staff, has enabled an extensive range of abatement measures to be identified (refer Appendix B).

Direct abatement measures have been organised into a number of the programs and associated priority actions to provide clear direction and to guide decision-making.

Briefly, the direct abatement programs are:

1. Solar Scale Up (SSU)
2. Building Energy Efficiency (BEE)
3. Public Lighting Energy Efficiency (PLEE)
4. Clean and Resilient Energy Supply (CARES)
5. Resilient Mobility (REMO)
6. Green Office Green Organisation (GOGO)

More detailed information on the programs and associated priority actions are provided in the pages that follow and Appendix A provides a complete list.

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.3 Solar Scale Up (SSU) Program

Consists of small to larger scale (1kW to 100kW) photo voltaic projects developed in partnership with the Northern Alliance for Greenhouse Action (NAGA)

Goal

To maximise the use of photo voltaics, while minimising impact on operating and capital expenditures.

Targets / Outcomes

1. To install 400kW consisting of Depot (100 kW), Aquarena (100kW), Mullum Mullum Stadium (100kW) and assorted smaller buildings (100kW). For community organisations that are tenants within Council owned buildings and who have a lease agreement with Council, a Solar and Energy Efficiency program will be investigated. Refer section 3.4 for further information.
2. A stretch target is to investigate, and if appropriate, develop a plan by FY1920 to replace 100% GreenPower purchases with solar PV on various Council buildings. This is equivalent to 1000kW for 1800 tCO2e of carbon abatement or 200 kW installed per year over five years.

Principles and considerations

- Undertake through EPC - requires no upfront capital expenditure – neutral net budget impact
- Majority of electricity used on site – correctly size PV so majority (50% or more) under the demand curve (11c/27c per kWh), and only a small amount of generated electricity is exported to the grid (8c/kWh)
- Positive Charge - give consideration to what role they might play.
- Investigate Solar Premium offer to tenants - consider the option to install PV on community buildings leased to community groups; initial idea is that tenants would accrue all the utility bill savings, but the PV would be paid through a Solar Premium that would be added to their rent; the amount of the Solar Premium would be determined by a number of factors including – payback over 10 years, but be sufficiently low that the tenants would still achieve annual savings on utility bills for the first 10 years; as Solar Panels typically have a 25-year life, tenants will have the remaining 15 years where the utility bill savings will not be offset against a 'Solar Premium' on their rent and thereby they would achieve 100% of savings; if the offer proceeds, it could potentially be rolled out with a similar energy efficiency offer (refer Building Energy Efficiency program).

1. Solar Scale Up (SSU) Program – *in association with NAGA* – Priority Actions

Key Words		Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
1.1	Solar Depot	Investigate the implementation of large scale PV systems (approx 100kW) at the Depot (DAM 15)	EEP STP	A						EPC
1.2	Solar Public Toilets	Investigate the implementation of small scale PV systems (less than 10kW) for all other facilities where Council has Financial Control as well as Operational Control e.g. public toilets via an EPC to establish the Service Provider (DAM 5 6 8 11 12 13 14)	EEP STP	A						EPC
1.3	100kW PV Solar Premium	Investigate the implementation of large scale PV systems (approx 100kW) on building assets that are tenanted and where Council does not pay the utility bills – e.g. Aquarena and Mullum Mullum Stadium. Council would negotiate a 'Solar Premium' to be added to rental for 10 years to recover costs (DAM 10)	EEP STP		A					EPC
1.4	<15kW PV Solar Premium	Solar Premium: Investigate the implementation of Solar PV Systems <15kW each- ~30* Pines and Community Buildings (Total 100kW) - 21c/kWh (assumed $1.70/watt) ~650m2 (DAM 7)	EEP STP			A				EPC
1.5	PV Replaces GreenPower	Investigate the possibility of replacing 100% of GreenPower abatement with a total of 1000kW of PV and, if appropriate, develop an implementation plan by FY1920	EEP UMG				A			EPC
1.6	Solar BBQ	Investigate the implementation of Solar PV Standalone Single Plate BBQ (DAM 4)	STP EEP					A		ADV
1.7	Solar BBQ	Investigate the implementation of Solar PV Standalone Double Plate BBQ (DAM 2)	STP EEP					A		ADV

Table 2 Solar Scale Up (SSU) - Priority Actions

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.4 Building Energy Efficiency (BEE) Program

Goal

To increase the energy efficiency of Council's building assets while minimising impact on operating and capital expenditures.

Targets /Outcomes

1. Energy Performance Contracting - Investigate opportunities to apply energy performance contracting to all Building Assets and develop a plan to rollout EPCs
2. Solar and Energy Efficiency (SEE) Premium **-** Investigate the development of a program, the Solar and Energy Efficiency (SEE) program, to install energy efficiency measures and 100 kW of PV on medium to small scale community facilities by FY201920, equiv to 360 kWh of renewable energy generation per year and 177 tCO2e of carbon abatement per year for 25 years. Measures financed through a cost-neutral SEE Premium added to rent for 10 years. Tenants reap 100% of benefit thereafter.

Principles and considerations

- Undertake through EPC – requires no upfront capital expenditure – neutral budget impact
- Use the Department of Treasury and Finance process and their accredited supplier list
- Investigate an Energy Efficiency Premium for Tenants – would include energy efficiency and photo voltaic (refer Solar Premium) offer to tenants; to be paid through Lease Agreement – Rent + Energy Smart Premium; energy efficiency measures to be paid through utility bill savings from implementation of efficiency measures and PV generation over ten years – so cost neural to tenants; after 10 years tenants would accrue all the utility bill savings
- Minimum human intervention or behaviour change - focus on efficiency measures that do not rely on behaviour change, or human intervention
- Sequential / parallel EPCs - consider and evaluate the options for implementing EPCs for photo voltaics and building energy efficiency retrofits. General experience indicates combining both into a single EPC is the best way to proceed.

2. Building Energy Efficiency (BEE) Program – Priority Actions

Key Words		Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
2.1	Depot EPC	Investigate EPC for Depot, Pines etc (DAM 70)	STP EEP	A						EPC
2.2	Large Facilities	Investigate EPCs for building assets commencing with a sample set of large facilities: MC² + Civic Offices- excl HVAC and Trigen System, Depot, Pines etc (DAM 43)	STP EEP			A	A			EPC
2.3	Public Toilets BBQs	Investigate EPCs for all other facilities where Council has Financial Control as well as Operational Control e.g. public toilets, BBQs (DAM 43)	STP EEP			A	A			EPC
2.4	Aquarena Mullum Mullum	Investigate EPCs for large facilities, that are currently or will be under construction e.g. Aquarena and Mullum Mullum stadium where Council has OC but no FC (DAM n/a)	STP EEP		A	A	A			EPC
2.5	Tenant Premium Offer	Investigate establishing an offer for tenants – a Solar and Energy Efficiency (SEE) premium for tenants that can be added to their rental for 10 years, should they choose to take up the offer, to pay for PV and energy efficiency measures (DAM 16 17 19 23 24 25 31 33 45 46 53)	STP EEP			H	H			EPC
2.6	AMS Refurbishments	Continue to identify opportunities to improve energy efficiency as part of the AMS refurbishment program (DAM 20 21 22 26 27 28 29 20 32 34 35 36 38 39 40 41 42 47 48 49 50)	STP EEP	O	O	O	O	O	O	AMS
2.7	Water EPC	Incorporate Water Efficiency Program (5% reduction) for Council Buildings into the EPC for Building Energy Efficiency (DAM 65)	STP EEP			A	A			EPC
2.8	Smart Meters	Continue the roll out of smart meters to all Council Building Assets	STP EEP	A	O	0				CORE

Table 3 Building Energy Efficiency (BEE) - Priority Actions

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.5 Public Lighting Energy Efficiency (PLEE) Program

Goal

To maximise the energy efficiency of Council's public lighting while minimising the impact on operating and capital expenditures.

Targets / Outcomes

1. Investigate the development of a Public Lighting Master Plan that includes an audit of all Council's public lighting assets
2. Explore the forming of a strategic partnership with Vic Roads with the aim of replacing major road street lights with more efficient and smart technology

Principles and considerations

- Adopt a strategic approach that identifies opportunities and adopts a whole-of-life approach to delivery of integrated outcomes
- Energy Performance Contracts - investigate the option of EPCs - require no upfront capital – neutral budget impact
- Learning from the experience of others - consider the experience of Moreland City Council and Department of Treasury and Finance process to inform Manningham's investigation into EPC for Public Lighting
- Opportunities - identify opportunities to upgrade public lighting assets so that they are more energy efficient and reliable while minimising impact on operational and capital expenditure
- Jurisdictional Issues - given that LEDs are not covered by the distributor's Operations, Maintenance and Repair schedules as yet, how confident are we that third parties can take over this responsibility on behalf of Council?

Public Lighting Inventory

The list below provides an inventory of street lights across Manningham. However the inventory is not complete. It does not include other public lighting which provides illumination for public parks, pathways, sporting reserves, car parks and for security within the municipality. Currently there is no central register of all Council's public lighting. A key action arising out of the *Manningham Public Lighting Procedures & Guidelines (draft March 2008)* was to seek funding to carry out a full audit of Council's public lighting. This action is still outstanding. However such an audit will be a necessary pre-cursor for the various EPC public lighting projects and hence has been included in the PLEE Program of actions.

Quantity	Type
3000	Standard 80W mercury vapour (Stage 3 & 4 will changeover these lights to 25W LEDs)
2000	T5 Fluoro lights – Stage 1 & 2 changeover
2500	Decorative 80W mercury vapour
1620	150W x High Performance Sodium (HPS)
745	250W x High Performance Sodium (HPS)
1278	70W x High Performance Sodium (HPS)

Table 4 Partial Public Lighting Inventory *

* note: no inventory exists for lighting types other than street lighting

3. Public Lighting Energy Efficiency (PLEE) Program – Priority Actions

Key Words		Priority Action Description	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
3.1	Public Lighting Audit	Develop a Business Case for an audit of public lighting	ETS EEP	A						ADV
3.2	EPC Investments & Distributor issues	Investigate the options for undertaking an EPC approach to future street lighting upgrades including cost estimates and resolution of Distributor issues	ETS EEP	A						EPC
3.3	EPC Procurement	Develop documentation for tenders for the staged implementation of an EPC contract and award	ETS EEP		A					EPC
3.4	EPC Rollout	Roll out of EPC contract	ETS EEP			A	A	A	A	EPC

Table 5 Public Lighting Energy Efficiency (PLEE) - Priority Actions

NOTES:

- Implementation program to be developed to align with 10 year Capital Works Program Allocations
- Program development to consider distributor changeover program for existing streetlights and timeframe for distributor approvals for LED lights

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.6 Clean and Resilient Energy Supply (CARES) Program

Goal

To position Manningham City Council for a cleaner and more resilient energy supply system for the 21st century

Targets / Outcomes

1. Displace fossil fuel sources with increased energy efficiency and clean or renewable energy
2. Diversity of supply - investigate alternative sources of fuel, power, lighting, heating and cooling that do not necessarily rely on highly centralised fossil fuel systems e.g. photo voltaics, waste-to-energy, solar thermal, wind power, wave power, cogeneration, trigeneration, district thermal energy, green electric vehicles and biofuels
3. Storage - investigate storage and battery technologies for various energy types e.g. thermal, electrical etc
4. Smoothing Demand - aim to minimise / remove peaks from demand cycle
5. Smart Systems - investigate the options to employ smart technologies such as smart meters, controls and communications technologies
6. Demand Response - investigate ways in which Manningham City Council could shed discretionary Peak Electrical Demand, as necessary. Estimate the market value of this demand-shedding capability.
7. Monitoring and Reporting - continue to incorporate best practice smart metering, controls, monitoring and reporting of energy use by Council

Principles and considerations

- Energy Performance Contracts – continue to investigate the use of EPCs - require no upfront capital, neutral net budget impact - for CAP projects as appropriate, with a focus on energy efficiency, storage, smoothing demand and clean energy generation
- Strategic Partnerships - test the market and seek strategic partnerships with stakeholders and service providers having relevant capabilities and capacities e.g. United Energy, Yarra Valley Water (Waste Water Treatment Plant)

4. Clean and Resilient Energy Supply (CARES) Program – Priority Actions

	Key Words	Priority Action Description	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
4.1	Clean & Efficient	Continue to investigate energy efficiency, clean or renewable energy solutions and their applicability to Council operations and service delivery	EEP STP	O	O	O	O	O	O	CORE
4.2	Storage Technologies	Continue to investigate Storage Technologies and their applicability to Council operations and service delivery	EEP STP	O	O	O	O	O	O	CORE
4.3	Fuel Diversity	Continue to investigate diversification of vehicle fuels and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.4	Demand Smoothing	Continue to investigate Demand Smoothing solutions and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.5	Waste to Energy	Continue to investigate waste-to-energy solutions and implement where appropriate	EO EEP	O	O	O	O	O	O	CORE
4.6	Smart Systems	Continue to investigate smart technologies such as smart meters, controls and communications technologies and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.7	Waste Contractors	Continue to investigate opportunities in the waste management procurement process to reduce the carbon content of contractor fuels	EO EEP	O	O	H	O	O	O	CORE
4.8	Demand Response	Investigate ways in which Manningham City Council could shed discretionary Peak Electrical Demand, as necessary. Estimate the market value of this demand shedding capability.	EEP STP	O	O	H	O	O	O	CORE

Table 6 Clean and Resilient Energy Supply (CARES) Priority Actions

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.7 Resilient Mobility (REMO) Program

Goal

To continue to transition Manningham City Council to more efficient, clean and resilient mobility solutions.

