PERTH SOLAR CITY

Local Government End of Project Report

Australian Government
Solar Cities

TOWN OF BASSENDEAN Home by the Swan
CITY OF BAYSWATER The Garden City - Quality Lifestyle
BELMONT • CITY OF OPPORTUNITY
shire of kalamunda
Shire of MUNDARING
city of swan
EMRC

Executive Summary

Perth Solar City is the most comprehensive energy efficiency initiative in WA. The Broad Reach Program developed and implemented more the 30 energy efficiency and renewable energy projects within Perth's Eastern Region.

Since its commencement in 2009, over 16,000 households have participated in the Perth Solar City program, making it WA's most comprehensive energy efficiency program. Collectively households saved over $1 million on their electricity bills last year. This equates to approximately 37 tones of CO2 emissions.

In total, 3,515 households received a home eco-consultation; 6,300 households received 12 months of eco-coaching; 700 homes were fitted with a SunPower photovoltaic (PV) system, and 1,100 homes purchased a Solahart solar hot water system.

To deliver a program of this scale a Consortia approach was used to bring together innovation, diversity and industry-leading expertise from the community. Western Power, as lead consortium member, was accountable for the delivery of the Program on behalf of the Department of Climate Change and Energy Efficiency. Consortium partners include; Botanic Gardens and Parks Authority, EMRC, Mojarra, Prospero Productions, Solahart, SunPower and Synergy.

Table of Contents

Background and History

The Solar Cities Program was launched in 2004 by the Howard Government to showcase sustainable energy models that could help consumers and retailers to monitor their energy use and use energy more wisely. The program included distributed solar technologies (including solar thermal and photovoltaic technologies), energy efficiency, load management, smart meters and cost-reflective pricing. This initiative forms part of Australia's long term greenhouse response in the energy sector to move towards integrated use of low-emissions supply technologies, distribution generation, significantly enhanced energy efficiency and markets that deliver responsive and effective price signals.

The Solar Cities programme is consistent with the directions set by the Ministerial Council on Energy (comprising Commonwealth, State and Territory Ministers responsible for energy) and will inform future greenhouse and energy market policy.

In 2007 the Eastern Metropolitan Regional Council (along with the original consortium) put forward an application to become one of only a handful of Solar Cities across Australia. EMRC's first application was unsuccessful with Victoria being announced as the 6th and last of the Solar Cities.

In 2008 the Australian Government announced funding for one more Solar City (seven in total and bring the Australian Governments total investment to $94 million). This time EMRC's application was accepted. The Perth Solar City Program received $13.9 million in grant funding over three years for the program. In addition over $30.9 million has been invested in cash and in-kind support provided by the Perth Solar City consortium. This brings the total of the Perth program over $44.1 million.

In early 2009 Western Power took over from the Department of Housing and Works as lead consortium agent. The timing of the 2008 State election and the division of the Department of Housing and Works, led the Start Government to change the lead consortium agent. The Building Management and Works section, through which the project was developed, was transferred to Treasury, which was not eligible to lead the consortium based on the Australian Government's guidelines for the program. At this time the consortium partnership was reconsidered and re-established.

The Perth Solar City Program was officially launched in September 2009 by the then Minister for Environment, Heritage and the Arts, Hon Peter Garrett.

Product and Services Overview

Smart Grid Trial

Background

Smart Grid, and the enabling smart metering infrastructure, is new technology shown to enable customers to better manage their electricity use, help reduce peak demand, facilitate the greater uptake and management of renewable generation, as well as increasing network efficiency.

Progress

The Smart Grid trial had three key core objectives:

- To promote end-to-end smart grid technology including the establishment of the Home Area Network (HAN) as an open platform for delivering additional services to customers.
- To understand customer response to smart grid technology.
- To develop a robust cost benefit analysis for a wider roll-out of the smart grid technology.

Key Results

- Deployment – As of 30 November 2011, Western Power exceeded its target of 8,767 meters, installing at total of 8,944 smart meters in the EMRC suburbs of Bassendean, Darlington, Forrestfield and Midland.
- Operations – As of 30 November 2011, the three key elements of the smart grid infrastructure; smart meters, communications infrastructure and the network management system, have been successfully deployed and are operating as planned or exceeding performance benchmarks.
- Evaluation - A survey of 104 smart meter recipients was conducted during October 2010, with the following results:
    - Level of satisfaction: 82% of customers surveyed rated the smart meter installation process as either, excellent, very good, good or neutral.
    - Level of understanding regarding the benefits of the smart meter (unprompted and promoted): 62% of smart meter recipients did not understand the benefits of smart meters.
    - Interest in receiving further smart meter related information: 88% of recipients wanted to know more about the benefits of their smart meter.

For more detailed information in relation to the Smart Grid Trial please refer to page 16 of the Perth Solar City 2012 Annual Report (available on the Perth Solar City website).

Air Conditioning Trial (ACT)

Background

The continuing uptake of refrigeration air conditioner systems, in particular over the last 10 to 15 years, is recognised as a key driver of increasing peak energy demand for electricity in the South West Interconnected System (SWIS).

Demand for electricity is greater during hot weather, and peaks in demand correlate strongly with maximum daily temperatures. The increase in peak demand, which must be supported by costly network augmentation, has resulted in the less efficient use of existing network resources.

As part of Perth Solar City, a Demand Response (DR) trial of residential air-conditioners was undertaken. Over the summer periods of 2010/2011 (year one) and 2011/2012 (year two), householders were invited to opt-in to the trial. The Air Conditioning Trial (ACT) researched the technical feasibility and cost effectiveness of DR as a tool for reducing electricity consumption at times of peak demand.

Participants were paid an incentive, and the trial utilised Western Power's Smart Grid to wirelessly communicate with air-conditioners to cycle the compressor while the fan continued to run. The trial was the first of its kind in Australia to utilise smart grid infrastructure.

By selecting and constraining the operations of air-conditioners during certain time periods, DR of air-conditioners has the potential to significantly reduce participant aggregated electricity consumption at peak times without noticeable impact on comfort levels of the participants. The aggregated reduction of demand during times of peak use may in turn contribute to the deferment of capacity investments to supply these peaks.

Progress

The key objectives of ACT were to:

- Test and prove the operations of the end-to-end technology for DR of air-conditioners (Year one and two).
- Measure the demand reduction achieved through the use of DR of air-conditioners (Year one and two).
- Determine the potential of using DR of air-conditioners to defer costly network investment – cost of demand reduction (Year two).
- Understand overall participant response, as well as the most effective means of engaging and recruiting participants to such trials (Year two).

6,600 smart meter households were invited to participate in Year one via an Expression of Interest (EOI) campaign. Of these, 788 EOI were returned (11.9%) with 625 considered suitable for further assessment. A total of 202 households were successful participants in Year one of the trial (26.8% of the respondents or 31% of the original invitees)

Key Results

- Performance of the Smart Meter Enabled DR Technology – Ten ACT demand response events were run between January 2010 and March 2011. These events confirmed the end-to-end functionality of the Smart Grid and Home Area Network (HAN) infrastructure.
- Effect on Peak Electricity Demand – The average reduction recorded across all events ranged between 1543.64W and 891.91W per air-conditioner, or up to 20% of the peak demand of participating households.

For more detailed information in relation to the ACT please refer to pager 16 of the Perth Solar City 2012 Annual Report.

In-home Display (IHD)

Background

Householders in WA currently receive an electricity bill approximately every 60 days. This is a limiting factor in a householder's ability to better manage their electricity use.

Perth Solar City provided a Western Australia first trial, to test In Home Display (IHD) technology and its impact on residential electricity use. Households were provided an IHD that shows their electricity consumption in real-time, both in units (kWh) and in cost ($). This information allowed users to monitor and understand their electricity use (through cause and effect), which may in turn have an impact on their electivity consumption behaviour.

As Perth Solar City consortium member, Synergy was responsible for the procurement and deployment of IND's, and the requirement of trial participants. The IHD was branded MAX (MAXimise your savings) and was provided free of charge to over 2,200 households.

The IHD was enabled by Western Power's Smart Grid. The IHD communicates wirelessly with the smart meter via the Home Area Network to provide real-time electricity consumption information. The device is portable within the home, and allows for households to view the change in consumption and cost as a result of switching appliances on or off. Western Power also provided ongoing technical support to IHD participants.

Progress

The objectives of the In Home Display Trial under Perth Solar City were:

- To test the IHD technology via smart grid enabled Home Area Network.
- To test the customer response to the IHD as a single method of providing participants with access to real time electricity consumption information.

As at the 30 November 2011, Synergy had deployed 1,931 IHD representing 87% of their program target. 1,544 IHD were deployed to smart meter households without the householder specifically opting in to the trial. 397 MAX units were deployed to households that specifically opted-in to the trial.

During this period, Western Power was able to test the IHD technology via its smart grid enabled Home Area Network. Western Power completed end to end system testing, functional testing and user acceptance testing.

Key Results

Key results of the trial focused on:

- Technology;
- Recruitment;
- Effect on electricity consumption; and
- Participant evaluation.

Paring rate to 30 November 2011:

- 56% of all IHD recipients paired their device units.
- The pairing rate for IHD when received unsolicited through the mail were significantly lower than for those households who were pre-engaged.

Analysis was completed for 813 participant households who received and paired IHD in the period 9 February 2011 to 30 June 2011. An average of 6.82% reduction of electricity use was evident in the immediate timeframe following the deployment of the first IHD. This equates to a $114.44 cost saving per household per year.

For more detailed information in relation to the In Home Displays please refer to page 56 of the Perth Solar City 2012 Annual Report.

Time of Use Tariff (PowerShift)

Background

PowerShift, a voluntary three-part time-of-use tariff, was developed by Synergy for Perth Solar City. PowerShift is the first tariff in WA which seeks to more closely align electricity consumption blocks with time-based costs of supply. PowerShift provides customers with the financial incentive to reduce household electricity cost by shifting consumption away from times of peak time of peak demand.

