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1.0 Foreword

In Western Australia, the CSIRO predicts climate change to result in hotter days and nights; reduced rainfall in the southern region, but more intense rain periods; more extreme weather conditions such as long periods of drought and severe storms; more bushfires; and rising sea levels. It is expected that the City will be affected by these impacts.

This Energy Reduction Plan provides an opportunity for the City of Wanneroo as an organisation to implement evidence-based cost-effective projects and innovations which lay the foundations for the City's energy resilient future. In addition to assisting in mitigating the impacts of Climate Change, energy reduction measures have the potential to realise significant cost reductions for both the City and its residents.

The City of Wanneroo is one of the fastest growing Local Government areas in Australia and one of the largest in the Perth Metropolitan Region. As a result, the City is experiencing a rapid growth in the size and extent of its operations and related assets (e.g. buildings, depots, vehicle fleet, motorised equipment, parks and lighting, irrigation, etc.). As the City continues to grow, its operations will require increased energy resources, which could have various negative impacts on the environment and impede the City's ability to achieve "a sustainable natural, built and healthy environment".

The City of Wanneroo is taking a lead role in climate change response by making reductions in energy usage and diversifying energy sources. The City aspires to be an energy reduction and sustainability leader within the Australian Local Government sector.

2.0 Purpose

This Energy Reduction Plan is a key initiative of the Climate Change Adaptation and Mitigation Strategy 2015-2020 and has been informed by a comprehensive Energy Audit and Energy Monitoring Strategy.

The Energy Reduction Plan document provides a framework to deliver energy reduction strategies across the City and identifies key actions that need to be progressed in order for the City to realise energy savings into the future.

It will also envisaged that the ongoing implementation of the Energy Reduction Plan will become the catalyst for behaviour change both within and external of the City of Wanneroo organisation towards more sustainable decision making and behaviour.

3.0 Previous Energy Reduction Initiatives

Sustainable Development *[insert leaf graphic]:*

- 2011: Jointly developed the award winning EcoVision display homes (open to the public for 12 months) that showcased affordable sustainable design options including solar panels, water conservation, universal access and healthy home principles.

Energy Reduction Initiatives *[insert Light globe graphic]:*

- 2009: Installation of a 24Kw solar panel system at the City of Wanneroo Civic

Centre.

- 2012: Installation of a 30Kw (maximum allowable capacity) solar panel system at Aquamation.
- 2014: Installation of a 24 Kw Solar panel system with 30Kw inverter on both Clarkson Library and Kingsway Indoor Stadium with monitoring devices.
- 2015: Installation of a Voltage Optimisation system at Aquamation.
- 2016: Installation of 12Kw additional solar panels at Clarkson Library and Kingsway Indoor Stadium plus an additional 5Kw of panels and an energy monitoring system at Aquamation.
- 2016: A voltage optimisation system has been installed at Aquamation to reduce electricity costs with a project payback of less than two years.
- 2016: Planned Civic Centre extension project has a large number of sustainable inclusions. These include passive solar design orientation, solar panels and energy efficient lighting.

Governance and Financial Savings *[insert Dollar graphic]:*

- 2010: Establishment of the Sustainability Investment Reserve Fund for the purpose of expenditure on sustainability initiatives that demonstrate improved environmental benefit and financial savings.

Electricity savings made through the instillation of sustainable technologies are returned to the City's Sustainability Investment Fund for future project investment.

Approximately \$224,185 amount committed to the Sustainability Investment Reserve Fund since 2010.

4.0 Strategic Alignment



Figure 1: Hierarchy of strategic alignment

The City of Wanneroo's Strategic Community Plan highlighted the community's desire for environmental sustainability by including strategies to improve energy efficiency and minimise the impacts of climate change. The Energy Reduction Plan is a specific action resulting from the Climate Change and Adaptation Management Strategy, with the objective of reducing the City's energy use. Both the Climate Change and Adaptation Management Strategy and the Energy Reduction Plan align with the environmental pillar of the City's Strategic Community Plan.

5.0 Energy Reduction Plan

The Energy Reduction Plan has many discrete elements which together contribute to an overall effort to reduce energy use (refer Figure 2).

