CENTRAL VICTORIA SOLAR CITY

Local energy solutions.

Central Victoria Solar City
FINAL REPORT
2012-2013

CONTENTS

Australian Government
Solar Cities

SRA Sustainable Regional Australia

University of Ballarat
Learn to succeed

Printed June 2013 on recycled paper using vegetable-based inks

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ACRONYMS & ABREVIATIONS	FULL NAME
ADC	Average Daily Consumption
BEA	Business Energy Assessment
CSC	Castlemaine Secondary College
CVGA	Central Victorian Greenhouse Alliance
CVSC	Central Victoria Solar City
DCCEE	Department of Climate Change and Energy Efficiency
DEECD	Department of Education and Early Childhood Development
DRET	Department of Resources, Energy and Tourism
HEA	Home Energy Assessment
HEAT	Home Energy Assessment Team
HHSE	Household Solar Electricity
HVAC	Heating Ventilation Air Conditioning
IHD	In-Home Energy Display
kW	Kilowatts
kWh	Kilowatt Hour
LED	Low Emitting Diode
LGA	Local Government Association
MW	Megawatt
MWh	Megawatt Hour
PFIT	Premium Feed-In Tariff
PV	Photovoltaic
PV	Photovoltaics
RECS	Renewable Energy Certificates
SHW	Solar Hot Water
SME	Small to Medium Enterprise
SRA	Sustainability Regional Australia
SV	Sustainability Victoria
SHPS	Swan Hill Primary School
TFIT	Transitional Feed-in Tariff
TOU	Time of Use (tariff)
TSAT	Tilted Single Axis Trackers
UB	University of Ballarat
VECCI	Victorian Employers Chamber of Commerce and Industry

1. EXECUTIVE SUMMARY

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BACKGROUND

The Solar Cities Program began in 2004 as an initiative of the Australian Government. The program sought to identify and explain the barriers to the uptake of energy saving measures for a wide range of electricity consumers. The program was unique in that it brought together the Commonwealth Government, industry, business councils and the local community to trial a range of product offerings and to consider the cost benefit of each offer relative to its impact on energy consumption. The program supported Solar Cities in seven locations around Australia; Central Victoria, Townsville, Alice Springs, Blacktown, Moreland, Adelaide and Perth. Each of the Solar City Programs was managed by a consortium, often including an electricity retailer and a distributor.

Central Victoria Solar City (CVSC) included several points of difference that made the trial and its results relevant to the big picture policy debate underway in Australia today. The project team and consortium responsible for the implementation of the program will share the findings included in this report with the Australian Government and key players in the design of Australian energy policy.

Central Victoria Solar City was funded by the Australian Government in 2008. Fourteen local governments, covering one third of Victoria's land mass, were included in the trial. CVSC tested energy saving measures in the residential market, for small and medium business, hospitals, community centres and schools. CVSC was delivered by a consortium of industry and community leaders including Origin, Powercor, Bendigo and Adelaide Bank, the Central Victorian Greenhouse Alliance and Sustainable Regional Australia (SRA). SRA, as lead proponent, was accountable for delivery of the program on behalf of the Commonwealth Department of Resources, Energy and Tourism (DRET), formerly the Department of Climate Change and Energy Efficiency (DCCEE). CVSC gratefully acknowledges the funding and expertise provided by DRET, the Victorian Government Sustainability Fund, Sustainability Victoria, and the cash and in-kind contributions of consortium members.

INDEPENDENT EVALUATION

Central Victoria Solar City was the only Solar City that engaged an independent evaluation partner, The University of Ballarat, from inception. The University's role in evaluating the impact of each offer the project tested in the residential trial has been integral to the success of the program. Independent, robust evaluation methodology has allowed the CVSC project team the opportunity to advise government and the energy industry on the impact of each intervention on consumer energy use behaviour.

RESULTS

The Central Victoria Solar City Trial successfully engaged households and businesses in adopting a range of energy saving measures. At the completion of the trial, CVSC found that the following average net energy savings (savings made over and above those made by matched control groups), could be directly attributed to the program:

- Home Energy Assessments - reduced consumption by **9%**
- Solar Hot Water – reduced consumption by **22%**
- Household Solar PV – reduced consumption by **13%**
- In-Home Displays – reduced consumption by **5%**
- Retrofits – reduced consumption by **5%**
- The average energy saving achieved across all residential interventions was **13%**.

The home energy assessment had the greatest impact on the outcome of the trial overall as it acted as the channel through which participants were recruited into other household packages such as Solar PV and Solar Hot Water. The CVSC trial found that home energy assessments achieved savings of 9 per cent of participants' average daily consumption.

The household intervention group overall saved approximately 2kWh per day or 730kWh per annum. This roughly equates to 3million kWh or 3,000MWH of electricity saved by the intervention group over two years after having an assessment. Household participants saved approximately $730,000 over the two year trial[1] as a result of the assessment.

The CVSC trial clearly demonstrated the value of consumer education to achieve behaviour change.

However these results were not shared equally among residents of central Victoria, with almost a quarter of the intervention group falling into the top two household income categories. Renters were significantly under represented with only 2 per cent of the intervention group renting their home. More work is needed to address split incentives between landlords and tenants and to address cost barriers for low income households in accessing energy savings. The consortium acknowledges that the Australian Government's Low Income Energy Efficiency Program may tackle these issues over the next few years.

At the time the Solar City trial was introduced in 2008 the price of solar PV was almost ten times the current price. The solar PV trial's objective, to address the barriers to the uptake of PV, was therefore addressed by market forces, together with improved customer support and community engagement. The value proposition for households to invest in solar PV is now clearly an economic and environmental one. Barriers to uptake were

1. Based on a price in between peak and off peak rates of 25 cents per kilowatt hour.

significantly reduced with the introduction of the three times REC multiplier for 1.5kW systems in 2010. CVSC found that solar PV systems were an effective tool in reducing electricity consumption from the grid, delivering a saving of 13% of participants' average daily consumption.

The CVSC trial found that replacing electric storage hot water systems with solar water heaters was a highly effective way of reducing household electricity use, with gross savings of 41% of average daily consumption being achieved by participants (with 22% of savings being directly attributable to the effect of the CVSC program). Although the retrofit sub-trial achieved a lower average saving than other trials, retrofit participants expressed the greatest satisfaction out of all household sub-trials, suggesting that the offer exceeded expectations.

The project's In-Home Display trial demonstrated the value of smart meters in delivering real time energy use feedback to participants. The consortium acknowledge the contribution made by Powercor in particular in advancing the roll out of smart meters to CVSC participants ahead of scheduled implementation in central Victoria. The CVSC trial has demonstrated the significant role smart meters can play in the future through communicating real time energy use that informs consumer behaviour. The CVSC trial found that participants with an In-Home Display saved an average of 5% on their average daily consumption by monitoring use alone. This is significant when it is considered that the communication was not coupled with a price signal, such as a 'cost reflective pricing tariff', to shift usage to a different time during the day. More work is needed in this area to test the impact of pricing signals on load shifting and energy efficiency.

Solar Parks

CVSC trialed the business model and technology required for communities to generate their own renewable electricity locally by establishing Victoria's first two solar parks in Bendigo and Ballarat. Within the seven Solar Cities, CVSC's solar parks were the only iconic installation which sought to test the commercial viability of solar parks developed through a community ownership model. The CVSC project team worked in close partnership with Bendigo and Adelaide Bank, learning from the bank's renowned community enterprise model, to support communities beginning the journey toward development of their own renewable energy power stations.

Renewable Communities

Renewable Communities was CVSC's most innovative sub-trial. The project was initiated mid-way through the research trial in 2010, when a group of community leaders in Newstead agreed to pursue the challenge of facilitating a 'whole of community' approach to energy saving and renewable energy generation. Newstead's early success in engaging 80% of households in completing a home energy assessment inspired other towns to become involved. In 2011 CVSC hosted the national Community Power Conference to explore the appetite for community owned, renewable power stations.

By the end of the project CVSC had partnered with two other communities, Kyabram and Murchison. The project employed a home energy assessor in each location and built links with local community leaders. CVSC funded a pre-feasibility study to investigate the best option for renewable energy generation in each town, and ran workshops to assist community members to unpack the findings from each study. CVSC's initial community partner Newstead has since partnered with Automation and Power Technologies (ABB) to complete a technical feasibility study into the development of a solar power station.

CVSC found that there were significant benefits to be realised by the development of community owned, renewable power stations. The level of interest in this type of asset increased throughout the life of the Central Victoria Solar City trial. Although the whole of community approach to facilitate energy saving did not have a greater impact on participants' energy use in the smaller towns, residents' appetite for information on community renewable energy was significant. CVSC suggests that this interest is driven by a desire to increase prosperity in regional towns through community ownership of essential services. The precedent set by Bendigo and Adelaide Bank, through the Community Bank model, has sparked regional communities' interest in the viability of taking ownership of services consumed by local residents.

The pre-feasibility studies completed by Crockford McCartney and Earth Systems identify the future potential commercial viability of community renewable energy to generate electricity at competitive prices.

The renewable community trial successfully opened up a regional dialogue on the potential benefits that can be realised through community renewable energy.

Small Business

CVSC offered business energy assessments to one hundred and twenty small to medium businesses. The project team found that the most significant barriers to the uptake of energy saving measures were imperfect information and split incentives between business operators leasing their premises and their landlord. For SME trial participants there was a decrease in energy use of 5%. CVSC suggests that the Australian Government continue researching strategies to address barriers to the uptake of energy saving measures through the Energy Efficiency Information Grants Program.

Health Services

CVSC partnered with Ballarat Health Services to demonstrate best practice in energy efficiency in a health environment. The project included 78kW of solar panels, two electric vehicles and

two industrial solar hot water systems. Ballarat Health Services supported $800,000 in enhanced energy efficiency measures, including an integrated building management system and high performing building materials. The project showcased options for regional health providers in reducing energy consumption and the generation of renewable energy onsite. CVSC and Ballarat Health developed a case study which captured the cost benefit of each intervention tested at Ballarat Health. The project team also wrote to all Victorian hospital CEOs and Boards of Directors to encourage a greater focus on energy saving in the health sector and share new knowledge developed through Ballarat Health Services' energy efficiency precinct.

Schools

Two partnerships were established with 'lighthouse' schools, Castlemaine Secondary and Swan Hill Primary School, to showcase opportunities for primary and secondary school students around the benefits of renewable energy. Twenty-five teachers from across the region also participated in professional development convened by CVSC, which provided an introduction to developing a model solar car and solar boat program within the school curriculum. Based on the Victorian Essential Learning Standards (VELS) these units are now available for all Victorian teachers through the Department of Education and Early Childhood Development website. CVSC also provided ten schools, who engaged a teacher in the professional development program, with $1,500 sponsorship to cover the cost of solar panels and electronics materials to enable students to design and construct solar boats and cars.

Greenhouse Gas Emissions

The annual greenhouse gas reductions achieved by the CVSC project can be divided into reductions achieved through increased energy efficiency and reductions achieved through renewable energy generation. Reductions achieved through the reduced energy use of 'final survey' householders and businesses equalled 1,172 tonnes per annum. Reductions achieved through energy generated from the two Solar Parks, the Health Services trial, Schools trial and the 389 'final survey' household solar PV participants were 2,223 tonnes per annum. Together they represent an annual 3,395 tonne reduction in greenhouse gas emissions in central Victoria as a result of the project.

Acknowledgement

CVSC gratefully acknowledges the role of participants in the research trial. We wish to extend our thanks to members of the control and intervention groups for their contribution to advancing research in energy saving measures. CVSC acknowledge the contribution of the University of Ballarat in providing robust, independent evaluation of the program and consortium members for sharing their expertise and resources in the pursuit of new knowledge.

On a personal note I would like to extend my thanks to the SRA team. Over the life of the project SRA employed 28 people across 14 local government areas. Working with you was a great honor and your contribution to advancing energy savings in central Victoria is commendable.

Leah Sertori
CEO, Sustainable Regional Australia
Project Director, Central Victoria Solar City

2. INTRODUCTION

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The purpose of this final report is to publish the findings from the Central Victoria Solar City trial and make recommendations to key stakeholders around the uptake of energy efficiency measures. The report provides an overview of the purpose of the research trial and the rationale for government and private sector investment. It highlights the consortium's approach to testing energy saving measures in the residential, business, community and public sectors. The report includes results from the trial in two key areas, energy savings and engagement. The report's commentary aims to explain the impact of each intervention on participants' energy use, and in the case of the household and small business trials, participants' average daily consumption of electricity. This report also shares observations relating to community engagement in the project, including the impact the project has had on energy literacy and the appetite for community renewable energy in Central Victoria.

The Solar Cities program worked to a broad brief, to identify the barriers to the uptake of energy efficiency and trial solutions to overcome those barriers. Central Victoria Solar City sought to identify and overcome barriers to the uptake of energy saving measures in diverse market segments including residential, small to medium business, local government, health services and schools.

CVSC's partnership with the University of Ballarat allowed the project to present impartial, scientific analysis of data controlled for variance in weather, participant values and beliefs, and other external influences that may have impacted on participants' average daily consumption. The value of independent evaluation is evident in this report, as the Central Victoria Solar City trial findings have isolated the real impact of the intervention on participants' energy use.

Capturing the Needs and Interests of Regional Australia

As the only large, regionally based solar city, CVSC sought to understand the specific interests and needs of regional Australian communities in relation to energy efficiency measures and renewable energy. CVSC found that the price of electricity was an issue affecting regional centres and towns as many communities do not have access to the reticulated gas network. Local governments expressed the need for a hedge against the rising cost of electricity for their residential and commercial customers. CEOs and mayors stated that their interest in the project was in informing a strategic approach to energy efficiency. They expressed interest in facilitating a whole of community approach to energy efficiency and gaining a better understanding of the opportunities to develop solar energy and waste-to-energy power stations.

Both energy industry and regional community leaders engaged in the Renewable Communities trial acknowledged that developing a strategy for the future generation, distribution and sale of electricity at the local level was complex and involved significant work during the 'pre-feasibility' stage. Despite this, stakeholders acknowledged that local electricity generation might form part of the solution to delivering electricity at predictable prices to local customers in the future.

The Impact of Energy Saving Measures

This final report outlines the impact of each intervention on residential and business participants' energy use. The CVSC trial identified the home energy assessment as a successful tool in engaging participants in behaviour change and supporting the take up of energy saving measures such as solar hot water systems, solar PV and retrofitting activity.

CVSC found that once participants were engaged in a home energy assessment they were then able to consider how appropriate each intervention product may be for their home. The rate at which participants engaged in CVSC's other product offers, after completing an assessment, was relatively high. This suggests that a major barrier to the take up of energy saving measures is a lack of access to expert advice and points to an opportunity to increase the availability of home energy assessments. However, the assessment, while proven to be highly valued by participants, was not a service that CVSC participants were willing to pay for. The majority of participants responded that they would be willing to pay less than $100 for a home energy assessment, one third of the provider's cost of delivering the service.

Authorship

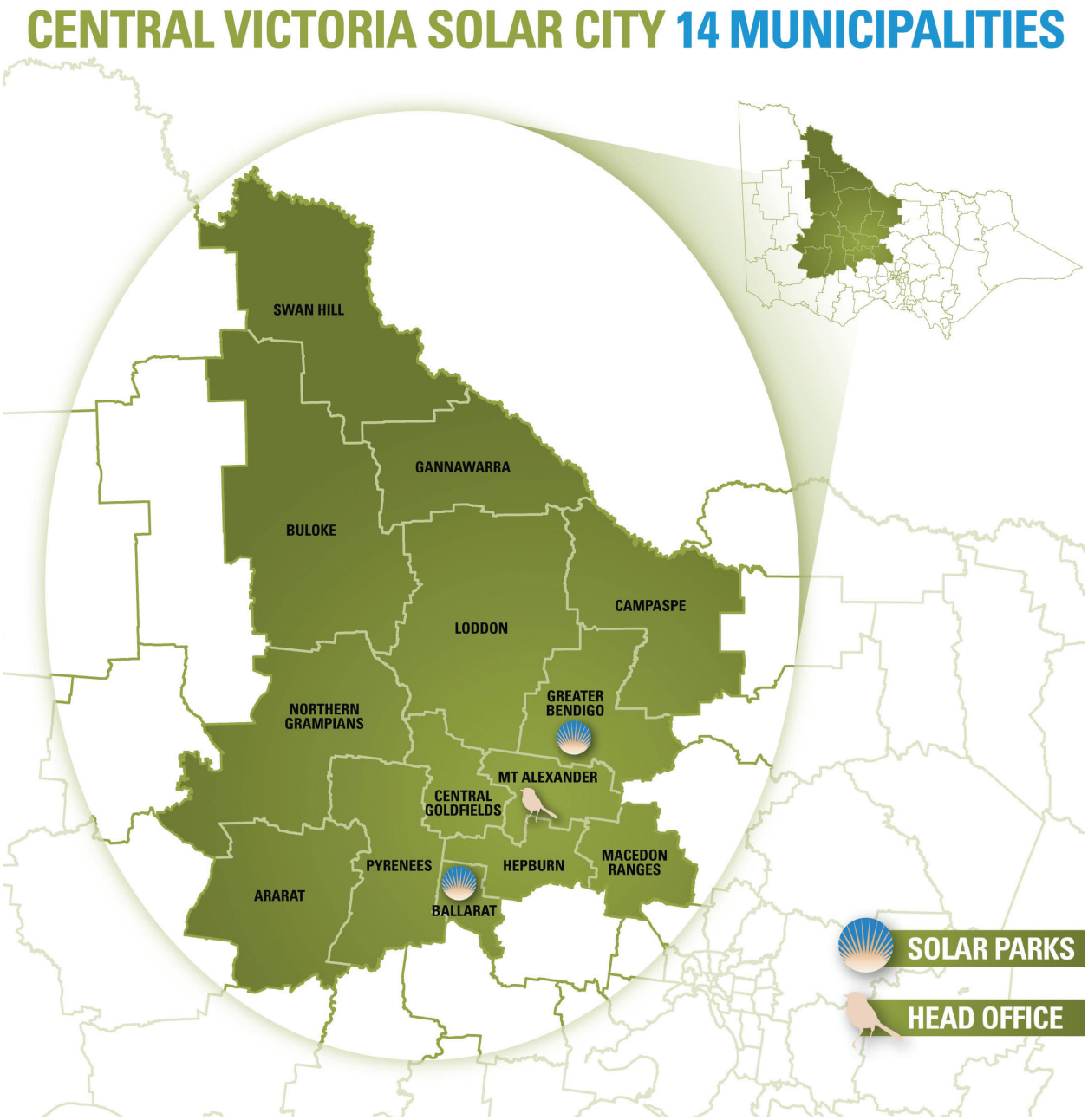
This report was written by Central Victoria Solar City with assistance from the University of Ballarat (UB). CVSC leads discussion on strategies used to engage program participants and discussion of the barriers and potential solutions to increasing energy efficiency across various market segments. The University of Ballarat provided sections describing research design, methodology, participant profiles and analysis of the program's influence on household and business energy consumption. The University of Ballarat will also publish an academic evaluation of the CVSC trial. The report will be made available on SRA's website.

Delivery by a Consortium

The Australian Government introduced the national Solar Cities trial by calling for expressions of interest from consortiums suitably qualified to conduct a research trial into energy use. The initial bid for Central Victoria Solar City was lead by the Central Victorian Greenhouse Alliance (CVGA) who approached consortium members Bendigo and Adelaide Bank, Powercor and Origin to bid for a project based across the CVGA's 14 municipal members.

CVGA approached Powercor and Origin to join the consortium to leverage their knowledge of the energy industry and draw on their combined capability around innovative product and service delivery. Origin's role within the consortium included the provision of products such as household solar PV, solar hot water systems and retail electricity plans. Powercor supplied and installed smart meters to participants ahead of the scheduled Victorian roll out. Powercor also provided In-Home Displays paired with smart meters to provide participants with a reading of their electricity consumption in real time, and PV check meters to measure the gross energy output of those participants who had solar PV installed.

Bendigo and Adelaide Bank joined the consortium to provide finance for Victoria's first solar parks, delivered through the CVSC trial. At the time the consortium was developed, securing finance for the development of renewable power stations such as the



solar parks was challenging as the level of risk taken by the financier was deemed to be high. The CVSC consortium members worked together to inform the credit application that secured finance through Bendigo Bank. The project would not have been in a position to test the business model for community renewable energy without the support of the consortium, and in particular, Bendigo and Adelaide Bank.

In 2006 the consortium members agreed to develop a special purpose entity to deliver the Central Victoria Solar City program. The scale and complexity of the project warranted the creation of a new business to engage participants, manage the research partnership and develop relationships with local stakeholders. CVGA founded Sustainable Regional Australia Pty Ltd to act as lead proponent of the program.

The consortium developed a governance model consisting of a Steering Committee and three sub-committees: marketing and communications, data and operations. The Steering Committee provided governance for the delivery of the project and compliance with the funding agreement. All decisions relevant to project design were signed off by the Steering Committee which met monthly throughout the life of the program. Each sub-committee was responsible for leveraging consortium member expertise to enhance aspects of the project's strategy, product and service delivery.

The marketing campaign for CVSC's home energy assessments was a good example of the extent to which the project effectively leveraged consortium members' capabilities. Bendigo and Adelaide Bank encouraged customers to sign up for a free home energy assessment through its 32 branches operating in the region. Bank branches featured prominent window display advertising promoting opportunities to save energy through an assessment. Origin supported the campaign through a direct mail out, advertising on their bills to customers in the region, and newspaper advertising. Powercor leveraged their skill base in engaging with local media and CVGA engaged in face to face discussions with mayors and CEOs of local governments to increase awareness of the offer. The sub-committee structures increased the overall capacity to the small project team employed by SRA.

The consortium sub-committees also proved an effective mechanism for addressing challenges and improving the customer experience. Market settings changed constantly during the period when 1.5kW subsidised household solar PV systems were offered by the trial. Changes included changes to the system price, the feed-in tariff that customers could access, and timelines for installation and connection. The consortium's operations sub-committee established a weekly review of all CVSC customers in the pipeline for solar PV installation. By establishing this group, SRA was able to provide PV customers with visibility around where their installation was up to at each point throughout the process, which led to increased customer satisfaction.

The main benefit of the project's consortium approach was the capacity to leverage resources and expertise from large corporate entities whilst deploying a program via a nimble company with the capacity to make decisions at the local level.

Consortium members found that the ingredients for success within the consortium included a common vision and shared purpose, effective governance and communication.

CENTRAL VICTORIA SOLAR CITY CONSORTIUM

Sustainable Regional Australia

Sustainable Regional Australia (SRA) was the lead proponent of the Central Victoria Solar City research trial. SRA managed the day-to-day delivery of the CVSC project from its head office in Castlemaine. SRA is a company passionate about helping regional communities create solutions that reduce energy use and assist in the development of locally owned, renewable energy assets.