Prior to PowerShift, WA households on the South West Interconnected System (SWIS) had two electricity tariff choices:

- A1 tariff: a subsidised all-time tariff where customers are charged one flat rate (24.89c/kWh), regardless of when they electricity is used.
- SmartPower: a four-part time-of-use (TOU) tariff where premium charges occur from 11am – 5pm on weekdays (45.88c/kWh during weekdays in summer).

Peak electricity demand on the SWIS generally occurs in summer between 4pm and 8pm on weekdays. Peak demand places significant strain on the electricity network, resulting in the inefficient use of existing network resources, and requiring cost network augmentation. Neither the existing retail tariffs reflect the increased cost of electricity supply during peak demand periods, nor encourages households to use electricity outside of peak periods.

Progress

The key objectives of the Time-of-Use Tariff trial were to:

- Understand the potential for a voluntary peak demand based price signal to shift household electricity consumption (from periods of peak demand to periods of off-peak demand).
- Understand the potential for a voluntary peak demand based price signal to reduce household electricity costs.

A total of 746 households were recruited to the voluntary trial, representing 74% of the target for participation.

Synergy originally proposed a target of 5,000 PowerShift participations within the Perth Solar City target area. However, the target was reviewed during the 2010/11 and subsequently reduced to 1,000 participants.

Prior to the commencement of the recruitment campaign for PowerShift, Synergy developed an interactive web-based calculator to assist householders in determining the appropriateness of the

product. The PowerShift calculator enables customers to see how much money they could save per annum by shifting various percentages of their consumption to off-peak periods.

Of the 427 householders who signed up for the PowerShift, a total of 94 householders have requested to return to their A1 all-time tariff representing an attrition rate of 22%.

Key Results

The broad objectives of PowerShift was not to reduce a householders overall electricity consumption, but rather seek to:

- Reduce electricity consumption at times of peak demand (super-peaks).
- Reward householders for changing their electricity consumption behaviour to reduce consumption at times of peak demand.

As such, preliminary analysis seeks to understand the reductions in electricity consumption at super-peak, as well as the effects of shifting behaviour on householder's electricity costs.

Analysis was completed using NEM12 (interval) data from 334 participant households who had signed up for and remained on PowerShift. In the period 1 August 2010 to 30 June 2011 the preliminary analysis showed a reduction in electricity consumption during the super-peak of 10.9%.

For more detailed information in relation to the Time of Use Tariff please refer to page 68 of the Perth Solar City 2012 Annual Report.

Solar PV Saturation Trial

Background

The uptake of residential solar photovoltaic (PV) systems in WA has increased significantly in recent years. This is largely due to the considerable PV system cost reductions to the consumer as a result of reduced manufacturing costs, increased consumption in the marketplace and various start and federal government incentives. As at June 2012, it was estimated that there were 127,439 PV's connected to the distribution network, with a total capacity of 251MW.

The effects of this increased presentation of small scale residential solar PV systems on the electricity network are not fully understood. The potential for such effects as localised power quality issues and voltage compliance issues need to be researched.

The PV saturation trial is an initiative seeking to investigate the effects of a high penetration of PV systems on the power distribution network.

Results of a successful trial will be used to provide recommendations regarding the method of evaluating and managing high levels of solar PV system penetration on existing low voltage networks. This would include the development of guidelines for the design of future networks to accommodate the increasing amount of distributed energy generation in WA.

For the purposes of the trial, a minimum saturation level of 30% by number of customers was established. A residential distribution transformer (low voltage) was selected in one of the four existing Perth Solar City smart meter deployment locations. Smart meters enable the capture and analysis of power quality data at the household (meter point). In order to achieve the 30% saturation target, a significant discount was offered to householders supplied by the targeted transformer.

Progress

Western Power developed a brand for the trial – Solar Collective – and partnered with Perth Solar City consortium members SunPower to produce a compelling proposition for target householders to purchase and install a solar PV system. A further solar PV system discount of $2,500 was added to the existing program discount.

By December 2010, the minimum target of participants was reached with a total of 20 participants recruited. All 20 solar PV systems were installed during January and February 2011. The 20 new systems combined with the five existing PV systems in the area provided a saturation level of 32%.

A power quality data logger was installed on the Pavettal distribution transformer in order to measure and evaluate network performance.

Key Results

Initial results shows that reverse power flow into the high voltage (HV) network occurred regularly on clear days during the winter months.

The results show that short term voltage excursions outside the +6% limit occurred for at least one of the homes at the end of the low voltage (LV) network. The voltage at the customer level is within tolerance levels, and as such is not expected to cause any damage to appliances. This household connection point view, was enabled by the smart meters and flags the need to potentially address voltage regulation issues on saturation solar PV networks.

From these preliminary results it is clear that a relatively simple adjustment on the distribution transformer tap to a lower level, could allow somewhat larger PV penetration on this network while still maintaining voltage within limits for customers at the end of the LV network.

For more detailed information in relation to the Solar PV Saturation Trial please refer to page 84 of the Perth Solar City 2012 Annual Report.

Residential PV

Background

By installing solar photovoltaic (PV) systems, householders can generate their own electricity, and offset electricity consumption costs. This may include the export of surplus power to the local distribution network for which the householder is paid by the electrical retailer. Perth receives an average of 7.9 sun hours per day and as such has premium conditions for generation of solar power.

Perth Solar City assisted households in Perth's Eastern Region to take full advantage of these factors by providing a financial discount on SunPower residential solar PV system. Between April and September 2012, the residential PV discount was made available to the wider Perth metropolitan area.

This discount was made available via selected SunPower dealer in Perth's Eastern Region, and was in addition to other incentives such as Renewable Energy Certificates (REC's) and the WA residential net feed-in tariff (NFiT) and Renewable Energy Buy Back Scheme (REBS).

SunPower dealers received Perth Solar City customer referrals from the Living Smart Program, through the Perth Solar City call centre and website, and directly from the public. The solar PV system discount was promoted through a range of broad reach marketing methods as well as through larger scale solar PV systems at iconic locations as the Perth Zoo and Midland Foundry.

Progress

SunPower's objective was to install a total of 825 residential solar PV systems at a minimum size of 1.05kW per system. However, due to the WA Government's closure of the residential net feed-in tariff and a reduction in price of the Renewable Energy Certificates, demand for residential solar PV decreased significantly.

This decline in sales was addressed by:

- Increasing the discount available on residential solar PV systems via targeted campaigns.
- Offering the residential solar PV discount to the wider Perth metropolitan area between April and September 2012.

SunPower achieved 80% of the overall program, target for residential solar PV system. Strong solar PV system sales occurred for the period January to June 2011, with a subsequent sharp decline in sales following 1 July 2011. This was concurrent with the reduction in REC's as well as the ending of the net feed-in tariff.

Key Results

As at 30 November 2011, the total installed capacity of residential solar PV systems under Perth Solar City was 976kW, with an average system size of 2.27kW.

Preliminary analysis was undertaken using data from 6,064 smart meter households: 348 with a solar PV system and 5,716 households without a solar PV system.

Analysis indicates that for the majority of half-hour intervals where the solar PV system is generating electricity, the average interval demand was significantly less than that of customers without solar PV system generation. However, customers with solar PV system generation had slightly higher electricity demand (4.3kW) at peak times (5:30pm-8:30pm) than customers without (4.2kW).

Preliminary analysis was completed for 360 households with a SunPower solar PV system installed. The analysis showed an average electricity reduction from the electricity grid of 57.9% or 11.36kWh per day.

For more detailed information in relation to the Residential Solar PV Systems please refer to page 100 of the Perth Solar City 2012 Annual Report (available on the Perth Solar City website).

Solar Hot Water

Background

Heating water represents 25% of an average Perth household's energy cost. Solar hot water systems are proven to be more cost effective than most other storage and instantaneous systems for heating water. This is particularly the case in the Perth metropolitan area which receives an average of 7.9 sun hours per day.

The Perth Solar City program and Solahart provided a $1,100 discount (inc GST) on family sized Solahart solar hot water systems to residents in Perth's Eastern Region. Solahart are a Western Australian based company which manufactures solar hot water systems in Perth.

During 2010 and 2011, Solahart dealers received the bulk of Perth Solar City customer referrals from the Living Smart program, through the Perth Solar City call centre and website, and directly from the public. Methods used to promote the solar hot water discount during 2012 included local newspaper advertising the Eco House open days, community workshops and direct marketing.

Progress

Solahart's objective is to utilise the Perth Solar City discount to sell and install 1,190 family sized solar hot water systems on households in the Perth Solar City target area.

Key Results

Key results for residential solar hot water systems focused on:

- System installation trends;
- Demographic trends;
- Effect on electricity consumption; and
- Participant satisfaction.

The vast majority of households (98%) purchased an electric boosted solar hot water system (remaining 2% purchased a gas boosted system).

Of the 610 participants, a total of 48% disclosed their annual household income levels. Of the known income bands the most common was $50,001 - $100,000 annual household income.

Preliminary analysis was completed for 175 participant's households who had replaced an electric storage or electric instantaneous hot water system with an electric boosted solar hot water system during the period 7 January 2010 to 30 June 2011. An average 15% reduction in electricity use was evident.

For more detailed information in relation to the Residential Solar Hot Water Systems please refer to page 106 of the Perth Solar City 2012 Annual Report.

Marketing

Background

Since its launch back in 2009, the Perth Solar City program has been promoted through the delivery of a marketing strategy utilising community-based social marketing concepts. In 2010, the Collective Impact campaign was launched to show residents of Perth's Eastern Region that their individual actions, however small, are part of something greater – a 'collective impact'. It positioned Perth Solar City as the educator and enabler of the energy efficiency journey for households, and promoted the Program's products and services.

Progress

The objectives of the Perth Solar City program strategy were to:

- Create awareness of the Perth Solar City program;
- Promote Solar Cities as an Australian Government initiative and provide due recognition for its leadership and funding for the Program;
- Showcase iconic and demonstration solar PV systems installations;
- Building general knowledge of the energy efficiency products and services being offered under the program; and
- Create excitement about the benefits of the Program for households and the wider community to encourage participation.