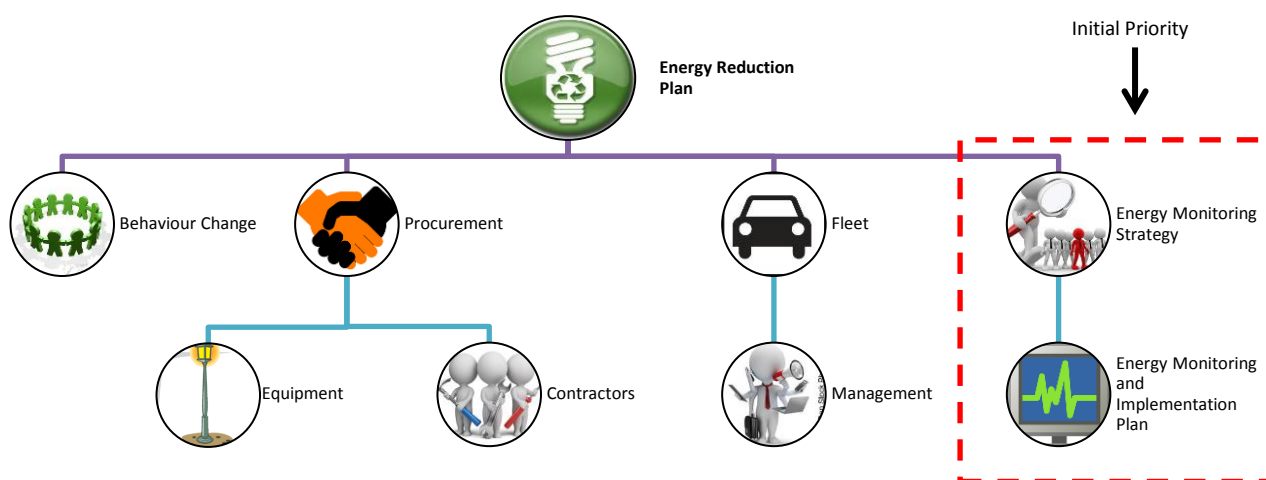


Figure 2: Elements of the Energy Reduction Plan

While it is possible to address all aspects of an Energy Reduction Plan simultaneously, given the City's developing maturity in this space and the resourcing necessary to do so, it is recommended that the City address the various aspects of energy reduction progressively.

Given this, the critical first element in the establishment/implementation of an ongoing energy reduction regime is the development of an energy monitoring strategy that establishes a reporting framework and database of current energy use patterns across the City. Without embedding a strong approach to energy monitoring the City cannot set baseline energy use patterns; develop knowledge of where energy is being used excessively; or identify options on how to best minimise this. This process is outlined in Figure 3 below.