Powercor

Powercor provided all metering installation and support for the Central Victoria Solar City program. Powercor offered the installation of a smart meter for the household trial participants at no cost. Powercor also provided interval or smart meters for the control group. Powercor offered strategic guidance and input into the delivery of each of CVSC's offers, in particular photovoltaics (PV) and the provision of In-Home Displays. Powercor provided in excess of $3.3million in-kind support to the CVSC initiative.

Bendigo and Adelaide Bank

Bendigo and Adelaide Bank championed the development of Australia's only regionally based Solar City, CVSC, to highlight the capability of regional and remote communities in reducing energy use and generating green energy innovatively. Bendigo and Adelaide Bank provided more than $14million in-kind in the form of intellectual property and access to financial products that CVSC would otherwise have found difficult to procure.

Origin

Origin provided CVSC's 1.5kW solar photovoltaic systems to the residential market. Origin played a leadership role in the design and construction of CVSC's two solar parks in Bendigo and Ballarat. Origin provided operational support and strategic guidance to the project overall, contributing to the key findings from CVSC's trial related to pricing and solar PV. Origin was also the lead proponent of Adelaide Solar City. Origin provided in excess of $3.5million in-kind to the CVSC initiative.

Central Victorian Greenhouse Alliance

CVGA initiated the Central Victoria Solar City project by rallying interested parties and coordinating the bid process. The bid took over 12months to develop and involved diverse stakeholders across 14 municipalities, energy retailers and distributors and all levels of government. CVGA continued to support the CVSC initiative by providing input from member councils and strategic guidance. CVGA contributed more than $1million in-kind to the CVSC project.

The team at Sustainable Regional Australia

FUNDING PARTNERS

The Department of Resources, Energy and Tourism

The Department of Resources, Energy and Tourism (DRET), formerly the Department of Climate Change and Energy Efficiency, provided $14.9million over five years to Central Victoria Solar City. Commonwealth funding supported the development of CVSC's two solar parks in Bendigo and Ballarat, rebates offered to residential participants, major projects at Ballarat Hospital and Swan Hill Primary School and formal research carried out by the University of Ballarat. The Commonwealth also funded the provision of free home energy assessments to household trial participants and subsidised energy assessments for small business trial participants.

Sustainability Victoria

Sustainability Victoria supported the Central Victoria Solar City initiative by providing $1.5million over five years. Sustainability Victoria's contribution supported the delivery of free home energy assessments, subsidised business energy assessments and development of battery storage at the Bendigo Solar Park.

Sustainability Victoria was a major supporter of Central Victoria Solar City's 100% Renewable Communities Program, delivered in Newstead, Murchison and Kyabram.

The Victorian Government Sustainability Fund

The Victorian Government Sustainability Fund (SF) supported CVSC by providing $1million over five years to contribute to the cost of the research and evaluation component of the initiative. The Victorian Government Sustainability Fund also supported CVSC in sharing the interim findings from the initiative through the Sustainability Funds's well established networks.

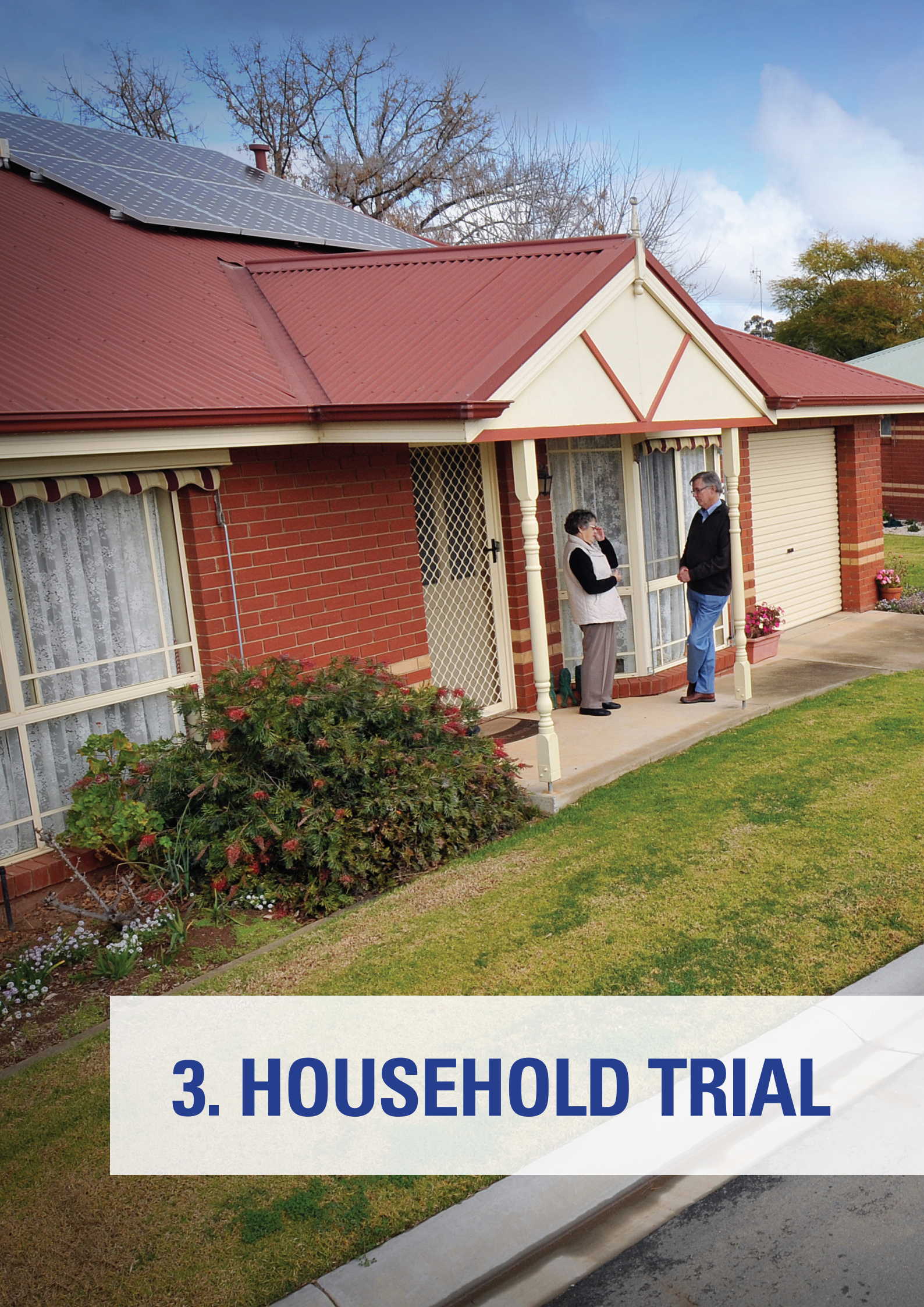
RESEARCH PARTNER

University of Ballarat

The University of Ballarat, through the Centre for Regional Innovation and Competitiveness (CRIC), and the Centre for Informatics and Applied Optimisation (CIAO), was responsible for providing the monitoring and evaluation component of the Central Victoria Solar City program. The University brought academic rigor and a robust methodology to the trial, using longitudinal analysis to assess different energy technologies and hypotheses relating to energy use behaviour change.

ACKNOWLEGEMENTS

Central Victoria Solar City would like to acknowledge the University of Ballarat, the Consortium and the SRA team for their report contributions, and Neriman Kemal and Greengraphics for their work in compiling this report.



3. HOUSEHOLD TRIAL

3.1 Introduction

Evaluation Background

The CVSC research trial was designed to gain a better understanding of consumer response to the adoption of energy efficiency technologies and services. As a funding requirement, the CVSC consortium partnered with the University of Ballarat (UB) to provide an independent evaluation of the program. This evaluation was delivered by two of the University's designated research centres:

- Centre for Informatics and Applied Optimization (CIAO) located in the School of Science Information Technology and Engineering
- Centre for Regional Innovation and Competitiveness (CRIC) located in The Business School
- UB's responsibilities included developing the evaluation design, theoretical and conceptual frameworks, the development and administration of survey instruments, data collection, uploading of data to meet DCCEE requirements and data analysis.
- The evaluation was designed to assess changes in energy use attributable to the CVSC program and each of its interventions. The key research questions included:
- What influence do technological, behavioural, social and economic factors have on the adoption of energy efficiency technologies and energy use?
- How do demographic and attitudinal characteristics influence the demand for CVSC packages and demand for energy?
- What combinations of measures provide the most effective and CO2 efficient energy consumption?

The CVSC program is unique in that it partnered with a tertiary institution to provide an independent evaluation of the program. This partnership provides a systematic and independent approach for collecting, analysing, and using information from the trial to improve future energy efficiency programs. The findings from this research are expected to improve knowledge and understanding of how energy efficiency programs work, assess program effectiveness and identify opportunities to increase energy efficiency. Such knowledge will help to ensure better policy decisions aimed at achieving energy security and lowering carbon pollution.

The Household Trial Product and Service Suite

The household trial's original product and service suite was launched in late November 2009. In May and June 2010 the CVSC project team revised the offer, responding to household feedback around cost barriers and information complexity. The revised suite, launched in July 2010, reflected a better understanding of customer expectations around value for money, such as the change in the Solar PV offer from a 2kW system priced from $6-$7,000 to a 1.5kW system priced from approximately $3,000.

The Home Energy Assessment offer, originally priced at $495 upfront, with a total of $550 in bonuses paid after various trial process and research obligations had been fulfilled, was also changed. At the centre of the revised product suite was a now free, 90 minute Home Energy Assessment (HEA). During this assessment householders could learn how to reduce their energy use through changes in energy use behaviour and household infrastructure. Once a participant experienced their free home energy assessment they were then eligible to consider a number of other products and service packages, including:

- The Retrofit Package, where participants could improve existing household fixtures and fittings to reduce energy use. Once participants spent $2,000 they received $500 cash back
- The Solar Hot Water Package, where participants received $500 cash back after acquiring a solar hot water service of their choice
- The Household Solar PV Package, where participants generated their own electricity at home through the purchase of a 1.5kW household solar PV system, and
- The In-Home Display (IHD) Package, where participants could test the value of near real-time feedback on energy consumption through an in-home energy display. This package was introduced in early 2011.

At the end of the household trial HEA participants who fulfilled all research obligations automatically went into a draw to win an eco-holiday valued at $5,000. In addition, Retrofit, Solar Hot Water and Household Solar PV Package participants who fulfilled research obligations also received a $250 performance bonus.

3.2 Methodology

The following section summarises the research design and methodology used to assess the benefits of the CVSC program. In particular, this section explains the evaluation design, participant recruitment and data collection and analysis procedures.

Evaluation Design: Household Trial

Impact evaluation seeks to answer a fundamental question: what would have happened without the program? Although it is not possible to observe how participants would have behaved without the program, it can be estimated by reference to a control group, the makeup of which is as similar as possible to the intervention group.

The voluntary nature of participation in energy efficiency programs often means that a true experimental design with randomly assigned treatment (i.e. intervention group) and non-treatment (i.e. control group) groups is not possible. As intervention group participants volunteered for the CVSC program's different interventions, rather than through random assignment, a non-equivalent groups *quasi-experimental design*[2] (NEGD) was adopted for this study - see Figure 3.2.1. A simple pre-post design without a control group would not allow for testing of whether differences would have occurred without the intervention. Therefore, this study has used a pre-post design with matched control groups to enable measurement of changes in electricity use attributable to the CVSC program's interventions.

Recruitment

The following details the different methods used to recruit intervention group and control group participants. The objective of these approaches was to ensure that each group was as similar as possible to allow for reasonable comparisons.

INTERVENTION GROUP

Sustainable Regional Australia (SRA), who lead the CVSC program, were responsible for recruiting both household and small to medium business (SME) trial intervention group participants. The most common interventions adopted by household research participants were HEAs (98%), household solar electricity (27%), in-home displays (24%) and the retrofit package (14%). A low proportion of research participants installed a solar hot water system as part of the program (4%) – see Table 3.2.1.

Table 3.2.1: Distribution of intervention group participants by CVSC package

Intervention	#	%
HEA	1,830	98%
Household Solar Electricity	482	27%
In-Home Displays	429	24%
Retrofit	350	19%
Solar Hot Water	65	4%

Notes: Due to multiple interventions per participant, figures sum to over 100%. A small proportion of participants (2%) joined the program before its re-launch and did not receive an HEA.

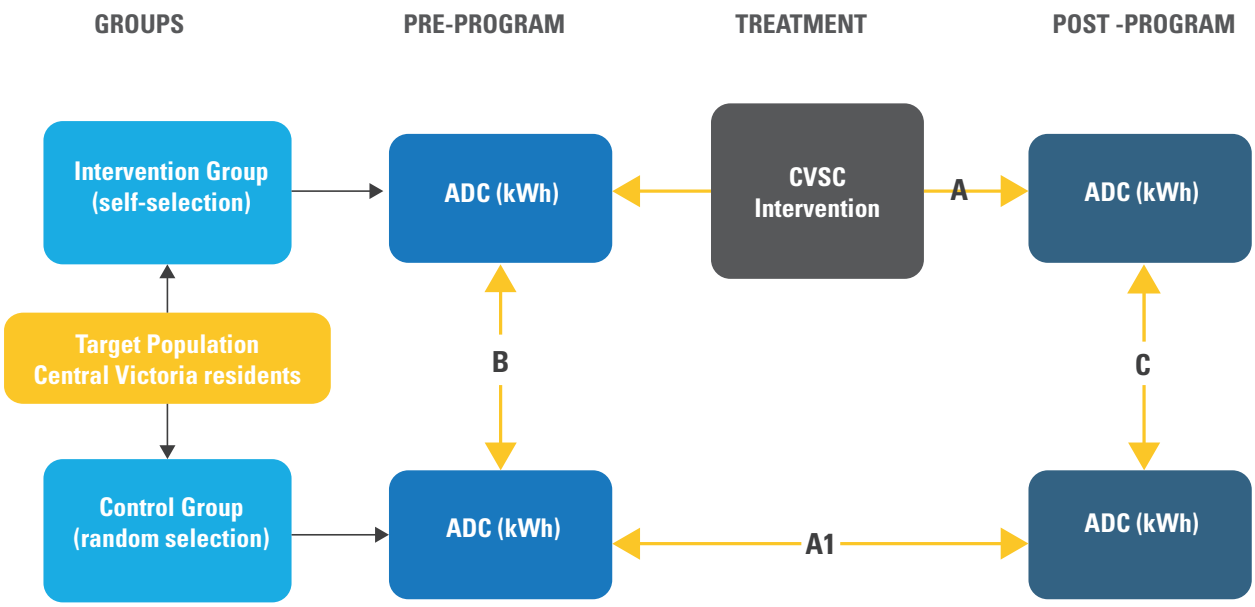


Figure 3.2.1: Evaluation Design

2. In Studies adopting the NEGD approach, assignment to treatment and control groups is not random.

CONTROL GROUP

Prospective control group participants were recruited using a short environmental values telephone survey with randomly selected households in the Central Victoria region. Recruitment was conducted over the first three quarters of 2010. During the recruitment process, 4,954 households completed the first survey, with 2,894 (58%) agreeing to receive further information about joining the CVSC evaluation's control group. After distributing these information packages, a quarter of recipients elected to join the project, which resulted in a control group of 715 households.

Data Collection

A longitudinal design was employed for the household trial, with measurements at baseline (and before baseline for some measures, e.g. historical energy consumption) and at intervals throughout the remainder of the project. As indicated by Figure 3.2.2, three major data sources were collected and monitored for the household study: electricity consumption, participant surveys and climate data.

To collect information about the determinants of household energy consumption, baseline surveys were administered with all participating households as part of the sign-on process. Two follow-up surveys, delivered in 2012 and 2013, were also used to measure changes in household characteristics, adoption of HEA recommendations, program satisfaction, free-ridership, spill-over and attitudes and barriers relating to energy efficiency and adoption of solar technologies.

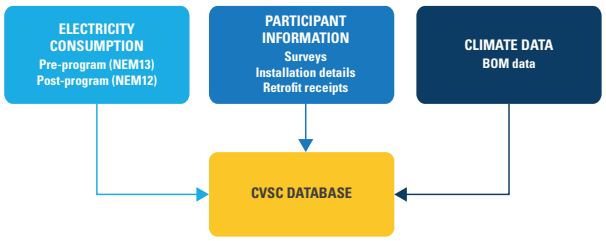


Figure 3.2.2: CVSC Evaluation Data Sources for the Household Trial

Data Analysis

All data sets were subject to stringent examination to ensure the negative impacts of survey errors, missing data, outliers and violations to assumptions of statistical tests were mitigated. Such quality control procedures help ensure that findings reported throughout the evaluation have a rigorous foundation. The details presented in this report represent a high-level summary of the evaluation. A more detailed report, The University of Ballarat Evaluation of the Central Victoria Solar Cities Program (2013), containing the full analysis, will also be published and made available.

Matched Pairs

A problem in quasi-experimental research designs is that there may be differences between the intervention and control groups outside program participation (Stuart, 2010). In such cases, any observed differences between the groups for variables of interest (e.g. electricity use) might be due to external reasons (e.g. climate, gas connection, demographic characteristics) rather than the intervention itself. Therefore, there is a need to reduce such potential bias through a statistical process called matching. This process aims to find control group members with similar characteristics to one (or more) intervention participant(s).

To enable valid comparisons, statistical matching was applied to correct for differences between the CVSC program's intervention and control groups. This involved matching program participants in both groups based on their likelihood to take part in the program given observed characteristics (e.g. geographic location, housing and demographic characteristics) – see Figure 3.2.3. This matching process corrected differences in characteristics between the two groups and thus, reduced potential biases from non-program factors.

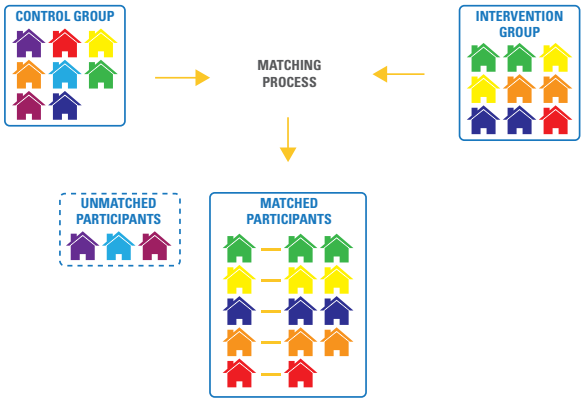


Figure 3.2.3: Matching Process

Modelling

Statistical models were used to compare energy use of the intervention and control groups. This analysis was directed at comparing changes in electricity use between intervention and control households; before (December 2009-November 2010), during (December 2010-November 2011) and after (December 2012-February 2013) the intervention period. This difference in differences measure represents the total change in energy use attributable to the CVSC trial and each of its interventions.

3.3 Participants

Participation in the CVSC program was a staged process that involved degrees of commitment. After being initially exposed to the CVSC program, 2,750 households were engaged in a Home Energy Assessment (HEA). Following completion of the HEA, a high proportion of participants (86%) chose to commit formally to the program by signing a participation agreement. This resulted in 2,483 households being offered the opportunity to join one or more of the programs other energy efficiency packages: retrofit rebate, solar hot water, household solar electricity or in-home energy displays.

The final step in the recruitment process was achieved by 1,196 households completing all the required household surveys for the trial. This represented 43% of the original HEA households engaged and was considered to be a strong response to the research requirements of the CVSC program. These households, and the randomly selected control group of 528 households, represented the program's research participants. The CVSC program evaluation is based on data collected from these groups of households.

Recruitment to the CVSC trial as a research participant required participants to complete two follow- up surveys which resulted in a funnelling effect with regard to commitment to the CVSC trial overall. This effect becomes evident as households move through the different selection stages from initial engagement to research participation, and is illustrated by Figure 3.3.1 and summarised in Table 3.3.1.

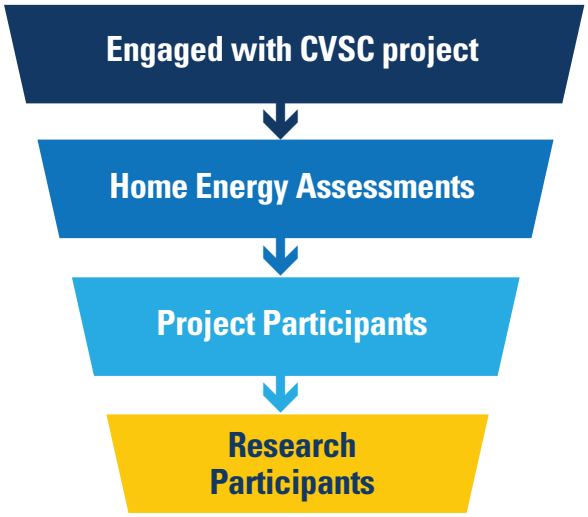


Figure 3.3.1: Intervention Group Recruitment

Intervention Group	#
Home Energy Assessments completed	2,750
Initial research participants	1,830
First follow-up survey participants	1,359
Final follow-up survey participants	1,196

Table 3.3.1: Participants by stage

Drop-out is experienced in nearly all longitudinal studies. For the CVSC evaluation, the major reasons for drop-out were participant withdrawal, moving house, loss of contact and morbidity. Baseline participant profiles were based on initial research participants, as this group is most likely to be representative of all program participants. As it is necessary to ensure that households have remained at the same place of residence throughout the study's pre- and post-intervention periods, only households completing all survey requirements (1,196) were used to assess the impact of the CVSC program and each of its packages on energy use.

As indicated by Table 3.3.2, households that took part in a program package with a financial bonus or rebate (Retrofit, SHW, Household Solar PV) were most likely to fulfill the study's research requirements. This fulfillment required the completion of a follow-up survey in late 2012 and a final survey in early 2013. This finding indicates that financial incentives are effective in retaining research participation.

Intervention	Initial Research Participants	Follow-up Research Participants	Final Research Participants	Retention rate[2]
Home Energy Assessments[1]	1,830	1,359	1,196	66%
Household Solar Electricity	482	413	397	82%
In Home Displays	429	345	328	76%
Retrofits	350	301	284	81%
Solar Hot Water	65	65	55	85%

Table 3.3.2: Research participants by survey stage

Notes: [1] HEA households that completed all survey requirements were eligible to go into a draw for an Eco Holiday valued up to $5,000
[2] Proportion of initial research participants fulfilling final research requirements

Control Group

Control group participants were recruited by UB using a short environmental values telephone survey with randomly selected

households in the Central Victoria region. Recruitment was conducted over the first three quarters of 2010. During this stage, 2,894 households agreed to receive further information about participating in the CVSC evaluation's control group. Following receipt of this information, 715 completed the study's initial research requirements. Nearly three-quarters of these participants (528) completed the study's follow-up and final surveys.