The Perth Solar City Program Office is responsible for the delivery of the marketing strategy, on behalf of the consortium. Marketing strategies undertaken to 30 November 2011 included:

- The two phase Collective Impact campaign (Phase 1 – raising awareness and Phase 2 – direct engagement);
- Direct mail;
- Eco House;
- Online marketing and communications; and
- Media and events.

For more detailed information in relation to Marketing please refer to page 116 of the Perth Solar City 2012 Annual Report.

Home Eco-consultations

Background

The energy consumption of a household is driven by the behaviour of its occupants, specifically the use of different appliances in the home. Often, households are unaware of how much electricity or gas a particular appliance requires to operate, or how the way it is used affects overall household energy consumption and subsequent costs.

As part of the Perth Solar City program, the Home Eco-consultation (HEC) was designed to assist participants to understand their own energy consumption. The HEC provides households with the opportunity to understand what is contributing to their current energy use. A follow up tailored report provides participants with information on what changes they can make to reduce energy use.

The HEC is delivered free to households as a once-off education-based engagement too that seeks to help participant households to:

- Benchmark their energy and water consumption based on the National Australian Building Environmental Rating Scheme (NABERS).
- Understand which appliances in their home are the most energy inefficiency.
- Understand how the householder's usage of these appliances affect their energy use.
- Combine funding to determine the best value-for-money behaviour and technological changes that could be implanted to reduce energy consumption, save money and decrease greenhouse gas emissions.

The HEC follows the Australian Standard guidelines for energy auditing and it's comprised of the following characteristics:

- Two assessors present in the home;
- A 90 minute consultation;
- Reports consolidating the findings of the HEC are mailed within three weeks of the consultation being complete.

Mojarra was the Perth Solar City consortium member responsible for the administration and delivery of the HEC to eligible households in Perth's Eastern Region. Since the start of the program, Mojarra was provided with referrals from the program call centre, the Living Smart program, collaboration with other consortium members and via Mojarra's own recruitment campaigns.

Progress

Mojarra's main objective for the program was to complete 3,500 HEC's (this number was exceeded by 17 HCE totalling 3517 HEC). Mojarra also undertook 20 school energy audits.

Key Results

Key participants statistics to 30 November 2011:

- 47% of participants on the free HEC service were either single or dual occupant households;
- 42% of participants in the free HEC service have completed a tertiary education;
- 60% of participant households were employed full-time, part-time or self-employed. 20% of participant households were retired;
- Only 322 households, or 14% of HEC participants, responded when asked about their household income level.

Analysis was completed from 762 participant households who had received a free HEC in the period 4 December 2009 to 30 June 2011. In order to effectively measure the relative effects of the HEC on participant electricity use, the analysis did not include any household who also participated in the

Living Smart Program. The preliminary analysis showed a 7.8% reduction in the average daily electricity use of participant households.

For more detailed information in relation to Eco-consultations please refer to page 142 of the Perth Solar City 2012 Annual Report.

Iconic Projects

Background

To support the objectives of Perth Solar City, and to promote the Australian Government's Solar Cities program, five iconic Perth locations were selected for prominent solar photovoltaic (PV) system installations to maximise community engagement and promote renewable energy.

The selected locations were the Midland Atelier, the Central Institute of Technology, Kings Park and Botanic Gardens, Perth Zoo and Perth Arena. Together they provide over 450kW of grid connected renewable energy capacity.

Iconic Site	Project	Consortium Member	Completion Date	Estimated annual cost savings ($/year) *	Estimated annual GHG emissions savings (kg CO2-e/year) ^
Central Institute of Technology	49kW solar PV system	SunPower	April 2010	$23,677	68,543
Midland Atelier	60kW solar PV system	SunPower	May 2010	$29,377	85,045
Perth Zoo Stage 1	90.9kW solar PV system	SunPower	March 2011	$44,285	128,202
Perth Zoo Stage 2	147.8kW solar PV system	SunPower	June 2012	$72,006	208,451
Kings Park and Botanic Garden	Energy efficient education building including 15kW solar PV system	BGPA	June 2012	$7,308	21,155
Perth Arena	111kW solar PV system	Synergy	November 2012	$54,078	156,550

* Cost savings based on avoided expenditure only. Cost savings calculated at large business (M1) rate of 31.78c/kW – current as at 30 September 2012

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

For more detailed information in relation to Iconic Projects please refer to page 148 of the Perth Solar City 2012 Annual Report.

Schools Program

Eco Superstar Documentary

Prospero Productions, a Perth Solar City Consortium member, was engaged to design and produce a high school based documentary focused on finding an environmental champion. Eco Superstar promoted awareness of energy efficiency, broader environmental issues, as well as the Perth Solar City program. In order to engage students, Prospero Productions designed the documentary with reality-TV style approach and branding putting students in a competition to determine an environmental champion.

The competition was launched at three different schools during March 2010, and was supported by online media tools such as social networking sites and a dedicated website. Eco Superstar finalists were judged online by the community, based on their environmental message, their creativity and ability to inspire. The subsequent Eco Superstar documentary following the two finalists during their two-week challenge to make their school and home more eco-friendly, reduce their energy use and organise an eco-event.

After some fierce competition, Perth Solar City was pleased to announce Sarah Brown from Mundaring Christian College as the winner of Eco Superstar 2010. Nate Wood from Helena College was the runner-up. The Eco Superstar documentary premiered on 20 October 2011 at the Astor Theatre, with over 200 people in attendance.

The Eco Superstar DVD can be used as an educational tool for junior to middle secondary classes including environmental studies, media studies and society and environment. Using the resources will help students be better able to:

- Identify environmental issues in the community;
- Decide how these environmental problems might be addressed at the personal and local level;
- Apply the ideas and values the Eco Superstar to their own homes and school communities.

Bring It Down energy challenge

Western Power designed and implemented Bring It Down as a school based electricity reduction challenge to test the response to access to real time electricity consumption information. The competition between schools focused on achieving energy reductions through the use of real time electricity consumption information via a web based display.

The competition structure included the following components:

- Entry was open to a minimum of five and a maximum of eight schools;
- The competition ran for seven weeks towards the end of term three and early term four (12 September to 31 October 2011) which included two week school holiday period;
- Participation was free for all schools – all display and monitoring equipment was installed and will be provided to schools beyond the life of the competition through to 30 June 2013;
- The competition uses a weekly points structure as a means of maintaining motivation throughout the competition;
- Schools were benchmarked based on school energy consumption for the same seven week period over the previous three years;
- The winning school would receive $10,000 of energy efficiency upgrades, as identified in their Perth Solar City schools energy audit.

The real time energy display formed the key technology component of the completion. It allowed schools to see what their energy use was on a daily basis in comparison to their own benchmark, as well as the performance of other competing schools. Additionally by using time based intervals, schools were also able to understand their electricity consumption during non-school hours and weekends. As a result, schools were able to identify areas for energy efficiency during these periods. The display technology provides real time energy consumption information to users via a web-based dashboard.

Mundaring Christian College won the Bring It Down challenge, winning all seven rounds. This included a 60% reduction in their benchmarked electricity use in the final week of the competition. Their total energy savings over the seven week period was 7,601kWh, representing a 54% reduction or over $1,900 of electricity saved.

For more detailed information in relation to Schools Engagement please refer to page 156 of the Perth Solar City 2012 Annual Report.

Local Government Contribution

Living Smart (Behaviour Change Trial)

Background

Living Smart was delivered by WA Department of Transport (DoT) (in partnership with the Eastern Metropolitan Regional Council) to test the effectiveness of engaging households in behaviour change across broad sustainability topics including energy and water efficiency, reduced car use and improved waste management. It builds upon the DOT's proven TravelSmart Household program that had delivered a 10% reduction in car trips within targeted communities of more than 200,000 households across the Perth Metropolitan area. It also drew upon the transformational Living Smart small group sustainability courses developed by the South Metropolitan Regional Council, City of Fremantle, Murdoch University and the Meeting Place.

A Living Smart demonstration project was developed in 2008/09 in the Perth suburbs Joondalup and Mandurah, which achieved strong engagement with around 60% of households participating. Changes in behaviour were achieved with households reporting adopting such new actions as switching off standby power and purchasing a solar PV system.

As part of Perth Solar City, Living Smart was offered to 10,000 households across Perth's Eastern Region with over 6,000 choosing to take part in the programs interactive features from April 2010 through to April 2011. The key principles of Living Smart's telephone based eco-coaching include:

- Understanding households motivations for changing their behaviour;
- Building effective relationships with households through coaching conversations;
- Facilitating self-directed conversations that provide households with the right information and advice at the right time;
- Setting simple and measurable targets for the household through the establishment of 'social contracts' and the provision of localised benchmarks.

Progress

Living Smart's objectives for Perth Solar City were to:

- Act as a mechanism for referrals to other Perth Solar City products and services;
- Identify and understand barriers relating to the adoption of energy efficiency behaviour and uptake of energy efficiency products and services;

- Understand the effect of such a targeted behaviour change program on household energy consumption.

In 2010/11 DOT offered their intensive behaviour change program, Living Smart Households, to 10,000 households across Perth's Eastern Region. 6,000 households chose to take part in the program's interactive features from April 2010 through to April 2011.

Key Results

Preliminary analysis was completed for 4,768 households who had participated in the Living Smart program. An average reduction in electricity use of 8.5% was evident. This is equivalent to a $122.50 cost saving and a Greenhouse Gas saving of 521kg CO2-e per household per year.

For more detailed information in relation to Behaviour Change please refer to page 124 of the Perth Solar City 2012 Annual Report.