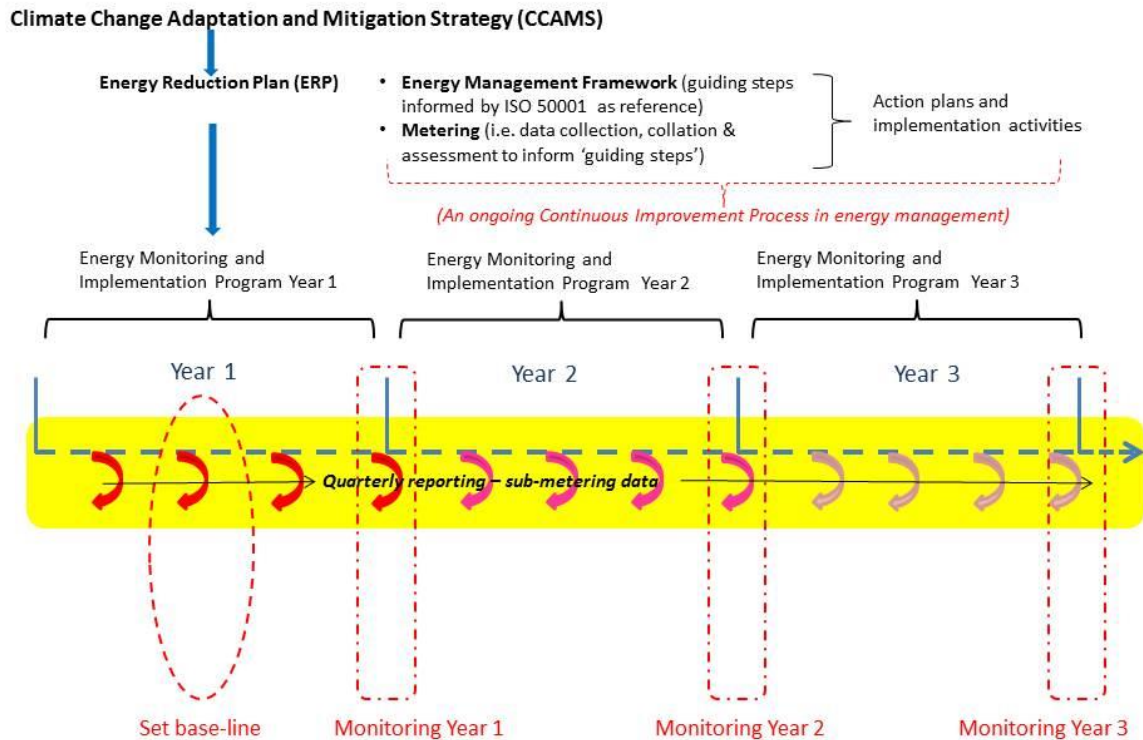


Figure 3: Energy Monitoring and Implementation Strategy

Other elements of the Energy Reduction Plan, which will be addressed in future stages of implementation, include:

- Behaviour change - targeting residents and employees of the City of Wanneroo to think and act in more sustainable ways.
- Procurement - engaging contractors or suppliers of goods or services to the City to engage in energy reductive practices within their own equipment and behaviour. This includes companies such as Western Power whom own and operate the majority of street lights within the City.
- Fleet – considering energy efficiency in the purchase, operation and maintenance of the City's fleet assets.

6.0 Energy Audit

In 2016, the City engaged expert consultants Climate Change Response (CCR) to undertake an energy audit for a selection of City facilities, to better understand the City's current energy consumption and identify potential opportunities for energy reduction.

6.1 Objective of the Audit

The objective of the energy audit was to undertake an assessment of the major energy consuming assets (and clusters) across the City's activities to:

- Assess energy use patterns;
- Identify data gaps; and

- Explore energy efficiency opportunities that are possible to consider for future implementation in the key load areas such as lighting, HVAC, water pumping etc.

It is important to note that initially only energy consumption was addressed, with water and gas to be addressed later in the process.

6.2 Approach

The energy audit was undertaken in compliance with Australian Standard AS 3598:2000 – *Level 1 Energy Audit* for the major energy consuming facilities and activity areas owned and operated by the City of Wanneroo.

The audit focussed on the City's key facilities/areas of operation that were either unique high energy using facilities (e.g. Aquamotion Aquatic Centre) or representative of a cluster of similar facilities (e.g. Wanneroo Community Centre). The findings of the study for these facilities could then be replicated in other facilities within the same cluster (i.e. Wanneroo Community Centre and other City of Wanneroo Community Centres).

The facilities inspected and discussed in the audit include the following:

1. Wanneroo Library and Cultural Centre;
2. Wanneroo Community Centre;
3. Wanneroo Aquamotion;
4. Kingsway Sporting Complex (including Kingsway Indoor Sports Centre)
5. Wanneroo Showgrounds (representative of parks and reserves);
6. Street Lights at Dundobar Road and the underpass at Joondalup Drive (representative of City managed street lights);
7. Carramar Golf Course; and
8. The Vehicle fleet

Each of the facilities was the subject of a walkthrough audit to help identify energy saving opportunities.

The City of Wanneroo Civic Centre building was not included in this audit as it was undergoing a major refurbishment at the time of the audit, and the audit would not have been able to ascertain accurate information on the standard energy consumption. In addition, the refurbishment scope of work was inclusive of energy efficiency initiatives.

6.3 City's Energy Efficiency Performance

The audit established that, like many local Councils, the City is currently performing only *moderately* in terms of energy efficiency. Key findings of the audit are outlined below:

- The City is showing energy efficiency improvements in the building and operation of more recent facilities, such as the Wanneroo Library and Cultural Centre.
- A number of examples of energy efficiency initiatives were identified that had been, or were already planned to be implemented and would save the City significant costs:

- LED lighting
 - Voltage optimisation units
 - Improved pumping and irrigation systems
- The City currently lacks a well-structured strategy, governance system and long term commitment to improve its energy efficiency and achieve the optimal level of ongoing significant energy and cost savings.
 - The City's operations and responsibilities for energy consumption are disparate and there is no-one with specific responsibility for tracking and improving energy consumption and efficiency across the City
 - There is no formal process to ensure energy efficiency initiatives are identified and implemented City-wide for optimal benefit, and to track and communicate the outcomes among all concerned.