Regional Participation

With low recruitment in some areas it was necessary to combine some LGAs for analysis purposes. The process of combining areas was based on regional proximities and climate characteristics, and is summarised in Table 3.3.3. Central Victoria's two largest population areas of Ballarat and Bendigo were well represented in both the intervention and control groups, with strong recruitment also occurring within the Mount Alexander Local Government Area (LGA). These areas provided over 40% of the program's intervention group. Compared with ABS population profiles, the Mount Alexander, Central Goldfields and Hepburn regions were over-represented in the intervention group, while Ballarat was significantly under-represented. For control group participants, Ballarat was over-represented, while the Northern and Western areas were under-represented.

	Households in region	Intervention group	Control group
Ballarat	22%	10%	35%
Bendigo	25%	25%	24%
Highlands (Macedon Ranges; Hepburn)	13%	17%	14%
Mt Alexander	5%	20%	7%
Northern (Buloke; Gannawarra; Loddon; Campaspe; Swan Hill)	21%	19%	12%
Western (Northern Grampians; Ararat; Central Goldfields)	11%	13%	6%

Table 3.3.3: Proportion of Households recruited in each LGA

Demographic Profiles

The CVSC program has mainly recruited participants who are home-owners or have mortgage commitments, are married or living with a partner and have English as their primary language. Renters were significantly under-represented with only 2% of the intervention group and 7% of the control group joining the trial renting their properties. As survey respondents were the household's key decision-makers for energy use, it was not surprising that both groups were older than the general population. About half the participants in both control (52%) and intervention groups (50%) were aged 55 years or more. Home Energy Assessors reported that younger members of the community were a difficult group to engage across all regions.

Thirty-one percent of the control group and 27% of the intervention group were retired. Persons in full-time employment were well represented in the study. Control group participants were generally representative of the CVSC region; however, there were significant differences between the intervention group and the CVSC region with two-thirds of intervention group participants (67%) in full-time or part-time employment compared to 58% for the region. The CVSC program also attracted a higher proportion of white-collar workers than that of the general regional population.

Compared with the CVSC regional profile, significant differences were observed with respect to income levels, as shown in Figure 3.3.2. Participants in both the intervention and control groups were more likely to have higher annual incomes than the general population. Almost a quarter of the intervention group (24%) were in the top two household annual income categories compared with 18% for the control group and 13% for the CVSC region (ABS 2006 data).

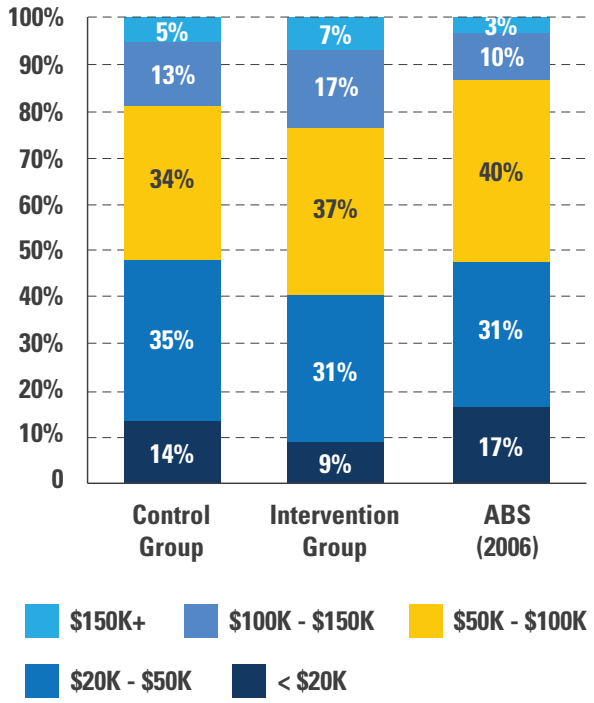


Figure 3.3.2: Distribution of household income by group membership and ABS (2006)

The program attracted those with higher levels of formal education. Although people with TAFE qualifications were under-represented in control and intervention groups, the total proportion of participants with post-secondary qualifications was significantly higher than in the general population within the CVSC region. Significant differences between the control and intervention groups were also observed, with 57% of the intervention group having completed tertiary studies compared with 49% of control group.

As reported in the CVSC Annual Report (2011/2012), intervention group households, compared with the control group, were significantly more likely to have undertaken energy curtailment behaviours, be members of environmental groups, and have adopted some form of solar technology prior to the commencement of the trial.

Overall, the intervention group was "greener" than the control group. This may be partly a reflection of the recruitment methods used by the HEA assessors (e.g. tapping into environmental group networks); but, it may also suggest that the CVSC program has engaged with households that were already leaning towards stronger environmental values.

Finally, analysis of the survey data revealed that intervention group households expressed stronger intentions to reduce energy and buy energy saving appliances and were generally:

- more thoughtful (than impulsive) when deciding about energy use;
- more knowledgeable about energy conservation matters; and
- believed they had greater control of their household's ability to use less energy.

Although such discrepancies are not surprising for a voluntary energy efficiency program, previous research has shown that such self-selection bias can lead to an over-estimation of program-induced energy savings. To mitigate the influence of such bias, statistical matching was used to control for differences and make the intervention and control groups more comparable.

Satisfaction Levels and Barriers to Participation

A follow-up survey was administered to all research participants in late 2012 to obtain, among other things, feedback from participants to measure satisfaction levels, adoption of HEA recommendations and reasons for joining the program. Table 3.3.4 summarises satisfaction, value and quality levels relating to the HEAs as reported by households with respect to each of the intervention groups. For participants who undertook an intervention in addition to the HEA, the experience was significantly more positive than participants who were engaged in a HEA (only). While all levels were relatively high, the ratings for HEA (only) households for satisfaction and value were significantly less than other interventions.

Over a quarter of participants receiving the HEA indicated that they had carried out all or most of the recommendations provided by their assessor. The majority of participants (66%) indicated that they had carried out some but not all of the recommendations provided. The major reasons nominated for not carrying out any HEA recommendations were financial considerations (48%) and planning to do it in the future (30%).

The major reasons for joining the program related to economic issues (save energy/reduce bill), while environmental concerns (e.g. sustainability, climate change) were of secondary importance. Conversion of interest into adoption of CVSC packages was highest for IHDs (84%) and the retrofit package (71%). Financial considerations represented the most significant barrier to participation for HHSE (31%), SHW (47%) and Retrofit households (37%). There was also evidence that a number of households interested in the HHSE (39%) and SHW (15%) packages decided to purchase a system outside the CVSC program.

Word-of-mouth (i.e. recommendations from friends or relatives) was of low influence compared to the economic or environmental reasons. Economic factors (save energy/reduce bill) were the major reasons for joining the program across each package group. The influence of evaluating home energy efficiency was higher for participants in the HEA (only), Retrofit and IHD groups than those who were part of the HHSE or SHW packages. In contrast, rebates associated with the program were not as influential for HEA (only) and IHD participants than those that bought an extra package. This suggests that participants joining the program for informational purposes were less likely to invest in the program's additional energy efficiency packages.

	Intervention Group	HEA (only)	RETRO	HHSE	SHW	IHD
Satisfaction	83%	80%	87%	85%	88%	85%
Value	76%	73%	80%	77%	81%	77%
Quality	86%	85%	88%	86%	85%	86%

Table 3.3.4: HEA satisfaction, value and quality ratings by intervention

3.4 Community Engagement

BACKGROUND

CVSC's community engagement strategy sought to enroll households in the residential research trial, as well as engage and maintain positive relationships with key stakeholders, including three levels of government, schools, businesses and a major regional hospital, and effectively share research findings. Three campaigns were run to deliver these objectives, the "Local Energy Solutions Campaign", the "Home Energy Assessment Team Campaign", which were both discussed in depth in last year's Annual Report, and the "Sharing the Knowledge Campaign", to disseminate findings from the research trial.

Local Energy Solutions Campaign

The campaign raised project awareness with two major launch events and delivery of a "Local Energy Solutions" multi-event Roadshow (29 presentations) across the 14 municipalities. The campaign also utilised above-the-line brand advertising and in-kind marketing support by stakeholders, including local councils and climate action groups. This campaign was not successful at formally engaging participants due to a relatively expensive service offering and product suite eg. CVSC's initial home energy assessments were priced from $495.

Home Energy Assessment Team (HEAT) Campaign

The HEAT campaign was designed to secure required participant engagement levels. This was done through customer-focused engagement that assured simplicity and ease of participation. Participants were engaged through a free home energy assessment, before deciding whether they would also adopt other products and services on offer. The campaign was launched following re-design of the product and service offering. CVSC offered home energy assessments at no cost and household PV from $199 upfront. The introduction of 'on-bill finance' and lower cost offerings, together with the HEAT campaign, led to successful engagement. Key elements of the HEAT campaign included:

- Simple messaging
- An advertising campaign showcasing each shire's 'trusted local face of energy'. Assessors were featured in DL flyers and through full-colour half page and strip advertising in newspapers across 14 shires.
- A Bendigo and Adelaide Bank Level 1 campaign consisting of street-facing advertising in the front windows of 32 branches as well as in-branch promotion.
- Origin Energy's $200,000 letterbox drop of their regional customers to support achievement of CVSC's engagement result for household solar PV.
- An engaging website to promote the offer and provide an online pathway for sign-up.
- Employment of a customer support officer available by phone to answer enquiries.
- Community group presentations, workshops and regular e-news updates.

HEAT Campaign Advertising

Sharing the Knowledge Campaign

The release of the 2011-2012 Annual Report signalled the beginning of CVSC's "Sharing the Knowledge" campaign, designed to distribute trial learnings. All major stakeholders received a copy of the Annual Report and all intervention participants received a four page project interim summary that shared key project achievements whilst omitting findings that might have influenced participant behaviour change. Stakeholders were also invited to the "Central Victoria's Energy Future" forum that the project hosted in November 2012. Fifty-nine representatives from across the 14 shires (municipal representatives, climate action groups, business leaders, state government) attended to hear and discuss interim findings of the trial. State and federal government stakeholders also received private briefings and in October 2012 Project Director Leah Sertori

presented interim findings at the National Solar Cities Conference in Brisbane.

The members of the CVSC consortium developed new knowledge and insights through the delivery of the program. Sustainable Regional Australia, as lead proponent, has gathered significant insights into the barriers to the uptake of energy efficiency. SRA has shared its experience and knowledge through submissions to the Productivity Commission, the Victorian Department of Primary Industry and the Australian Energy Market Commission. This final report on the outcomes of the trial and our recommendations will be presented to funding partners and key stakeholders in June and a copy will also be sent to each research participant in the program.

FINDINGS

The key finding of CVSC's primary engagement campaign, the HEAT campaign, was that face-to-face engagement by a trusted, independent, local home energy team assessor (HEAT) was successful in engaging consumers in the uptake of new energy use behaviour, products and services (Figure 3.4.1). The introduction of the Home Energy Assessment, at no cost, together with face-to-face engagement, supported by an above-the-line campaign, which included extensive print advertising and free media stories highlighting discounts, rebates, and good news case studies, increased sign-up rates dramatically.

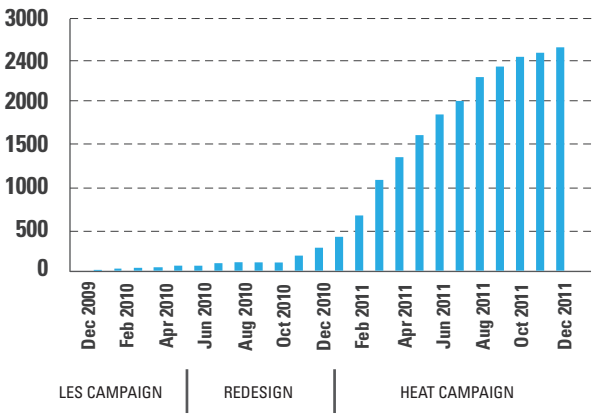


Figure. 3.4.1 CVSC Community Engagement Campaigns

With regard to the relative influence of various communications channels:

- Program participants were most likely to first learn about the program through newspaper advertisements (18%), friends or relatives (15%) or e-mail (14%).
- Participants were most likely to be exposed to program information through CVSC e-mails (58%), newspaper advertisements (34%) and the program's website (24%).
- The information sources that had the highest influence on the decision to participate in the CVSC program were community presentation(s), personal networks and friends or relatives, and
- The information sources with the strongest influence on participation were friends or relatives and community presentation(s).

DISCUSSION

Central Victoria Solar City's original engagement campaign, "Local Energy Solutions", was devised to support an original product offering that was complex and relatively expensive compared with today's prices. As a result the campaign struggled to enlist participants. This was compounded by a reliance on third party service delivery through local government and climate action groups. The CVSC project team believes that the HEAT campaign, which centred on local assessors making direct presentations to their community, using simple, clear information, worked well in engaging participants because community members trusted local assessors and the positive feedback about the project shared by their personal networks, friends and relatives. Contributions to this campaign from consortium partners, using their own networks and channels, drove further engagement. The project's first 100 bookings, after the launch of the HEAT campaign, came from staff at Bendigo and Adelaide Bank. Origin Energy's mail out, promoting the Solar PV offer to CVSC region customers, and Bendigo and Adelide Bank's advertising of a free home energy assessment in the front windows of 32 branches drove further engagement.

The three information sources that had the highest influence on the decision to participate in the CVSC program were community presentation(s), personal networks and friends or relatives. This finding highlights the importance of social sources on the decision to participate in energy efficiency programs. Councils were found to be influential but underexposed engagement sources. The CVSC project team believes that engagement programs that focus on a quality customer-centred experience, with face-to-face engagement and support from traditional media advertising, have a high likelihood of securing participation.

A quality customer experience increases the likelihood that friends, family and the personal networks of that customer might be inspired to participate. An important element of providing this participant engagement experience was the employment by the project of a customer service support officer who could troubleshoot supplier product and service queries during and after the sales and installation process. As a result of its consortium relationships, CVSC had a direct link to both retailers and distributors to help achieve a positive outcome for customers.

CVSC found that key stakeholders valued regular updates on the emerging trends and findings discovered through the trial. Annual forums illustrating new knowledge were found to be useful in facilitating a regional discussion about the barriers to energy efficiency. Representations from local government and state government departments gave positive feedback on the opportunity to workshop interim findings, following the publication of CVSC's Annual Report in 2012.

"Refer a Friend" Campaign winner, Craig Beasy from Swan Hill, celebrates his household solar PV system win with Swan Hill Home Energy Assessor Kristen Noles.

"Refer a Friend" Campaign

We all do it – we're influenced by our peers. This strategy of relying on referrals by peers was the basis of CVSC's "Refer a Friend" Campaign, whereby existing participants could "refer a friend" for a Home Energy Assessment and enter the draw to win a 1.5kW household solar PV system. This engagement campaign was supported by a DL flyer, a sticker, a dedicated online sign-up page on the CVSC website and also promoted directly by home energy assessors. This campaign resulted in significant project interest, with more than 60 people being eligible to win the solar PV system after one of their friends or neighbours took up an assessment on their recommendation.

OPPORTUNITIES

In relation to successful community engagement CVSC has identified the following opportunities:

1. Engagement through local organisations/experts with established brand credibility
2. Leveraging peer networks through tools such as the 'Refer a Friend' campaign
3. Position brands as trusted, valued service providers by providing a timely, helpful post-engagement customer support service.

CVSC Project Director Leah Sertori, Ganawarra Shire Economic Development Manager Roger Griffiths and Prof. John Martin, Director LaTrobe University Centre for Sustainable Regional Communities, discuss interim trial findings at the Central Victoria: Energy Future Forum, hosted by SRA, in Bendigo in November 2012.

3.5 RESULTS

3.5.1 Intervention Group

Overall, the CVSC program was successful in reducing household electricity use. Figure 3.5.1.1 illustrates the program's influence on electricity use, with the difference between the intervention group as a whole and the matched control group becoming more pronounced over time.

Figure 3.5.1.2 shows the consumption patterns for the intervention group compared with their matched control households, before, during and after the intervention. While there was no significant difference between the two groups before or during the intervention period, the differences were significant after the intervention. The intervention group decreased their consumption by **13%** more than similar households in the matched control group, suggesting that changes in energy use were significantly affected by participation in the CVSC program overall.

Over a third of participants in the trial (35%) did not join any of the program's other packages. A comparison with participants that did take part in at least one other CVSC packages indicated the following:

- Participants that only took part in the HEA package had lower intentions to reduce energy use; weaker beliefs about the environmental benefits of reducing energy and higher pre-program electricity use.

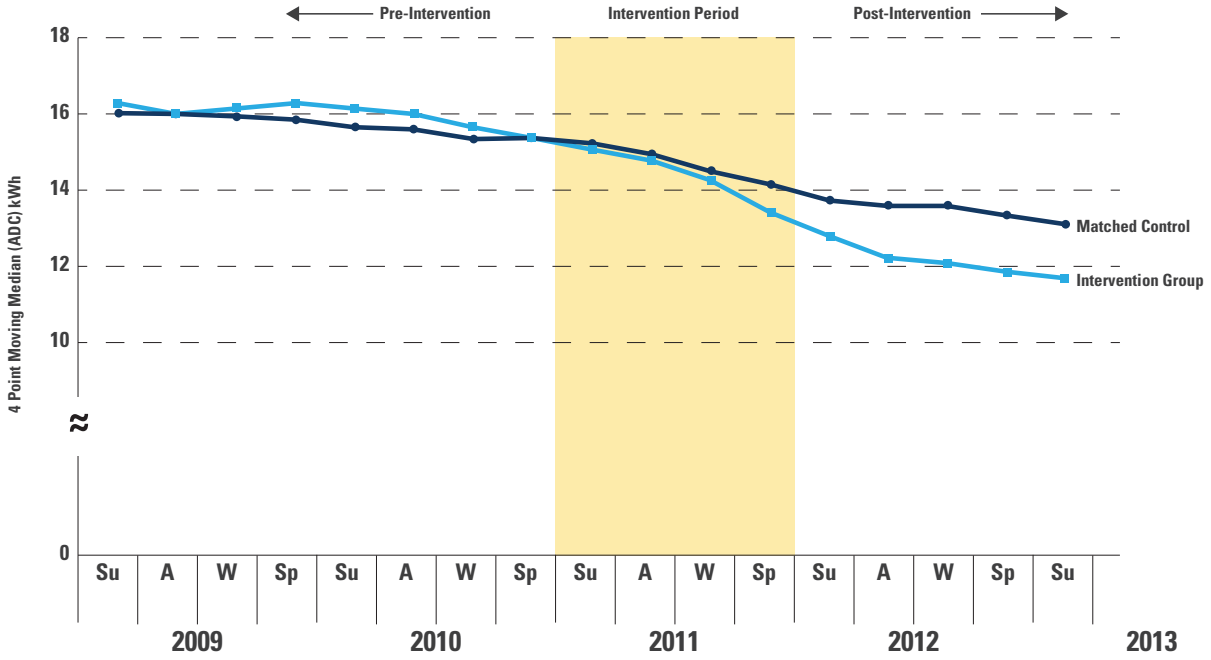


Figure 3.5.1.1: ADC for control and intervention households before, during and after intervention

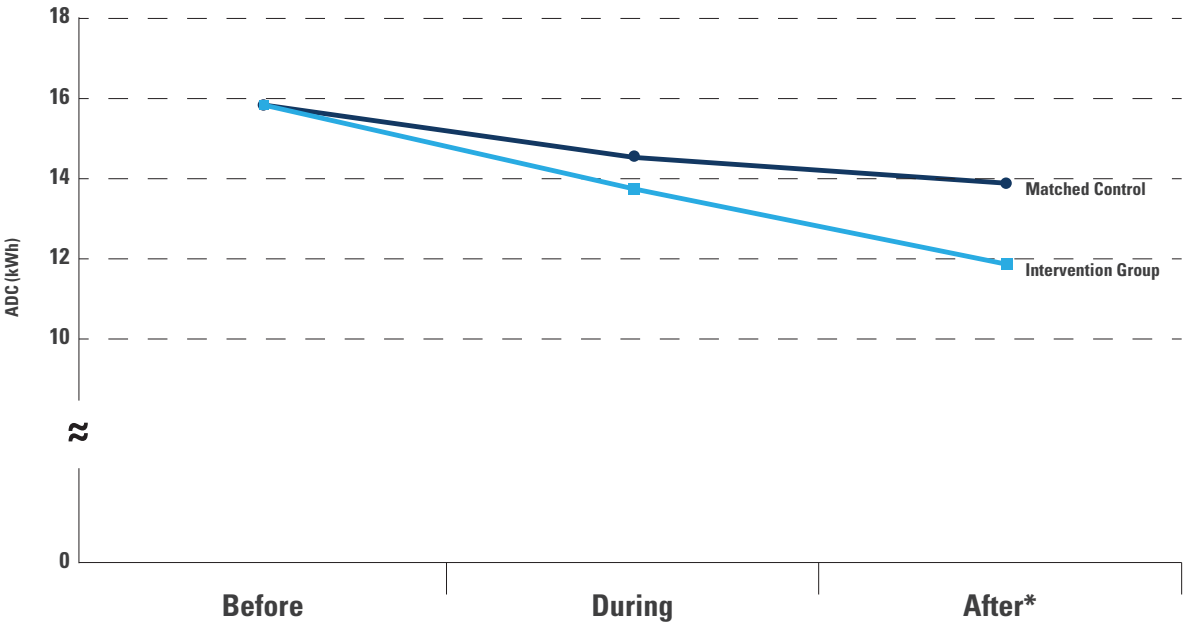


Figure 3.5.1.2: Average Daily Consumption: Intervention vs. Matched Control Group (kWh)

* Difference is statistically significant at the 95% level

- HEA only participants were also more likely to: be renters; be from the North, West or Highlands regions; have no gas connection; and have an electric hot water service.
- In contrast, participants that took part in another package were more likely to: have a mortgage; be from the Ballarat or Bendigo regions; have a reticulated gas connection; and have a gas hot water service.
- HEA participants that took part in at least one other CVSC package, also indicated higher levels of satisfaction, and perceived quality and value, with their assessment.

As expected some intervention groups achieved higher savings than others. Both net and gross savings are shown in Figure 3.5.1.3. All consumption changes were significant.

Gross savings represent the rudimentary difference in energy consumption between two points in time, such as before and after an intervention. Such a difference may be influenced by many other factors such as the weather, technology, changing demographics, policy changes, etc. Therefore a simple comparison of consumption before and after an intervention is not acceptable[3]. Net savings can be directly attributable to participation in the CVSC program because such savings allow for what would have happened had there been no participation.