Sustainable Communities Competition

The Sustainable Communities Competition was originally sponsored by Solahart as part of the revision of the Perth Solar City business case and was to be named the "Solar Your Street Competition". SunPower then sought involvement in the competition as a way of adding value to the Perth Solar City Program. As a result, Solahart became the inaugural sponsor of the competition, with SunPower being accepted into the competition at a later stage. Due to SunPower's sponsorship and a change in focus, the competition was re-named "The Sustainable Communities Competition" acknowledging Solahart and SunPower as joint sponsors.

The competition commenced during the Awareness phase of Perth Solar City as a way of building community interest in the program and its offerings. It encouraged sustainable behaviour at the community level by engaging with and encouraging people to work together in small neighbourhoods, communities or street groups.

The competition was open to residents of Perth's Eastern Region that met the terms and conditions (eligibility criteria) set out by the Perth Solar City Program. Communities such as streets, blocks, retirement villages or 'communities of interest' (such as groups of interested people or members of clubs) were encouraged to submit an entry. The primary criteria for entering the competition were that applicants reside within Perth's Eastern Region and apply as a group.

The competition aims included:

- Encouraging residents to accept that sustainability extends beyond their front gate;
- Raise the profile of Perth Solar City through involvement with the Perth Autumn Festival;
- Encourage and reward local communities to engage in energy efficiency behaviour;
- Provide a pathway and resources for community "Sustainability Champions" to engage their neighbours and community in the competition;
- Raise awareness of opportunities available through the Perth Solar City Program;
- Enable sponsors to have a presence and brand exposure through displays at workshops run throughout the competition and through association with specific category prizes; and
- Conclude with an event that will highlight and celebrate sustainable lifestyles in Perth's Eastern Region.

The competition was divided into two (2) stages as follows:

Stage one – The first stage of the competition was run in each member Council of Perth's Eastern Region at a time that coincides with the Perth Autumn Festival. This raising awareness phase incorporated a broad-reach media campaign. During this phase, 'toolkits' containing tips on engaging with members of the community will be sent to interested people who became 'Sustainability Champions' and were responsible for engaging members of their 'community'. The 'Sustainability Champions' were put in contact with Eco-Coaches who guide them in their community engagement activities and assisted them in making a case to be nominated as the 'Sustainable Community' for their local government area. Judging of entries then took place and six (6) winners were chosen on the basis of one (1) per member Council area.

Stage two – The second stage of the competition involves eco-coaching for the six winning communities combined with sustainability workshops leading up to a Regional winner being announced.

There were three different competition streams including:

1. Most Sustainable Community (existing efforts and/or most improved) in each of the six member Council areas (Environment House Gift Vouchers);
2. An individual SunPower winner selected at random from all participants who chose to be part of the Sustainable Communities Competition by being included in the application process (1.2kW PV system);
3. One Regional Champion Sustainable Community selected from the six "Most Sustainable Community" winners (2.1kW PV system).

The Most Sustainable Community winner was the Spring Road Kindergarten in the Shire of Kalamunda.

Demonstration Projects

Background

To engage the local community with Perth's Eastern Region about the benefits of energy efficiency and renewable energy, fifteen demonstration projects were implemented by the Eastern Metropolitan Regional Council and its member Councils (Town of Bassendean, City of Bayswater, City of Belmont, Shire of Kalamunda, Shire of Mundaring and City of Swan). Whilst they vary in scope and size, all are located within the community and mostly on public access buildings.

The demonstration projects allow the community to see renewable energy and energy efficiency in action within their community, and assist local councils to actively understand and reduce their energy expenditure and environmental footprint. Each project includes interpretive displays and engagement materials to promote energy efficiency as well as the Perth Solar City program.

Name of Demonstration Site	Project	Completion Date	Est. Annual energy savings ($/year) *	Est annual GHG emissions savings (kg CO2-e/year) ^
Bassendean Memorial Library	3.6kW PV system	July 2010	$1,752	5,262
Ashfield Reserve	4kW PV system	July 2010	$1,990	5,980
The RISE	15kW PV system	June 2010	$8,179	24,454
Ruth Faulkner Library	4kW PV system	June 2010	$1,393	4,186
Belmont Oasis Leisure Centre	Solar water heating + Energy efficiency lighting retrofit	Dec 2010 May 2011	$93,983	383,510
Midland Public Library	1kW PV system	June 2010	$560	1,684
Ellenbrook Community Library	2kW PV system	June 2010	$1,118	3,358
Altone Park Leisure Centre	10kW PV system + Energy efficient lighting retrofit + Energy management System	June 2010	$5,588	11,790
Mundaring Administration Centre	16.1kW PV system (upgraded to 22.61kW since program closure)	June 2010	$11,317	34,003
Kalamunda Administration Centre	Energy management System	June 2011	$1,588	60,000
Red Hill Waste Management Facility	9.1kW tracking PV system	April 2011	$6,424	19,302
EMRC Administration Centre	9.1kW PV system	March 2011	$4,590	13,791
Swan View Youth Centre	5kW PV system	August 2011	$2,683	8,078
Kalamunda Library	2.1kW PV system + solartube daylighting system	April 2011 Dec 2011	$4,223	14,547
Hazelmere Recycling Centre	4.38kW PV system	Feb 2012	$2,327	6,992
TOTAL	**91.88kW PV systems + additional project installations**		**$147,715**	**596,937**

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

For more detailed information in relation to Demonstration Projects please refer to page 154 of the Perth Solar City 2012 Annual Report.

Town of Bassendean

Bassendean Memorial Library

The Town of Bassendean installed a 3.6 kW grid connected solar PV system and undertook a lighting retrofit at Bassendean Memorial Library. The PV system was estimated to abate approximately 5,262 kg of greenhouse gas emissions and save the Town $1,752 per annum.

The Town's library, although relatively new (opened in 2005) is not as energy efficient as it could be, as a result the lighting retrofit was carried out. The retrofit included the replacement of all 36W florescent tubes and 50W halogen down lights with more energy efficient version of lighting.

The foyer of the library houses a visual display that details the energy, financial and greenhouse gas savings associated with the PV system. This display shows data in real time and allows residence and staff to see the real time impact the PV system is having.

Bassendean Memorial Library	Installed – July 2010
Type	Monocrystaline
Tilt	30
Orientation	North
Total Capacity (kW)	3.6
Estimated annual output (MWh p/a)	5.72
Cost of the proponents (ex GST)	$13,229
Total area covered by the installation (m2)	25.6
Number of panels	20
Number of inverters	2
Estimated financial savings p/a *	$1,752
Estimated greenhouse abatement (kgCO2e p/a) ^	5,262

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Ashfield Reserve

In addition to the installation of the Bassendean Library Demonstration Project the Town of Bassendean installed a sustainable public lighting project at Ashfield Reserve. Street lighting accounts for approximately 65% of the Town's energy costs, and was responsible for generating 904 tonnes of greenhouse gas emissions.

This demonstration project involved the installation of eight 6m 150W street lights with the additional of a 4.08kW PV system on the building at Ashfield Reserve. The data and information that is collected in relation to the PV is being displayed at the Perth Solar City visual display in the Town's Library.

Ashfield Reserve	Installed – July 2010
Type	Polycrystalline
Tilt	30
Orientation	North
Total Capacity (kW)	4.08
Estimated annual output (MWh p/a)	6.5
Cost of the proponents (ex GST) ~	$51,259
Total area covered by the installation (m2)	30.72
Number of panels	24
Number of inverters	1
Estimated financial savings p/a *	$1,990
Estimated greenhouse abatement (kgCO2e p/a) ^	5,980

~ Cost includes lighting and PV system

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

City of Bayswater

The RISE

As part of the City of Bayswater's commitment to the Perth Solar City Program a 15kW PV system was installed at the City's new multipurpose centre the RISE. The RISE is a landmark building for the future. It incorporates green building technology to make it more sustainable and reduce its impact on the environment.

RISE is an acronym for Recreation, Information, Socialising and Entertainment. The name of the new centre, the RISE, therefore reflects both the wide-range of facilities and services that it will provide to the City's residents. The scale of the facility places it as one of the City's most signature buildings.

The RISE	Installed – June 2010
Type	Designed
Tilt	25
Orientation	North
Total Capacity (kW)	15
Estimated annual output (MWh p/a)	26.58
Cost of the proponents (ex GST)	$162,787
Total area covered by the installation (m2)	101
Number of panels	79
Number of inverters	1
Estimated financial savings p/a *	$8,179
Estimated greenhouse abatement (kgCO2e p/a) ^	24,454

* Based on R1 tariff (30.62c)

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

City of Belmont

Ruth Faulkner Public Library

The City of Belmont had already installed a 1.2kW thin film grid connected solar PV system on the roof of the Ruth Faulkner Public Library. As part of the City's commitment to the Perth Solar City Program the City has upgraded the size of the existing 1.2kW thin film PV system to 2.1kW, and installed another 2.1kW polycrystalline demonstration PV system at the same location.

The different PV panel technologies are located side by side, assessing the same amount of sunlight. This will enable the City of Belmont to not only promote and showcase two forms of PV system currently available to residents; it will also enable data to be collected on the efficiency of the two types of PV panels.

The inside of the Library features interpretive displays, giving details of energy generation read-outs, financial savings and greenhouse abatement.

Ruth Faulkner Public Library		Installed – June 2010
Type	Thin Film	Polycrystalline
Tilt	20	20
Orientation	North	North
Total Capacity (kW)	2.1	2.1
Estimated annual output (MWh p/a)	2.55	2
Cost of the proponents (ex GST)	$4,845 (upgrade cost for 1.2kW system)	$12,600
Total area covered by the installation (m2)	Unsure	Unsure
Number of panels	15 (total)	11
Number of inverters	1	1
Estimated financial savings p/a *	$781	$612
Estimated greenhouse abatement (kgCO2e p/a) ^	2,346	1,840

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Belmont Oasis Leisure Centre

The Belmont Oasis Leisure Centre is a quality, multipurpose complex providing a range of facilities. The complex is owned by the City of Belmont and operated by Belgravia Leisure.