Essentially the key finding of the audit was that **“You can't manage what you can't measure”** and as yet the City does not have a system in place to overcome this deficiency. This was a major hindrance to the completion of the level 1 energy audit and until it is addressed it will prevent the successful completion of a level 2/3 audit, which is necessary to identify and quantify additional energy savings.

The audit therefore recommended that a suitable (preferably networked) sub-metering system be implemented across the City to provide for relevant monitoring, metering and apportioning of energy use and efficiency. It was recommended that this be implemented to assist in the effective ongoing monitoring of relevant energy data as well as to track the effectiveness of the implementation of various energy saving projects in the future.

6.4 Energy Consumption Patterns

Energy consumption in the facilities and activities over which the City has direct control were categorised as follows:

1. Electricity consumption at facilities;
2. Gas consumption at facilities; and
3. Fuel consumption in vehicles.

Figure 4 shows the total expenditure by energy type for the City for the 2014-2015 financial year.

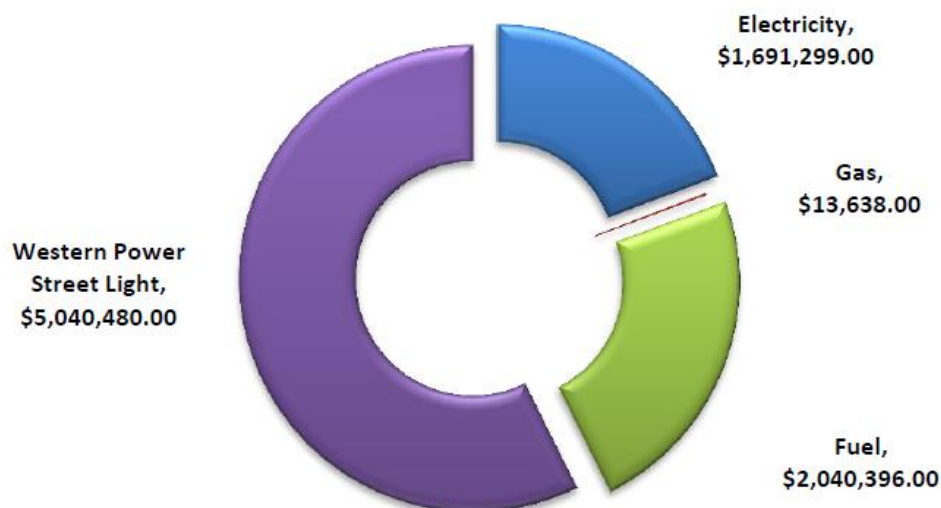


Figure 4: Expenditure on Different Energy Use Segments within the City in 2014-2015

In the 2014-15 financial year the City spent more than **\$8.7 million on energy**, with electricity and fuel costs comprising the majority of energy expenses, and gas only making up a minor proportion of overall energy use.

Street lighting costs from Western Power have been shown separately from the electricity category in Figure 4 to illustrate the significant financial outlay on infrastructure that the City has no control over with respect to its energy efficiency. The City paid \$5,040,000 for electricity consumed by street lights operated by Western Power, which accounts for approximately 72 per cent of the City’s total electricity cost. This highlights the importance of renegotiating supply arrangements with Western Power as a key strategy in the City’s overall approach to energy reduction.

With the exclusion of street lighting, 45 per cent of the remaining electricity costs are consumed by the following four main facilities;

- Kingsway Regional Sporting Complex;
- Wanneroo Library and Cultural Centre;
- Civic Centre Office Building; and
- Aquamotion.

Other classified clusters include parks, golf courses, community centres, clubhouses, City owned street lighting and office buildings and libraries.

7.0 Energy Monitoring Strategy

A key constraint to effective energy reduction at the City identified in the 2016 Energy Audit was the current lack of recording and monitoring of energy consumption at the sub-meter and individual equipment level. Although the Audit outlined a number of possible energy

reduction savings; it stated that these savings would not be achievable unless the City prepared an Energy Monitoring Strategy to properly inform the implementation of energy reduction initiatives. This is on the basis that:

- The City currently has no understanding of the energy capacity or requirements of individual buildings. It is therefore not currently possible to determine whether energy reduction and efficiency projects would represent a financial or operational risk to the City; and
- The City cannot accurately measure the benefits of any energy reduction or energy efficiency initiatives.