Targets / Outcomes

1. Continue to displace fossil fuel sources with increased energy efficiency and clean or renewable energy
2. Diversity of supply - continue to investigate alternative sources of fuel, e.g. green electric vehicles, biofuels etc
3. Reduce reliance on Private Vehicles - continue to foster use of public transport, car sharing, walking and cycling.

Principles and considerations

- Energy Performance Contracts – continue to investigate the use of EPCs
  - require no upfront capital expenditure, neutral capital budget impact
  - for CAP projects as appropriate, with a focus on energy efficiency, storage, smoothing demand, fuel diversity and clean energy generation

5. Resilient Mobility (REMO) Program – Priority Actions

Key Words		Priority Action Description	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
5.1	Mobile and Resilient	Continue to investigate mobility solutions that improve resilience, energy efficiency and are clean or renewable	EO STP EEP	O	O	O	O	O	O	CORE
5.2	Fuel Security	Continue to investigate fuel security solutions and their applicability to Council operations and service delivery especially as they apply to fuel disruption e.g. storage, alternative local and renewable fuels	EO STP EEP	O	O	O	O	O	O	CORE
5.3	Fuel Diversification	Continue to investigate diversification of vehicle fuels e.g. biodiesel for depot plant (DAM 52 56)	EO STP EEP	O	O	O	O	O	O	CORE
5.4	10% Electric Vehicle Fleet	Investigate replacing 10% of car fleet with electric vehicles by 2020; tie in with standard vehicle replacement cycle (DAM 60)	EO STP EEP				A			ADV

Table 7 Resilient Mobility (REMO) - Priority Actions

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

3.8 Green Office Green Organisation (GOGO) Program

Goal

Work co-operatively with staff to identify and implement direct abatement projects so that they actively participate in achieving the goals and objectives of the Carbon Abatement Plan.

Targets / Outcomes

1. Identify and implement projects that demonstrate direct carbon abatement
2. Monitoring and Reporting - provide timely and useful information on Council's progress towards carbon neutrality by 2020
3. Funding - advocate for and support Business Case submissions as part of the Budget Approval process where measures are unfunded

Principles and considerations

- Cross Organisation Groups - foster peer learning and integrated decision making, action and outcomes
- Participation - encourage all staff to contribute to Council moving towards zero net emissions by 2020
- Council Leadership - advocate and support the transition to an efficient, clean, smart and renewable energy system though Council's direct action where viable; otherwise, through investment in GreenPower and offsets.

6. GOGO – *fostering the change*

	Key Words	Priority Action Description	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
6.1	Civic Offices Permability	Civic Offices Draft Proofing and Duct Work	EEP STP	A	O					CORE
6.2	Cont Improv	GOGO to continue to foster internal change through innovative projects, communication and education to continuously improve Council's own energy and carbon performance	EMT EEP	O	O	O	H	O	O	CORE
6.3	Cont Improv	Municipal Offices - passive improvements e.g. installing blinds – completed FY1112 (DAM 61)	EMT EEP	-	-	-	-	-	-	CORE
6.4	EE Lighting	Various Council buildings - lighting efficiency improvement - completed FY1314 (DAM 62)	EMT EEP	-	-	-	-	-	-	CORE
6.5	EE Lighting	Depot - High Bay lighting upgrade improvement - completed FY1213 (DAM 63)	EMT EEP	-	-	-	-	-	-	CORE

Table 8 GOGO - Priority Actions

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

4.0 Financing Direct Abatement

Summary

This section outlines two important tools, marginal abatement costs (MACs) and marginal abatement cost curves (MACCs). These tools assist with assessment of direct abatement actions to determine which measures can be justified on cost savings alone and which measures rely a broader 'best value analysis'.

It then describes Energy Performance Contracting (EPCs), a low risk, self-financing method for improving the energy and carbon efficiency of Council assets. EPCs will be applied to building energy efficiency retrofits, installation of photo voltaics, operation of trigeneration and cogeneration systems and public lighting energy efficiency upgrades.

4.1 Data Tools - Measures Identified and Costed

Extensive investigation and stakeholder consultation across the organisation was undertaken to identify the range of carbon abatement measures (refer *Appendix B. Direct Abatement Measures (DAM)* to 2020*)* that could be applied through to 2020.

Collection, collation and analysis of this data enabled the production of a number of data tools that underpin the Carbon Abatement Plan. A key decision support tool, the marginal abatement cost (MAC) for each measure, is described in more detail below.

4.2 Marginal Abatement Cost

How does Council assess which measures to implement?

Factors such as the volume of greenhouse reduction over the project life in relation to the capital investment, the time value of money (discount rate), and estimated cost savings need to be taken into account. All these are captured in the measure called marginal abatement cost, abbreviated to MAC with the following formula in Excel –

$$MAC\ (\$/tCO_2e) = \frac{\text{Net Present Value}}{(\text{- Present Value(Discount Rate, Project Life, GHG savings pa))}}$$

where Net Present Value (NPV) is given by –

$$NPV = \text{Total Costs + Present Value(Discount Rate, Project Life, Cost Savings pa)}$$

Measures with a negative MAC are cost saving. Measures with a positive MAC value have an associated cost. However if a measure has a positive MAC value that is less than the cost of offsets or GreenPower (MAC =$23 to $39), as shown in the *Table 10 Indirect Abatement Options ($/tCO2e),* it may still be worthwhile to implement.

The CAP analysis is based on the assumption that direct abatement measures with MACs values up to $46 per tCO2e may be suited to an energy performance contracting approach. This assumption will be tested through procurement and CAP modelling will be adjusted according based on feedback from the successful EPC provider.

4.3 Marginal Abatement Cost Curve (MACC)

A marginal abatement cost curve (MACC), a simplified example of which is shown as Figure 5, can be used to inform decision-making. Each coloured bar represents a distinct measure, e.g. install LEDs in street lighting. All measures below the x-axis and less than the price of Offsets (e.g. offsets @$5 represented by a grey dotted line) are cost saving. There may also be a range of measures that, whilst not justifiable on cost savings alone, may be deemed as worth doing based on social, environmental and governance values, i.e. Best Value.

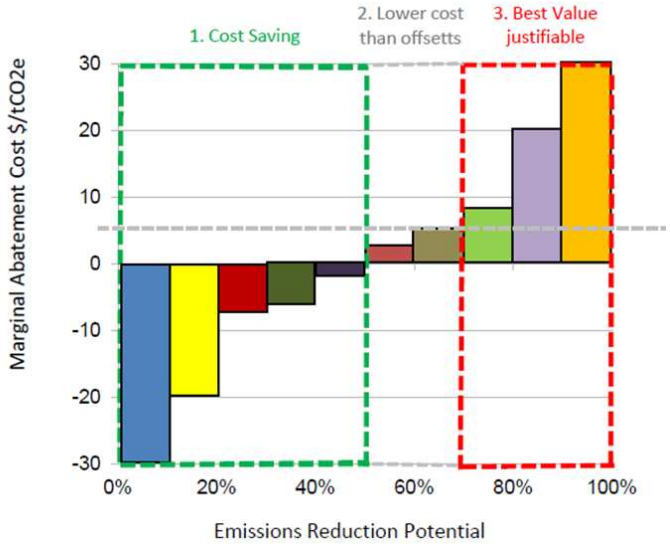

Figure 5 Marginal Abatement Cost Curve

4.4 Energy Performance Contract (EPC)

Energy Performance Contracting (EPC) is the approach identified to fund the majority of energy and carbon efficiency actions in this Carbon Abatement Plan.

An EPC is an arrangement whereby an organisation engages with an accredited provider to undertake an assessment of energy savings, and when completed, the EPC provider guarantees the savings to be achieved through capital investments proposed by the EPC provider.

The criterion for capital investment is that there is a 7 to 10 year break-even point between capital cost and energy cost savings. The savings are used to redeem the loan and when the loan is cleared savings are provided back to the client.

Energy Performance Contracting also has the potential to improve the Quadruple Bottom Line (QBL) performance as follows:

- Environmental Performance - improved energy and water efficiency; reduced greenhouse emissions; smaller carbon footprint.
- Financial Performance - efficiency measures financed through savings over the payback period of the contract; zero impact on budgets during the payback period; positive impact on operational budgets beyond payback period.
- Social Performance - improved comfort levels for occupants – e.g. during extreme climate events such as heat waves or cold spells; reduced peak electrical demand thereby reducing likelihood of brown-outs and their impacts if they do occur.
- Governance - Council demonstrates leadership in energy and water efficiency.

4.5 EPCs at Manningham

Energy Performance Contracting will be investigated for the funding and implementation of the following CAP priority actions:

- Solar Scale Up (SSU) – e.g. 100 kW array for Depot in conjunction with Building Energy Efficiency works at the Depot
- Building Energy Efficiency (BEE) - e.g. energy efficiency retrofits and photo voltaics for community facilities
- Public Lighting Energy Efficiency (PLEE) - e.g. investigate the funding of a public lighting audit and master plan followed by implementation
- Co- generation and tri-generation (under the CARES program) – investigate optimisation, operation and maintenance of these systems

4.6 EPC Consultancies

The procurement process associated with securing Energy Performance Contracts may require technical, commercial and legal advice from external consultants to provide due diligence and to support decision making. Accordingly, an estimate of $150,000 has been included in the costing and NPV calculations. However, the CAP has not requested a budget allocation for EPC consultancies, as a Business Case justification will be put forward if and as necessary.

4.7 Key findings for financing direct abatement

Overall, Council will be able to abate 19%[5] of its forecast emissions for 2020 without any additional investment on its part. 6% of these emissions are the direct result of existing projects within the Capital Works program to 2020, the majority of which have already been implemented. Consequently, Council is not only reaping a greenhouse reduction, but also has the potential to achieve an estimated cost saving of $164,922 per year.

It is anticipated that the remaining 13% of abatement will be funded through an energy performance contracting process. Over contract period, typically 7 or 10 years, Council will receive the benefit of the asset improvement ($4,074,169) and the greenhouse reduction. Once the contract expires it will also receive the substantial cost savings, which will favourably impact upon the operating budget.

To achieve zero net emissions (ZNE) from 2020, Council will be required to invest in offsets for the remainder of its carbon footprint.

[5] CAP modelling assumes that direct abatement measures with a MAC<$46 /tCO2e will be suited to an EPC approach and therefore self-funded. This assumption will be tested during the EPC procurement process. CAP estimates and modelling will be updated, if necessary, to reflect the market response. Also refer to section 6.1 for further discussion.

4.8 Financing Direct Abatement - Analysis to FY1920

The 10 Year Capital Works program contains $0.811M for 6% abatement, and it is estimated that Council will engage in a number of Energy Performance Contracts (EPC) to the value of $4.074M for 13% abatement. This gives a total capital investment of $4.885M and 19% yearly abatement over the coming decade. The returns for this investment is forecast to be an operational saving of $165,000 pa on the $0.811M capital works and at least a further $407,000 pa (10%) on the $4.074M EPC works. The CAP forecasts operational savings of some $572,000 pa from 2025 (refer Figure 6. and Table 9).