Participants also indicated their levels of satisfaction, quality and value associated with each package. These are summarised in Figure 3.5.1.4, in which several aspects are apparent:

- Satisfaction and quality levels associated with the Retrofit group are considerably higher than for all other groups. This may be the result of participants being responsible for decisions made regarding energy efficiency purchases.
- Value levels are typically less than (or the same as) those relating to Satisfaction and Quality.
- The lowest level in all three aspects were reported by IHD participants

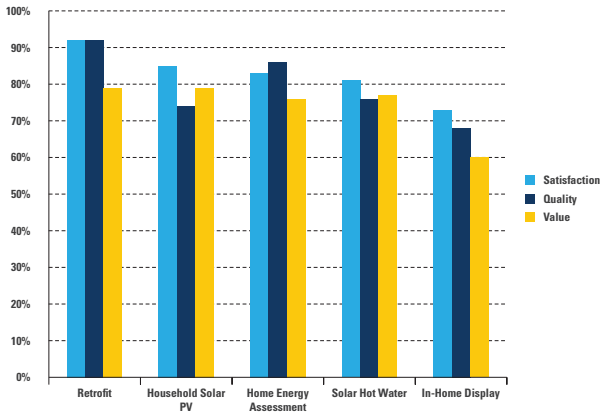


Figure 3.5.1.4: Package satisfaction, value and quality ratings by package

*Difference is statistically significant at 95% level

CONCLUSION

Overall, the CVSC program was successful in reducing household electricity use and this became more pronounced over time. The intervention group decreased their consumption by **13%** more than similar households in the matched control group, suggesting that changes in energy use were significantly affected by participation in the CVSC program overall.

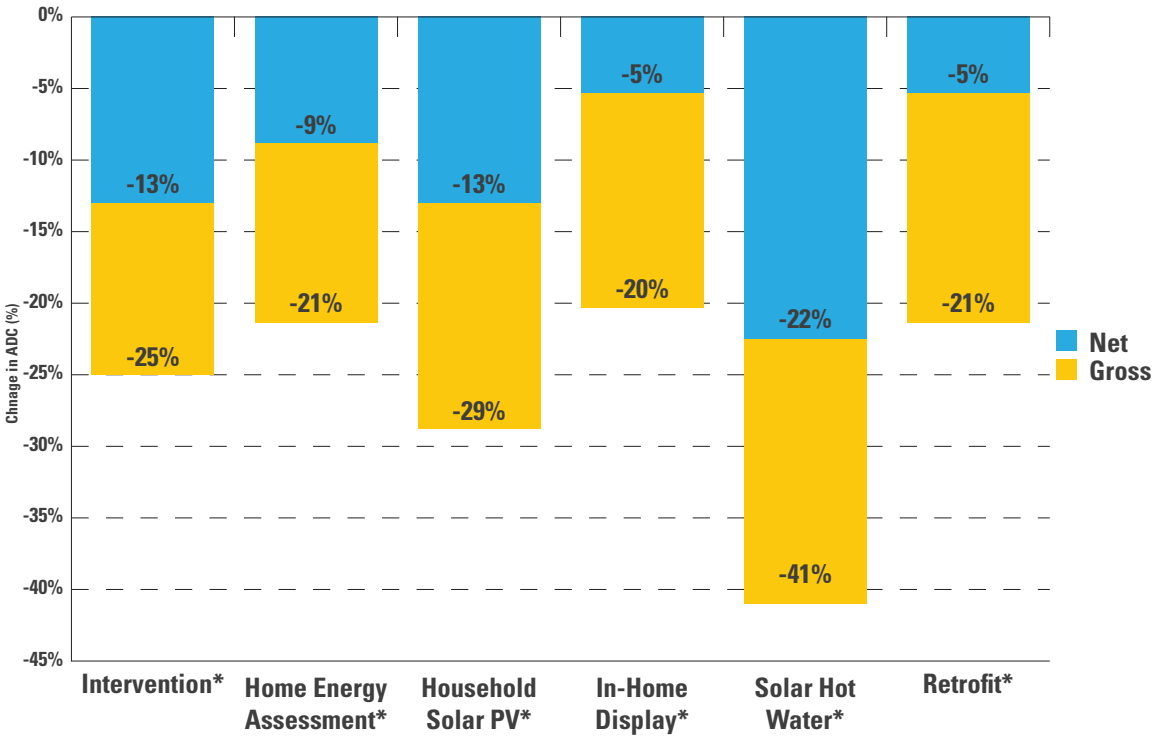
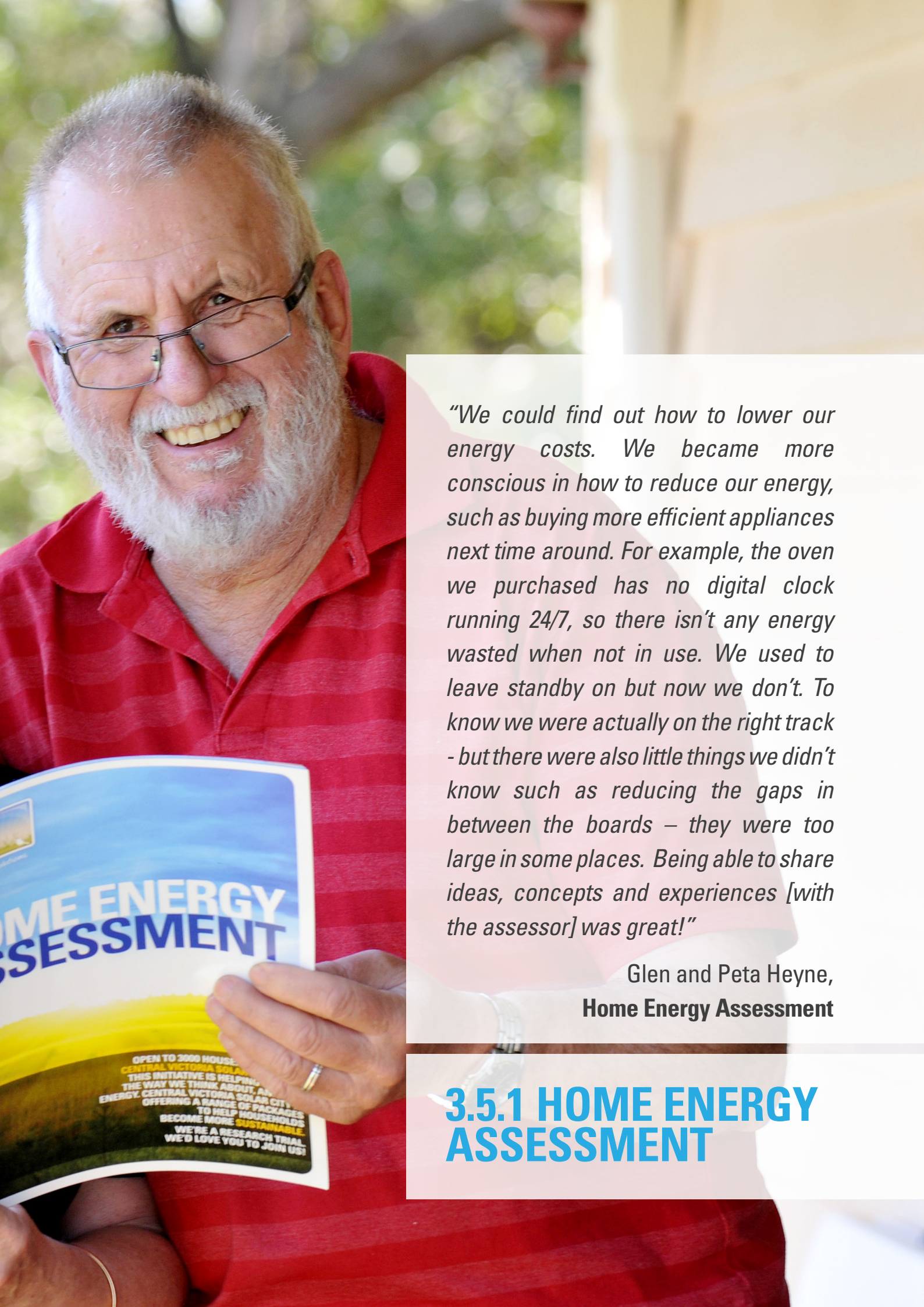


Figure 3.5.1.3: Gross and net changes in electricity use by package (%)

3. Energy Efficiency Program Impact Evaluation Guide 2012


CENTRAL
VICTORIA
SOLAR CITY
WHO IS
ACKNOWLEDGEMENTS



"We could find out how to lower our energy costs. We became more conscious in how to reduce our energy, such as buying more efficient appliances next time around. For example, the oven we purchased has no digital clock running 24/7, so there isn't any energy wasted when not in use. We used to leave standby on but now we don't. To know we were actually on the right track - but there were also little things we didn't know such as reducing the gaps in between the boards – they were too large in some places. Being able to share ideas, concepts and experiences [with the assessor] was great!"

Glen and Peta Heyne,
Home Energy Assessment

3.5.1 HOME ENERGY ASSESSMENT

BACKGROUND

The Central Victoria Solar City Home Energy Assessment (HEA) trial sought to measure the impact of a free, 90 minute energy assessment on household energy use and discover how effective it was in sharing energy efficiency information. The assessment was the primary mechanism through which central Victorian residents received energy efficiency information about how they might reduce their household energy use.

The Assessment and the Customer Experience

After hearing about the assessment through one of the various channels discussed in the community engagement chapter, participants registered for an assessment online via the CVSC website. Participant details were forwarded to the local energy assessor who then contacted the participant and made a booking. As part of the trial, the CVSC project team designed an energy efficiency education program for participants. The suite of educational material delivered to recipients of a Home Energy Assessment featured a coffee table style Home Energy Assessment magazine, which included clear information and advice on:

- Active and passive heating and cooling
- Insulation and draft stopping
- Lighting
- Appliances
- Other energy information referral sources eg. Sustainability Victoria, and
- A simple action plan for participants to complete.

Other educational material shared with household participants included household case studies hosted on the Central Victoria Solar City website, and energy saving tips and tricks delivered through assessor-run local community events, workshops and presentations. The HEA itself involved a combination of kitchen table conversation, energy bill analysis, including a lesson on how to read the bill, a household walk through, and consideration of one or more energy efficiency and renewable energy product and service packages being offered in addition to the assessment. This avenue of up-selling and cross-selling provided an opportunity for the assessor to develop a set of energy saving recommendations tailored to the household needs. At the end of 90 minutes, the customer signed their participation agreement and together with the assessor answered a number of research booklet questions, which formed part of the project's data collection strategy.

FINDINGS

Free Home Energy Assessments (HEA) were delivered to 2,750 households across the central Victoria region. Of this group, 1,830 households completed the initial survey requirements making them eligible to take part in the CVSC research trial.

Figure 3.5.2.1 shows the consumption patterns for the HEA (only) households compared with their matched control households, before, during and after the intervention. The similarity between these two groups is evident until after the intervention when the difference becomes significant. The HEA (only) households decreased their consumption by **9%** more than similar households in the matched control group. This suggests that changes in energy use were significantly affected by participation in the HEA component alone of the CVSC program.

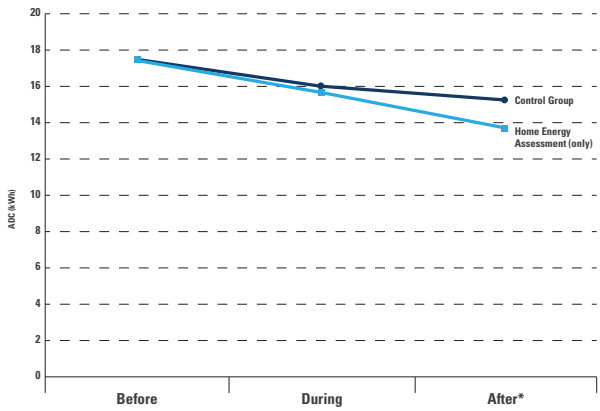


Figure 3.5.2.1: Average Daily Consumption: HEA (only) vs. Matched Control Group (kWh)

*Difference is statistically significant at 95% level

DISCUSSION

The major reasons for joining the program related to economic factors (save energy/reduce bill), with environmental concerns (e.g. sustainability, climate change) being of secondary importance. HEA (only) households were also more likely to have a gas connection (and gas hot water) and occupy rental premises. These characteristics limit the ability for these households to undertake further interventions.

Over a quarter of participants receiving an HEA indicated that they had carried out all or most of the recommendations provided by their assessor. The majority of participants (66%) indicated that they had carried out some but not all of the recommendations provided. The major reasons nominated for not carrying out any HEA recommendations were financial considerations (48%), that they were planning to do it in the future (30%) and the recommendations would not result in sufficient energy savings (12%). HEA participants were more likely to install major insulation features since joining the program than the control group. In particular, HEA participants were more likely to install draft stoppers, curtains, window awnings, double glazing and floor insulation. The most common changes to general appliance or lighting use were turning appliances off standby, turning lights off more often and replacing standard light globes. HEA participants were more likely to indicate using appliances during off-peak tariffs than the control group.

Table 3.5.2.1 shows that there was a strong relationship between the HEA experience and adoption of energy efficiency

recommendations. The more recommendations participants carried out the higher their levels of satisfaction, value and quality.

	HEA Recommendations Adopted		
	Carried out all or most (25%)	Carried out some but not all (66%)	Carried out none (9%)
Satisfaction	88%	82%	71%
Value	82%	75%	64%
Quality	90%	85%	77%

Table 3.5.2.1: Satisfaction, Value and Quality ratings by participants by recommendations adopted

Survey participants were asked to comment on program improvements in the context of the HEA. A larger proportion of participants (46%) did not provide any feedback or were unable to offer suggestions for program improvement. Where feedback was received, the two main areas related to a more comprehensive assessment (e.g. less generic, more than a walkthrough, costs/benefits analysis) and improved communication (e.g. improved promotion, following up on enquiries/concerns).

Most respondents indicated that they referred to their Home Energy Assessment booklet once every six months or less. This suggests that although the booklet was useful for facilitating the HEA, it was used less often by participants following the assessment. HEA participants indicated that their current perceived knowledge of ways to improve their household energy efficiency was generally higher than that of control group participants.

The CVSC project team propose that results showing a significant increase in participant energy efficiency knowledge after their assessment, 11% more than the control group, was due to the quality of customer service, and the simplicity and relevance of information delivered by home energy assessors using the HEA booklet, during the assessment. Feedback from participants attest to this observation, and is confirmed by the finding that, in the major reasons nominated for not carrying out any HEA recommendations, only 1% of respondents suggested that they did not understand how to carry out the recommendations.

Although participants generally indicated a very high level of satisfaction with the HEA service there was some ambivalence towards paying for such a service. When asked to indicate how much they would be willing to pay for a similar service, 84% of respondents suggested less than $100, with the most common response being between $50 and $99 (33%).

More than two-thirds (67%) of participants had shared energy efficiency recommendations with others (non-participant spillover) and slightly more than half (52%) indicated that they had sourced additional energy efficiency information (participant spillover).

CONCLUSION

Over the course of the trial the HEA (only) households decreased their electricity consumption by **9%** more than similar households in the matched control group. These findings suggest that changes in energy use were significantly influenced by participation in the HEA program.

OPPORTUNITIES

Based on the results of the Home Energy Assessment sub-trial CVSC has identified the following opportunities:

1. The role of Home Energy Assessments be further investigated as a channel to provide consumer education and increased take up of energy saving measures within energy efficiency schemes.
2. Increase the capacity for peer learning and development between energy assessors.

Participant Satisfaction – Strong Team Culture, Quality Education Tool, Local Assessors

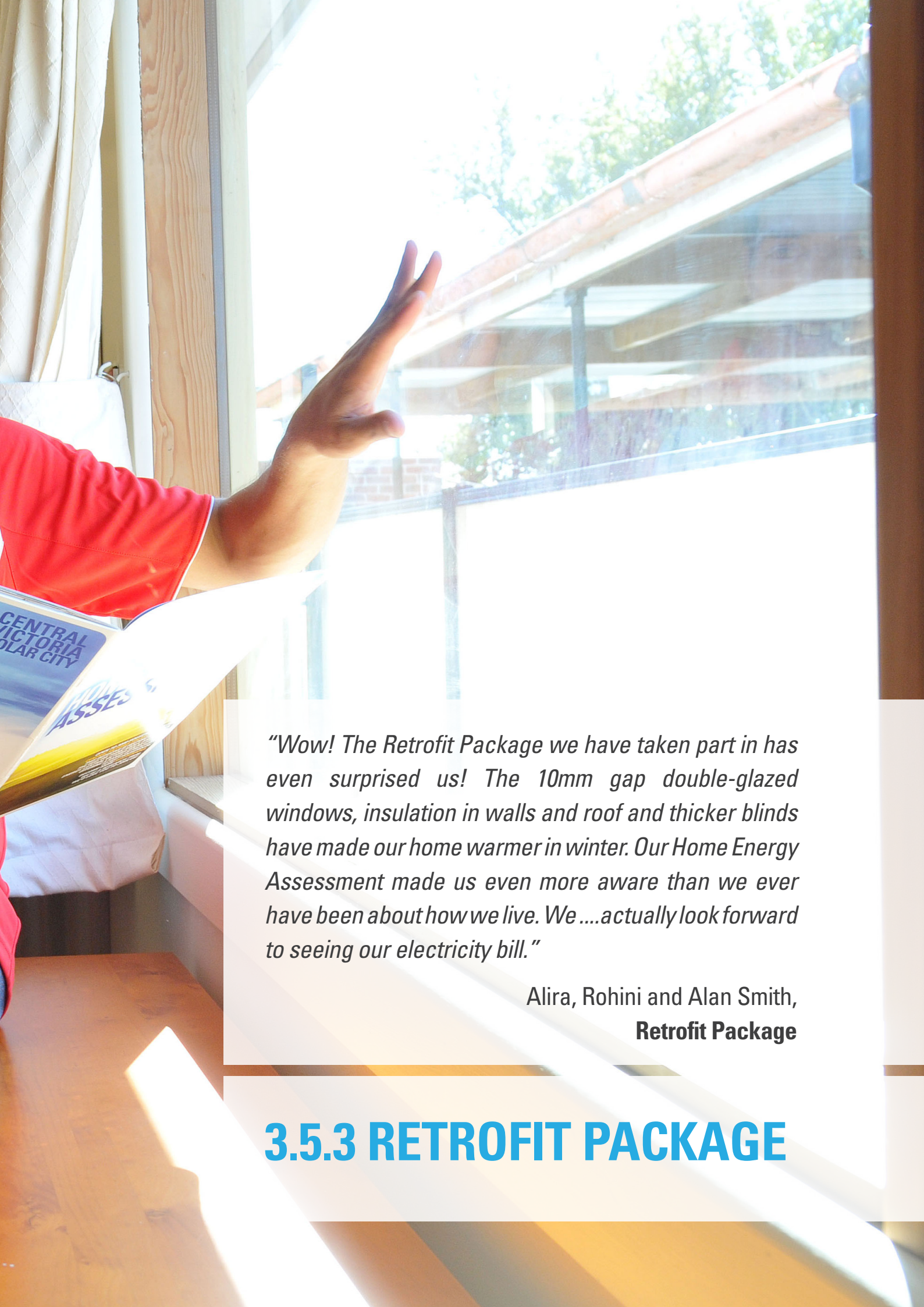
Participants generally reported high levels of satisfaction and perceived quality regarding the CVSC program's Home Energy Assessments (HEAs) and rated the service quality of the assessors very highly.

University of Ballarat – Follow Up Survey December 2012

The CVSC project team believes that one factor behind high levels of participant satisfaction regarding the home energy assessment was the culture developed and led by the HEAT team leader. "Fly Home Fridays", a monthly catch up drawing together assessors from across the region, helped ensure regular cross-fertilisation of ideas, sharing of failures and successes and the dissemination of regular technology updates within the team.

Also missing in the central Victorian market was an assessment delivered by a trusted local using a quality education tool. The team delivered the assessments using a coffee table style home energy assessment magazine that outlined easy to achieve, no and low cost behavioural and infrastructure changes. Because assessors were local, they were able to confidently recommend local suppliers where applicable, and also leverage local knowledge to motivate residents as to what their town/shire as a whole might be doing in regards to reducing energy consumption.


WHO IS
ACKNOWLEDGEMENTS
Australian Government
Solar Cities



"Wow! The Retrofit Package we have taken part in has even surprised us! The 10mm gap double-glazed windows, insulation in walls and roof and thicker blinds have made our home warmer in winter. Our Home Energy Assessment made us even more aware than we ever have been about how we live. We ....actually look forward to seeing our electricity bill."

Alira, Rohini and Alan Smith,
Retrofit Package

3.5.3 RETROFIT PACKAGE

BACKGROUND

The Retrofit sub-trial sought to discover whether assisting households to improve existing energy fixtures and fittings would lower energy use. Each participant who had a Home Energy Assessment and selected the Retrofit Package was provided with a set of customised recommendations around energy efficient infrastructure, equipment and appliances that would support reductions in energy use. Retrofit participants had a 6 month time frame to complete suggested improvements and send their retrofit expenditure receipts to the CVSC project office. If participants spent $2,000 or more on retrofit items they were eligible to receive $500 cash back from the project as well as a $250 performance bonus at the end of the trial once all research surveys had been completed ($750 in total).

Early recruitment information indicated there was considerable interest in the retrofit program, which eventually led to 350 participants. Participants spent a total of over $1.2million, or an average of $3,430 per household on energy efficient retrofits. The most popular retrofit items included energy efficient curtains, blinds and external shading - see Figure 3.5.3.1.

Action	Households %	Spend	Total %
Curtains and Pelmets	29%	$184,419	15%
External Shading	23%	$212,518	17%
Insulation (Install)	21%	$137,995	11%
Appliance (Replace)	20%	$123,673	10%
Heating Equipment	16%	$155,906	13%
Cooling Equipment	13%	$105,527	8%
Window (Double Glaze)	10%	$149,612	12%
Sub-total	94%	$1,069,650	86%

Figure 3.5.3.1: Retrofit Expenditure

Differences in the patterns of recruitment across target regions were not statistically significant, although the program was relatively less popular in the northern and western regions. The main incentive for households that joined the retrofit program were economic (save energy/reduce bill). Environmental reasons (e.g. sustainability, climate change) were of secondary importance. The rebates attached to the program were important motivating factors in influencing participation.

A comparison between participants that did and did not take part in the program's Retrofit Package indicated the following:

- Retrofit participants had higher pre-program energy use; higher intentions to reduce energy use; stronger beliefs about the environmental benefits of reducing energy and felt more in control of their ability to reduce energy use.
- Retrofit participants were also more likely to: be from the Mt Alexander region; not have a gas hot water service; be tertiary educated and be employed and less likely to be retired.
- Participants in the Retrofit program were also more likely to take part in the program's SHW Package and less likely to have joined CVSC's Solar PV and IHD Packages.