An Energy Monitoring Strategy is a series of actions that are guided by the requirements under *ISO50001 - Energy Management Systems* which is a “best practice” standard of system for energy management. While there is no requirement to achieve complete accreditation under the standard (formal accreditation can be a significant cost), by following the process towards accreditation it will ensure the City’s approach to energy management is equal to the standard of leading organisations around the world.

An Energy Monitoring Strategy was subsequently prepared by CCR to form a key component of this Energy Reduction Plan. The Energy Monitoring Strategy recommended the preparation of an Energy Monitoring and Implementation Program, comprising an energy monitoring phase in year one and both monitoring and implementation phases for year two and so on.

The monitoring phase is broken down into a number of steps, as illustrated in Figure 5, with the completion of each step in the process being critical before progressing to the next step.

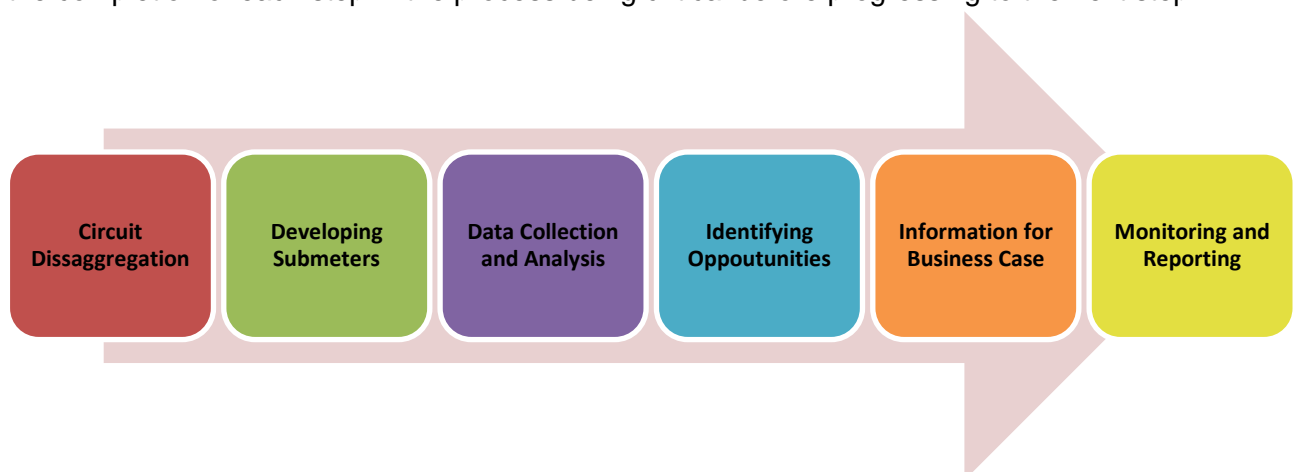


Figure 5: Energy Monitoring & Implementation Program process

- *Circuit Disaggregation and Deploying Submeters*

At present, most of the buildings and infrastructure owned by the City have one central meter. This is not considered to be best practice as it does not provide information about whether particular electrical equipment is failing or operating ineffectively. It also does not enable specific monitoring of the elements that make up a building’s energy performance such as heating and cooling.

Circuit disaggregation is a process by which each circuit within a facility or site is identified and labelled. Sub meters are then installed to monitor energy usage on each circuit, allowing much more accurate analysis of the energy performance of that facility or site.

- *Data Collection & Analysis; Identifying Opportunities & Business Cases*

The data collected from the sub-meters is then analysed to identify energy reduction opportunities as well as faulty or underperforming equipment thereby allowing for quicker implementation of corrective actions.

The data collected provides a benchmark of energy use; is used to support business cases for the implementation of energy reduction strategies (i.e. identifying and pursuing opportunities for action that will lead to a reduction in energy usage); and is also used in the assessment of the success of implemented energy reduction strategies.

Critical to the effective collection and management of data is the data collection protocol. A robust data collection protocol should indicate the sources of the data, the format of the data and the frequency of collection. Clear delineation of responsibility for maintaining, analysing and responding to the data is necessary to enable accountability across the organisation. The data collection protocol also provides for standardisation and comparability of data consumption and subsequent implementation energy reduction strategies across the City.