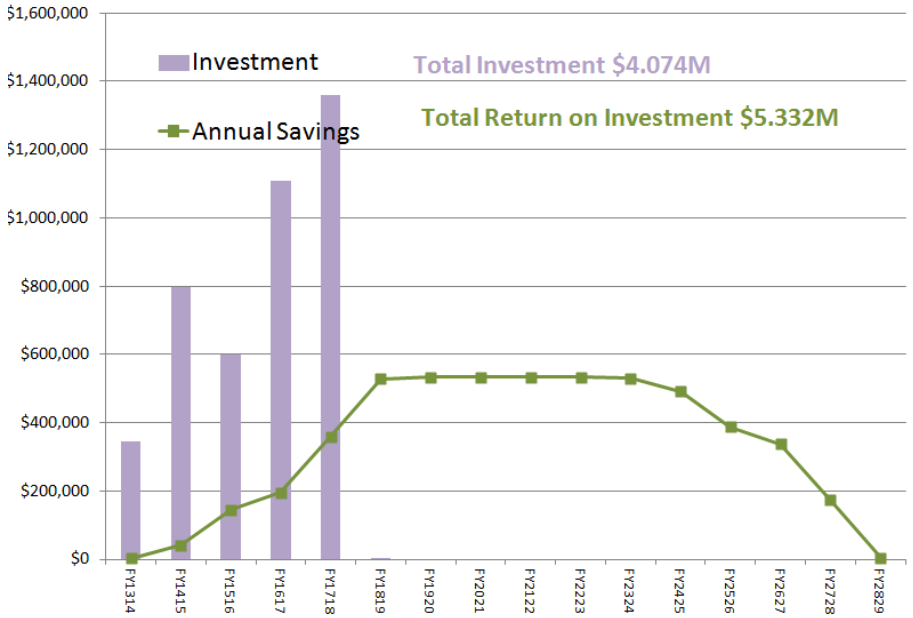

Figure 6 EPC Works - Investment and Savings

As depicted in Figure 3 below, the Plan estimates a total investment in EPC Works of $4.074M for a total Return on Investment of $5.332M over ten years.

Notably, the CAP has identified 13% of new abatement projects that:

- are self-financed through cost savings over the duration of the contract
- have some $407,000[6] of cost savings arising from EPC Works with overall negative NPV and MAC ratios, as follows:

NPV (TOTAL) =	- $30,021	MAC (TOTAL)=	- 1

[6] Note the CAP modelling identifies $516,726 cost savings on EPC Works however the savings quoted are somewhat less and represent 10% of EPC Works investment.

FIN YEAR	Capital Works Expenditure & Abatement		Capital Works Cost Savings		EPC Works Expenditure & Abatement		EPC Works Cost Savings		Total Works (CW + EPC)	Total Abatement GHG Reduction (tCO^2e)	
	($)	(tCO^2-e)	Annual ($)	Cumulative	($)	(tCO^2-e)	Annual ($)	Cumulative	($)	Annual	Cumulative
FY1112	$730,709	1,046	$150,424	$150,424	$-	0	$-	$-	$730,709	1,046	1,046
FY1213	$30,800	123	$7,326	$157,750	$-	0	$-	$-	$30,800	123	1,068
FY1314	$28,239	54	$6,860	$164,610	$-	0	$-	$-	$28,239	54	1,122
FY1415	$7,000	11	$190	$164,800	$205,000	300	$25,000	$25,000	$212,000	311	1,433
FY1516	$2,000	3	$-	$164,800	$797,212	547	$103,348	$128,348	$799,212	550	1,820
FY1617	$6,000	10	$122	$164,922	$600,000	532	$50,224	$178,572	$606,000	542	3,165
FY1718	$3,500	4	$-	$164,922	$1,107,820	949	$164,669	$343,241	$1,111,320	953	3,492
FY1819	$-	0	$-	$164,922	$1,359,600	244	$168,513	$511,754	$1,359,600	244	3,736
FY1920	$3,000	3	$-	$164,922	$4,537	126	$4,971	$516,726	$7,537	129	3,865
TOTAL	$811,248	1,253	$164,922	$1,462,072	$4,074,169	2,698	$516,726	$1,703,641	$4,885,417	3,951	20,747

Table 9 Financing Direct Abatement – Analysis to FY1920

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5.0 Indirect Abatement

Summary

Council can reduce its 2020 carbon footprint by 19% through direct abatement action. This leaves a 'zero net emissions gap' of 81%. This section addresses how abatement elsewhere, for example in Australia through renewable energy generation and regeneration of native forests, or overseas, through clean energy generation in developing economies, can be used indirectly to offset Council's own emissions.

5.1 What is Indirect Abatement?

'In-direct abatement' refers to abatement that is achieved by third parties either in developing countries through development of clean energy, or in Australia through regenerating native forests and generating renewable energy.

As shown in the earlier sections of the CAP, 81% of Council's emissions can only be offset by 'indirect abatement' that is undertaken elsewhere

5.2 What are the Options?

In-direct-abatement can be achieved through investment in GreenPower, GreenFleet or Offsets.

In the following pages, the various ways in which emissions can be 'offset' are addressed in sections –

5.3 Renewable Energy Target and GreenPower

5.4 Greenfleet Offsets

5.6 Clean Development Offsets

5.3 Renewable Energy Target & GreenPower

Price barriers impede the rapid take-up of renewable energy. Renewable generation projects generally require $100/MWh for viability and capital raising whereas Black Power (largely coal-generated power) only requires $45/MWh. Even with a Carbon Price of $20/MWh, a further $35 renewable subsidy is required to raise finance for Green Power generation (refer Figure 7). Hence a market in Renewable Energy Certificates (RECs) has been created for Energy Retailers who are required by legislation to source 20% of their energy from renewables by 2020. Consequently, implementation of an effective RET scheme should result in a 20% cleaner grid electricity by 2020.

In 2000, the Office of the Renewable Energy Regulator (ORER) described the Renewable Energy Target (RET) as follows:

> *" The RET is the advent of a new way of thinking about electricity, . . . It places a separate value on the environmental quality associated with the method of generation of electricity."*

What is the role of GreenPower? GreenPower is a way in which electricity customers can voluntarily support the growth of renewable energy by ensuring there is an adequate demand for RECs. Strong demand supports a REC price greater than $35/MWh, the difference between Renewable Energy generation and combined Black Power and Carbon Price (refer Figure 7).

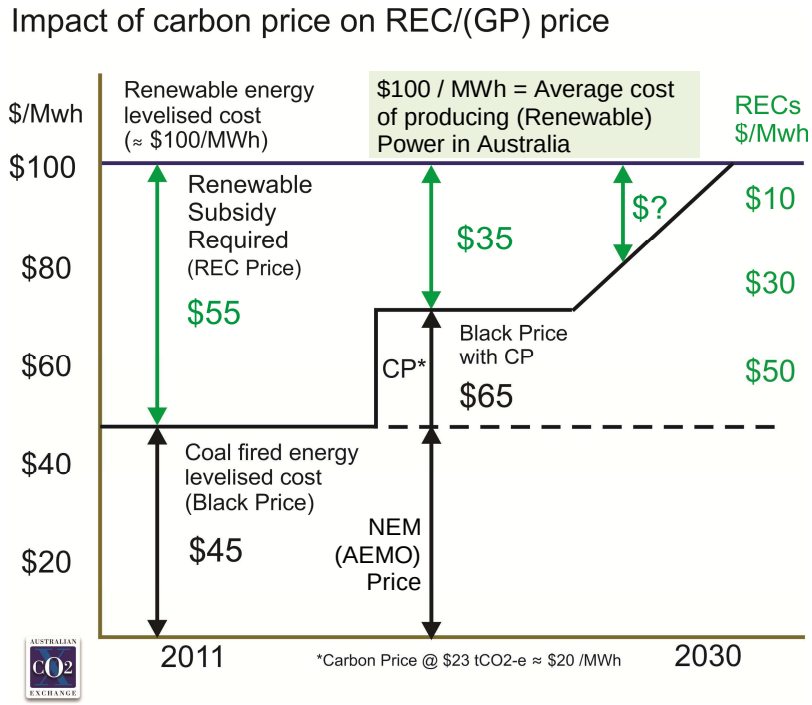


Figure 7 Impact of Carbon Price and RECs on Renewable Energy Finance

RECs, GreenPower and your Electricity Bill

Renewable Energy Certificates when surrendered) represent the environmental attributes of 1 MWh of electricity purchased from a renewable source.

For every REC surrendered, another MWh of renewable energy must be produced.

RECs can therefore be used to “offset” the emissions from your electricity use.

5.4 Greenfleet Offsets

Planting trees is the tried, proven and globally accepted way to offset carbon emissions in the long term. Planting a biodiverse mix of native species is the only way to ensure that the resulting forests meet the highest standards of ecological sustainability.

By investing in Greenfleet offsets, Council supports the planting of biodiverse forests and consequently is investing in the future health and vitality of Australia’s unique natural heritage.

Since 1997 Greenfleet has developed scientifically sound and accredited methods for capturing atmospheric carbon in biodiverse native forests.

Greenfleet is a Recognised Offset Entity under the Carbon Farming Initiative, and registered to provide financial services in relation to emissions units by ASIC.

5.5 Advocacy for Carbon Pricing to Support Renewables

By far the best solution to reducing greenhouse emissions is to accelerate the transition to clean and renewable energy generation both here in Australia and overseas. Consequently, the CAP recommends continuing the movement to a cleaner national electricity grid by advocating for:

- maintenance of existing Renewable Energy Target and the establishment of a higher Renewable Energy Target by 2030;
- providing the conditions for an effective price $35/MWh or higher for Renewable Energy Certificates; and
- continuing with a strong carbon policy and maintaining an effective Carbon Price of $20/MWh or more.

5.6 Clean Development Offsets and FY1819 Review

International markets in offsets have been established to support clean development in developing and third world economies. It is estimated that an offset price of $20 per tCO2e is required. At the time of preparing this report (May 2014), the market for offsets has collapsed to $3 to $5 /tCO2e due to poorly performing carbon markets around the world (refer Appendices E and F). Global climate and carbon policies will need to stabilise before an effective offset market once more emerges.

However, these prices can rise rapidly. There are many strong regional carbon markets already. All that is required is for the European market to recover and the USA and China to establish national carbon markets.

Consequently, the Carbon Abatement Plan (CAP) adopts the following positions:

- *reducing reliance on clean development offsets* as a form of abatement in the long term as prices may fluctuate from a low of $3 to a high of $20; and
- undertaking a review in FY1819 to reconsider the CAP goal and the level of Council investment in offsets.

Indirect Abatement Options	May 2014 Cost $/tCO2e
Offsets - Indian Waste Heat Electricity Generation	$3.50
Offsets – Indian Wind Farms	$3.00
Offsets – Australian Protection of Tasmanian Native Forest	$12.00
GreenFleet – offset of emissions from vehicles	$13.50
GreenPower – Australian Renewable Energy Certificates ($31 to $53)/MWh divided by 1.35 =($23 to $39) per tCO2e	$23 to $39

Table 10 Indirect Abatement Options ($/tCO2e)

6.0 Towards Zero Net Emissions

Summary

This section identifies the main patterns of emissions and abatement, addresses the use of estimates, and the role energy performance contracts play in increasing the accuracy of CAP modelling over time. It then broadly outlines some of the considerations for Council as it moves towards zero net emissions by adopting the TZNE Scenario approach.

6.1 CAP Modelling Assumptions

Marginal abatement cost (MAC) analysis, described in section 4.2, revealed that a number of measures not only reduced greenhouse emissions but also paid for themselves in the short term and over the long term reduced operating expenses.

By considering different values for MACs, CAP modelling indicated that measures with MACs = < $46 / tCO2e delivered an overall negative NPV and MAC indicating that, in aggregate, they could be commercially viable under an energy performance contracting approach. This assumption will be market tested when Council releases an expression of interest for energy performance contracting and modified, if necessary, based on the market response (refer *7.5 Governance (GOV) Program and Priority Actions*).

Until such time, CAP modelling is based on the assumption that all measures with a MAC value up to $46 per tCO2e are suited to an energy performance contracting process.

6.2 Increased Accuracy of CAP Modelling Over Time

CAP analysis relies on estimates such as estimates for energy efficiency, greenhouse reductions and savings associated with each measure.

Using these estimations, the Net Present Value (NPV) and marginal abatement cost (MAC) are then derived and as such are only indicative.

However, overtime CAP modelling will be tested and improved through:

1. the majority (approx 16%) of the 19% of direct abatement measures being covered by energy performance contracts, service providers will confirm or offer a revised guaranteed abatement figure; the CAP forecast for direct abatement will be modified accordingly
2. the majority of direct abatement measures being covered by energy performance contracts, service providers will nominate which measures they will offer guaranteed savings to finance the capital investment necessary to implement measures
3. through monitoring of Council's utility bills
4. through the monitoring and verification, which forms the backbone of all energy performance contracts, of abatement measures once they have been implemented.