FINDINGS

Figure 3.5.3.2 shows the average daily consumption (kWh) for the Retrofit households compared with their matched control households, before, during and after the intervention; the difference only becoming significant after the intervention. The Retrofit group decreased their consumption by **5%** more than the corresponding households in the matched control group. This result was significant and suggests that changes in energy use were significantly affected by participation in the Retrofit component of the program.

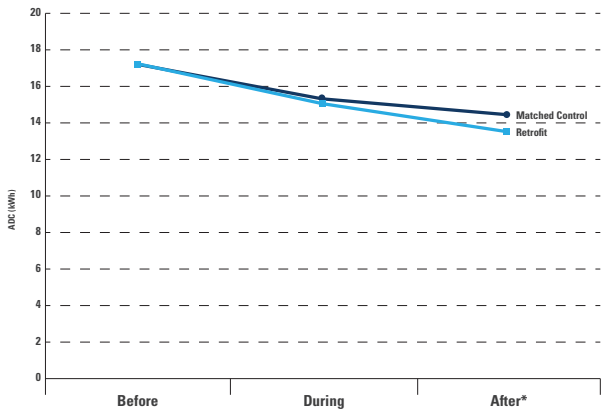


Figure 3.5.3.2: Average Daily Consumption: Retrofit vs. Matched Control Group (kWh)

*Difference is statistically significant at 95% level
Note: Analysis has controlled for participation in other CVSC packages

DISCUSSION

The incentive of a $750 bonus to households who participated in the retrofit trial proved successful in helping reach recruitment targets. This package 'sold out' before the end of the household trial rollout, with 810 participants engaged. Anecdotal evidence collected from interviews with the home energy assessors suggested that the bonus payment was a positive incentive to join the project. This initial engagement figure translated into 350 actual participants who completed the full requirements of

the Retrofit Package. In the University of Ballarat's Follow Up Survey - December 2012, participants who had originally signed up for this package, but not taken it up in the end, were asked their reason for not doing so. The most common reason for not taking part was financial considerations (37%).

However, the offer of the $750 bonus did not appear to be sufficient to overcome capital barriers for lower income groups. The cost associated with retrofitting was nominated by 37% of prospective participants as being a major reason for not committing to the package. Additional barriers included time constraints (12%), concerns about financial payback (12%), and the rebate not being enough to justify purchases (11%). Retrofit participants reported amongst the highest levels of satisfaction (87%), quality (88%) and value (80%) with respect to their participation in the program. Such high ratings may be due to their higher levels of perceived behavioural control than those expressed by participants in other intervention groups.

There was much discussion within the CVSC project team about how a voucher system might work in future programs directly targeting low income earners across a wider region. The main challenges identified would be around having to limit vouchers to a restricted number of retailers because of the administrative challenges in managing each retailer/project office partnership across the region.

Other observations worth noting by the CVSC project team were that, despite the clear time frames given during the assessment, a small number of participants took more than 6 months to return their receipts and were disappointed not to receive their $500 'cash back' bonus. As well as this, despite receiving customised energy saving recommendations, some participants made improvements outside the guidelines that made them ineligible to receive a bonus payment. This issue could have perhaps been alleviated by another contact point with the home energy assessor before the participant purchased retrofit items. However, this extra support must be weighed up against the financial cost of further engagement.

CONCLUSION

The Retrofit group decreased their consumption by **5%** more than the corresponding households in the matched control group and this significant reduction in electricity use can be attributed to participation in the Retrofit trial.

Sue Harling, CVSC's Ballarat home energy assessor, talks with Ben Gamble and Teri Hurst-Cridge about the benefits of double-glazing.

"Having our home assessed and then time to sit down with the assessor to discuss options gave my husband and I the opportunity to work towards home energy reduction improvements that suited our own situation. We are very pleased with the Solar Hot Water unit we chose under the project. Being able to further reduce our carbon emissions and electricity costs with the unit we've had installed has been a fantastic and important objective for our family and, with thanks, made possible through the CVSC project."

Maxine Plant,
Solar Hot Water Package

3.5.4 SOLAR HOT WATER

BACKGROUND

The CVSC Solar Hot Water (SHW) sub-trial sought to identify the barriers to the uptake of solar hot water in the Central Victorian region and the effect that solar hot water had on household energy consumption. The project target for engagement in this sub-trial was 200 participants. When the package closed in May 2011, 234 participants had subscribed to this intervention. Sixty-five participants went ahead and installed a SHW unit. Despite incentives to join the trial and the proven savings in switching from electricity hot water systems to alternative energy sources, the SHW trial was the least popular of the intervention options, not only in uptake but also in interest levels.

The CVSC project team identified significant barriers to the uptake of the SHW package when it was first offered in late 2009/early 2010. Under the original offer, participants could choose between three Origin solar hot water units, installed by Origin subcontracted plumbers. Evacuated tube systems, more suitable for colder areas, were not available from Origin at the time, and because sub-contracted plumbers were often sent from Melbourne, there were sometimes lengthy delays around the resolution of installation and post-installation issues. As a result of these early teething problems, which manifested in some participant complaints, this package was revised as part of the household suite redesign process in 2010. The revised package opened up the supply and installation process to solar hot water providers across the Central Victorian region. Participants were offered $500 cash back for purchasing and installing a system of their choice (a $250 bonus from the project office upon receipt of purchase and installation receipts, and a $250 performance bonus at the end of the trial.) Importantly, participants could now 'go local' with their purchasing.

The major reasons for buying an SHW service as part of the program were to reduce electricity bills (88%), increase energy self-sufficiency (83%) and take advantage of rebates (78%). Participants who bought a SHW system through the program were generally very satisfied with the experience. SHW participants generally suggested the quality of the system they bought through the program was very high, especially in reducing their impact on the environment and saving them money in the long run.

As the potential benefits of installing solar hot water are greatest for households with an electric system, it is not surprising that this package was more attractive for participants with such systems. Over three-quarters of SHW participants (77%) had an electric hot water system before taking part in the program, compared with less than a third of intervention group participants (30%) that did not take part in the SHW package. SHW participants were also:

- Less likely to have a reticulated gas connection or an existing gas hot water service
- More likely to take part in the program's Retrofit package
- Less likely to receive an In-Home Energy Display as part of the program, and
- More likely to have stronger intentions to reduce energy use and higher levels of pre-program electricity use than intervention group participants that did not install a solar hot water system as part of the program.

FINDINGS

Figure 3.5.4.1 shows the average daily consumption (kWh) for SHW households compared to their matched control households, before, during and after the intervention. The SHW group decreased their consumption by **22%** more than similar households in the matched control group. Of all the intervention groups this was by far the strongest result and suggests that changes in electricity use were very significantly affected by participation in the SHW component of the CVSC program. These results are consistent with earlier findings on the differences between gas and electric hot water households where it was found that more than 40% of average household electricity use can be attributed to the heating of hot water. The gross effect for this group was found to be 41%.

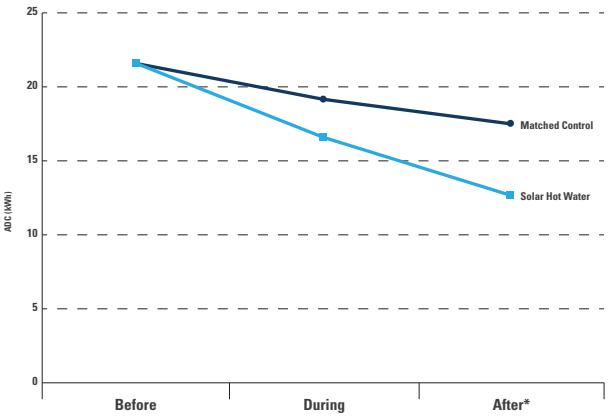


Figure 3.5.4.1: Average Daily Consumption: SHW vs. Matched Control Group (kWh)

*Difference is statistically significant at 95% level
Note: This analysis has been controlled for participation in other CVSC packages.

DISCUSSION

Financial considerations for many households were a significant barrier to the uptake of energy efficiency technologies and the decision to join the SHW trial required a substantial up-front capital outlay. The three most common reasons for not taking part in the program's SHW package were financial considerations (47%), buying a system through a different provider (15%) and concerns about financial payback (12%). The small uptake of the SHW package may, in part, be explained by existing adoption levels. Anecdotal evidence suggested there was already a fairly high penetration of solar hot water in the central recruitment areas of the CVSC trial. Indeed, this is supported by data from Australia's renewable energy regulator which show parts of northern and central Victoria (areas that were part of the CVSC trial) have the highest uptake of solar power in the state.

Over three-quarters of SHW participants (28%) indicated that they would have purchased a SHW system regardless of the CVSC program, and that participation in the CVSC program did not influence their decision to install SHW. The latter group may be characterised as free riders.

SHW participants reported among the highest levels of satisfaction (88%), quality (85%) and value (81%) with respect to their participation in the program. Such high ratings may be because of the high immediate impact of replacing an electric hot water system with solar.

During the trial engagement period for this product most retailers did not offer finance packages such as those offered to Household Solar PV clients eg. Origin's Solar PV offer of 'zero dollars upfront/ monthly repayments thereafter'. This lack of attractive financing options and solar hot water's higher upfront cost made solar hot water a less affordable product, in comparison to solar PV, for many project participants.

Other barriers were also identified. Unlike the Household Solar Energy intervention, Solar Hot Water participants did not have access to a CVSC project team customer service advisor to walk them through the complex language and processes related to solar hot water, nor did they have instant access to advocacy when installation issues and delays occurred. Whilst Household Solar PV participants did not have to spend time sourcing suppliers and installers, Solar Hot Water participants were responsible for their own research, quotes and management of the installation process.

The CVSC team acknowledges that project participants may have chosen the Household Solar PV package over the SHW package because the Household Solar PV package installation process was managed for them, it had a lower price, it had more attractive financing options and it also had the potential to generate an income ie. the Premium Feed-In Tariff, for participants whose energy use was less than that generated by their household PV system.

Access to plumbers, with comprehensive solar hot water training, knowledge and skills, was limited in some CVSC project areas and in general there was a lack of up-to-date training and knowledge within the plumbing industry about the installation of solar hot water units.

It is interesting that in relation to the quality and value of the system purchased, participants believed that their purchase was highly rated in regard to its potential to reduce their household's impact on the environment. The CVSC project team believes that this indicates that participants were very aware that a reduction in carbon emissions was a tangible benefit of a solar hot water intervention, even though emissions weren't one of their primary motivations for investing in solar hot water.

CONCLUSION

Of all the interventions the SHW group recorded the most significant decrease in their electricity use. Compared to the matched control group, SHW intervention households reduced their consumption by **22%**.

OPPORTUNITIES

As a result of the Solar Hot Water sub-trial CVSC has identified the following opportunities:

1. Explore options to reduce the up-front cost of solar hot water. Options may include on-bill finance, which proved an attractive feature in the take up of CVSC's Solar PV offer.
2. Investigate opportunities to better illustrate the long term cost savings attributed to solar hot water, particularly for households without access to the reticulated gas network.
3. Encourage the plumbing industry to both explore further training around the installation process for different types of solar hot water systems, and disseminate findings related to the gross electricity savings of switching from electric storage hot water services to solar hot water.

"Apart from the obvious benefits of having solar PV installed, such as cheaper power bills, there is also the satisfaction of knowing that we are doing something positive in the battle to help lower carbon emissions. We feel that we are conveying a silent message to the community to install solar panels and use energy that is clean, renewable and relatively cheap. Each time we look at our solar panels we are reminded that we are helping to make the world a much healthier place – especially for our grandchildren."

Margaret, Rebecca & David Cooper,
Household Solar PV Package

3.5.5 HOUSEHOLD SOLAR PV

BACKGROUND

The objective of the Household Solar PV trial was to measure the impact of household solar electricity systems on electricity consumption behaviour. CVSC offered a 1.5kW solar PV system through Origin. The offer included a 10% discount off the product price, a waiving of the Powercor service truck visit fee and a $250 performance bonus at the end of the trial.

Of the 860 initial sales enquiries sent to Origin, 521 participants officially accessed the project's Solar PV offer. Of these 397 completed the final survey and are represented in the energy use research findings.

Consortium member Origin Energy was the product provider. Through Origin, the CVSC trial was able to offer participants a 1.5kW system that met the Australian standard. Origin introduced an 'on-bill finance solution' for PV customers, which allowed them to purchase the product for an upfront cost of $199 followed by monthly repayments for the balance of the system's cost. After the system was installed and checked by an independent electrical inspector, consortium partner Powercor installed the smart meter and conducted a final electrical inspection. Having both Origin and Powercor in the consortium allowed the CVSC project to supply an end-to-end solar PV service. An SRA customer support officer, based at the CVSC project office in Castlemaine, helped monitor and respond to participant issues and follow up questions around solar PV.

The timing of the CVSC Household Solar PV Package coincided with state-wide feed-in tariffs for electricity exported by solar PV systems. Four hundred and twenty-seven households participating in the CVSC program received a Premium Feed in Tariff (PFIT), which entitled them to 66 cents for every excess kWh exported to the energy grid. Due to the close out of PFIT in September, 2011; 94 participants received a Transition Feed in Tariff (TFIT). These participants were eligible for 25 cents per kWh plus a bonus of 6 cents per kWh from Origin Energy for their net exports. These feed-in tariffs were a major incentive for participants to purchase a solar PV system through the program. Less than a third of participants (29%) indicated that they would have still been likely to invest in a solar PV system if the feed-in tariffs were not available.

As part of the trial a number of solar PV households were also installed with a check meter to measure gross solar PV output. These check meters sought to measure the proportion of each household's change in energy consumption that was derived from consuming energy from solar panels as opposed to change in energy behaviours/installation of energy saving devices.

FINDINGS

Figure 3.5.5.1 shows electricity use for Solar PV households - compared with their matched control households - before, during and after the intervention. While there was no significant difference between the two groups before the intervention the differences were significant both during and after the intervention. The Household Solar PV group decreased their consumption by **13%** more than similar households in the matched control group. This suggests that changes in energy use were significantly affected by participation the CVSC program's Solar PV package.

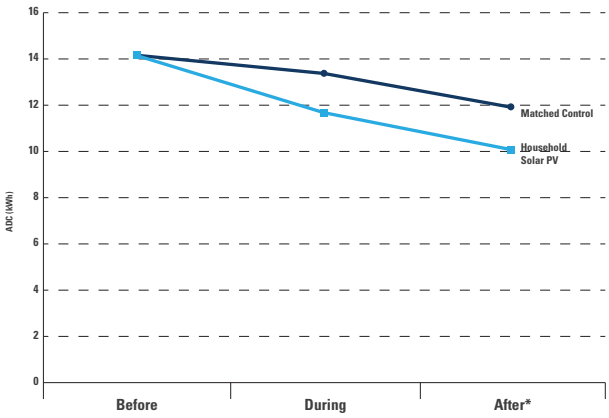


Figure 3.5.5.1: Average Daily Consumption: Household Solar PV vs. Matched Control Group (kWh)

While the above analysis looks at the influence of taking part in the CVSC program's Solar PV package, it does not assess the direct influence of installing a Solar PV system. To develop an estimate of the influence of Solar PV systems on off-grid electricity use, a regression analysis, using check meter data, was undertaken to control for participation in the program's other packages and installation of SHW system across both the Solar PV and matched control groups.

This analysis suggested that 18% of the variance in electricity use can be explained by these program and solar technology related factors. Estimates from this analysis suggest that the installation of a 1.5-2kW system reduced off-grid energy use by an average of 13%. Installation of a larger system (3kw+) had a greater influence on off-grid energy use with average reduction of 24%. When controlling for the influence of solar technologies on energy use, participation in the program's other packages (HEA, IHD, Retrofit) does not have a significant influence on changes to participant energy use. This finding suggests that changes to the Solar PV participants' energy use have been chiefly driven by the adoption of solar technologies and factors outside the program.

Of all the interventions offered, the Household Solar PV intervention created the strongest interest among households. Those that took up the offer expressed relatively high levels of satisfaction (85%) with their decision to buy a system through the program; however, perceptions of value (79%) and quality (73%) were not as high. This disparity could be due to systems exceeding participant expectations, but the quality and value of a 1.5kW system being perceived as inferior to larger systems available in the market.

The major reasons for joining the Solar PV program related to economic reasons with participants citing the prospects of reducing energy bills (93%), increasing energy self-sufficiency (73%) and taking advantage of rebates (71%) as being influential in their decision to join.

Participants that bought a solar PV system through the program were more likely to be from Central Victoria's two major urban areas, Ballarat and Bendigo, than other intervention group participants that did not already have a solar PV system. This finding suggests the CVSC program's Household Solar PV package was either more attractive for residents in these regions or gained a higher profile (or a combination of both). Further, Household Solar PV participants were less likely to be located in the North, West and Highlands regions. This disparity is possibly related to high relative levels of pre-program solar PV adoption in the Highlands (22% of intervention group participants) and West (19%) regions. Related to these differences in geographic location, Solar PV participants were also more likely to:

- Be connected to reticulated gas;
- Have a gas rather than electric hot water system;
- Have lower levels of pre-program electricity use; and
- be part of the CVSC program's IHD package, due to how these devices were distributed to participants.

The CVSC program has been successful in attracting market segments that had not already adopted HHSE before the program. A comparison between the program's HHSE and pre-program adopters (15% of intervention group participants), identified the following differences:

- Pre-program adopters of solar PV were 'greener' than the program's Solar PV participants in terms of their environmental values and attitudes towards the environmental benefits of using less energy.
- Adopters of solar PV before the program reported higher levels of perceived control over their household's energy use and knowledge about resource management.
- Participants that bought a solar PV system through the program suggested stronger intentions to reduce energy use than those with an existing Solar PV system. This indicates that the program's solar PV package provided participants with a means to act on these intentions.
- Pre-program adopters were more likely to own their house outright and accordingly, less likely to have a mortgage than participants that bought a solar PV system through the program.
- Pre-program adopters were also more likely to have a solar hot water system; bottled gas; be tertiary educated; and live in the West or Highlands regions. In contrast, participants that bought a solar PV system through the CVSC program, were more likely to have a gas hot water system; reticulated gas; secondary school as their highest qualification and live in the Bendigo region.
- Due to their early adoption of renewable technologies, it is not surprising that pre-program adopters of solar PV were more likely to join the CVSC program's Retrofit rebate package than the program's Solar PV participants.

Product Issues, Installation Challenges and Customer Care

Nearly half of the Household Solar PV participants indicated that they contacted the CVSC office about issues relating to their system (University of Ballarat – Follow Up Survey December 2012). The CVSC Operations subcommittee received 37 formal complaints (out of 521 Household Solar PV participants) relating to this intervention during the project. In 2011 these complaints related primarily to connection delays and issues relating to feed-in tariff eligibility. In 2012 complaints related primarily to dysfunctional inverter displays and other system-related faults. The CVSC project team dedicated considerable time and resources to the handling of these complaints, which included brokering issues between Origin and Powercor. A customer service officer was employed by SRA to liaise between customers, retailer and distributor, and other staff backed up in this role across the life of the project. At times this was a challenging role for staff, with a high amount of technical and personal support required to resolve some customers' solar PV concerns. However, the team strove to ensure strong customer-focused support and found that by dealing with, and closing out, each complaint with a high degree of care and patience, a high level of trust was created between the project team and the participant group.

"Participants that contacted the CVSC office concerning issues with their Household Solar PV system were generally very satisfied with the response provided."

University of Ballarat – Follow Up Survey December 2012

DISCUSSION

Of all the interventions, Household Solar PV had the highest free ridership. Had the package not been available, 43% of respondents suggested that they would have still installed PV and that their decision was not influenced by the CVSC program. Over the trial period, households on the PFIT and TFIT tariff have on average, exported about 40% of the electricity generated from their PV installation.

Most of the challenges that created complexity around the delivery of the Household Solar PV package were covered in detail in earlier annual reports. They included:

- Close-out of the Premium Feed-In-Tariff (PFIT), which created a sales spike across the state and subsequent delays, as well as confusion about the new Transitional Feed-In Tariff (TFIT)
- The prequalification of becoming an Origin retail customer and shifting to a Time-Of-Use Tariff
- Smart meter delivery timeframes, and
- Extra pre-qualifications such as check metering and not being able to shift from a Climate Saver Tariff to a Time-Of-Use Tariff.

From the challenges above, and the day to day observations of the CVSC project team, a number of key lessons around the customer experience of the purchase, installation and certification of solar PV can be drawn:

Activity	Barrier or Benefit	Outcome and Lesson
The Customer Experience - Solar PV Information	**Barrier**: Information provided to participants considering the purchase of a solar PV system was complex and hard to digest. This made it difficult for participants to compare and contrast product offers. Product information did not clearly explain the tariff arrangements or installation process.	**Outcome:** The participant's expectation to receive clear and concise information related to the product itself, feed-in tariffs and installation process was difficult to manage. **Lesson**: The disparate players involved in the provision and installation of solar PV have a significant opportunity to improve the customer experience and increase the take up of solar PV. This may be achieved by improving the customer's ability to see the complete transaction and installation process at the point of sale.
The Customer Experience - Customer Support	**Barrier:** Dedicated customer service officer supporting solar PV participants.	**Outcome:** Participants who raised a query relating to the progression of their installation were able to quickly access feedback through the CVSC office. **Lesson**: Participants value the ability to 'check in' on the progress of their installation. This was particularly evident during the transition between feed-in tariffs when demand for solar PV was extremely high.
The Customer Experience - Finance	**Benefit:** During the program, the supplier offered a 24 month on-bill finance solution for participants purchasing their solar PV system.	**Outcome:** Out of the 521 sales, 506 participants utilised the finance package. **Lesson**: The finance package was an important factor in the uptake of PV systems in the project. Such packages may be an effective driver to increase the uptake of solar PV as feed-in-tariffs and REC incentives reduce.

CONCLUSION

Over the course of the trial the Household Solar PV group decreased their consumption by **13%** more than households in the matched control group. This significant reduction in electricity use can be attributed to participation in the Household Solar PV trial.

OPPORTUNITY

In relation to Household Solar PV Central Victoria Solar City has identified the following opportunity:

1. Streamline the customer experience. There is an opportunity to bring disparate players in the solar PV market together to improve the overall customer experience. This may be achieved by agreeing on a unified communications approach to better educating prospective customers about the steps involved in acquiring a solar PV system.

CAMPASPE SHIRE CASE STUDY

CENTRAL VICTORIA SOLAR CITY
Local energy solutions.

Participants: Kate and Duncan Worsfold, Campaspe Shire. Assessor: Lisa Booth

The Worsfolds are an energy conscious family who live on a small property outside Kyabram. While leading busy lives with their two children, Lucy and Will, the couple were keen to take part in the Central Victoria Solar City project and hoped that doing this would help them reduce their bills.