- *Monitoring & Reporting*

A system to promptly record and track all utility bills received from suppliers forms a critical element of this program as the bills can be verified with the data collected from the installed sub-meters. This provides the building/energy manager the ability to analyse the gaps and identify areas for improvement on an ongoing basis.

8.0 Energy Monitoring & Implementation Program

There are a number of steps the City needs to take to reach the point of best practice and realise the financial benefits of energy reduction. In essence, the proposed approach to energy monitoring set out in the Energy Monitoring Strategy is a critical component that underpins and enables the effective operation of the Energy Reduction Plan.

This Energy Reduction Plan is not a static plan - rather it needs to continually evolve as a part of an ongoing continuous improvement process in energy management. Given that the City does not currently have a strong monitoring and reporting framework in place supported by a defined governance structure, it is critical that the development of these elements form a key part of the first stage of the Energy Reduction Plan.

Only once these frameworks are in place and a strong approach to data collection and management is embedded in the organisation, can implementation plans for energy reduction initiatives be prepared and justified. The delivery of a structured energy monitoring and implementation program is a necessary part of the ongoing implementation of the Energy Reduction Plan.

The proposed approach to ongoing energy monitoring and implementation of reduction measures is illustrated in Figure 6 below:

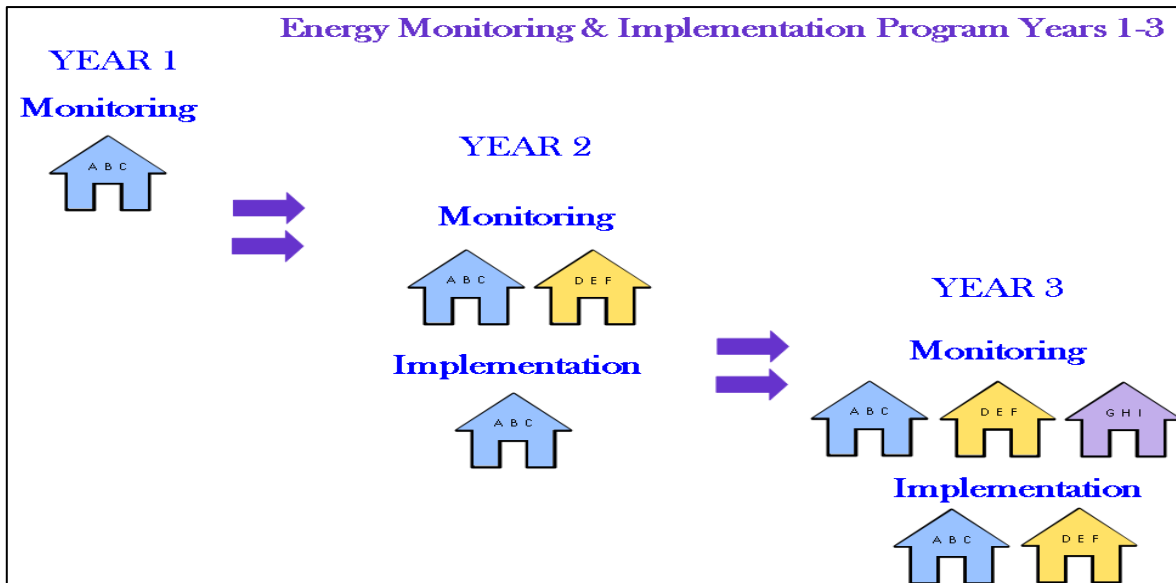


Figure 6: Energy Monitoring & Implementation Program Years 1-3

Figure 6 illustrates the first three years of the proposed monitoring and implementation program. The monitoring phase includes the circuit disaggregation, sub-metering, data collection and analysis and identification of opportunities stages as outlined previously. This information should then be used to support business cases for energy reduction or renewable energy installation strategies to be delivered in the implementation phase.

The buildings recommended by CCR for inclusion in year one are:

- Aquamotion;
- Kingsway Indoor Stadium; and
- Girrawheen Library.

These buildings have been chosen for their size and energy savings potential and are represented as A,B and C in Figure 6.

In year two, the same three buildings (A,B,C) should continue to be monitored and the implementation of the identified energy reduction strategies should commence. The energy reduction strategies should be assessed at the end of year two and this assessment information, coupled with the continued monitoring data, evaluated to provide a comprehensive understanding of the success of the strategies and energy savings for these buildings.