6.3 Direct Abatement and Energy Performance Contracting

The measures and their parent programs that are considered to be highly suited to an Energy Performance Contracting approach are described below:

- Energy efficiency retrofit programs for Council buildings and community facilities – refer the Building Energy Efficiency (BEE) program
- Lighting upgrades to more energy efficient technology, e.g. converting street lighting to LED technology – refer the Public Lighting Energy Efficiency (PLEE) Program
- Installing photo voltaics on Council building assets – refer the Solar Scale Up (SSU) program
- Utilising cogeneration and trigeneration for heating, cooling, power and reducing peak electrical summer demand – refer the Clean and Resilient Energy Supply (CARES) program.

6.4 EPCs Applied to Capital Works Direct Abatement Projects

Council has applied an EPC to the MC² 405 kW Trigeneration System (DAM #1) and the associated estimates can be updated yearly with actual performance figures. At an estimated 618 tCO2e of abatement, this project represents 3% of the 19% of estimated direct abatement.

A 100kW cogeneration system has been installed at Aquarena. As part of the CARES program, Council will investigate, in partnership with YMCA, the applicability of the EPC approach to Aquarena. At an estimated 300 tCO2e of abatement, this project represents 1.5% of the 19% of estimated direct abatement.

6.5 Percentage of Direct Abatement projects under EPCs

Potentially, a further 3% to 4.5% of Capital Works projects could come under EPCs. Therefore, the overall EPC total, when added to the initial 13% under EPCs, ranges from to 16% to 17.5% of the estimated 19% direct abatement.

6.6 Pattern of Emissions and Abatement

Some of the key findings of the CAP analysis have been summarised in Table 11.

Consideration of the information given in Table 11 reveals larger patterns in emissions and abatement, namely:

- Given that Victorian brown coal generated electricity forms 67% of Council's carbon footprint (item #6), improving electricity efficiency or switching to cleaner or renewable electricity generation, constitutes the majority of Council's identified direct abatement measures
- An effective Renewable Energy Target would achieve a 20% cleaner electricity supply and automatically reduce Council's carbon footprint by 13% by 2020 (item #7)
- Direct Abatement resulting from the existing Capital Works program to 2020 will result in 6% of overall abatement (item #2)
- Direct Abatement through Energy Performance Contracts (item #3) is anticipated to deliver a further 13% (nb comparable with RET improvement of 13%)
- In total, Direct Abatement by Council will result in 19% of overall abatement (items #2 and #3)
- Maintaining GreenFleet and GreenPower investments contributes 11% of overall indirect abatement (item #4)
- The remaining 70% emissions would need to be offset to achieve zero net emissions (item #5)
- CAP modelling assumes that all abatement actions with a MAC>$46 are not commercially viable under an EPC approach (item #8).

For further information on the role of the Renewable Energy Target, GreenPower and offsets in achieving zero net emissions, refer to Section 5.3.

#	EMISSION / ABATEMENT	TYPE	tCO2e	%BAU
1	BAU 2020 Forecast	E	20,758	100%
2	Capital Works (CW) to 2020	DA	1,253	6%
3	EPC for MAC=<$46	DA	2,691	13%
4	GreenPower & GreenFleet	IDA	2,283	11%
5	Zero Net Emissions Gap (1-2-3-4)	IDA	14,530	70%
6	BAU 2020 Electricity emissions	E	13,826	67%
7	Effective RET (=20%CleanElec)	IDA	2,782	13%
8	MAC>$46	DA	722	3%

Table 11 Emission and Abatement Sources

Legend

TYPE = type of abatement or emission

E = Emission Source

DA = Direct Abatement

IDA = Indirect Abatement

6.7 Scenario Analysis

After exploration of a number of scenarios (refer Table 3) the CAP has adopted Scenario 4, called the TZNE Scenario, for moving towards zero net emissions by 2020 and beyond.

The TZNE Scenario 4 was selected because:

- Choosing Scenarios 1 or 2, effectively doing no direct abatement other than what is already in the capital works program, would be a 'lost opportunity' to take advantage EPCs to deliver cost savings, reduced greenhouse emissions, improvements to Council assets for a zero-net impact on capital expenditure and, beyond EPC contracts, lower operating expenses. Therefore Scenarios 1 and 2 were ruled out
- Scenario 3 included the roll-out of EPCs, but no support for GreenPower and GreenFleet which together constitute 11% of 2020 abatement; this Scenario was not chosen as CAP strongly recommends supporting GreenPower and the Renewable Energy Target to drive a transition to a 20% renewable electricity grid by 2020 which would result in 13% abatement(refer Table 11)
- Scenario 4 was selected because it takes advantage of the opportunity that EPC-driven direct abatement promises and, through GreenPower, supports the transition to renewable grid electricity
- Scenario 5 was not selected, largely because it did not support GreenPower in the short term. However, it will be reconsidered, as will all scenarios, as part of the FY1819 Review (refer sections 6.8 and 7.0 Governance and FY1819 Review).

	Scenario 1 BAU plus 100% Offsets		**Scenario 2** BAU plus GP+GF+Offsets		**Scenario 3** EPC MAC=<$46 plus Offsets		**TZNE Scenario 4**[7] MAC=<$46 plus GP+GF+Offsets		**Scenario 5** MAC=<$46 plus Offsets + reinvest	
Unit	tCO2e	$	tCO2e	$	tCO2e	$	tCO2e	$	tCO2e	$
Capitol Works	1,253	$811,248	1,253	$811,248	1,253	$811,248	1,253	$811,248	1,253	$811,248
EPC Works (Energy Performance Contracts)	0	$0	0	$0	2,691	$4,074,169	2,691	$4,074,169	2,691	$4,074,169
GreenPower and GreenFleet	0	$0	2,283	$77,625	0	$0	2,283	$77,625	0	0
Clean Development Offsets[8]	19,505	$73,395	17,222	$65,555	16,814	$64,446	14,530	$56,606	16,814	$64,446

Table 12 Scenario Analysis

[7] Scenario 4 is the preferred CAP scenario, often referred to as the TZNE Scenario where TZNE is an abbreviation for 'Towards Zero Net Emissions"

[8] Calculations assume a Voluntary Gold Standard Offset price of $3 or $3.50 (refer Appendices G. and H) which is currently well below the full market price of $20.

6.8 TZNE Scenario – Towards Zero Net Emissions

The TZNE Scenario consists of two stages. :

Stage 1 – aiming for 30% of abatement

Stage 1 will focus on achieving the 30% abatement by achieving:

- 19% of Direct Abatement through the Capital Works Program (6%) and Energy Performance Contracts (13% EPCs). This will have a zero net budget impact as the Capital Works program is already funded through to 2020 and EPC's are self-financing
- 11% indirect abatement through GreenPower and GreenFleet.

In summary, in Stage 1 Council will:

- Continue with the implementation of the Capital Works program to 2020 which will lead to 6% of abatement
- Undertake a number of investigations into applying Energy Performance Contracts to: public lighting, installation of photo voltaics, implementation of energy retrofits to building assets, and operation and maintenance of trigeneration and cogeneration systems at MC^2 and Aquarena – 13% of abatement
- Maintain investment in GreenPower and GreenFleet to 2020, so as to demonstrate leadership and commitment to a clean and resilient energy supply system for Australia – 11% of abatement

Stage 2. In FY1819 Review - closing 70% gap

Stage 2 commences with the FY1819 Review (refer 7.2) which will update the CAP so that it will guide decision making and action to 2020 and beyond.

The FY1819 Review will:

- Investigate the various means of means of closing the remaining 70% gap in abatement and to what extent 'zero net emissions' is an achievable goal
- Consider indirect abatement (offsets, GreenPower, GreenFleet) and the market mechanisms that contribute their effectiveness e.g. the Australian Renewable Energy Target and international Carbon Markets
- Monitor the effectiveness of the international market for offsets to FY1920 and where possible minimise price exposure by prioritising direct abatement action over purchase of offsets
- Identify technology improvements and opportunities for self - financing abatement actions that reduce Council's carbon footprint, improve assets and reduce operating expenses beyond the contract duration.
- Reconsider the CAP goal in the light of review findings.

For further discussion on the FY1819 Review refer to section 7.0 Governance and FY1819 Review.

7.0 Governance and FY1819 Review

Summary

This section summarises the two stages of the Towards Zero Net Emissions (TZNE), the challenges to be addressed in the review scheduled for FY1819, and an outline of the Governance Program and its Priority Actions.

7.1 TZNE Scenario, Challenges and CAP Goal

The Plan adopts the TZNE Scenario where Council works 'towards zero net emissions' in two stages as follows:

Stage 1 – aiming for 30%

Stage 1 focuses on direct abatement through the Capital Works program (6%) and energy performance contracting (13%) in order to take advantage of energy and carbon savings at no net cost to Council. A further 11% of abatement will be through GreenPower and GreenFleet taking the anticipated total abatement to 30%.

Stage 2 – FY1819 Review - closing the 70% gap

Before Council makes a final commitment to a carbon footprint goal for 2020 and beyond, the CAP will undertake a review in FY1819. Stage 2 consists of the FY1819Review into how to close the 70% gap, if 'zero net emissions' is to be achieved.

Challenges

The FY1819 timing has been chosen due to the current changeable nature of climate and carbon policies at a State, Federal and International level.

It is anticipated that by FY1819 the policy environment will have stabilised, providing a more predictable context in which Council can identify leadership goals for Climate 2020 and the CAP.

CAP Goal

Consequently, the FY1819 review will re-consider:

- the Climate 2020 and CAP goal – *a Carbon Neutral™ Council by 2020*
- the level of investment, if any, in offsets

7.2 Key Elements of the FY1819 Review

It is recommended that Council reviews and reconsiders the goal *'a Carbon Neutral Council by 2020'* in FY1819 especially in relation to:

- The Effectiveness of the Offsets: Effective Carbon Markets will lead to offsets priced at approximately $20 per tCO2e, the price point necessary to foster clean development in third world and developing economies
- Council's Abatement Investment Strategy: What level of investment, if any, to be made in offsets and how much in direct abatement action
- Funding of Abatement and Accreditation: What funding mechanisms and opportunities exist for ongoing investment in direct abatement action, the purchase of offsets and, if it chooses, the funding necessary to become an accredited Carbon Neutral™ Council (approximately $15,000 every two years). For example, one mechanism could be capturing some of the cost savings accrued to fund ongoing abatement measures, offsets and accreditation.

7.3 CAP Coordination

Coordination of the CAP will be through EEP's Environment Team working closely with relevant stakeholders and guided by the CAP Management Process (refer 1.3) and the Governance Program and Priority Actions as outlined in section 7.5 below.

As implementation and funding will rely largely on Energy Performance Contracts, a major coordination task will be the associated procurement process leading up to awarding of contracts.

7.4 Monitoring and Reporting

Progress towards achieving CAP goals will be monitored and reported each year, largely based upon the data from the following key sources:

- CarbonMetrix Utility Management System: this system captures all Council's utility bills that require payment by Council;
- Energy Performance Contracts: a key element of EPCs is the monitoring and verification of cost and energy savings arising from the implementation of EPC measures; this information will inform CAP monitoring and reporting.
- Where Council is not responsible for payment of utility bills (no 'financial control'), the same methods used to establish the FY1112 Baseline Inventory will be employed if no other method is available.

7.5 Governance (GOV) Program and Priority Actions

Goals

Efficiency, de-carbonise and leadership

Principles and considerations

- Cross Organisation Groups - foster peer learning and integrated decision making, action and outcomes through cross organisational groups such as GOGO and the Utilities Management Group
- Participation - encourage all staff to contribute to Council Moving toward zero net emissions by 2020
- Council Leadership - advocate and support the transition to an efficient, clean, smart and renewable energy system though Council's direct action where viable; otherwise through investment in GreenPower and offsets.

ABBREVIATIONS FOR PRIORITY ACTIONS

Each priority action has been allocated against the relevant year(s) and allocated a rating as follows.

Abbrev	Ratings
A	To be acted upon
O	Ongoing
EPC	Energy Performance Contract
CORE	Part of core budget
ADV	Advocacy through a Business Case Report

Targets / Outcomes

1. Coordination and Facilitation of the implementation of CAP programs and priority actions
2. Leadership - provide the necessary leadership to ensure the uptake of the CAP within Council and support by Councillors
3. Engagement and Participation - engage staff so that they actively participate in achieving the goals and objectives of the Carbon Abatement Plan
4. Monitoring and Reporting - provide timely and useful information on Council's progress towards carbon neutrality by 2020
5. Funding - advocate for and supporting Business Case submissions as part of the Budget Approval process where measures are unfunded
6. Budget Impact - minimise impact on budgets by using Energy Performance Contracting where practical
7. 21st Century Energy System - position Manningham City Council for a clean and resilient energy future in the 21st century
8. Carbon Neutral Council Accreditation - in FY1819 review Council becoming an NCOS accredited Carbon Neutral™ Council
9. Advocacy and Strategic Advice - continue to advise and advocate to progress the rapid transition to a Clean and Resilient Energy Supply (CARES)
10. Indirect Abatement Investment - continue to review the level of investment in GreenPower, GreenFleet and offsets.