"We learnt that you can't make informed decisions if you don't have the information, and this project gave us access to simple, professional advice for free," Duncan said.

After receiving advice from their assessor, the Worsfolds installed a number of energy efficiency, and renewable energy products and services, including household solar PV.

"We are now equipped with simple ways to improve heating and cooling in our home, and we're a lot more informed about the value of solar energy."

A: 10 Templeton St Castlemaine, Victoria 3450 P: PO Box 557 Castlemaine, Victoria 3450
T: (03) 5479 1900 F: (03) 5406 0953 E: info@sustainableregionalaustralia.com.au

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Australian Government Solar Cities

Case studies showcasing local energy champions were used in each municipality to highlight the benefits of engaging in energy efficiency and household solar solutions.


$1.57 Today
0.787 kW

"Using our In-Home Display has been a great way for us to monitor our energy consumption and costs. It has also enabled us to see how much electricity we are generating. The other feature that we have used is to compare our electricity usage on a month to month basis. We have found these functions helpful in trying to reduce our electricity use."

Colleen Garsed,
In-Home Display Package

3.5.6 IN-HOME DISPLAYS

BACKGROUND

During the second half of 2011, eligible CVSC participants receiving a Home Energy Assessment were offered the opportunity to trial, at no cost, an In-Home Display (IHD) device that provided near real-time feedback on energy consumption. The IHD, a small visual device paired with a smart meter, makes available to participants information about the cost of the energy they consume and illustrates through easy to understand graphical interfaces how changes in energy use behaviour and appliance use alter energy consumption and expenditure.

The IHD trial sought to:

- Measure the effectiveness of the IHD as a method of providing participants with access to near real-time electricity consumption information
- Measure the impact of the IHD on participant's energy use, and
- Understand the value of smart meters for consumers when paired with an In-Home Display.

This sub-trial was introduced after the original Smart Rates package, designed to demonstrate the impact of integrating cost-reflective pricing, was withdrawn from the household trial. CVSC's Smart Rates retail electricity plan sought to measure the impact of passing on the 'real cost' of energy during 'critical peak events' to consumers. Smart Rates was a cost-reflective pricing product which offered consumers a fixed off-peak price of 13 cents for 355 days, 24 hours per day each year. The remaining 10 days of the year could be 'called' as a 'critical peak event' by the retailer. Origin, as the product provider, could notify participants of a critical peak event 48 hours prior to the event and then change the cost-reflective price of $2.00 per kilowatt hour between 2pm-8pm on those ten days. After intensive research and product development the consortium agreed that the risk posed to participant health and wellbeing could adequately be addressed during the trial. As a result the consortium did not offer the Smart Rates product to participants in the research trial.

The consortium had acquired a number of In-Home Displays as a communications tool to assist participants to respond to the pricing signals within the Smart Rates trial. Following withdrawal of the Smart Rates pricing product, CVSC sought to test the impact of the IHD as a 'stand alone' product on energy use.

CVSC first introduced the offer to participants interested in purchasing solar PV to allow participants to better monitor system generation through the In-Home Display. The offer of an IHD was also later extended to participants who chose to engage in the trial by having a home energy assessment only. Because of the way that the IHD communicated with the meter, there were strict qualifications around which participants were able to join this trial. Participants wishing to take up the offer could not have an electric slab heating tariff, a Climate Saver tariff, or an off-peak electric hot water tariff. As such, this trial was mainly limited to households connected to the reticulated gas network.

524 household participants were engaged in the IHD trial, with 328 staying with the trial through to completion of the final survey.

Consortium member Powercor began installing the In-Home Display devices during late 2011, with installation completed for all participants during the first half of 2012. They were distributed at no cost to participants. Initially the IHDs were installed at the same time as households' smart meters. However, as Powercor's information technology capacity developed during rollout, they were able to begin remotely pairing IHDs to households where there was already an existing smart meter. This sped up the installation process.

FINDINGS

Data analysis for the IHD trial was based on the energy use of the 328 IHD participants who completed the final survey and as such a full data set was available. Figure 3.5.6.1 shows the consumption patterns for IHD households compared to their matched control households, before, during and after the intervention. The IHD group decreased their consumption by **5%** more than similar households in the matched control group. This result was the same as for the retrofit group, and represented the smallest savings attributable to the program. Despite the relatively small saving the decrease in energy use was significantly affected by participation in the IHD component of the CVSC program.

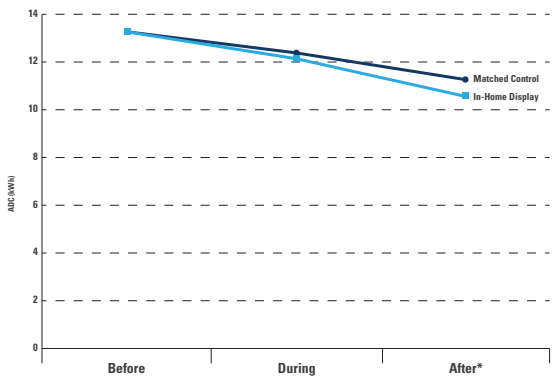
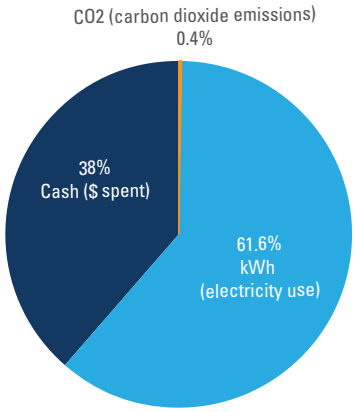


Figure 3.5.6.1: Average Daily Consumption: IHD vs. Matched Control Group (kWh)

*Difference is statistically significant at 95% level
Note: Analysis has controlled for participation in other CVSC packages

The most common reasons for not taking part in the program's IHD package related to availability (36%) and eligibility (18%). It should be noted that the IHD Package was not rolled out until the second half of the trial engagement period, and that available energy assessors, combined with restrictions around meter pairing eligibility, meant that the trial had strong concentrations of participants in the Ballarat, Bendigo and Newstead areas.

84% of participants who received an IHD indicated they set up the device. The most common setting nominated was electricity use (61%) followed by $ spent (38%) – see Figure 3.5.6.2. Only 1% mainly used the CO2 emission setting.



Q: What setting do you normally have your In Home Energy Display on? (Base = IHD Participants that have referred to the device (n=251))

Figure 3.5.6.2: IHD Device Setting

Some differences between participants that did or did not receive an IHD as part of the program were observed. In particular, IHD participants were more likely to have:

- Lower levels of pre-program electricity use and be located in the Ballarat region.
- A reticulated gas connection or gas hot water service.
- Participated in the program's Household Solar PV package and less likely to have joined CVSC's Retrofit or SHW packages.

Satisfaction, value and quality levels for the IHD package were lower than those reported for other interventions. Only a moderate level of satisfaction was also reported with the clarity of the IHD manual. For households that had not set up the display, 42% identified problems understanding the manual as being the major reason why they did not setup the device.

Active users of the IHD indicated that the device improved household knowledge of electricity use patterns and helped guide ways to reduce energy use. The most common changes nominated by participants were curtailment behaviours, such as turning off lights (53%), televisions (45%), computers (43%) and other appliances (45%). Forty-two percent of IHD participants stated they were shifting electricity use from peak to non-peak times.

Participants in the trial indicated a reluctance to pay for such a device, with 56% indicating they would be prepared to pay $50 or less for these devices. A further 33% indicated that they would pay less than $100 if the IHD had not been provided for free as part of the program.

DISCUSSION

IHDs provide customers with their real-time energy consumption information, which could indirectly facilitate a transition to purchasing more energy efficient appliances by influencing subsequent consumer purchases. The IHD trial was offered late in the CVSC program and therefore relatively limited longitudinal data was available in relation to their influence on appliance replacements.

Less than a quarter of IHD trial participants said they had not made any changes, indicating that a near real-time display was a successful prompt for facilitating simple behaviour change. The CVSC project team believes that the majority of participants set their IHD screens on the electricity usage setting because they were aware of the importance of knowing their daily energy use and that better managing their consumption would see it reduce.

Another observation of note by the CVSC project team was that participants in this trial appreciated the graphical interface of this consumption monitor. The CVSC project team received consistent feedback from IHD participants that its visual, graphic nature made it easy to ascertain knowledge at a glance rather than having to study figures and data.

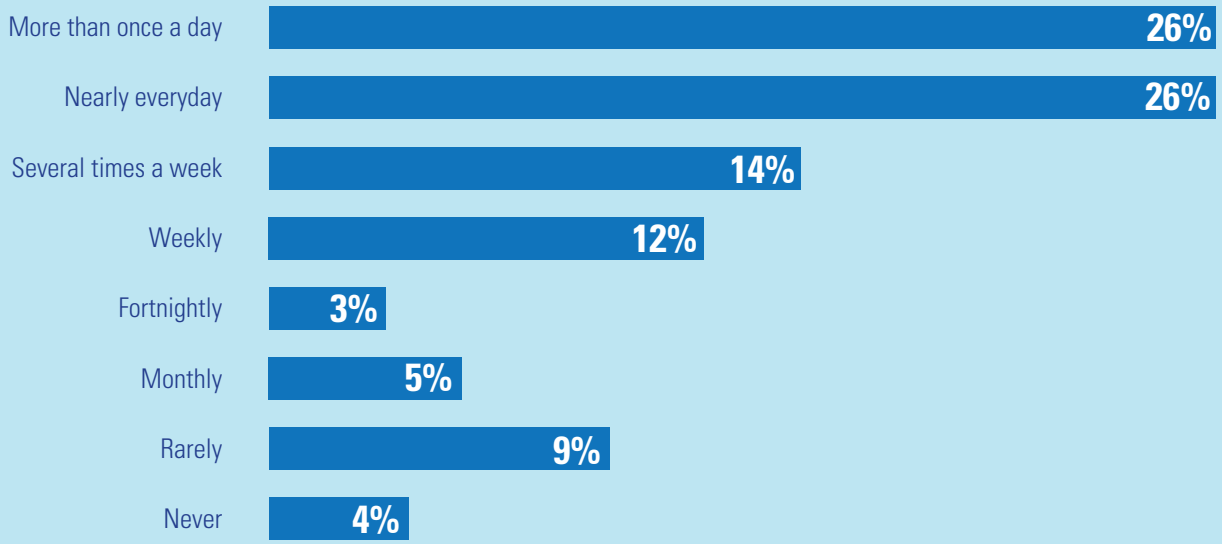
The major reason for participants not setting-up the device was a lack of understanding around how it was done/not understanding the manual. All IHD participants were provided with a manual explaining how to set it up and how to troubleshoot any basic issues. Participants could also ring the project office for IHD advice and support. An opportunity to increase participant use of IHDs in future projects could include demonstrating how to use the device and running through frequently asked questions during the energy assessment itself.

CONCLUSION

Despite active users of IHDs indicating that the device improved household knowledge of electricity use patterns and helped guide ways to reduce energy use, the IHD group decreased their consumption by only 5% more than households in the matched control group. This result represented the smallest savings attributable to the CVSC interventions.

Addicted to Conscious Energy Use!

Like a petrol gauge for energy, an In-Home Display allows householders to view their consumption in near real time and monitor dollar for dollar how their consumption affects what they pay on their bills. One of the most interesting aspects of the IHD trial was how often the majority of participants looked at their IHDs. Current retail billing does not allow customers to see the direct effect of an appliance, whereas the IHD allows customers to turn off their fridge and see in near real time the energy it is using. Most households (66%) indicated that they referred to their IHD several times a week or more, meaning that two thirds of the trial's participants were consciously connecting behaviour and usage to bills on a regular basis!



Q: Since receiving your In-Home Energy Display, roughly how often have you referred to the device?
(University of Ballarat – Follow Up Survey December 2012)

38% of IHD trial participants set their devices to show dollars spent

4. SOLAR PARKS

4. SOLAR PARKS

BACKGROUND

One of the objectives of Central Victoria Solar City was to test the technical and commercial viability of medium scale solar parks. In preparing the bid for Central Victoria Solar City, the Central Victorian Greenhouse Alliance canvassed interest in medium scale solar projects across its membership of fourteen local governments. CVGA found that Councils were interested in exploring the viability of medium scale installations of solar PV. CVGA's stakeholders wanted to better understand the technical elements of building and operating a solar park, including the design process, cost of materials, reliability, seasonal generation and maintenance costs involved. They also wanted to know more about the economic model for medium scale solar, including the rate of the feed-in tariff and the power purchase agreement needed to make a solar park in a paddock, as opposed to rooftop solar PV, commercially viable.

CVSC's consortium members Origin, Powercor and Bendigo Bank identified the development of the solar parks as a valuable learning opportunity. Origin was appointed to design and construct the parks in Bendigo and Ballarat. Origin engaged PSG Elecraft as lead contractor in Bendigo to develop the Bendigo Solar Park. Bendigo Solar Park has a 333kW capacity, of which 16kW is mounted on tracking systems and the balance installed as a fixed array. Bendigo Solar Park includes a battery storage system. The park is located adjacent to the Bendigo Livestock Exchange in Huntly. Origin engaged Sharp to design and construct the Ballarat Solar Park, which is located opposite the Ballarat Airport. Ballarat Solar Park has a 330kW capacity, of which 16kW are mounted on tilted oscilating tracking systems.

Powercor expressed interest in exploring the requirements of connecting a medium scale solar park to the electricity grid. Powercor provided discounted connection fees for both solar parks and worked closely with Origin and other consortium members during the commissioning of the parks.

Bendigo and Adelaide Bank provided SRA with finance to develop the parks. At the time the parks were developed, little was known about the reliability of medium-scale solar PV or its impact on the grid in Victoria. Bendigo and Adelaide Bank played a critical role in establishing the parks by committing to provide finance at market rates. One of the Bank's objectives in supporting the trial was to explore opportunities for regional communities to increase prosperity through developing renewable energy assets.

The then Department of Climate Change and Energy Efficiency (now the Department of Resources, Energy and Tourism), agreed to develop a simulated feed-in tariff and simulated capital allowance, to be claimed on a quarterly basis, based on the parks' generation. These were established to test the revenue required to sustain operation of a solar park of this size and offered in place of a one off capital grant. Other solar cities testing iconic, medium scale solar installations opted for a one off capital grant. The value of testing the simulated feed-in tariff was significant as it provided a more realistic comparison for stakeholders between CVSC's subsidised parks developed as part of the trial and the revenue required to develop medium scale solar parks in future.

Sustainability Victoria provided finance for the development of the parks, supporting the trial of battery storage and tracking systems in particular.

The solar parks were designed to act as a gateway initiative, to provide new knowledge on the reliability of medium-scale solar PV technology and insight into the business model required for commercial success. Key stakeholders attended site tours at the solar parks, received annual reports on the generation result from both parks and updates on the market conditions for medium scale solar. Over the three and a half years the parks have been in operation, visitors from across Australia and overseas have visited the parks to learn about the viability of medium-scale PV. CVSC were able to use the new knowledge gained through the trial to give presentations on the parks at the National Solar Power Australia Conferences in 2011 and 2012, the National Solar Cities Conference in 2011 and 2012 and regular presentations to state government stakeholders in Victoria.

The Business Model

The business model sought to identify and explore the ingredients required to develop solar parks outside of a trial. The Bendigo and Ballarat Solar Parks had four revenue streams including the simulated feed-in tariff, simulated capital allowance, Power Purchase Agreement (PPA) and participant contribution. The first three streams, feed in tariff, capital allowance and PPA were paid to SRA based on the parks' generation.

The CVSC Consortium intended to facilitate community ownership of the Bendigo and Ballarat Solar Parks at the conclusion of the trial. It was thought that the parks may continue to provide an income stream for community sustainability projects after the CVSC trial was complete. However due to the relatively high cost

Ballarat Solar Park

Bendigo Solar Park

of developing the parks in 2009, approximately ($12,000 per kilowatt) and the difference between the subsidised income stream (combined rate of 88cents per kilowatt hour which included the feed-in tariff, capital allowance and PPA), compared to the forecast income the parks could earn post trial (approximately 8 cents per kilowatt hour), the parks were not commercially viable. As such, SRA and the consortium did not pursue the objective of facilitating community ownership of the parks. The consortium did explore options to secure a higher PPA after the CVSC trial, meeting with electricity retailers to explore their appetite to offer a higher power purchase agreement, however the project team could not secure a viable offer.

The trial produced significant new knowledge related to the development of both the commercial model for medium scale solar PV and the technical design of solar parks. The project team and consortium were able to share this knowledge with communities expressing interest in developing similar parks, with the Australian, State and Local Governments participating in the program, and solar industry stakeholders.

Bendigo and Ballarat Solar Parks will continue to be operated by Origin after completion of the CVSC trial.

FINDINGS

Generation

Electricity generated by Bendigo and Ballarat Solar Parks is recorded by a Powercor meter located at each park. Generation data is recorded in half hourly intervals. Figures 4.1 and 4.2 illustrate three years of generation data for both parks and Figures 4.3 and 4.4 represent solar radiation data for Ballarat and Bendigo during these years. Generation by the parks was consistently reliable with the exemption of some operational issues at Ballarat. The trial demonstrated that fixed, medium-scale solar PV installations were a reliable, proven technology for generating electricity. The quality of the panels (Yocosol and Sharp) and inverters (Fronius and Sharp) chosen for the project proved to be fit for the parks' purpose.

Maintenance

Maintenance for both parks was managed by Origin and carried out by sub-contractors. Maintenance activities were carried out at Origin's cost, as the Power Purchase Agreement for both parks included the delivery of maintenance at both sites. The Ballarat