Previously, the City used a gas boiler for 100% heating of Olympic sized indoor swimming pool, and the children's indoor Lagoon pool. On average, the boiler used approximately 11,991.33 GJ p/a. Costing approximately $120,000 p/a with significant greenhouse gas emissions.

As part of the City's commitment to the Perth Solar City Program the City installed two solar pool heating systems, comprising the installation of 177 panels (HC40) for the 50m Olympic sized indoor pool and the installation of 36 panels (HC50) for the Lagoon pool. This reduces reliance on the gas boiler for heating.

Additionally a lighting retrofit was carried out installing 12 LED car park lights and replaced 65 halogen down lights, 48 PLC fluorescent globes and 169 fluorescent tubes with their LED equivalent. It is estimated that the lighting retrofit will reduce electricity use by 65%-85%.

The inside of the Belmont Oasis Leisure Centre features an interpretive display, giving details of gas usage, financial savings and greenhouse abatement.

Belmont Oasis Leisure Centre	Solar Water Heating Installed – December 2010	Lighting Retrofit Installed – May 2011
Type	Heliocol panels	• 40 watt LED streetlights • 9 watt LED downlight • 3 watt LED downlight • PLC 6 watt Gecko Tail light • 8 watt LED T8 replacement tube 600mm
Tilt	Various	NA
Orientation	Various	NA
Estimated annual output	6,889GJ	NA
Cost of the proponents (ex GST)	$256,680	$24,437

Total area covered by the installation (m2)	690m2 of tubing	NA
Number of panels	231	NA
Estimated financial savings p/a	$93,167	$816
Estimated greenhouse abatement (kgCO2e p/a)	353,000	30,510

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Shire of Kalamunda

Administration Building

As part of the Shire of Kalamunda's commitment to the Perth Solar City Program, the Shire implemented an Energy Demand and Reduction Management System (EDRMS). The system involves the implementation of a hybrid system providing energy reduction strategies through management of waste energy, occupancy detection and with the aim of installing daylight harvesting. Daylight harvesting is a strategy that involves the EDRMS using lighting controls that switch or dim the lights in response to available daylight. They can be operated wither manually or automatically.

To identify how energy is used within the building, monitoring devices were installed at each distribution board within the building. Occupancy sensors have also been installed in low occupancy areas including hallways, toilets, meeting rooms and storerooms to switch off lights when not required.

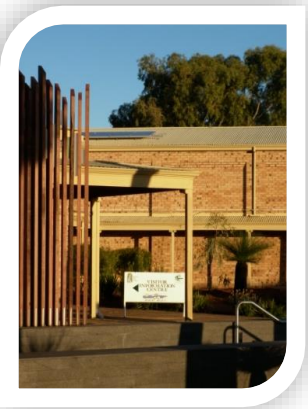
To further control the energy load currently being used within the building, an option is to install dimmable electricity ballasts which offer greater flexibility and control over the amount of lighting required.

The project also delivers information and education component as all data received is logged in real time and displayed at the front counter for both staff and visitors to the Administration Building to view. The distribution of real-time data provides a platform for individuals to be accountable and involved in

the energy reduction process. Each staff member will be able to monitor their personal contribution to the buildings energy use on their desktop computer.

At commencement of the demonstration project it was estimated that the EDRMS and lighting retrofit will result in a 20% financial saving and offset approximately 60,000kg of greenhouse gas emissions each annum.

Administration Centre	Installed – June 2011
Type	Energy Management
Project financial savings p/a	<20%
Estimated greenhouse abatement (kgCO2e p/a)	60,000



Kalamunda Library

As part of the Shire of Kalamunda's commitment to the Perth Solar City Program the Shire installed a 2 kW grid connected solar PV system at the Kalamunda Library. The 2.16 kW system is estimated to offset approximately 3,386kg of greenhouse gas emissions each year, with an annual cost saving of approximately $1,066.

In addition to the PV system, the Shire has also installed Solatubes throughout the library facility to disperse natural light through the high traffic areas of the library. Four inefficient 400W metal halide Hi-Bay lights have also been upgraded to energy efficient 100W LED lights. With a reduction in internal lighting required it is anticipated approximately 1,161kg of greenhouse gas emissions will be offset each year, with an annual cost saving of approximately $3,157.

The inside of the Library features an interpretive display, giving details of energy generation readouts, financial savings and greenhouse abatement.

Kalamunda Library	Solar PV System Installed – April 2011	Solatube Installed –December 2011	LED Lights Installed – December 2011
Type	Monocrystalline	750DS + 290DS	100W Hi-Bay
Tilt	To roof angle	NA	NA
Orientation	North	NA	NA
Total Capacity (kW)	2.16	NA	0.1
Estimated annual output (MWh p/a)	3.48	1.64	3.50
Cost of the proponents (ex GST)	$12,950	$13,192	$3,003
Total area covered by the installation (m2)	15.5	NA	NA
Number of panels	12	7 units	4 units
Number of inverters	1	NA	NA
Estimated financial savings p/a *	$1,066	$502	$2,655
Estimated greenhouse abatement (kgCO2e p/a) ^	3,386	1,490	9,671

* Based on R1 tariff (30.62c) – April 2013, 37.48c peak, 8.16c off peak

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Shire of Mundaring

Administration Building

As part of the Shire of Mundaring's commitment to the Perth Solar City Program, the Shire originally installed a 16kW grid connected solar PV system to the roof of the Shire's Administration building. After its installation the Shire increased the size of the system to total 22.61kW.

The 22.61kW system is estimated to offset approximately 34,003kg of greenhouse gas emissions each year.

Inside of the administration building features an interpretive display giving details of energy generation read outs, financial savings and greenhouse abatement.

Administration Building	Installed – June 2010
Type	Monocrystalline
Tilt	23
Orientation	North
Total Capacity (kW)	22.61
Estimated annual output (MWh p/a)	36.96
Cost of the proponents (ex GST)	$95,093
Total area covered by the installation (m2)	152
Number of panels	119
Number of inverters	4
Estimated financial savings p/a *	$11,317
Estimated greenhouse abatement (kgCO2e p/a) ^	34,003

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Swan View Youth Centre

As part of the Shire of Mundaring's commitment to the Perth Solar City Program the Shire installed a 5kW grid connected solar PV system at the new Swan View Youth Centre. The 5kW system is estimated to offset approximately 8,078kg of greenhouse gas emissions each year.

The Swan View Youth Centre has only recently been constructed and it is estimated that the facility will generate 25,000 visitors per annum. This new centre is location within the existing Brown Park Recreation grounds which includes the Brown Park Community Centre, the Bruce Douglas Pavilion, two ovals, skate park and a number of tennis courts.

The inside of the Centre features an interpretive display, giving details of energy generation read-outs, financial savings and greenhouse abatement.

Swan View Youth Centre	Installed – August 2011
Type	Polycrystalline
Tilt	25
Orientation	North
Total Capacity (kW)	5
Estimated annual output (MWh p/a)	8.78
Cost of the proponents (ex GST)	$28,433
Total area covered by the installation (m2)	39.3
Number of panels	24
Number of inverters	1
Estimated financial savings p/a *	$2,688
Estimated greenhouse abatement (kgCO2e p/a) ^	8,078

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

City of Swan

Midland and Ellenbrook Libraries

Within the City of Swan's Strategic Plan (2008-2012), the City recognised it has an important role to play in assisting households and businesses in reducing energy consumption and the production of greenhouse gases.

To address this objective, the City of Swan has installed a 1kW grid connected solar PV system on the roof of the Midland Public Library and a 2kW grid connected solar PV system on the roof of the Ellenbrook Community Library.

The 1kW system is estimated to offset approximately 1,684kg of carbon dioxide equivalent each year, and an annual cost saving of approximately $560. The 2kW system is estimated to offset approximately 3,358kg of greenhouse gas emissions each year, and an annual cost saving of approximately $1,118.

Libraries	Midland Library Installed – June 2010	Ellenbrook Library Installed – June 2010
Type	Monocrystalline	Monocrystalline
Tilt	23	23
Orientation	North	North-North East
Total Capacity (kW)	1	2
Estimated annual output (MWh p/a)	1.83	3.65
Cost of the proponents (ex GST)	$6,000	$11,000
Total area covered by the installation (m2)	9	18
Number of panels	6	12
Number of inverters	1	1
Estimated financial savings p/a *	$560	$1,118
Estimated greenhouse abatement (kgCO2e p/a) ^	1,684	3,358

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Altone Park

The City of Swan has an important role in assisting households and businesses to reduce energy consumption and the production of greenhouse gases. This commitment is detailed in the City's Sustainable Environment Policy.

With this commitment in mind and with energy prices on the rise, the City installed a 10kW solar PV system at the Altone Park Leisure Centre as a part of the Perth Solar City program. This facility is owned and operated by the City and attracts over 300,000 visitors per annum.

On average, the annual electricity usage at this site is 93,139 kWh per annum, costing the City approximately $10,185 p.a. and generating significant amounts of greenhouse gas emissions each year.

The 10kW solar PV system is estimated to offset approximately 16,790 kg of greenhouse gas emissions each year, and an annual cost saving of approximately $5,588.

The main foyer area within the Centre features an interpretive display giving a visual display of energy generated read outs, financial savings and greenhouse abatement. The City will also seek to actively engage the local community through the demonstration PV system.

In additional to the installation of solar panels, the City has also undertaken an energy assessment of the Altone Park site and installed a wide range of energy efficiency measures on site including:

- Installation of variable speed motors on pool pumps;
- Installation of pool blankets;
- Installation of solar hot water heating;
- Further development of the energy monitoring system on site.

Altone Park Leisure Centre	Installed – June 2010
Type	Monocrystalline
Tilt	23
Orientation	North
Total Capacity (kW)	10
Estimated annual output (MWh p/a)	18.25
Cost of the proponents (ex GST)	$90,000 (including other sustainability initiatives)
Total area covered by the installation (m2)	100
Number of panels	46
Number of inverters	2
Estimated financial savings p/a *	$5,588
Estimated greenhouse abatement (kgCO2e p/a) ^	16,790

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

Eastern Metropolitan Regional Council (EMRC)

Administration Centre

As part of its commitment to the Perth Solar City Program, EMRC installed a 9kW roof mounted system located at the EMRC's Ascot Administration Building and is estimated to offset approximately 13,791kg of greenhouse emissions.