7. Governance Program

Key Words		Priority Action Description	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
7.1	Raise awareness	Continue to support cross organisation groups that progress the goals of the Carbon Abatement Plan and result in identification of opportunities, coordinated action and integrated outcomes e.g. GOGO and the Utilities Management Group	EMT EEP GOGO UMG	O	O	O	O	O	O	CORE
7.2	Monitoring	Continue monitoring and reporting on energy and carbon use	EMT EEP UMG	O	O	O	O	O	O	CORE
7.3	Monitoring	Monitor 'carbon abatement pathway trajectory' year by year and adapt actions and strategies if necessary	EMT EEP UMG	O	O	O	O	O	O	CORE
7.4	Clean development investment	Continue to monitor investment in: the transition of Australia's energy system to renewable energy via Renewable Energy Certificates (GreenPower); biodiversity remediation of Australian bush (Offsets); the transition of developing countries to low carbon energy systems (Offsets); renewable energy and offsets, overall, for the current year and forecast for 2020	EEP	O	O	O	O	O	O	CORE
7.5	UMG	Utility Management Group to continue progressing effective monitoring and reporting for all Council's assets, operations and service delivery	EMT PROC EEP	O	O	O	O	O	O	CORE
7.6	Accreditation	As part of the FY1819 Review, review Council becoming an NCOS accredited Carbon Neutral Council™	EMT EEP					A	O	CORE
7.7	Offsets & Direct Abatement	Monitor the effectiveness of the international market for offsets to FY1920 and where possible minimise price exposure by prioritising direct abatement action over purchase of offsets	EMT EEP					A	O	ADV
7.8	Advocacy	Continue to advocate for policies and programs that accelerate the transition to clean and renewable energy generation both here in Australia and overseas. In particular, continue the transition to a cleaner national electricity grid by advocating for: maintenance of existing Renewable Energy Target and the establishment of a higher Renewable Energy Target by 2030; providing the conditions for an effective price of $35/MWh or higher for Renewable Energy Certificates; a strong carbon policy and maintaining an effective Carbon Price of $20/MWh or more.	EMT EEP	O	O	O	O	O	O	CORE
7.9	Funding	Consider funding Carbon Neutral Accreditation and Verification, purchase of offsets and investment in abatement measures partly / fully through operational savings, during or on completions of EPCs	EMT EEP					A	O	CORE
7.10	New Technology	Identify technology improvements and opportunities for self -financing abatement actions that reduce Council's carbon footprint, improve assets and reduce operating expenses beyond the contract duration.	STP EEP	O	O	O	O	O	O	CORE
7.11	FY1819 review	Review and reconsider the Climate 2020 and CAP goal 'Carbon Neutral™ Council by 2020' refer section 5.9 CAP	EMT EEP					A		CORE
7.12	EPCs	Support investigations into EPCs, the EPC procurement process across the organisation, implementation, Monitoring and verification	EMT EEP STP ETS	A	A	A	A	A	A	CORE

Table 13 Governance - Priority Actions

APPENDICES

A. CAP Programs and Priority Actions

	Key Words	Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
1. Solar Scale Up (SSU) Program – in association with NAGA										
1.1	Solar Depot	Investigate the implementation of large scale PV systems (approx 100kW) at the Depot (DAM 15)	EEP STP	A						EPC
1.2	PV Public Toilets	Investigate EPC PV for all other facilities where Council has Financial Control as well as Operational Control e.g. public toilets via an EPC to establish the Service Provider (DAM 5 6 8 11 12 13 14)	EEP STP	A						EPC
1.3	100kW PV Solar Premium	Investigate the implementation of large scale PV systems (approx 100kW) on building assets that are tenanted and where Council does not pay the utility bills – e.g. Aquarena and Mullum Mullum Stadium. Council would negotiate a 'Solar Premium' to be added to rental for 10 years to recover costs (DAM 10)	EEP STP		A					EPC
1.4	<15kW PV Solar Premium	Solar Premium: Investigate the implementation of Solar PV Systems <15kW each- ~30* Pines and Community Buildings (Total 100kW) - 21c/kWh (assumed $1.70/watt) ~650m2 (DAM 7)	EEP STP			A				EPC
1.5	PV /GreenPower	Investigate the possibility of replacing 100% of GreenPower abatement with a total of 1000kW of PV	EEP UMG				A			EPC
1.6	Solar BBQ	Investigate the implementation of Solar PV Standalone Single Plate BBQ (DAM 4)	STP EEP					A		ADV
1.7	Solar BBQ	Investigate the implementation of Solar PV Standalone Double Plate BBQ (DAM 2)	STP EEP					A		ADV
2. Building Energy Efficiency (BEE) Program										
2.1	Depot EPC	Investigate EPC for Depot, Pines etc (DAM 70)	STP EEP	A						EPC
2.2	Large Facilities	Investigate EPCs for building assets commencing with a sample set of large facilities: MC² + Civic Offices- excl HVAC and Trigen System, Pines etc (DAM 43)	STP EEP			A	A			EPC
2.3	Public Toilets BBQs	Investigate EPCs for all other facilities where Council has Financial Control as well as Operational Control e.g. public toilets, BBQs (DAM 43)	STP EEP			A	A			EPC
2.4	Aquarena Mullum Mullum	Investigate EPCs for large facilities, that are currently or will be under construction e.g. Aquarena and Mullum Mullum stadium where Council has OC but no FC (DAM n/a)	STP EEP		A	A	A			EPC
2.5	Tenant Premium Offer	Investigate establishing an offer for tenants – a Solar and Energy Efficiency (SEE) premium for tenants to be added to their rental for 10 years to pay for PV and energy efficiency measures (DAM 16 17 19 23 24 25 31 33 45 46 53)	STP EEP			H	H			EPC
2.6	AMS Refurbishments	Continue to identify opportunities to improve energy efficiency as part of AMS refurbishment program (DAMS 20 21 22 26 27 28 29 20 32 34 35 36 38 39 40 41 42 47 48 49 50)	STP EEP	O	O	O	O	O	O	AMS
2.7	Water EPC	Incorporate Water Efficiency (5% reduction) (DAM 65) for Council Buildings into EPC for Building Energy Efficiency	STP EEP			A	A			EPC
2.8	Smart Meters	Continue the roll out of smart meters to all Council Building Assets	STP EEP	A	O	0				CORE

	Key Words	Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
3. Public Lighting Energy Efficiency (PLEE) Program										
3.1	Master Plan	Develop a Business Case for an audit of public lighting	ETS EEP	A						ADV
3.2	EPC Investigation	Investigate the options for undertaking an EPC approach to future street lighting upgrades including cost estimates and resolution of Distributor issues	ETS EEP	A						EPC
3.3	EPC Proc	Develop documentation for tenders for the staged implementation of an EPC contract and award	ETS EEP		A					EPC
3.4	EPC Rollout	Roll out of EPC contract	ETS EEP			A	A	A	A	EPC
4. Clean and Resilient Energy Supply (CARES) Program										
4.1	Clean & Efficient	Continue to investigate energy efficiency, clean or renewable energy solutions and their applicability to Council operations and service delivery	EEP STP	O	O	O	O	O	O	CORE
4.2	Storage Tech	Continue to investigate Storage Technologies and their applicability to Council operations and service delivery	EEP STP	O	O	O	O	O	O	CORE
4.3	Fuel Diversity	Continue to investigate diversification of vehicle fuels and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.4	Elec Demand	Continue to investigate Demand Smoothing solutions and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.5	Waste to Energy	Continue to investigate waste-to-energy solutions and implement where appropriate	EO EEP	O	O	O	O	O	O	CORE
4.6	Smart Systems	Continue to investigate smart technologies such as smart meters, controls and communications technologies and implement where appropriate	EEP STP	O	O	O	O	O	O	CORE
4.7	Waste Contractors	Continue to investigate opportunities in the waste management procurement process to reduce the carbon content of contractor fuels and waste management practices	EO EEP	O	O	H	O	O	O	CORE
4.8	Demand Response	Investigate ways in which Manningham City Council could shed discretionary Peak Electrical Demand, as necessary. Estimate the market value of this demand shedding capability.	EEP STP	O	O	H	O	O	O	CORE
5. Resilient Mobility (REMO) Program										
5.1	Resilient Mobility	Continue to investigate mobility solutions that improve resilience, energy efficiency and are clean or renewable	EO STP EEP	O	O	O	O	O	O	CORE
5.2	Fuel Security	Continue to investigate fuel security solutions and their applicability to Council operations and service delivery especially as they apply to fuel disruption e.g. storage, alternative local and renewable fuels	EO STP EEP	O	O	O	O	O	O	CORE
5.3	Fuel Security	Continue to investigate diversification of vehicle fuels e.g. biodiesel for depot plant (DAM 56 59)	EO STP EEP	O	O	O	O	O	O	CORE
5.4	10% Electric Vehicle Fleet	Investigate replacing 10% of car fleet with electric vehicles by 2020; tie in with standard vehicle replacement cycle (DAM 60)	EO STP EEP				A			ADV

	Key Words	Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
6. GOGO – fostering the change										
6.1	Civic Offices Permability	Civic Offices Draft Proofing and Duct Work	EEP STP	A						CORE
6.2	Cont Improv	GOGO to continue to foster internal change through innovative actions, communication and education	EMT EEP	O	O	O	H	O	O	CORE
6.3	Cont Improv	Municipal Offices - passive Improvements e.g. installing blinds – completed FY1112 (DAM 61)	EMT EEP	-	-	-	-	-	-	CORE
6.4	EE Lighting	Various Council Buildings - lighting efficiency improvement - completed FY1314 (DAM 62)	EMT EEP	-	-	-	-	-	-	GOGO
6.5	EE Lighting	Depot- High Bay lighting upgrade improvement - completed FY1213 (DAM 63)	EMT EEP	-	-	-	-	-	-	GOGO
7. Governance Program										
7.1	Raise awareness	Continue to support cross organisation groups that progress the goals of the Carbon Abatement Plan and result in identification of opportunities, coordinated action and integrated outcomes e.g. GOGO and the Utilities Mgt Group	EMT GOGO UMG	O	O	O	O	O	O	CORE
7.2	Monitoring & Reporting	Continue monitoring and reporting on energy and carbon use	EMT UMG EEP GOGO	O	O	O	O	O	O	CORE
7.3	CAP Progress	Monitor 'carbon abatement pathway trajectory' year by year and adapt actions and strategies if necessary	EMT EEP	O	O	O	O	O	O	CORE
7.4	21st Century Clean Energy	Continue to monitor investment in: the transition of Australia's energy system to renewable energy via Renewable Energy Certificates (GreenPower); biodiversity remediation of Australian bush (offsets); the transition of developing countries to low carbon energy systems (offsets); renewable energy and offsets, overall, for the current year and forecast for 2020	EEP	O	O	O	O	O	O	CORE
7.5	UMG	Utility Management Group to continue progressing effective monitoring and reporting for all Council's assets, operations and service delivery	EMT PROC EEP	O	O	O	O	O	O	CORE
7.6	Accreditation	As part of the FY1819 Review, review Council becoming an NCOS accredited Carbon Neutral Council™	EMT EEP					A	O	CORE
7.7	Offsets & Direct Abatement	Monitor the effectiveness of the international market for offsets to FY1920 and where possible minimise price exposure by prioritising direct abatement action over purchase of offsets	EMT EEP					A	O	ADV
7.8	Advocacy	Continue to advocate for policies and programs that accelerate the transition to clean and renewable energy generation both here in Australia and overseas. In particular, continue the transition to a cleaner national electricity grid by advocating for: maintenance of existing Renewable Energy Target and the establishment of a higher Renewable Energy Target by 2030; providing the conditions for an effective price of $35/MWh or higher for Renewable Energy Certificates; continuing with a strong carbon policy and maintaining an effective Carbon Price of $20/MWh or more.	EMT EEP	O	O	O	O	O	O	CORE
7.9	Funding	Consider funding Carbon Neutral Accreditation and Verification, purchase of offsets and	EMT EEP					A	O	CORE