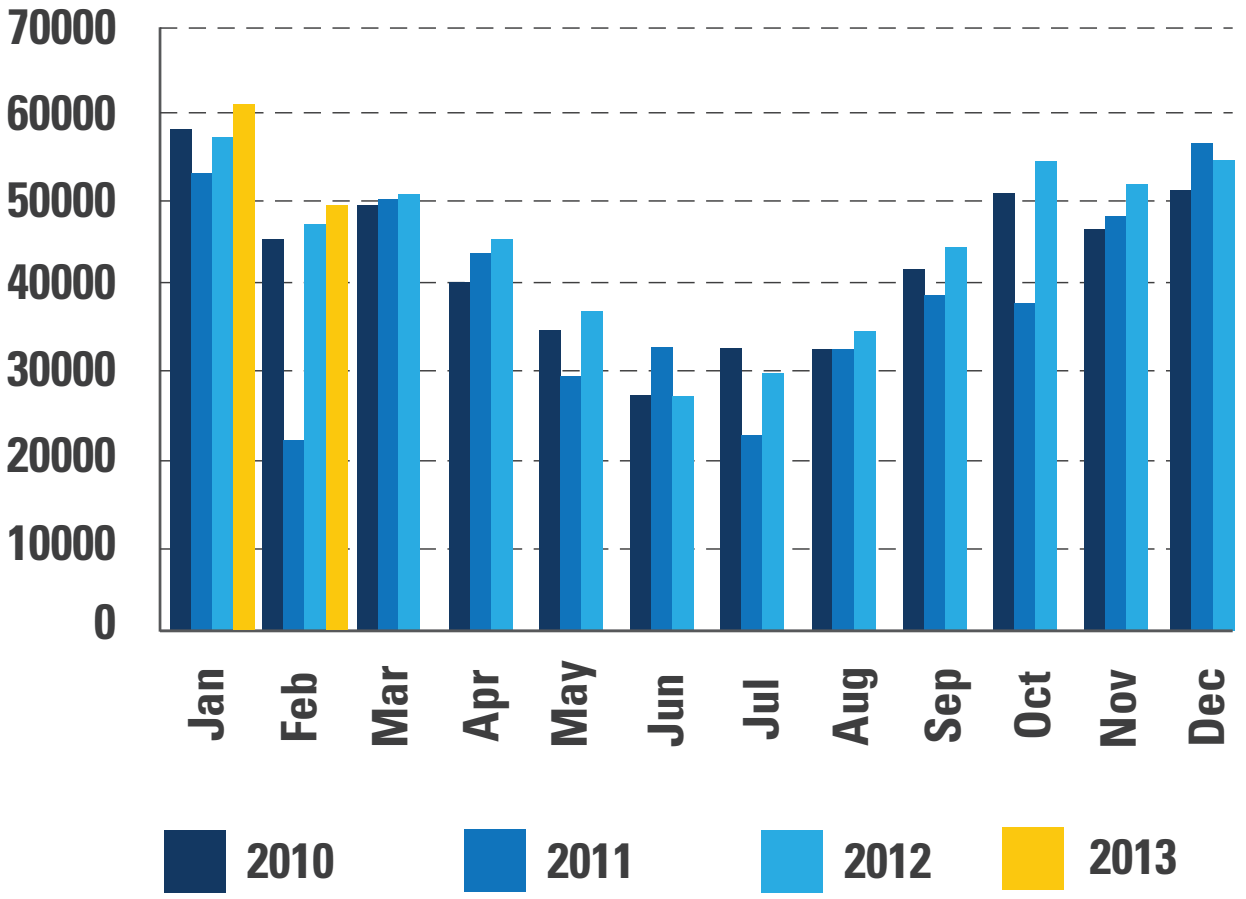


Fig 4.1 Ballarat Solar Park Generation

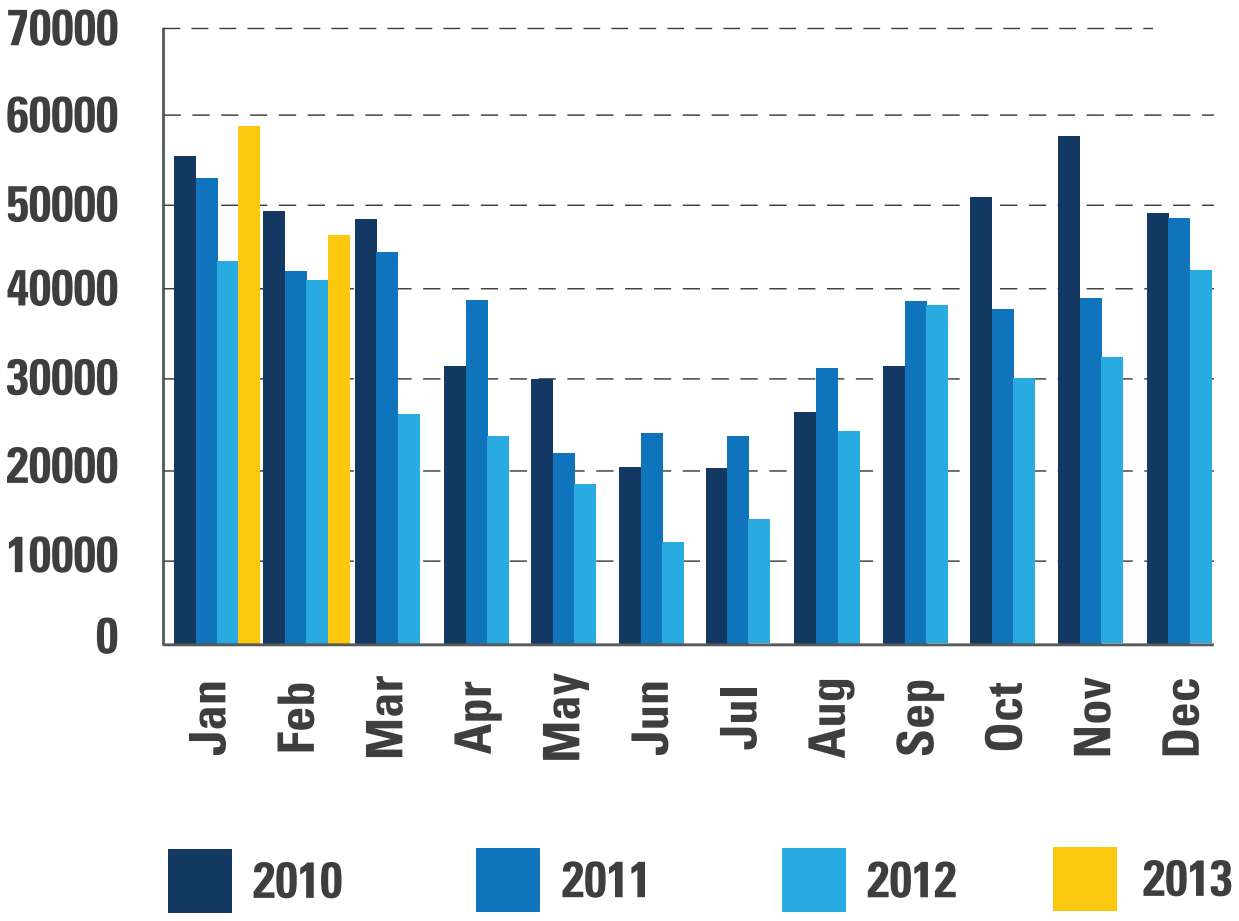


Fig. 4.2 Bendigo Solar Park Generation

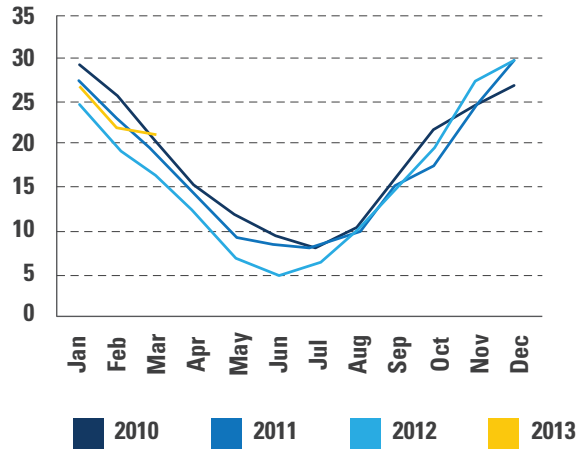


Fig. 4.3 Ballarat Radiation Data

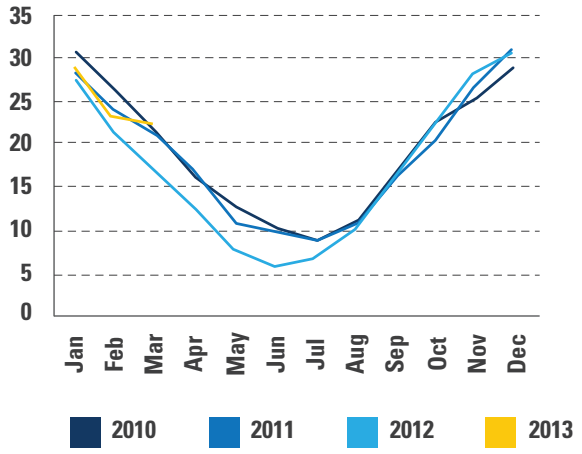


Fig. 4.4 Bendigo Radiation Data

Solar Park experienced a greater number of faults and outages than Bendigo. The Bendigo Solar Park operated consistently since commissioning in late 2009. It is worth noting that a decrease in average radiation levels each year in each location during the trial mirrored decreased generation, except in 2012, in Bendigo, where generation increased despite lower solar radiation. This difference could be explained by ambient temperature and wind speed, which impact panel temperature, and in turn, panel performance.

Tracking Versus Fixed Arrays

Annual averaged generation data recorded from tracking systems demonstrated a significant variance when compared with the fixed arrays. Bendigo Solar Park achieved the greatest increase in generation from the tracking systems, which produced 21% more electricity than fixed arrays of the same capacity at the Bendigo park. The Ballarat tracking systems delivered 12% more electricity than fixed arrays of the same capacity at the Ballarat site. The variance in the tracking result between Bendigo and Ballarat can be explained by maintenance issues with the Ballarat trackers.

Although the tracking systems did produce significantly more electricity, the maintenance issues in the CVSC trial suggest that tracking systems were not a financially viable strategy for increasing generation at Bendigo or Ballarat. The relative cost of the tracking equipment and the maintenance they required was greater than the increased income earned by optimising generation. The role of the tracking equipment in educating key stakeholders in the electricity generation from solar PV process was valuable. Tracking systems provided a point of interest for school and community groups visiting the parks and inspired further research, particularly by secondary school students, into optimising generation through orientation and tilt of the panels.

Battery Storage

An energy storage system was designed and installed at the Bendigo Solar Park to test the feasibility of storing energy from peak generation times when demand is low, and discharging it to the grid during peak demand periods. The system consisted of a charger/rectifier set, 48 lead acid 1600 Ah batteries and 12 inverters to convert the electricity from DC to AC power during the discharging stage. Testing was conducted during 2011 and is reported on in detail in the previous annual report. Overall, the system had capacity to store and discharge approximately 60kWhs of energy each day, which is approximately 5% of the Park's total daily capacity.

Whilst the batteries performed to specification they do not present an effective storage solution because much larger capacity is needed to store enough energy to facilitate maximum use of energy generated by a medium scale asset.

DISCUSSION

Strong Community Interest

The parks have created a significant amount of community interest and have provided a focal point for conversation and ongoing education around renewable energy. Having the parks close to the population centers of Bendigo, Ballarat and Melbourne made it possible for hundreds of visitors from interest groups and the general public to visit the parks and learn firsthand the technical processes around medium scale generation and ask questions about the operation of the parks.

The following captures some of the key discussion points stimulated by community interest in the parks:

- The desire to understand medium scale energy generation and how to develop a community's energy literacy
- Initiation of conversations around how communities become involved in community energy ownership
- When will medium scale solar PV and other renewable energy options have a financial model that provides a sound return on investment to community shareholders?

5. RENEWABLE COMMUNITIES

5. RENEWABLE COMMUNITIES

BACKGROUND

The Renewable Communities program is unique in its approach within the national Solar Cities trial. In this program the CVSC project team partnered with community leaders in the three regional Victorian towns of Newstead, Kyabram and Murchison to collectively reduce energy use and explore options to establish community owned, renewable energy assets. Specifically, the trial set out to:

- Identify and test different approaches in engaging communities to collectively reduce energy consumption
- Compare the effectiveness of a collaborative community approach to achieve energy savings with a traditional, market based approach
- Identify options for local generation of renewable energy.

Approach

The approach was first trialled in Newstead, a small town in Mount Alexander Shire. Newstead was chosen as the pilot location on the basis of the community's capacity to lead and manage projects. Prior to 2010 Newstead leaders had established a wireless internet network, a community garden and a playground, demonstrating their capability in engaging local residents and liaising with third party organisations.

In the early stages of the pilot project community leaders expressed a desire to learn more about CVSC's Bendigo and Ballarat solar parks. Newstead leaders canvassed interest from local community members for the concept of a solar park funded by residents and developed in the town. The concept for community ownership of their proposed solar park came from Hepburn Wind, a cooperative organisation developed by local residents to generate renewable energy powering Daylesford and Hepburn.

The three Renewable Communities leadership groups met regularly to share ideas & learnings.

Inspired by the achievements of Hepburn Wind, the Newstead leaders brokered a Memorandum of Understanding with SRA. The role of the community leadership group in the 'Renewable Newstead' project was to recruit residents and businesses to complete energy assessments, participate in a pre-feasibility study to identify options to generate energy from renewable fuel sources within or close to the township, and to lead a discussion based on the outcomes of the pre-feasibility study with the community.

In July 2012, the program sought to work with another two communities to implement an energy savings and renewable energy generation trial. Successful applicants Murchison and Kyabram joined the project.

Each town entered into a Memorandum of Understanding (MoU) with SRA. Through the MoU, Sustainable Kyabram (SKY Inc) and GV Community Energy agreed to provide leadership and governance for the project. In addition, two project officers were employed part-time. These officers were predominantly employed to deliver community engagement and energy assessment outcomes. A project manager mentored each leadership group on governance, shared expertise around technical and energy industry knowledge, and facilitated connections with networks of other communities and energy market leaders.

FINDINGS – NEWSTEAD

Eighty per cent of all Newstead households received an assessment and of these households 45% completed all research requirements for participation in the research conducted by the University of Ballarat (i.e. 23% of Newstead households).

Several differences between program participants from Newstead and other areas were identified, mainly related to socio-economic characteristics. In particular, Newstead participants were more likely to: be single; have small houses; have annual household incomes of $50,000 or less; be unemployed, and have an electric hot water service. The Newstead area does not have reticulated gas access and nearly two-thirds of the town's participants used bottled gas. Participants from Newstead had similar intentions to reduce energy use, knowledge, attitudes and beliefs towards energy conservation, environmental values and pre-program adoption of solar technologies as program participants from other areas.

While 39% of Newstead program households chose to take up at least one of the intervention packages offered under the program the corresponding up-take for other households in Mount Alexander was 53%. The Newstead micro engagement model differed fundamentally from the recruitment strategies deployed across other regions and represented a successful mechanism to attract initial interest in the program; however this did not translate into higher levels of commitment to the research aspects of the CVSC program nor to the intervention packages (eg. Solar PV) offered.

As with other households across the CVSC region, Newstead residents valued the assessment service, however, they indicated a greater questioning of the quality of the HEA. Newstead households were the least likely of all respondents to support payment for the assessment.

Overall, Newstead households rated their involvement in the CVSC Renewable Communities trial highly; however, their satisfaction with the program was generally not as high as the average indicated across the LGAs or that reported in the Mt Alexander Shire. It is possible that the engagement model deployed in Newstead created very high expectations for the program and these expectations were relatively more difficult to meet.

Figure 5.1 shows the consumption patterns for the Newstead households compared to their matched control households, before, during and after the intervention. The differences were not significant.

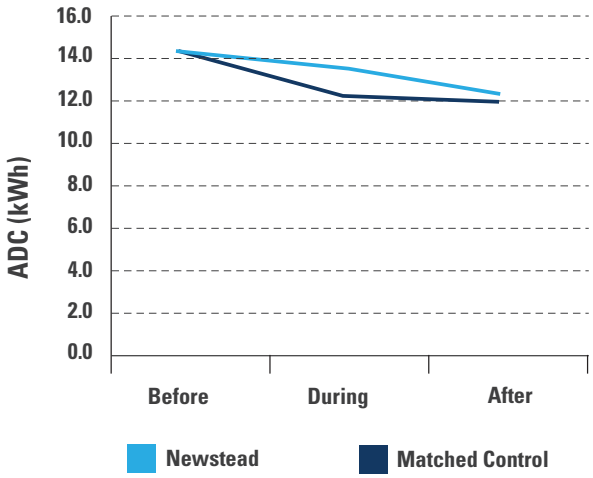


Figure 5.1: Average Daily Consumption: Newstead vs. Matched Control Group (kWh)

The electricity use levels of Newstead households remained the same as those for the matched control group, which suggests that participating in the Home Energy Assessment micro-engagement component of the Renewable Communities sub-trial had no significant effect with respect to changes in energy use. This result suggests Newstead households would have implemented similar energy efficiency measures anyway. Energy use evaluation was not conducted for Murchison and Kyabram because their projects began too late in the trial to gather enough relevant data for meaningful analysis.

DISCUSSION - NEWSTEAD

CVSC found that although initial interest in a collective approach toward energy saving was high the participants in the Newstead trial did not reduce their energy use more than their matched pairs in the control group. The energy savings achieved by participants who completed the Home Energy Assessment in the rest of Mount Alexander Shire was greater than the Newstead cohort. This may suggest that although the community valued the service provided, their interest or capacity to take up further energy saving measures was less than the intervention group. This may be explained by the lower income of residents in the Newstead area compared with the intervention group overall.

The lack of energy savings achieved in Newstead suggests that the first proposition CVSC sought to test, the impact of a whole of community approach to energy saving, was not as effective as the traditional market based model in influencing behaviour change.

The secondary objective of the pilot was to identify options to generate energy from renewable sources and to examine the economic viability of a locally owned, renewable power station. Sustainability Victoria provided funding to SRA to complete three pre-feasibility studies, one for Newstead and two for the towns to be recruited into the program after the Newstead pilot was complete.

SRA outsourced the pre-feasibility study for Newstead to local firm Crockford McCartney. The study outlined several potential options including solar PV, both through a solar park in a paddock and a distributed park model (on the rooftops of established buildings), as well as geothermal, wind and biomass options for generating electricity.

The cost to develop a power station using any of the renewable energy options covered in the report was too high to present a compelling value proposition for local investment. Nevertheless the community leaders remained committed to exploring innovative approaches to working around the costs. Some of the ideas explored included aggregating demand with local customers to present a business case to an electricity retailer, to offer the community an attractive Power Purchase Agreement (PPA) to purchase electricity generated from the asset. The concept was to bring hundreds of new customers to a preferred retailer in exchange for an attractive PPA. The community leaders were not able to secure a commitment from a retailer to acquire power at a price that would make the model viable in 2010.

The community leaders also explored options to develop a solar park on the rooftop of a large energy user within 20km of the township. The proposal included a large solar installation funded by Newstead community members, where electricity was sold to the customer for an agreed rate per kilowatt hour. This idea had stronger commercial potential but was less attractive to the community as the proposal did not deliver the visibility the community aimed for in an iconic installation for their town.

The Newstead community remain committed to the development of a renewable energy asset. After the completion of the pilot program in 2011 the community established a new partnership with ABB, a global developer of solutions for power stations. The SRA team introduced ABB to Newstead community leaders following a presentation at the Solar Power Australia conference in 2012. ABB went on to complete a technical feasibility study for a solar gas hybrid power station in Newstead. ABB have also leveraged their expertise and network within the energy sector to further inform the community leaders' approach. By the end of 2012, the Newstead community had introduced the idea of trialling a micro-grid, including a centralised solar farm, distributed rooftop solar photovoltaics and battery storage.

The local leaders involved in the project shared the expertise they have developed through the program with over 30 communities who attended the Community Power Conference hosted by SRA and LaTrobe University in 2011. They have also been asked to share their experiences with policy makers, industry leaders and community volunteers from across Australia. The dedication of the Newstead community to advancing community renewable energy has been extraordinary, particularly their willingness to invest time and energy in the pursuit of an idea that's time has not yet arrived, in the belief that it will come.

KYABRAM & MURCHISON

The Newstead pilot was completed in December 2011. Sustainable Regional Australia called for expressions of interest from towns in regional Victoria to host a similar trial that explored options for renewable energy generation. The rationale for introducing another two communities into the program was to test the extent to which local factors such as access to renewable fuel sources, access to capital and local capability of the grid to accommodate a generation asset could increase the viability of a community owned, renewable power station.

Kyabram and Murchison were selected from a field of 12 applicants. They were selected on the basis of the demonstrated capability of community leaders to engage diverse groups within the towns towards achieving a common goal.

The leadership groups in Kyabram and Murchison completed an induction with the SRA team at the outset of the program, to clarify roles and responsibilities. As was the case in Newstead, leaders took on responsibility for engaging residents and businesses in taking up an energy assessment. The assessments provided a starting point for conversations on energy consumption, energy prices and the potential to generate renewable energy locally, though a community owned asset. The leadership groups also took on responsibility for sharing the findings from the pre-feasibility study on options to generate electricity locally with members of their communities.

In Murchison, 135 home and 5 business energy assessments were conducted. 76 social surveys into energy use, energy

Marg Clarke from Murchison enjoyed her home assessment experience.

behaviour and renewable energy were also completed. 97% of those surveyed were interested in a community owned, renewable energy asset for their town and 77% strongly supported Renewable Murchison building an electricity generator that used renewable energy sources. 98.5% found the home energy assessment valuable.

In Kyabram, community leaders were highly effective in engaging locals in collaborative community meetings to discuss energy saving measures and options for renewable generation. A total of 26 workshops and community events were held over 12 months.

The outcomes from the community consultations in both Kyabram and Murchison included very strong support for the concept of a locally owned, renewable power station and significant appetite to invest, on the condition that the rate of return was greater than bank interest. Community leaders successfully engaged local government and large business in pursuit of a shared goal to develop a local renewable power station.

SRA engaged Earth Systems to complete an options analysis for Kyabram and Murchison, to outline renewable energy generation options and issues for consideration. The detailed reports are available on SRA's website. High level findings indicated that an opportunity to develop a biomass facility in Kyabram was viable and should be further explored. The reports also support the

Renewable Milk

Kyabram is a rural town heavily reliant on agriculture. During the early months of Renewable Kyabram, project officers Doug and Lisa spoke with a number of local dairy farmers who were considering solar. There were common threads to each conversation: they had the roof space, they had access to capital, they had demand for the energy, they were seriously concerned about the impact of rising electricity costs on their business and they were confused about how to proceed with purchasing solar PV. As a result Doug and Lisa sought to find tailored, specific information on solar PV for dairy farms.

Renewable Kyabram initiated the "Renewable Milk" concept, supported by the Goulburn Murray Lardcare Network. GV Community Energy was engaged to do initial economic modelling for two farms. Six farms were then invited to attend a pilot workshop to discuss the modelling results and outline next steps. Many other industry stakeholders also attended, including Dairy Australia, Murray Dairy, the Goulburn Broken River Catchment Management Authority, the Shire of Campaspe, local milk processors (Fonterra, Murray Goulburn, Tatura Milk), Dairy Energy Assessors and electricians.

As a result of the workshop a proposal has been put forward to GV Community Energy and Murray Dairy to further investigate the viability of purchasing solar PV for a further five dairy farms.

development of distributed rooftop photovoltaic installations where electricity generated is sold directly to users.

SRA and community leaders in Kyabram and Murchison will unpack the findings from the Earth Systems reports in June 2013 and develop an action plan to achieve each community's goal of generating energy locally, from renewable sources.

CONCLUSION

CVSC found that there were significant potential benefits to be realised from community owned, renewable power stations. The level of interest in community owned, renewable energy power stations increased throughout the life of the Central Victoria Solar City trial. Although the whole-of-community approach to facilitate energy saving did not have a greater impact on participants' energy use in Nestead, residents' appetite for information on community renewable energy was significant. CVSC suggest that this interest is driven by a desire to increase prosperity in regional towns through community ownership of essential services. The precedent set by Bendigo and Adelaide Bank, through the Community Bank model, has sparked regional communities' interest in the viability of 'taking ownership' of services consumed by local residents.

The feasibility studies completed by Crockford McCartney and Earth Systems point to the future commercial viability of community renewable energy to generate electricity at competitive prices.

The Renewable Communities trial successfully opened up a regional dialogue on the potential benefits that can be derived through community renewable energy.

6. SMALL TO MEDIUM BUSINESS TRIAL

6. SMALL TO MEDIUM BUSINESS TRIAL

BACKGROUND

The Small to Medium Enterprise (SME) trial sought to identify the most effective approach to support businesses to reduce their energy use.

Business Energy Assessments

In mid 2011 the CVSC SME trial began with the launch of a Business Energy Assessment offer designed in response to local market research. The assessment offered was a Level 1 AS/NZS 3598 2000 Business Energy Assessment (BEA) priced at $275. After the first six months of the trial this price point was reassessed in response to demand from bigger energy use businesses with more complex energy infrastructure. A tiered pricing scale was developed, based on businesses' annual energy consumption.

Supporting take up of the assessment was an engagement strategy focused on leveraging local council, business networks, trusted advisor endorsement, and presentations made to business and community groups, to showcase the benefits of a business energy assessment. The assessment itself was supported by an education workbook used by the assessor and the SME to step businesses through their energy use behaviour and capital improvements to heating and cooling, lighting, and equipment and appliances. Three business types were identified as markets: retail businesses, accommodation-based businesses and offices. Recruitment to the SME trial was strongest in Greater Bendigo, Hepburn and Mt Alexander which reflected the trial's recruitment strategy.

120 businesses were engaged in a Business Energy Assessment as part of the trial. Of these, 30% percent of businesses paid more than the $275 entry level price, with the majority of these being part of the next pricing bracket ($550). The 120 businesses spent a median of $7,935 on electricity over the course of one year.

Solar PV Customer Support Service

A business-focused solar PV customer support service was introduced to replace BEA delivery during the final months of the SME trial. This commercial trial sought to test whether a solar PV information and referral service for SMEs would translate into increased PV sales. It was introduced in response to consistent feedback from business owners wanting clear and independent solar PV information, particularly around payback periods and how to compare and analyse quotes for a PV system.

Participants in this trial were offered a 'one-stop shop' approach to solar PV support. The service included a one-on-one onsite consultation with a commercial solar PV support officer. Information and advice around the benefits of solar, payback periods, system size and technical specifications etc were discussed. The support officer then approached 3 solar PV preferred suppliers for quotes. These quotes were compared by the support officer, who then went back to the business with a final supplier recommendation.

FINDINGS

Business Energy Assessments

Of the original 120 Business Energy Assessment trial participants, 62 completed initial and follow-up surveys to collect information relating to the nature of the enterprises, recommended energy saving actions, projected electricity savings, changes to organisational and site characteristics, adoption of energy efficiency recommendations, and subjective assessments of the effectiveness of the program. As such, analysis was conducted from data provided by these 62 participants. Electricity use data was provided by Powercor from 2010 to 2013, which included at least one year of data pre- and post-intervention for participating businesses.

Over half the SMEs engaged in the trial were classified as being small (under 10 employees). A small number of 'micro organisations' employed only one person (owner/operator) and only 3 organisations had more than 50 employees (EFT). Categorising SMEs on the basis of annual turnover saw 51% reporting a turnover of less than $1m and 49% having a turnover of greater than $1m. Similarly, there was a fairly even split between SMEs occupying leased and owned premises.