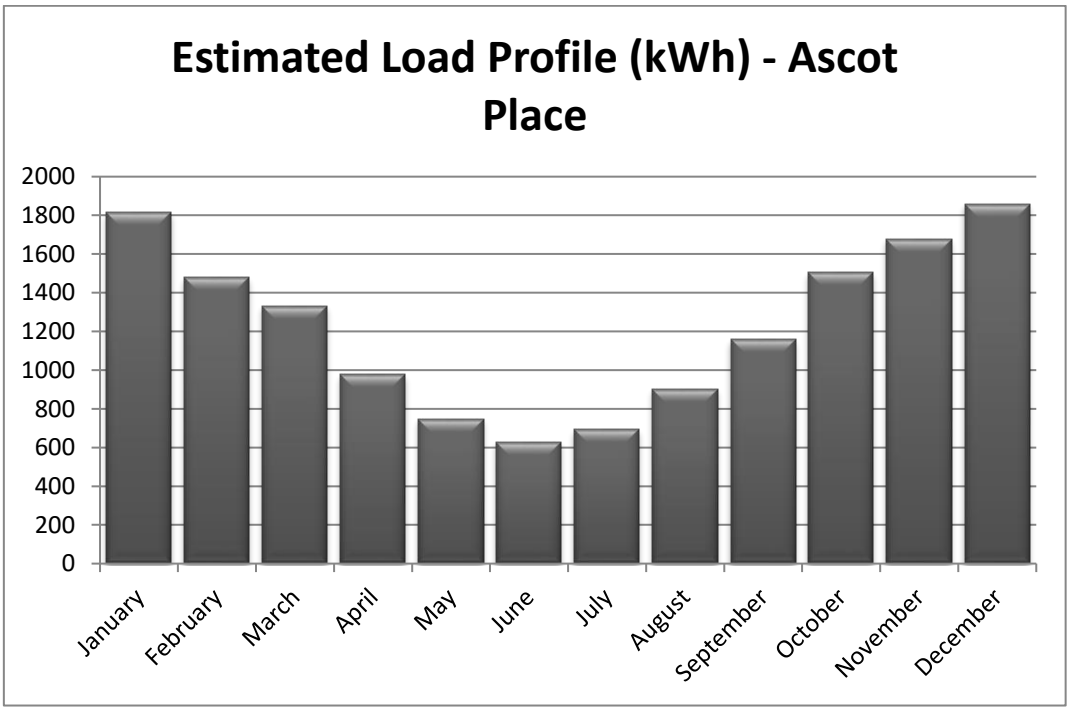
A visual display and laptop provide long term backup, retrieval and display of key system data. Data is transmitted from the inverters to EMRC reception area where the visual display and laptop are located. This information is visible to staff, stakeholders and customers as they pass through the reception area. Information delivered not only includes the systems energy generation and greenhouse gas abatement but also an overview of member Council's demonstration projects and other products and services that EMRC's Environmental Services team provide to the region.

Administration	Installed – March 2011
Type	Monocrystalline
Tilt	Flat on roof
Total Capacity (kW)	9.12
Estimated annual output (MWh p/a)	14.99
Actual annual output (MWh p/a)	13.91
Cost of the proponents (ex GST)	$55,675
Total area covered by the installation (m2)	61.3
Number of panels	48
Number of inverters	2
Estimated financial savings p/a *	$4,590
Actual financial savings p/a *	$4,258
Estimated greenhouse abatement (kgCO2e p/a) ^	13,791
Actual greenhouse abatement (kgCO2e p/a) ^	12,515

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

The graph below shows the estimated load profile of the Ascot Place 9kW PV system. As we would expect the profile shows a decline in winter as the hours of daylight reduce.



Red Hill Waste Management Facility

EMRC additionally installed a 9kW tracking solar PV system at the Red Hill Waste Management Facility.

The tracking PV system at Red Hill operates on a timer mechanism that pivots the mounted panels from east to west over the course of the day, with the aim being to track the sun's path through the sky at its most optimal angle, thus maximising the energy potential of the system. The system moves back to the east facing position at the end of the day, ready to start the next day's course.

By allowing the system to track, the efficiency level of the system is increased. The system is estimated to save just over 19,302kg of greenhouse gas emissions making the tracking feature of the

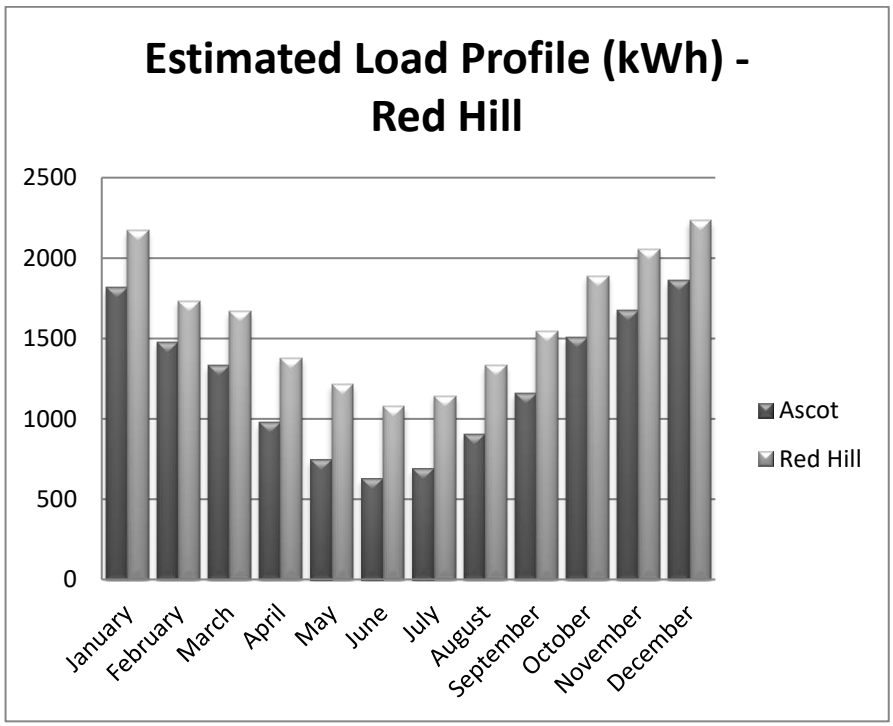
Red Hill system approximately 23% more efficient that a standard roof mounted system that is located at EMRC's Ascot Place Administration Building.

Red Hill	Installed – April 2011
Type	Monocrystalline
Tilt	Tracking
Orientation	Tracking
Total Capacity (kW)	9.12
Estimated annual output (MWh p/a)	20.98
Actual annual output (MWh p/a)	14
Cost of the proponents (ex GST)	$79,898
Total area covered by the installation (m2)	61.3
Number of panels	48
Number of inverters	3
Estimated financial savings p/a *	$6,424
Actual financial savings p/a *	$4,287
Estimated greenhouse abatement (kgCO2e p/a) ^	19,302
Actual greenhouse abatement (kgCO2e p/a) ^	12,614

* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

The graph below shows the estimated load profile of the Red Hill 9kW tracking system in comparison with the 9kW mounted system at Ascot Place. The graph shows the additional efficiency of the system due to the tracking mechanism.



Hazelmere

As part of the it's commitment to the Perth Solar City Program, EMRC installed a 4.38kW PV system at the Hazelmere Recycling Centre.

The system includes six 255W monocrystalline modules (black = 1.53kW), six 235W polycrystalline modules (Blue = 1.41kW) and sixteen 90W thin film modules (Small Black – 1.44kW) on a ground mounted support.

As the systems generate electricity EMRC will be able to compare and contrast the productivity of the three systems.

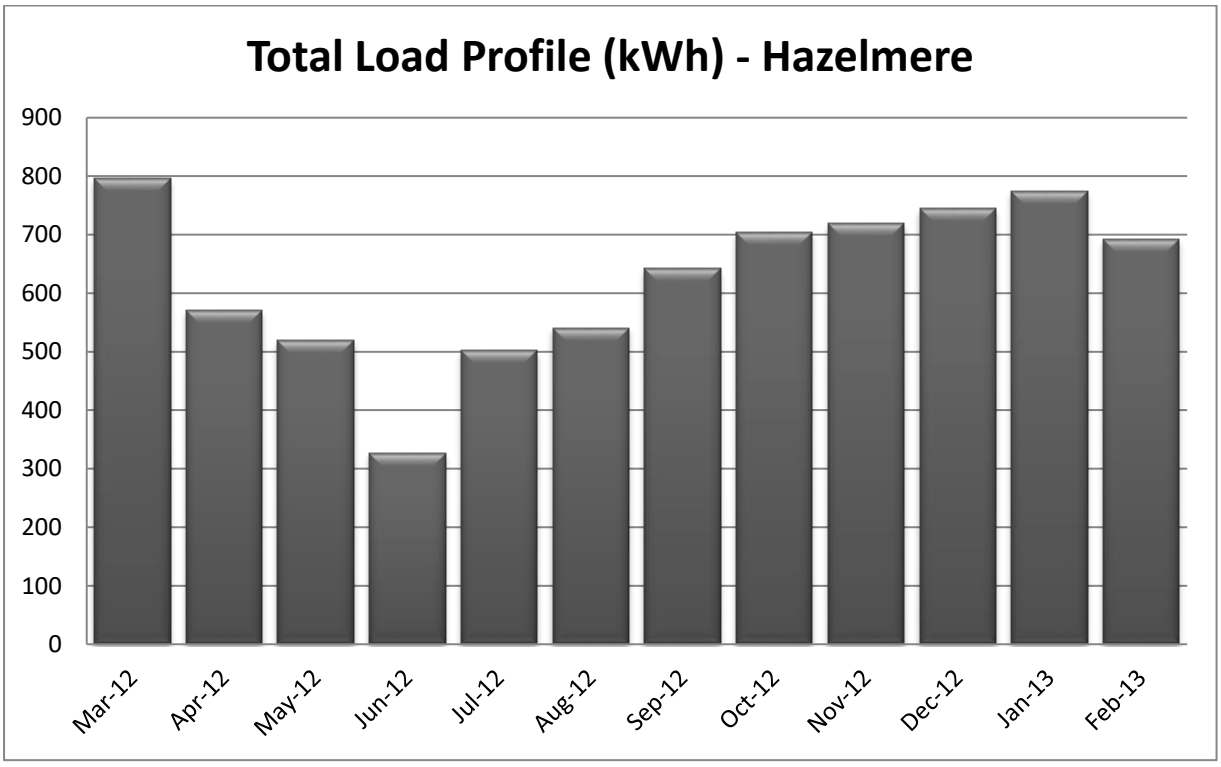
Hazelmere			**Installed – February 2012**
Type	Monocrystalline	Polycrystalline	Thin Film
Tilt	45	45	45
Orientation	North	North	North
Total Capacity (kW)	1.53	1.41	1.44
Estimated annual output (MWh p/a)	2.65	2.45	2.50
Actual annual output (MWh p/a)	2.56	2.43	2.50
Estimated total annual output(MWh p/a)	7.60	-	-
Actual total annual output(MWh p/a)	7.53	-	-
Cost of the proponents (ex GST)	$29,768	-	-
Total area covered by the installation (m2)	40	-	-
Number of panels	6	6	16
Number of inverters	1	1	1
Estimated financial savings p/a *	$811	$750	$766
Actual financial savings p/a *	$784	$744	$766
Total Estimated financial savings p/a *	$2,327	-	-