	Key Words	Priority Actions	Responsible Unit	FY 1415	FY 1516	FY 1617	FY 1718	FY 1819	FY 1920	FUNDING
		investment in abatement measures partly / fully through operational savings, during or on completions of EPCs								
7.10	New Technology	Identify technology improvements and opportunities for self -financing abatement actions that reduce Council's carbon footprint, improve assets and reduce operating expenses beyond the contract duration.	STP EEP	O	O	O	O	O	O	CORE
7.11	FY1819 Review	Review and reconsider the Climate 2020 and CAP goal '*Carbon Neutral™ Council by 2020*' refer section 5.9 CAP	EMT STP EEP					A		CORE
7.12	EPCs	Support investigations into EPCs, the EPC procurement process across the organisation, implementation, Monitoring and verification	EMT EEP STP ETS	A	A	A	A	A	A	CORE

B. Direct Abatement Measures (DAM) to 2020

ID#	Measure	Program Group	Cost Savings /yr	Cost of Measure	GHG Savings (tCO2e)	Water (kL)	Project Life (yrs)	kWh / yr	Payback (yrs)	NPV	MAC ($/tCO2-e)	
63	Depot- High Bay Lighting Upgrade	GOGO	$7,309	$28,350	21		15	19,947	4	-38,220	-199	
18	Stage 2 Street Lighting- 1,033x 80 Watt MV to T5 Fluorescent lamps	PLEE	$91,866	$280,668	391		20	289,981	3	-692,567	-167	
51	Replace the remaining 2472 decorative 80W MV to 25W LED at $550/each	PLEE	$168,513	$1,375,000	244		20	180,675	8	-410,234	-159	
17	Doncaster Senior Citizens- EE Project	BEE	$4,014	$6,080	22		10	16,056	2	-22,113	-145	
59	Depot- Soy Biodiesel (B20) use in 23 depot vehicles (tractors and mowers)	REMO	$2,500	$2,500	15		10	0	1	-15,059	-144	
44	Stage 3 Street lighting - 750x 80Watt MV to 25 watt LED @$550 inc install	PLEE	$60,701	$412,500	203		25	150,563	7	-294,887	-124	
37	Stage 4 Street lighting - 1190x 80Watt MV to 25 watt LED @$550 inc install	PLEE	$96,313	$654,500	323		25	238,893	7	-467,887	-124	
16	Bulleen Pavilion- EE Project	BEE	$4,286	$9,750	24		10	17,911	2	-20,353	-120	
65	Various Council Buildings- Water Efficiency Program (5% reduction)	BEE(Water)	$13,914	$20,000	14	5981	2	0	1	-2,194	-98	
62	Various Council Buildings- Lighting Efficiency Improvement	GOGO	$4,360	$19,139	34		15	6,650	4	-20,572	-67	
45	Bulleen Senior Citizens- EE Project	BEE	$4,113	$14,210	35		10	26,281	3	-14,678	-59	MAC =< $46
25	Warrandyte Seniors- EE Project	BEE	$1,271	$4,200	12		10	8,925	3	-4,727	-56	
7	Solar PV Systems <15kW each- 30* Pines and Community Buildings (Total 100kW) - 21c/kWh	SSU	$26,368	$200,000	177		25	131,400	8	-107,277	-52	
71	Civic Offices – draft proofing and duct work	GOGO	$35,000	$140,000	384		15	284,440	4	-178,777	-51	
19	Timber Ridge Pavilion- EE Project	BEE	$1,641	$6,000	17		10	12,697	4	-5,526	-46	
46	Riescheicks Reserve- EE Project	BEE	$2,053	$10,880	11		10	8,390	5	-3,539	-44	
15	Solar PV System- Depot (100kW) - export at 8c/kWh (assumed $1.50/watt)	SSU	$15,440	$150,000	177		25	131,400	10	-29,925	-14	
70	Depot energy efficiency works (EPC)	BEE	$20,854	$175,000	162		15	120,000	8	-14,936	-10	
3	Standalone PV Systems conversion for Warrandyte Bridge Public Toilet	SSU	$794	$7,464	0		16	336	9	-39	-9	
5	Standalone PV Systems conversion for Whipstick Gully Public Toilet	SSU	$794	$7,464	0		16	336	9	-39	-9	
6	Standalone PV Systems conversion for Warrandyte Reserve Public Toilet	SSU	$794	$7,464	0		16	336	9	-39	-9	
8	Standalone PV Systems conversion for Schramms Public Toilet	SSU	$794	$7,464	0		16	336	9	-39	-9	
11	1* Standalone PV System for new Macedon Square public toilet	SSU	$794	$7,464	0		16	336	9	-39	-9	
12	Standalone PV Systems conversion for	SSU	$794	$7,464	0		16	336	9	-39	-9	

	Ruffey Park Lake Public Toilet										
13	Standalone PV Systems conversion for Church Road Lake Public Toilet	SSU	$794	$7,464	0	16	336	9	-39	-9	
14	Standalone PV Systems conversion for Stiggants reserve Public Toilet	SSU	$794	$7,464	0	16	336	9	-39	-9	
9	Aquarena- EE Project inc 100kW Cogeneration Plant	CARES	$25,000	$205,000	300	15	0	8	-22,698	-8	
1	MC²- 405kW Trigeneration	CARES	$58,350	$437,750	618	12	458	8	-25,706	-5	
64	Refrigerant- Hydrocarbon Substitute	CARES	$4,971	$4,537	126	1	0	1	-110	-1	
23	Heimat House- EE Project	BEE	$1,688	$11,900	11	10	8,190	7	44	1	
53	Donvale Soccer Pavilion- EE Project	BEE	$728	$5,300	5	10	3,872	7	187	5	
48	Deep Creek Child Care Centre- Refurb Project	BEE	$190	$2,000	9	12	6,324	11	493	7	
56	Depot- Soy Biodiesel Trial (B100)	REMO	-$84	$500	19	15	0	#N/A	1,268	7	
21	Ajani Centre- Refurbishment Project	BEE	$292	$3,500	13	12	9,735	12	1,180	11	
29	Deep Creek MCHC- Refurbishment Project	BEE	$85	$2,000	6	12	4,240	24	1,326	29	
10	Solar PV 200kW system- Aquarena & Mullum Mullum Stadium	SSU	$23,856	$400,000	355	25	262,800	17	121,987	30	
28	Schramms Cottage- Refurbishment Project	BEE	$17	$450	1	12	720	26	313	41	
27	East Doncaster Hall- Refurbishment Project	BEE	$37	$1,000	2	12	1,532	27	708	43	
36	Doncaster Reserve Pavilion- Refurbishment Project	BEE	$69	$2,000	3	12	2,313	29	1,449	58	
20	Boronia Grove Former Scout Hall- Refurbishment Project	BEE	$27	$1,000	2	12	1,114	37	788	66	
26	Templestowe Memorial Hall- Refurbishment Project	BEE	$27	$1,000	1	12	1,109	38	789	66	
39	Warrandyte Community Child Care Centre- Refurbishment Project	BEE	$43	$2,000	2	12	1,812	46	1,655	85	
40	Koonung Park Pavilion- Refurbishment Project	BEE	$27	$1,500	2	12	1,327	57	1,289	91	
24	Pines Learning Activity Centre PLAC- EE Project	BEE	$549	$8,650	7	10	5,291	16	4,794	96	
22	Wonga Park Public Hall/ MCHC- Refurbishment Project	BEE	$16	$1,000	1	12	801	62	873	102	
42	Deep Creek Reserve Pavilion- Refurbishment Project	BEE	$22	$1,500	2	12	1,113	67	1,323	111	
33	Playhouse Theatre EE Project	BEE	$1,225	$16,000	9	10	6,530	13	7,396	119	
47	Bulleen Park Pavilion (Old Back) #2- Refurbishment Project	BEE	$40	$3,000	3	12	2,011	75	2,681	124	
61	Municipal Offices- Passive Improvements e.g. installing blinds	GOGO	$120	$8,291	5	20	0	69	7,020	133	
43	Energy Performance Contract- Municipal Offices, Pines, MC2	BEE	$27,562	$385,000	105	15	78,000	14	133,969	141	
49	Currawong Residence & Conference Room- Refurbishment Project	BEE	$68	$3,000	2	12	1,133	44	2,460	202	
52	Upgrade 20 80W MV minor/public street lights with standalone PV/LED lighting @ $6050/unit estimate	PLEE	$8,701	$121,000	8	25	5,840	14	19,605	213	
34	Wilsons Road Reserve Pavilion- Refurbishment Project	BEE	$8	$1,000	1	12	406	123	936	215	
2	Standalone Double Plate BBQ	SSU	$1,261	$24,714	4	25	3	20	10,017	227	
30	Twin Hills MCHC Refurbishment Project	BEE	$36	$2,000	1	12	629	56	1,714	254	

MAC =< $46

MAC > $46

4	Standalone Single Plate BBQ	SSU	$831	$15,825	2		25	4	19	6,146	278
32	Park Orchards Pre School- Refurbishment Project	BEE	$12	$1,000	0		12	291	83	905	290
31	Bulleen Preschool- EE Project	BEE	$72	$1,500	0		10	288	21	994	364
50	Park Orchards- Refurbishment Project	BEE	$12	$2,000	1		12	441	167	1,905	403
54	Partner with VicRoads to replace the high performance sodium (HPS) lamps with 80to25W LEDs @$1000/each (3643 lamps)	PLEE	$45,485	$3,643,000	614		20	454,854	80	3,161,127	486
41	Colman Park Pavilion- Refurbishment Project	BEE	$18	$1,000	0		12	131	56	857	610
35	Pound Office- Refurbishment Project	BEE	$8	$600	0		12	81	75	536	616
38	Tunstall Road MCHC- Refurbishment Project	BEE	$8	$1,500	0		12	209	188	1,436	641
60	Green Electric Vehicle conversion of 10% of general fleet (green offset via Greenfleet)	REMO	$26,701	$139,900	28		3	0	5	69,828	941
55	Replace 2000*32W T5's with 25W LED Plug Ins@$200/each	PLEE	$1,840	$400,000	25		15	18,396	217	383,245	1694
	TOTAL		$783,873	$9,416,006	4,562	5,981	14	2,627,256	12	2,560,666	64

C. Scope 1, 2 and 3 Emissions

Under the National Greenhouse and Energy Reporting Act 2007 (NGER), emissions are categorised as either Scope 1, 2 or 3 emissions.

Scope 1: Direct Greenhouse Gas Emissions

Emissions generated by sources owned or controlled by the Council are classed as Scope 1. For the Council this includes the burning of fuels (e.g. liquid petroleum gas, natural gas, and general fleet vehicles), and the use of refrigerants (e.g. in air conditioners and refrigerators).

Scope 2: Indirect Greenhouse Gas Emissions

An activity that generates electricity, heating, cooling or steam that is consumed by one or more facilities, but that are not part of the organisation is classed as Scope 2. For the Council, this is relevant for electricity. All electricity consumed by the Council except for any Green power procured, is generated externally from non-renewable energy sources.

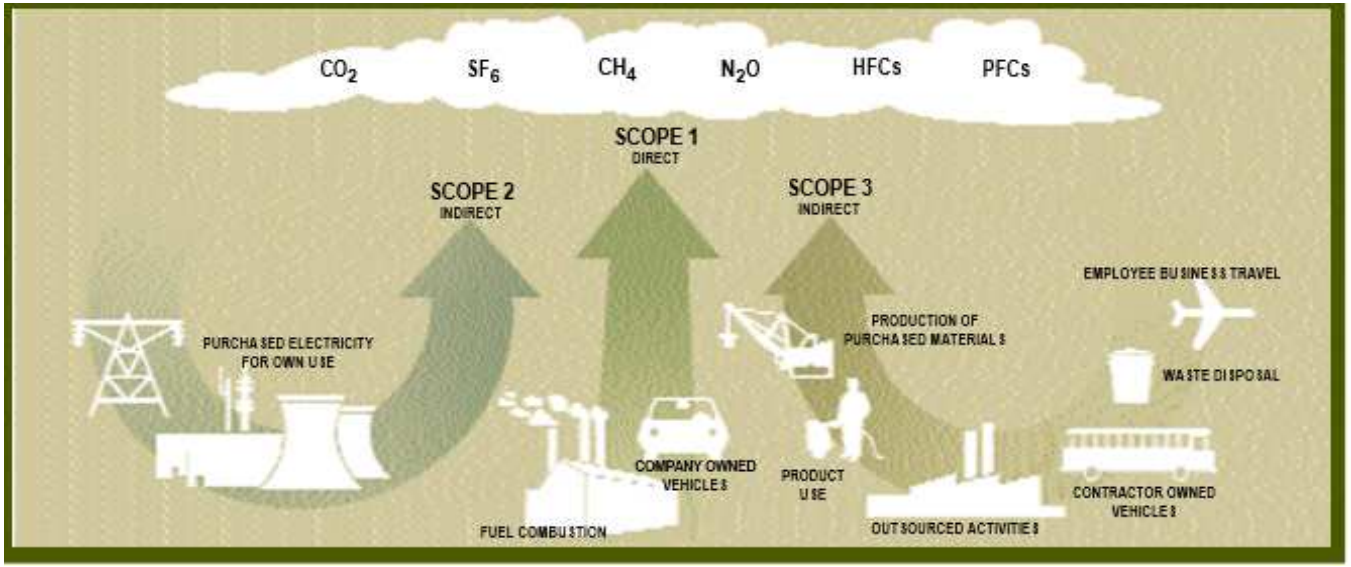


Figure 8 Scope 1, 2 and 3 Emissions Sources

Scope 3: Other Indirect Greenhouse Gas Emissions

All emissions (except Scope 2) that are generated in the wider economy as a consequence of an organisation's activities, but that are physically produced by another facility are classed as Scope 3 emissions. Under the NGER Scheme this is an optional reportable emissions category.