In year two, monitoring should also commence for a second set of large buildings (D,E,F). By year three, buildings (D,E,F) also move into the implementation phase and another set of three buildings (G,H,I) commence monitoring. This illustrates the process of continual improvement and energy savings.

9.0 Recommendations

The Energy Audit found that the City currently lacks a well-structured strategy, system and long term commitment to improve its energy efficiency and achieve the optimal level of ongoing energy savings. This means that the City is poorly positioned in terms of its

performance and preparedness to position itself as a model in energy efficiency and energy reduction.

As a foundation step in implementing the Energy Reduction plan it is recommended that the City proceed as quickly as possible to develop a Sustainable Energy Management Framework and commence the implementation of an Energy Monitoring and Implementation Program in one or more City facilities.

	Recommendation	Principal Resource	Timeframe for Implementation
Energy Monitoring Strategy			
1.	<p>Development of an overarching Sustainable Energy Management Framework that reflects the City's current Structure, resourcing and responsibilities.</p> <p>This guides the implementation of the Energy Monitoring Strategy.</p>	Assets, City Growth (with assistance from consultants)	2017/18 Reviewed annually
Energy Monitoring and Implementation Program			
2.	<p>Confirm list of assets to be include in scope of annual metering, dependent on budget allocation.</p> <p>In year 1, it is recommended that this include consideration of the following high energy use facilities:</p> <ul style="list-style-type: none"> • Aquamotion; • Kingsway Indoor Stadium; and • Girrawheen Library. 	Assets, City Growth (with assistance from consultants)	Annually
3.	For confirmed list of assets, develop tree diagrams to classify the circuit disaggregation and show the electricity end uses with associated benchmarks and targets.	Consultants (with Assets)	Annually
4.	For confirmed list of assets, install sub-meters and develop an energy monitoring template based on the circuits identified in the tree diagrams to feed data for key performing indicators.	Consultants (with Assets)	Annually
5.	Develop a Data Collection Protocol and energy bill verification system for the Building or Energy Managers to verify energy bills with readings from the sub-meters.	Assets City Growth (with Consultants)	Annually

	Recommendation	Principal Resource	Timeframe for Implementation
6.	Provide training to all facility managers of identified assets on the installed metering systems, monitoring templates, key indicators and Energy Bill verification system for their respective buildings.	Assets City Growth (with consultants)	Annual
7.	Review energy monitoring, data collection and benchmarks to inform new targets (i.e. for identified circuits) and conduct gap analysis based on the new technologies available for improvement of performance.	Consultants	Quarterly and Annual Ongoing
8.	Develop an annual action plan that identifies energy reduction projects based on identified and evaluated business plans for consideration as part of the City's annual budget cycle.	Consultants (with Assets)	Annual
Procurement			
9.	Review the current supply arrangement with Western Power for public streetlighting with a view to renegotiating these agreements to provide for more energy efficient operation.	Contracts & Procurement (with advice from Assets, City Growth & consultants)	2017/2018
10.	Identify opportunities to pro-actively negotiate for lower tariffs with energy retailers, with a view to implementing strategies to reduce and/or shift loads from on-peak to off-peak, which will potentially reduce electricity bills.	Contracts & Procurement (with advice from Assets, City Growth & consultants)	2017/2018
11.	Review the City's procurement/purchasing process and capital project approval process to identify opportunities to require energy efficiency to be considered in final purchasing decisions.	Contracts & Procurement (with advice from Assets, City Growth & consultants)	2017/2018
12.	Review the City's planning policies, specifications and guidelines to identify opportunities to require levels of energy efficiency for lighting, pumping and irrigation systems installed by developers and other third parties through the land development process.	City Growth (with advice from Consultants)	2017/2018

	Recommendation	Principal Resource	Timeframe for Implementation
	Behaviour Change		
13.	Develop a City-wide behaviour change program specifically addressing energy and greenhouse gas reduction across its activities.	City Growth	2018/19

10.0 Review and Expansion of Scope

The Sustainable Energy Management Framework and associated Energy Monitoring Strategy/System should undergo an annual review with a major review after every five years to ensure it continues to represent the best operating efficiency for the City.

Following the successful implementation of the initial recommendations outlined above, the City should not only begin to expand energy monitoring and reduction measures to other facilities managed by the City (as set out in Figure 6), but also begin to address the other aspects of the Energy Reduction Plan (as shown in Figure 2), including:

- Gas and Water consumption
- Fleet Vehicles
- Behaviour Change