Total Actual financial savings p/a *	$2,306	-	-
Estimated greenhouse abatement (kgCO2e p/a) ^	2,438	2,254	2,300
Actual greenhouse abatement (kgCO2e p/a) ^	2,355	2,236	2,300
Estimated greenhouse abatement (kgCO2e p/a) ^	6,992	-	-
Actual greenhouse abatement (kgCO2e p/a) ^	6,928	-	-

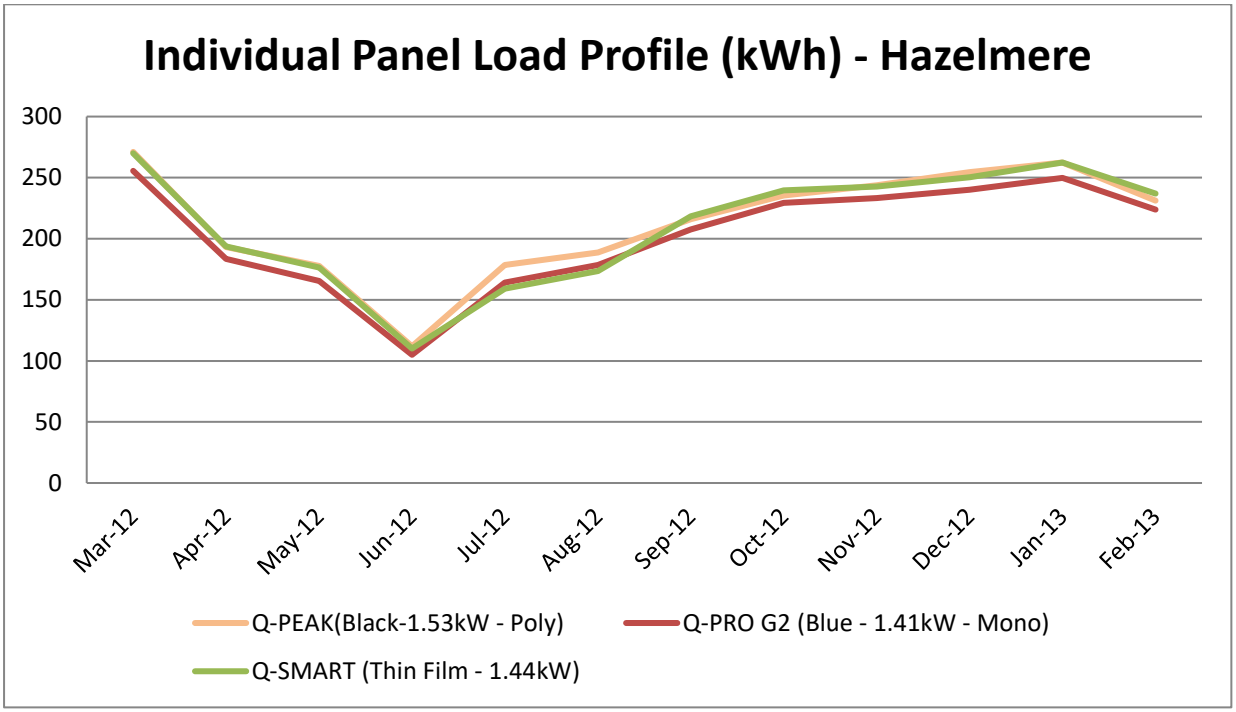
* Based on R1 tariff (30.62c) – April 2013

^ Based on emission co-efficient of 0.92kg/CO2-e per kWh – National Greenhouse Account Factor – July 2012

The graph below shows the actual load profile of the Hazelmere system over a one year period.

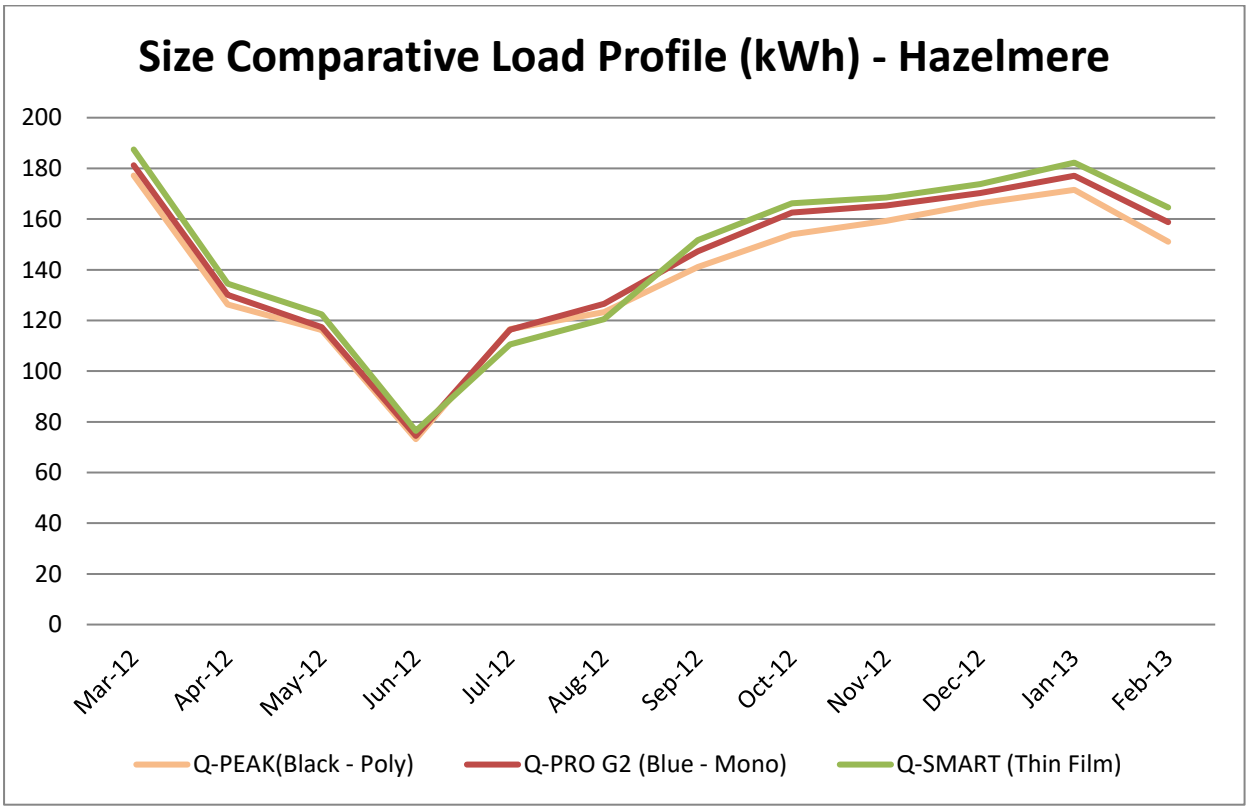


The graph below shows the individual panels load profile for the same period. From this table we would indicate that the Polycrystalline and Thin film are outperforming the monocrystaline panels.

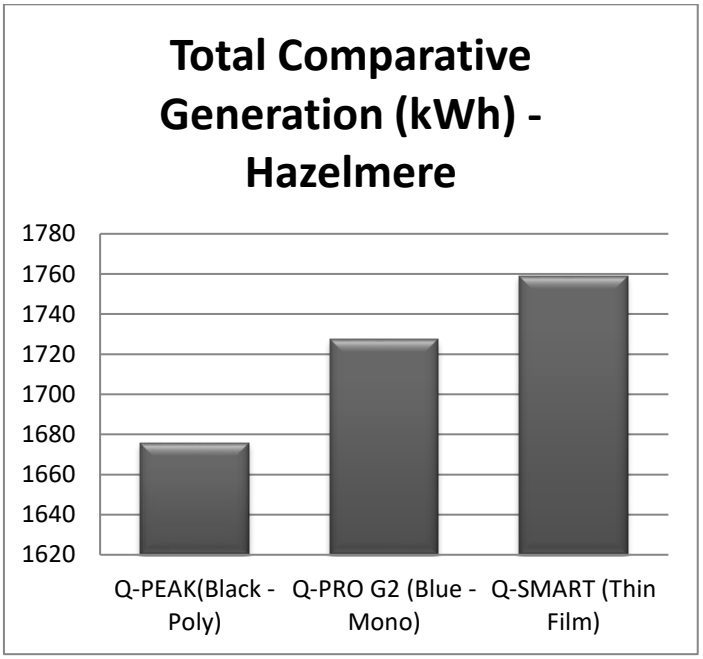


Due to the fact that the panel size of each individual system is different (due to panel wattage for each type of panel). As a result the data was manipulated to reflect a comparative state at a 1:1 ratio.