For this assessment the following Scope 3 emissions have been included:

1. Major contractor fuels
2. Electricity (for buildings where Council has financial control but no organization control)
3. Natural gas (for buildings where Council has financial control but no organization control)
4. Street lighting
5. Paper
6. Water and sewerage
7. Corporate travel – home health and other business travel
8. Corporate travel – public transport
9. Corporate travel – taxi
10. Electricity (extraction, processing and transmission)
11. Natural gas (extraction, processing and transmission)
12. Unleaded petroleum (extraction, processing and transmission)
13. Diesel (extraction, processing and transmission)
14. Liquid petroleum gas (extraction, processing and transmission)
15. Biodiesel (extraction, processing and transmission)
16. Council waste

Scope	Source	QTY	Units	FY1112 (tCO2e)
1	Natural Gas (OC & FC Buildings)	3,875	GJ	199
1	ULP	5,980	GJ	403
1	Diesel	11,745	GJ	821
1	LPG	1,560	GJ	94
1	Biodiesel	249	GJ	1
1	Refrigerants	NA	NA	165
2	Electricity (OC & FC Buildings)	7,996	GJ	2,599
2	Electricity (Minor Lighting)	2,832	GJ	920
3	Major Contractor Fuels	34,422	GJ	2,589
3	Electricity (OC but no FC Buildings)	4,571	GJ	1,676
3	Natural Gas (OC but no FC Buildings)	21,087	GJ	1,165
3	Street Lighting	17,175	GJ	6,297
3	Paper	14	tonne	20
3	Water & Sewerage	NA	kL	285
3	Corporate Travel - Home Health & Other Business Travel	1,562	GJ	117
3	Corporate Travel - Public Transport	NA	GJ	1
3	Corporate Travel - Taxi	53	GJ	3
3	Electricity (E,P&T)	10,828	GJ	451
3	Natural Gas (E,P&T)	3,875	GJ	15
3	ULP (E,P&T)	5,980	GJ	32
3	Diesel (E,P&T)	11,745	GJ	62
3	LPG (E,P&T)	1,560	GJ	8
3	Biodiesel (E,P&T)	249	GJ	-
3	Council Waste	12	tonne	10
	TOTAL tCO2e			17,931
	GreenPower Purchases			- 1,788
	Greenfleet			- 587
	Net Total tCO2e			15,556

Figure 9 FY1112 Baseline Inventory - Scope 1, 2 and 3 Emissions

D. Setting the Boundaries of the GHG inventory

Setting the boundary of an emissions inventory involves determining the inclusions and exclusions of the carbon footprint. There are four key steps:

Step 1: Determining the organisational boundary- this defines the entities/facilities that will be included in your energy and emissions inventory e.g. Council and/or third Parties; and

Step 2: Determining the operational control boundary - This defines the single organisation that has the greatest authority to introduce or implement policies relating to operations, environment and OH&S at the facility.

Step 3: Determining the financial control boundary - This defines the single organisation that has financial control at the facility.

Step 4: Determine whether the boundary of the inventory is best based on:

- financial control alone
- operational control alone,
- both financial and operational control
- all council owned or operated sites.

The following table provides a list of the advantages and disadvantages of each boundary type and a subsequent score that has been allocated to reflect its relevance to Council's specific requirements.

Figure 10 shows the breakdown of an allocation of operational and financial control across all facilities Council owns or operates.

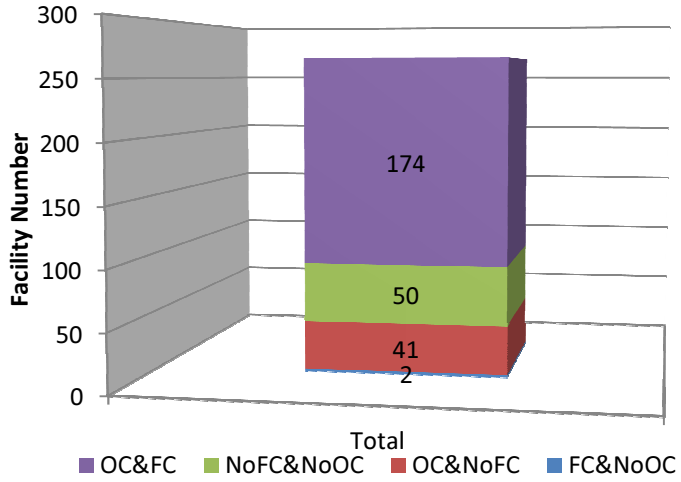


Figure 10 Facility Control Allocation Breakdown

Defining the boundary of Council's GHG inventory

After consideration of the advantages and disadvantages outlined in Table 14, the CAP adopted the greenhouse gas inventory boundary defined by all sites for which Council has Operational or Financial Control (FC&OC).

Boundary Type	Advantages	Disadvantages	Score
All sites for which Council has **Operational Control (OC)**	Acceptable for NGER and NCOS Offsetting is cheap	Does not justify past and future expenditure 3rd parties perceive inventory as incomplete and 'Greenwash' Sourcing 3rd party billing data is time consuming and can be troublesome No real advantage over FC&OC with only 2 more sites to be added Less $ to be saved through mitigation	6/10
All sites for which Council has - **Operational and Financial Control (FC&OC)**	Considered as robust Acceptable for NGER and NCOS Handing responsibility for FC reduces net emissions 3rd parties perceive inventory as complete and council as reporting honestly Justifies past and future expenditure in energy efficiency expenditure	Sourcing 3rd party billing data is time consuming and can be troublesome	9/10
All sites for which Council has - **Financial Control (FC)**	Easy to access data through billing data as emissions are limited Acceptable for NCOS if high materiality Offsetting is cheap Easy to track annually Handing responsibility for FC reduces net emissions	3rd parties perceive inventory as incomplete and 'greenwash' Only 70% of electricity and natural gas usage is included in the inventory Does not justify past and future expenditure Less opportunities for GHG emission reductions Not acceptable for NCOS if low materiality results from handing responsibility to 3rd party	7/10
All Council Owned or Operated Sites	Considered as most robust Most acceptable for NCOS 3rd parties perceive inventory as complete and council as reporting honestly Justifies past and future expenditure in energy efficiency expenditure Handing responsibility for FC reduces net emissions	Sourcing 3rd party billing data is costly and can be troublesome Expensive to offset No real advantage over FC&OC Handing responsibility for FC doesn't reduce net emissions	5/10

Table 14 Setting Boundaries of Carbon Inventory

Operational and / or Financial Control

An extensive analysis of Council's assets was undertaken in order to allocate financial control (FC) and operational control (OC). This involved considering the ownership of the asset, assessing who had greater control over implementation of environmental, health and safety policies and the payment of invoices for electricity, gas and water at each facility.

The form used to assist in allocating operational and financial control is depicted in Figure 11. A complete analysis of over two hundred and fifty of Council's Building Assets was undertaken. An excerpt of this much larger table is provided in Table 15.

For the assets under the Council's financial and operational control activity data (amounts of resources used, or usage rate) was collected and categorised under specific emission source types. Emission factors were then used to convert the activity data for each emission source into carbon dioxide equivalent emissions, expressed as tonnes CO_2-e.

The emission factors used in the development of Manningham City Council's baseline greenhouse gas inventory were primarily sourced from National Greenhouse Accounts (July 2013) and the Victorian EPA Greenhouse Gas Management Plan (2010-2011).

Facility Name Description						
Address/Latitude and longitude						
Corporation Name		**Address**		**ABN**		
	Policy		**Policy Score (0-30)**	**Council**	**Organisation 1**	**Organisation 2**
Operating Policies	Who operates electrical appliances, internal lights, security lights, etc?					
	Who operates HVAC system (heating ventilation and air conditioning system)?					
	Who has the ability to upgrade facility assets?					
	Who pays the electricity bill?					
	Who pays the gas bill?					
	Who implements maintenance/cleaning at the facility?					
	Who pays land rates?					
	TOTAL					
Environmental Policies	Who has the greatest authority to implement environmental policies?					
	TOTAL					
OH&S Policies	Who has the greatest authority to implement OH&S policies?					
	TOTAL					
TOTAL	**OPERATIONAL CONTROL TOTAL**					

Figure 11 Template for NGERS Operational Control Analysis

Site Code	Name	Site Code Notes	Building Owner	OPERATIONAL CONTROL	FINANCIAL CONTROL	Breakdown	FC_WATER	FC_ELEC	FC_GAS
BU000256	12 Clay Drive Doncaster (Residence)		COUNCIL	COUNCIL	COUNCIL	OC&FC	COUNCIL	COUNCIL	COUNCIL
BU000187	Aquarena Sports Centre		COUNCIL	COUNCIL	3rd PARTY	OC&NoFC	SPORTING CLUB	SPORTING CLUB	SPORTING CLUB
#N/A	Aranga Reserve	Streetlights	COUNCIL	3RD PARTY	3RD PARTY	NoFC&NoOC	#N/A	#N/A	#N/A
BU000015	Beverly Hills Pre-School (Damala St)		COUNCIL	PRESCHOOL	PRE SCHOOL	NoFC&NoOC	COUNCIL	PRESCHOOL	PRESCHOOL
BU000075	Bucks Reserve Public Toilet		COUNCIL	COUNCIL	COUNCIL	OC&FC	COUNCIL	COUNCIL	COUNCIL
BU000218	Bulleen / Templestowe Community House		COUNCIL	COUNCIL	COUNCIL	OC&FC	COUNCIL	COUNCIL	N/A
BU000210	Bulleen Library		COUNCIL	COUNCIL	3RD PARTY	OC&NoFC	LIBRARY	LIBRARY	LIBRARY
BU000226	Bulleen M.C.H Centre		COUNCIL	COUNCIL	COUNCIL	OC&FC	COUNCIL	COUNCIL	COUNCIL
BU000045	Bulleen Park Pavilion No 1		COUNCIL	COUNCIL	COUNCIL	OC&FC	COUNCIL	COUNCIL	COUNCIL

Table 15 Excerpt from Operational Control Determination Form

E. Table of Operational Control Allocations

A table has been generated that lists Operational Control allocations for Building Assets using the format below.

BUILDING NUMBER	BUILDING NAMES associated with each service delivery as listed below	OPERATIONAL CONTROL	FINANCIAL CONTROL	CONTROL CODE
BUXXX – Building Unit numbers allocated against each Building Asset	AGED CARE / SNR CITIZENS	Operational Control allocated (Council or ?) against each Building Asset	Financial Control allocated (Council or ?) against each Building Asset Council or ?	Finally, based on previous two columns, a Control Code is allocated (OC or FC?)
	ART CENTRE			
	CHILD CARE CENTRES			
	COMMUNITY FACILITIES			
	WARRANDYTE BASKETBALL STADIUM			
	COUNCIL WORK PLACES			
	DWELLINGS RENTED			
	HERITAGE BUILDINGS			
	LIBRARIES			
	MATERNAL & CHILD HEALTH CENTRE			
	NURSING HOME			
	PLAYGROUP			
	PRESCHOOL			
	PUBLIC HALL			
	PUBLIC TOILET			
	SCOUT HALL/GIRL GUIDE			
	SPORTING FACILITY			
	SPORTS PAVILION			
	PUBLIC BBQS			
	MISCELLANEOUS			

Table 16 Operational Control Allocations for Building Assets

F. Carbon Neutral™ Accreditation

How does Council become Carbon Neutral™ ?

For Council to claim carbon neutrality or to use the term Carbon Neutral™ Council requires accreditation under the National Carbon Offset Standard (NCOS) Carbon Neutral Program.

National Carbon Offset Standard (NCOS) Carbon Neutral Certification

The NCOS Carbon Neutral Program provides guidance to organisations in the selection of carbon offsets and provides a framework and minimum requirements for measuring, auditing and offsetting carbon emissions in order to achieve 'carbon neutral'. Manningham City Council can be certified under the NCOS Carbon Neutral Program if it demonstrates to have measured and reduced their carbon footprint, and offset the remaining carbon emissions.

Certification under the NCOS Carbon Neutral Program is valid for a period of 5 years and in order to maintain certification, the Council must:

- Monitor and reduce emissions accordingly
- Submit updated carbon footprint, Carbon Abatement Plan, public disclosure summary and annual report to the Department of Environment within four months of the end of the reporting year
- Purchase and cancel sufficient eligible offsets to offset total emission for the reporting year
- Ensure reports at the end of the first year of certification and every second year thereafter are audited by a third party

Once certified the organisation is able to use the NCOS Carbon Neutral Certified logo under license for promotional and marketing purposes.

As Manningham City Council has not, as yet, elected to proceed with formal accreditation under the NCOS Carbon Neutral Program*, it cannot claim to be a 'Carbon Neutral™ Council' as this term has been trademarked*. Rather than carbon neutral, an alternative description such as '*zero net emissions'* can be used instead.

Benefits of Carbon Neutral™ accreditation

By going carbon neutral Council can:

17. Reduce its greenhouse gas emissions and its contribution to climate change
18. Reduce the resources used and potentially reduce costs
19. Demonstrate leadership and strengthen its corporate and community reputation
20. Contribute to Australia's transition to a low carbon, clean energy economy of the 21st century so that our nation remains internationally competitive in a low carbon world.

G. Types of Carbon Credits

Essentially, the types of carbon credits can be split into two forms:

- those within the voluntary market and
- those within the compliance market.

Each type of carbon credit adheres to a particular standard or certification.

1. COMPLIANCE CARBON CREDITS

Certified Emission Reduction (CER) units

The most common type of compliance credit is a CER (Certified Emission Reduction unit) which originates from projects in developing counties. Certification and overall approval of these abatement projects and their credits is known as the Clean Development Mechanism (CDM).

Emission Reduction Unit (ERU)

Like CER in developing nations, within developed nations, a mechanism known as Joint Implementation or JI, produces compliance credits referred to as Emission Reduction Units or ERUs.

New South Wales Greenhouse Gas Abatement Certificate (NGAC)

The New South Wales Greenhouse Abatement Certificate (NGAC) certification process is comprehensive. It includes Kyoto Protocol measures, but goes beyond these. In summary the NGAC certification process ensures the following:

- That each NGAC represents one tonne of carbon dioxide stored for at least 100 years.
- That the trees have been planted since 1990.
- That the trees weren't planted on old growth forest cleared land (the land must have been clear prior to 1990).
- That should the tree from which your carbon credit came come to any harm within 100 years of your purchase e.g. Fire, disease, logging; that carbon credit will be replaced immediately from another source.

2. VOLUNTARY CARBON CREDITS

Voluntary Carbon Unit (VCU) or Voluntary Carbon Standard (VCS) credit

The VCS Programme provides a robust, global standard for approval of credible voluntary carbon credits.

VCS credits or Voluntary Carbon Units (VCU) must be real, the abatement must have occurred, they must be additional by going beyond business-as-usual activities, be measurable, permanent, not temporarily displace emissions, the findings need to be independently verified and unique so they cannot be used more than once to offset emissions. The VCS is the most widely known and chosen standards in the voluntary market due to it's Kyoto compatibility as well as it's ability to manage a wide range of project types and methodologies.

Verified (or Voluntary) Emissions Reduction (VER) and Gold Standard VER

The most popular type of carbon credit used to offset emissions around the world voluntarily is a VER, a Verified or Voluntary Emission Reduction unit and there are many different types. Before CDM or JI projects deliver credits used for Compliance purposes such as CERs and ERUs they can produce VERs. These credits can be verified to a number of specific standards, including the Gold Standard. Not all projects go on to register within the CDM or JI, often due to the size of the project and the inhibitive costs associated with compliance registration, so their choice of one or more of these voluntary standards is made based on it's overall viability and compatibility to them.

Renewable Energy Certificate (REC)

A REC is not a carbon credit that represents one tonne of CO_2e emissions but rather a unit that relates to how much CO_2e is saved by the adoption of renewable energy and how efficiently one mega watt hour (MWh) of electricity can be produced. This can vary from as little as a 500 kilos of CO_2e, to as much as almost two tonnes from older, less efficient power stations. Like carbon credits, in an attempt to faze out and replace traditional, emission intensive activities, RECs provide financial subsidies for the power sector to help renewable energy projects become more viable around the world.

New technology and innovations to existing technology are rapidly being realised in areas such as; solar Photo Voltaic (PV) cells, wind farms, subterranean geothermal power plants, wave collection technology, hydroelectric, tidal power, renewable biomass and more. Depending on their location, these projects can produce RECs but as they also displace CO_2e they can often be a more viable project if a choice was made in favour of producing carbon credits instead, for example VCUs, VERs or CERs.

Source: http://www.carbonplanet.com/types_of_carbon_credits

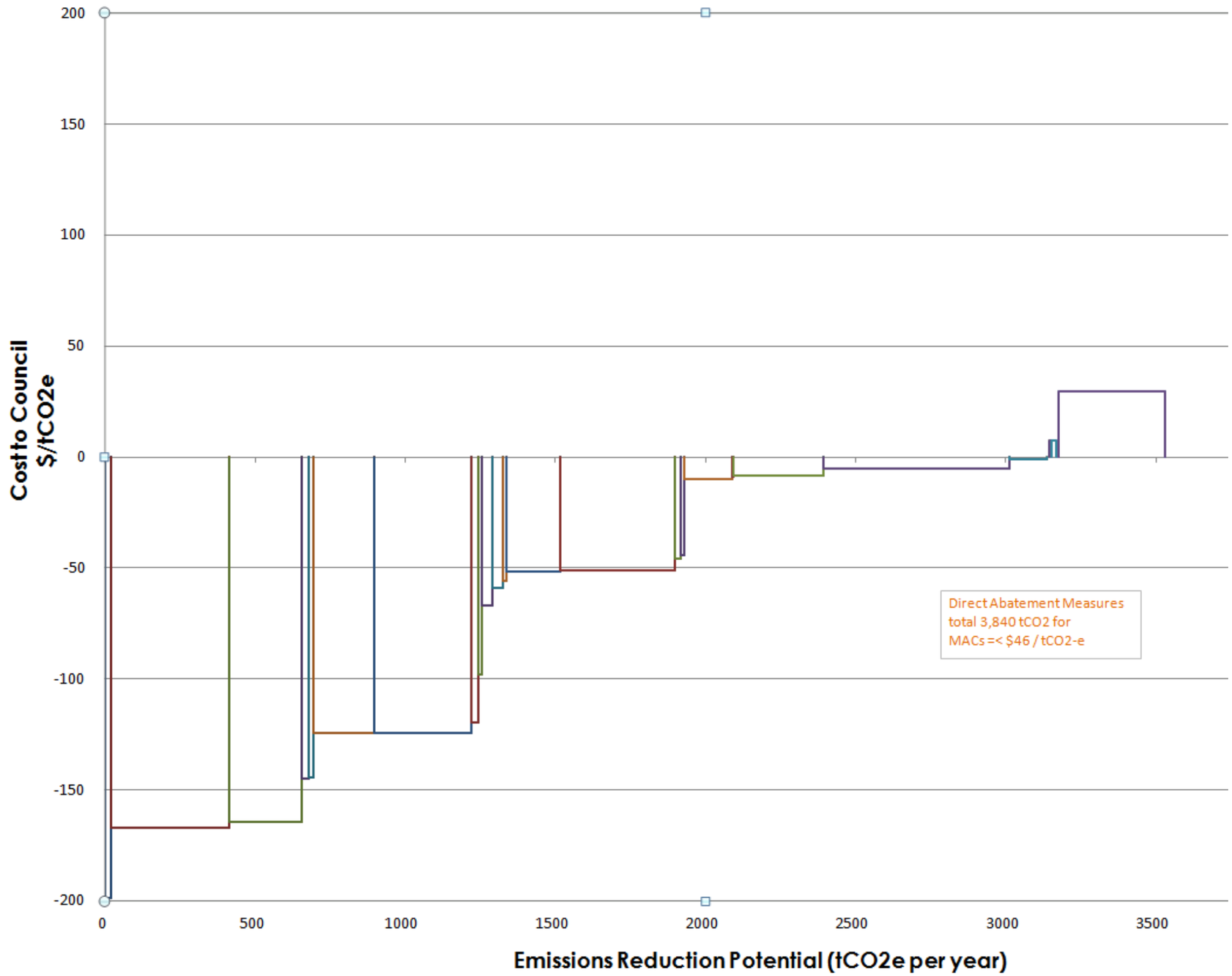
H. Clean Development Offsets

The table below briefly outlines the types and sources of offsets that are designed to act as a clean development mechanism for third world and developing economies. It is worth noting that with an effective market for carbon abatement in place, offsets would typically be valued at $20 /tCO2e. They are currently extremely undervalued. Also, with regards to Carbon Neutral™ accreditation, only the VCS offsets are recognised.

Offset Type	Recognition	Cost ($/tCO2e)	Other Notes
VCS (Voluntary Carbon Standard)	International recognition Most commonly sought after Eligible under NCOS	$3.50 e.g. Indian Waste to Energy $3.00 e.g. Indian Wind On occasion an get VCS Offsets as low as $1.50 It is worth noting that with an effective market for carbon abatement in place, offsets would typically be valued at $20 /tCO2e	Diverse Indian/Chinese wind. Possibility of aligning the location of carbon offsets in countries where council has similar demographics. Verified by a 3rd party Wind is cheapest, though biomass, small hydro etc are available.
VCS Gold Standard	Better than VCS Broader measured social impacts e.g. job creation, infrastructure, roads etc. Low supply due to stringent process More demand More expensive Eligible under NCOS	$10 - $20	42 NGOs verify it Social benefits are also verified Doesn't include forestry
Greenhouse Friendly	Not internationally accepted Broad range of Projects Eligible under NCOS	$4 - $6	Wide range of Projects
Other sources	Often poor recognition Broad range of Projects Not eligible under NCOS	$3 - $10	Often have poor or no verification

Table 17 Offset Types

I. MACC – Direct Abatement Measures MAC=<$46



Legend (In order left to right)

- Depot- High Bay Lighting Upgrade
- Stage 2 Street Lighting- 1,033x 80 Watt MV to T5 Fluorescent lamps
- Replace the remaining 2472 decorative 80W MV to 25W LED at $550/each
- Doncaster Senior Citizens- EE Project
- Depot- Soy Biodiesel (B20) use in 23 depot vehicles (tractors and mowers)
- Stage 3 Street lighting - 750x 80Watt MV to 25 watt LED @$550 inc install
- Stage 4 Street lighting - 1190x 80Watt MV to 25 watt LED @$550 inc install
- Bulleen Pavilion- EE Project
- Various Council Buildings- Water Efficiency Program (5% reduction)
- Various Council Buildings- Lighting Efficiency Improvement
- Bulleen Senior Citizens- EE Project
- Warrandyte Seniors- EE Project
- Solar PV Systems <15kW each- 30* Pines and Community Buildings (Total 100kW) - 21c/kwh
- Civic Offices draught proofing and duct work
- Timber Ridge Pavilion- EE Project
- Riescheicks Reserve- EE Project
- Depot Energy Efficiency works (EPC)
- Standalone PV Systems conversion for Warrandyte Bridge Public Toilet
- Standalone PV Systems conversion for Whipstick Gully Public Toilet
- Standalone PV Systems conversion for Warrandyte Reserve Public Toilet
- Standalone PV Systems conversion for Schramms Public Toilet
- 1* Standalone PV System for new Macedon Square public toilet
- Standalone PV Systems conversion for Ruffey Park Lake Public Toilet
- Standalone PV Systems conversion for Church Road Lake Public Toilet
- Standalone PV Systems conversion for Stiggants reserve Public Toilet
- Aquarena- EE Project inc 100kW Cogeneration Plant
- MC^2- 405kW Trigeneration
- Refrigerant- Hydrocarbon Substitute
- Deep Creek Child Care Centre- Refurbishment Project
- Depot- Soy Biodiesel Trial (B100)
- Solar PV 200kW system- Aquarena & Mullum Mullum Stadium

J. MACC – Direct Abatement Programs MAC=<$46