The graph below demonstrates that the Thin Film that is outperforming the other two systems.



The below graph indicates the comparative total of the systems clearly indicating that the Thin Film is currently outperforming the Monocrystalline and Polycrystalline.



Research tends to favour monocrystaline panels over the other two panels as the preferred product for the below reasons.

Monocrystaline

- Uses a single crystal – looks more appealing;
- Purity of the silicon is higher due to the use of a single crystal;
- Tend to have the highest efficiency and a larger temperature performance range (performs in both hot and cooler temperatures).

Polycrystalline

- Is made up of many crystals (fractured look);
- The cost of the system is cheaper;
- Lower efficiency rating;
- Performs better at lower temperatures – not good in high temperatures.

Thin Film

- Performs better in high temperatures and shading;
- Requires more space due to the fact that the panels are smaller in wattage;
- They have a faster degradation rate and as a result their life is generally much shorter.

(Information taken from www.energyinformative.org)

Cost Breakdown

The estimated cost breakdown based on the October 2010 Consortium Agreement were as follows. The actual cash and in-kind hour contributions may have altered upon project completion and as a result be higher than those shown below.

		DCCEE Grant Funding Available	Estimated Cash Contribution	Estimated In-kind	Total
Bassendean	Bassendean Memorial Library	$24,000.00	$10,351.00	$9,676.00	$44,027.00
	Ashfield Reserve	$34,000.00	$40,000.00	$11,676.00	$85,676.00
Bayswater	The RISE	$72,240.00	$62,000.00	$19,352.00	$153,592.00
Belmont	Ruth Faulkner Library	$19,783.00	$13,000.00	$9,676.00	$42,459.00
	Oasis Leisure Centre	$87,217.00	$88,680.00	$9,676.00	$185,573.00
Kalamunda	Public Library	$20,125.00	$7,000.00	$9,676.00	$36,801.00
	Administration	$36,414.00	$50,000.00	$9,676.00	$96,090.00
Mundaring	Administration	$42,500.00	$60,000.00	$9,676.00	$112,176.00
	Swan View Youth Centre	$24,240.00	$10,000.00	$9,676.00	$43,916.00
Swan	Ellenbrook and Midland Library	$27,610.00	$10,000.00	$9,676.00	$47,286.00
	Altone Park	$67,305.00	$75,305.00	$32,103.00	$174,713.00
EMRC	Administration + Red Hill + Hazelmere	$72,500.00	$87,679.00	$0.00	$160,179.00
	Sustainable Communities	$19,173.76	$0.00	$0.00	$19,173.76
Living Smart	Delivery	$1,080,000.00	$0.00	$1,936,712.00	$3,016,712.00
Total		**$1,627,107.76**	**$514,015.00**	**$2,077,251.00**	**$4,218,373.76**

The figures are based on the October 2010 Consortium Agreement

Lessons and Learning's

There are a number of lessons and learning's that can be taken from this program that can be applied to future projects. A list of common and reoccurring lessons and learning's are detailed below.

Activity	Barrier or Benefit Observed	Learning or Outcome Achieved
Tendering Process – request for quote (RFQ)	**Barrier:** • Lack of interest by suppliers to request for quotes • Suppliers advised that this is due to the onerous processes of local government. **Benefit:** • Advertising tenders has achieved a greater response than requesting quotes from potential suppliers	**Learning** • Talking to potential suppliers and explaining project requirements prior to issues tenders or RFQ's may help with engaging contractors and eliciting interest in submitting tenders • Simplification of local government procurement practises would assist with generating interest from suppliers • Advertising tenders appears to be a more successful way of generating interest
Changes in product costs	**Barrier:** • Required to amend original scope of project plans to meet the changes in relation to product costing **Benefit:** • Majority of cases the cost of products (especially PV systems) reduced quite significantly over the course of the program resulting in many of the projects scope becoming larger	**Outcomes:** • The increase in size of PV systems has resulted in projects with considerable potential for energy efficiency and community engagement **Learning:** • Having the flexibility to take advantage of downward movement in prices has proven to be beneficial
Incorrect or inefficient information when developing project proposal	**Barrier:** • Contractors not supplied with sufficient information at the time of the development of project proposal to enable accurate quote to be made	**Outcomes:** • Adversely affects the implementation of the project resulting in the allocation of additional Council funds, recalling of tenders and delays in the delivery of the projects **Learning:** • Contractors should be provided with sufficient information to enable accurate cost estimates to be made at the time project proposals are developed. Additionally the scope of the project and its deliverables should be well thought through to ensure the contractor understands what to quote and deliver.
Community Group Engagement	**Benefit:** • Direct contact with community groups proved to be effective.	**Outcomes:** • Eco-coaches and EMRC staff attended community group meetings to promote aspects of Perth Solar City, which proved to be an effective means of gaining support **Learning:** • Approaching community groups directly, rather than by broad-reach marketing is an effective means of generating interest.

Data Collection – Collecting Data	**Barrier:** • Collecting required information from member Council representatives on progress and quarterly data with demonstration projects presented a challenge for the Project Coordinator.	**Outcomes:** • A large amount of time is spent in making contact by phone, email and in person to chase up information. While tools have been developed to enable member Council to report on progress and data, some representatives were not providing this information. • Additionally each demonstration project has different data capturing software which makes it hard for the Project Coordinator to learn and assist each individual site when issues arise, making data capture a much harder task. **Learning:** • An incentive-based method may assist as a way on encouraging continued completion of required information and data. • During the scoping of the projects, each individual site should have included the same data capturing software to allow for easier capture and manipulation of data.
Under-estimation of project implementation timeframes	**Barrier:** • A number of member Councils expressed problems implementing demonstration projects within agreed timeframes due to commencing the procurement process with inadequate allowance for project over-runs. • Member Councils underestimated the amount of time taken up by LGA procurement processes	**Outcomes:** • A number of demonstration projects failed to be implemented within the originally agreed timeframes. **Learning:** • Member Councils need to make sure that allowances are made for their own LGA procurement processes and their effect on achieving project milestones.
Uncertainty in relation to ownership of renewable energy credits (REC's)	**Barrier:** • There was uncertainty in relation to what member Councils should have done with their REC's.	**Outcomes:** • Commissioning of the system was delayed as a result of negotiation between councils and contractors in relation to the ownership of REC's**.** **Learning:** • Local government and other organisations would benefit from incorporating the ownership of REC's into their tender or contract documentation when negotiating contracts with suppliers.
Structural issues in relation to installation	**Barrier:** • Structural integrity of buildings not assessed before developing project plans.	**Outcomes:** • A few sites were required to either amend their original proposal or pay for additional works on their buildings in relation to unforseen structural issues. **Learning:** • Structural integrity of the building should be assessed during the scoping and development of a project plan.
High turnover of staff	**Barrier:** • There is a high turnover of staff within local government (and to an extent contractors).	**Outcomes:** • Ineffective transfer of information due to staff turn-over, delay in outputs and reporting. **Learning:** • Adequate record keeping, handover notes and keeping a number of different people within the organisation up to date on the projects progress would have assisted with a smoother

		transitional period. • An idea may be the formation of a Reference Team within each member Council (or project) that is updated quarterly and involved in the projects development and delivery at a more finer detail. The resignation of one or two key players within a project group significantly reduces the corporate knowledge that is with held and passed on to the next person.
Continued motivation and engagement	**Barrier:** • Lack of motivation and reduced ability to engage with staff and community once the key elements of the program have been completed.	**Outcomes:** • Review and development of a new Community Information and Engagement Plan each year. • Development and implementation of the Information Kit. **Learning:** • In a program such as this one, once the bulk of the program is completed the ability to keep staff and community motivated and engaged becomes much harder. As a result planning for this at the beginning of the program is required to make sure that there is enough excitement and engagement to last until the completion of the project.

Where to now?

The Solar Cities programme was developed with directions set by the Ministerial Council on Energy (comprising Commonwealth, State and Territory Ministers responsible for energy) and will inform future greenhouse and energy market policy.

A number of the lessons and learning's that have been communicated to the Australian Government through the seven Solar Cities have already been utilised to help with the design and development of the Clean Energy Future Grant Programs.

The EMRC will continue to lead the way and work on energy efficiency and climate change adaptation programs with its member Councils.

In late 2012 the EMRC was announced as a successful recipient of more than $647,000 in funding from the Australian Government's Community Energy Efficiency Program (CEEP). The $1.3 million regional project titled 'Re-energising Perth's Eastern Region' acknowledges the collaborative efforts of EMRC, Town of Bassendean, City of Bayswater and Shire of Mundaring. Four community facilities in Perth's Eastern Region will undertake energy efficiency upgrades under the program.

EMRC will work with the three Member Councils to implement upgrades of street lighting, pool pump efficiency, internal lighting, air conditioning and solar pool water heating. These upgrades will help Member Councils to improve their energy efficiency and ease the increasing costs of operating these facilities. The projects will also promote energy efficiency to households and communities across Perth's Eastern Region and beyond and will provide an excellent showcase for a more widespread adoption of these efficiency technologies in the broader community.

The annual reduction in energy usage for this project is estimated at 1.22 million kilowatt hours, which equates to a reduction in greenhouse gas emissions of 767 tonnes of CO2-e or the equivalent of the annual consumption of 196 average Perth households.

This activity is receiving funding from the Department of Resources, Energy and Tourism as part of the Community Energy Efficiency Program.