While reducing energy bills and energy usage were the prime reasons for joining the trial, environmental concerns and improving knowledge of the energy characteristics of the business were also considered to be important factors. The SMEs indicated an interest in reducing their carbon footprint and realised that taking a responsible attitude to environmental issues would be in the best interests of the business. It was seen by businesses that it was important that customers viewed their organisation as being environmentally friendly.

Survey responses indicated that SME respondents believed that there was sufficient information in relation to energy efficiency matters available. They also indicated having control over the decision to reduce their organisation's energy use. However, they further indicated that there would be some difficulties in accessing capital required to considerably reduce energy use.

Seasonal indexes were used to adjust the data for seasonal effects. Quarterly readings before the energy assessment were used to predict energy use after the energy assessment. This was

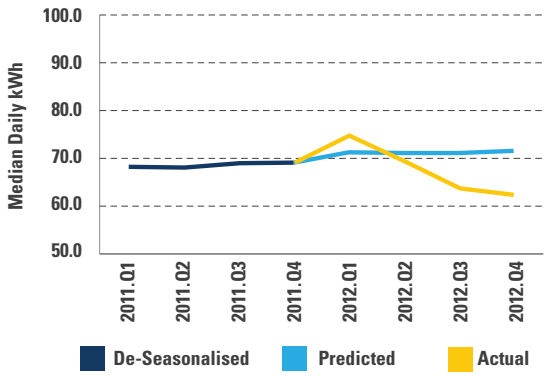
done using the most appropriate time series analysis for each participant. This provided an estimate of a predicted average daily consumption which was then compared to actual post-assessment electricity use. The difference between these predicted and actual observations represent the difference attributable to the BEA assessment. Table 6.1 provides an overall summary of the analysis undertaken.

	Predicted	Actual
ADC	71.3	67.5
Savings		**-5.3%**

Table 6.1: Average Daily Consumption: Predicted vs. Actual (kWh)

Figure 6.1 shows the predicted consumption based upon the time series modelling described above, as well as the actual consumption and the resultant savings attributable to participation in the program. The predicted value is an estimate of what would have been the case without having had a business energy assessment. The difference between what was predicted and what actually happened represents the savings attributable to the program. For the SME trial this amounted to a decrease in usage of **5.3%** which was found to be significant.

Figure 6.1: Predicted and Actual Consumption (kWh)



Significant differences were found between SMEs as follows:

- privately owned (5% reduction) vs. privately leased premises (0.4% increase)
- small staffing (5% reduction) vs. medium staffed organisations (1% increase)
- small turnover (8% reduction) vs. large turnover (1% increase).

Sixty-one percent of businesses reduced consumption by an average of 13%, while 39% increased use by an average of 12%. The largest savings were associated with businesses that were privately owned, or small in staffing, or turnover or size. The overall level of satisfaction with the program was high. The two main suggestions for improvement from participants related to more follow-up and that more attention be paid to potential savings associated with production equipment. Estimated savings achieved as a result of the program were typically 20% lower than original BEA predictions. However the BEA predictions were based upon all recommendations being undertaken. During the assessments most businesses indicated that they would adopt a 'staged approach' to implementing efficiency behaviours and infrastructure change, implementing different efficiency changes over time as part of their longer term business strategy.

One finding from the trial by the CVSC project team was that business decisions were financially driven and that cost savings must sit front and centre of the value proposition. Also identified was the importance of providing a whole of business energy analysis, reviewing current practices and needs across the organisation, as opposed to looking at pieces of equipment and specific behaviours in isolation. For example, in a number of businesses, there were multiple fax, scanning, and printing machines. In most instances these activities could be combined into one multifunction photocopier that used less power and had cheaper printing costs. The business energy assessor found that businesses tended to see equipment and behavioural inefficiencies in isolation, relying on a supplier's expertise on a particular product rather than viewing the efficiency of a product within a wider, whole of equipment context. CVSC recommends that businesses focus on consolidating equipment where possible to reduce overall energy consumption.

The CVSC project team also suggests that delivering a customised, pre-researched assessment tailored to fit particular business goals and schedule, as opposed to delivery of a generic assessment, helped ensure that actual time spent at the business was best used. In terms of pre-assessment research, energy bills were analysed prior to the site visit. Industry research was carried out beforehand in order to adjust assessment scope to the specific energy needs of each industry. Research was also completed beforehand to identify local suppliers and resources so that the most useful supplier recommendations could be made on the day.

Solar PV Customer Support Service

Over 100 businesses were approached with the offer to trial the project's solar PV information and referral service. Of these, 20 SMEs took up the offer. Of these 20 businesses, four went ahead to install solar PV.

As part of the service provided to participants, each of the three preferred suppliers were asked to trial forecast an annual yield for their system so that system cost could be compared alongside estimated actual generation rather than simple kW generation capacity. Businesses in the solar PV information and referral service trial fed back that they considered security of energy production just as important as price. Of the four installations that occurred as a result of this trial the cheapest quote did not necessarily secure the deal.

SME feedback about the customer support service trialed was very positive. Participants valued the service in terms of demystifying solar and introducing them to trusted suppliers. However, actual uptake of solar PV was low because there was no 'act now' incentive, such as a premium feed-in tariff or higher Renewable Energy Certificate (RECs) rebate, to prompt SMEs to

CASE STUDY: Major's SUPA IGA

Major's SUPA IGA is Rochester's oldest serving supermarket, spanning more than 100 years and four generations. It's a community icon, committed to the development of the community and its people.

Through their Business Energy Assessment, Major's SUPA IGA were presented with a number of opportunities to improve their energy efficiency. Major's SUPA IGA's annual energy consumption in 2011/2012 was 593 MWh. Approximately 55% of this was for refrigeration, 26% for heating and cooling, 12% for lighting, with the remainder of energy use going to cooking, checkouts and IT. As a result of their assessment, a potential 20% in energy savings, or $23,000 per year, was identified.

"Knowing where our energy is going gives us the power to manage it. Having an assessment breakdown our energy use into areas and identify 20% energy savings has given us a real picture of our future energy costs and a plan to reduce our energy consumption."

Proprietor Brad Major, Major's SUPA IGA

Major's SUPA IGA reduced their energy costs by:

- Airlocking the store entrance
- Upgrading the heating and cooling system
- Upgrading to LED lights
- Powering down point of sale (POS) and other equipment when the store is closed to reduce wasted energy consumption
- Adjusting thermostat settings so that heating, cooling and refrigeration loads are reduced.

purchase a system within a defined timeframe. Feedback across the board from SMEs was that they were waiting to see what happened to the price of solar over time, believing that in waiting they might secure a better deal. As it stands, the cost of commercial solar PV has dropped over the past few years and businesses had no reason to believe that this wouldn't continue.

The Barrier of Split Incentives

Apart from the BEA price barrier, and the lack of an 'act now' rebate for commercial solar, the challenge of split incentives was identified as the other major barrier to businesses undertaking energy efficiency and renewable energy measures. Where a site was leased there was reluctance for small business owners to undertake energy efficiency upgrades such as insulation, HVAC upgrades, double glazing, solar PV and hot water systems, to the fabric of their building, even if payback periods were within leasing terms. Many SMEs viewed building fabric and essential services as the responsibility of the landlord. A number of business owners commented on past difficulties around negotiating capital investment with landlords for essential services like hot water, heating, cooling and lighting. Negotiating investment with landlords on the grounds of efficiency, even if the efficiency provided the owner with an improved building fabric, was a barrier that many SMEs considered too high in considering energy efficiency measures.

OPPORTUNITES

As a result of the Small to Medium Business trial CVSC has identified the following opportunities:

1. SME energy efficiency engagement and marketing strategies focus on the cost saving benefits to business rather than reduced carbon emission and energy consumption benefits.
2. Business energy assessments be individually tailored, with assessors building in pre-assessment research time to analyse bills and business needs, so that time spent onsite is best used.
3. Energy assessments be subsidised for small businesses (under 20 staff) to address pricing as a barrier to uptake.
4. In order to reduce the barrier of split incentives, energy efficiency education for landlords should be offered and energy efficiency rating declarations for SME leaseholds be made mandatory, as per those currently required for office buildings over 200 metres square.
5. Governments investigate a commercial solar PV customer referral service, together with a clear financial incentive, to expedite the uptake of solar PV.

7. HEALTH SERVICES TRIAL

7. HEALTH SERVICES TRIAL

BACKGROUND

Ballarat Health Services (BHS) and CVSC formed a partnership to develop an energy performance precinct that demonstrates best practice in energy generation and efficiency in a hospital context. The partnership aimed to trial a range of energy efficiency measures and solar PV to develop a case study which would inform and inspire other Victorian hospitals to reduce their consumption. In October 2011 the Honourable Mark Dreyfus QC MP, the then Parliamentary Secretary for Climate Change and Energy Efficiency, announced the launch of the partnership at the Ballarat Base Hospital.

The partnership aimed to demonstrate how energy efficiency measures and solar PV could be integrated into the construction or refurbishment of hospitals and set a new standard as to what is possible in energy solutions for regional health providers. The partnership project included: 78kW of solar panels, two electric cars and two industrial solar hot water systems, sponsored by the Central Victoria Solar City project, and more than $800,000 in enhanced energy efficiency measures for the Ballarat Regional Integrated Cancer Centre, provided by Ballarat Health.

As a result, Ballarat Health was able to reduce their energy costs by $17,048.38 and carbon emissions by 263 tonnes. The estimated CO_2 savings per annum is equivalent to the removal of seventy-five motor vehicles from our roads each year.

A written report and DVD demonstrating the benefits of energy efficiency and renewable energy investment at BHS, were distributed amongst all community health centres and hospitals across the central Victorian region in February 2013. All health services across Australia are also able to access this information on the SRA website.

FINDINGS

'The timing was ideal - because we are in the middle of a major building project we had the ability to spread the funding across our sites so when we sat down we worked out the areas we could benefit from and what areas we could use where the energy savings would be pretty much straight away.'

Chris Lockett, Corporate Services Director BHS

Ballarat Health identified seven key areas of focus to demonstrate best practice in energy efficiency and generation. These areas were:

1. Integrated building management system software (Bauer Control System)
2. Development of a culture of energy efficiency within the leadership team and staff at BHS
3. A major solar PV investment for the Ballarat Regional Integrated Cancer Centre (35kW)
4. A major solar PV investment at the Queen Elizabeth Centre (25kW)
5. A trial of electric vehicles
6. Acquisition of commercial solar hot water services for Psychiatric Services and the Queen Elizabeth Centres, and
7. Development of re-fuelling car shelters fitted with a total of 18kW PV to charge electric vehicles.

Solar PV (35kW) - Ballarat Regional Integrated Cancer Centre

The CVSC project provided funding for Ballarat Health Services to source a 35kW PV array for the roof of the four storey Ballarat Regional Integrated Cancer Centre (BRICC). The Ballarat Regional Integrated Cancer Centre was chosen as a key demonstration site for PV based on the high profile of the new building in the community, the opportunity to combine PV generation with state of the art energy and efficiency measures in the building, and the desire of the hospital to showcase electricity generation through an interactive display in the foyer. The installation of PV at the site was held up due to delays in the timeline for completion of the building itself. The prominent location of the PV and the community and patient engagement approach adopted by BHS will ensure that the system remains a key discussion point, inviting further conversations about the hospital's commitment to sustainability.

Solar Car Shelters – Solar PV

As part of the BHS trial the project sought to demonstrate to BHS staff and the wider Ballarat community how vehicles could be powered using the sun's energy. Two solar powered car shelters

were built within the main BHS Base site car park (5kW) and at the Queen Elizabeth Centre (13kW). Panels were installed on the roofs of the car shelters to provide a plug-in point for connection, shelter for the cars and also to generate enough electricity to power two Mitsubishi i-Miev's.

Base site car park installation

The construction of a carport shelter and 5kW solar PV array in the existing pool carpark area of the Base Hospital site provided parking space for six vehicles, including one electric vehicle. A 9kW installation was originally planned for this roof. However, potential shading from the safety guard rail was such that it was decided to take 4kW from this array and add it to the QEC car shelter to maximize output.

Queen Elizabeth Centre supply department building installation

A 13kW solar PV array was installed to the supply department building roof. Amongst other loads this would supply the QEC electric carport, installed in early 2013. Increasing the size of the supply department building installation at the expense of the Base carport system size was a better investment financially, as well as from an energy efficiency perspective, as BHS currently pays an extra three cents per kilowatt hour at the QEC site compared to the Base site.

Queen Elizabeth Centre (QEC) George Skerritt Building – Solar PV

A 25kW system was installed on the George Skerritt Building. The location was chosen to ensure maximum electricity generation. Table 7.1 illustrates energy generation per annum for the PV systems installed by BHS.

	Solar capacity kW	MWh pa	Tonnes CO2e pa	Savings $ pa
Ballarat Health Service Solar Car Shelter	5	6.5	7.8	$911
Queen Elizabeth Solar Car Shelter	13	18	22	$3,127
BRICC Building	35	46	54	$6,208
George Skerritt Building	25	32	39	$5,594
TOTAL	78 kW	102.5 MWh pa	123 CO2e pa	$15,840 pa

Table 7.1: Energy Generated, Carbon Emissions Saved and Dollars Saved per annum as a result of Solar PV Investment

Electric Cars

In order to demonstrate the use of the solar energy generated from the carport shelters CVSC provided Ballarat Health with funding to purchase and trial two fully electric vehicles. Ballarat Health chose two Mitsubishi i-Mievs. These cars were the only completely manufactured, commercially available, fully electric cars available at the time of purchase. The electric cars are used for frequent short trips around Ballarat. The car battery is charged with electricity generated by solar panels on the roof of the car shelters. Currently the two electric Mitsubishi i-MIEV cars are housed separately at BHS two largest sites, the Base Hospital and QEC.

The Base Hospital vehicle is currently being utilised predominantly by BHS Engineering, which provides a diverse range of services to multiple BHS sites across Ballarat. The QEC vehicle is currently utilised by the BHS Ballarat Regional Integrated Cancer Centre (BRICC) project team. Both vehicles, according to users, are invariably half full to quarter full at the end of a day's use.

BHS's experience has been that the realistic distance expected from a single charge to the i-MIEV is 120km before batteries are depleted. The sizing of 18kW in solar PV arrays to support the charging of these cars has been more than adequate when charging from empty. The 18kW PV solar array provides, on average, 64.8kWh daily. Even when the two cars need to be fully charged they still leave a surplus of 32.8kWh, enough to charge an extra two electric cars.

Consistent feedback from staff was that there is little discernible difference between an electric car and a conventional car except for the lack of noise in the electric cars.

"The i-MIEV has been a great success as a transport vehicle within the Engineering Department. Its small size and zippy performance allows our maintenance personnel to quickly respond to requests across our many facilities in Ballarat. We have found it easy to drive and easy to charge and have never found range to be a problem."

Bob Pickard, Engineering Manager, BHS

Currently the i-MIEV's combined total for kms traveled is 8000km, saving the organisation $900 in fuel costs (at $1.50per/L) compared to the fuel needs of BHS's current fleet vehicles. For each litre of petrol used by the current fleet vehicles 2.3kg of CO2 emissions is released. To travel 8000kms in one of their current fleet vehicles BHS would need to fill up the car 10 times. Calculations indicate 1,380kg in CO2 savings as a result of using an iMIEV, as opposed to a current fleet vehicle.

Whilst BHS does not intend to expand its fleet of electric cars at present, they will be considered in the future. BHS will focus on weighing up electric vehicles' principal cost, range, availability of green energy, lifetime costs and long-term reliability, together with BHS's positive experience of the cars as a result of the CVSC project partnership.

Solar Hot Water

BHS's Psychiatric Services premises and the QEC building were retrofitted with evacuated tube solar hot water systems, to the combined value of $40,000. The solar heated water is stored in insulated tanks and available on demand. In the event the water temperature falls below 40 degrees Celsius, a highly efficient instant gas heating system is activated.

QEC Installation

Evacuated tube collectors have been connected to the existing QEC kitchen's domestic hot water supply. The existing system is supported by a Raypak boiler feeding into plate heat exchangers. The secondary side of the plate heat exchangers feed into a buffer tank which in turn supplies the kitchen's domestic hot water needs. Estimated CO_2 savings = 2,175.40kg per annum and estimated financial savings = $186.33 per annum.

Base Hospital Installation

Evacuated tube collectors have been connected to the existing Psychiatric Services domestic hot water supply. The existing system is supported by four Rinnai instantaneous water heaters. Estimated CO2 savings = 1,303kg per annum and estimated financial savings = $120.48 per annum.

The solar hot water services at the Queen Elizabeth Centre and Adult Acute Units have been operating since early 2012. The introduction of each system was seamless, with those using the solar heated water reporting no difference to the service. These highly efficient systems, which allow solar heating to occur even on cloudy days have reduced the quantity of gas previously required to heat water at both sites.

'It just shows there isn't a problem with installing these systems and people really don't know it's there. It's just a benefit that people start to see from a financial cost as well as doing our bit for the carbon footprint.'

Chris Lockett,
Corporate Health Services Director, BHS

Energy Efficiency Measures - Buildings

As part of their contribution to the partnership, Ballarat Health Services implemented a number of energy efficiency measures, including improved ventilation and heat recovery, utilisation of the Bauer Control System for energy savings, a selection of low toxicity materials, low energy lighting and cyclist facilities. The energy efficiency measures included in the building design for the Cancer Centre include low energy LED lights, efficient heat recovery systems and ventilation and facilities for secure bicycle storage to encourage more staff to ride to and from work.

It was difficult to estimate energy savings, related to energy efficiency measures for the new building, due to control factors, such as occupancy, weather, treatment cycles etc not yet being present. Having said this, Ballarat Health Services believes that the energy efficiency enhanced design will afford a minimum saving for the Day Procedure areas and Clinics of 10%. Based on this BHS estimates that the efficiency measures alone, not including the solar PV also provided to the BRICC, would save approximately 135,000kg CO2e per year.

Energy Efficiency Measures - Staff

In 2011 the CVSC team ran a session on energy efficiency for BHS staff. The team offered to provide a Home Energy Assessment to each member of the leadership team (60 in total). The presentation received an enthusiastic response and 24 assessments were carried out. The Home Energy Assessments experienced by BHS staff revealed that knowledge around energy efficiency varied widely. A number of participants had previously attempted to install solar energy technology in their homes but had found the process too confusing. Seventeen BHS staff took up the project's Household Solar PV Package. Responses to this package were very positive.

'The solar power is absolutely fantastic. It's a real economy saver and having the system has made me think about the way I use energy.'

Helen Manning, staff member, BHS

One staff member who took up CVSC's Retrofit Package removed trees in order to allow more natural heat and light into their home and eliminate shading that had previously affected solar panels on the roof. There was also an extra flow on effect from hospital staff being offered an assessment - one staff member recommended an assessment to five other Ballarat community members. Approaching large institutions and offering free energy assessments to staff was a great way to engage an organisation at a whole of staff level. Energy efficiency behaviour learnt in the home can translate into energy efficient behaviour at work.

8. SCHOOLS TRIAL

8. SCHOOLS TRIAL

BACKGROUND

As part of its aim to help change the way central Victorians think about, and use, energy, Central Victoria Solar City developed a program to educate school students about the benefits of solar energy. CVSC's schools program included the development of two lighthouse schools to provide inspiration and advice on solar energy projects to schools across Victoria. CVSC developed lighthouse school partnerships with Swan Hill Primary School and Castlemaine Secondary College. At Swan Hill CVSC funded two fixed photovoltaic arrays (2kWs and 1kWs) and a tracking photovoltaic system (1kW) on a pole-mounted, oscillating tracker. Over the course of the trial the systems together produced a total of 13,208kWh. This represents approximately 18 tonnes in reduced carbon dioxide emissions achieved over the period.

Students learnt how solar energy was created, converted to electricity and then distributed back into the grid. Students had access to interactive software which allowed them to measure, monitor and report on electricity generated by the panels. The investment in the tracking system, in particular, was valuable because students could see how the technology worked in a logical, visual way as the panels followed the position of the sun.

CVSC also supported Swan Hill Primary School and Castlemaine Secondary College to develop and deliver an innovative hands-on learning model solar car and boat program for students from Grade 5 to Year 9. This program aimed to increase student understanding of how renewable energy is sourced, generated and consumed through hands-on construction of vehicles powered by solar energy.

All Victorian schools were provided with access to the solar education programs curriculum units through the Department of Education and Early Childhood Development's (DEECD) Ultranet. Across Victoria the model solar car/boat program was also directly shared with twenty-five other Victorian schools through four hands-on workshops for teachers.

At Castlemaine Secondary College the project provided sponsorship of their model solar car team. At both Castlemaine and Swan Hill the project provided financial support for the schools to purchase new materials, to release science coordinators Phillip Scoles and Bruce Stevens from teaching commitments to develop the model solar car program, and engagement of a middle year educator to develop VELS-approved model solar car and boat curriculum units. Financial support was also given to Swan Hill Primary School to update their program materials.

Another outcome of the CVSC schools project included the development and distribution of a DVD and two written case studies on the model solar car and solar boat programs. These materials are available on the SRA website as well as the Department of Education and Early Childhood Development Ultranet.

Castlemaine Secondary College students and head science teacher Phillip Scoles celebrate their win.

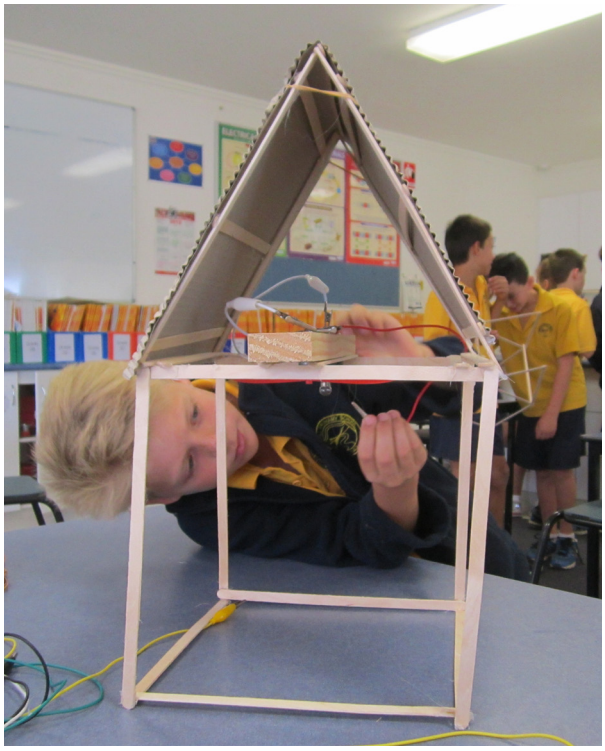
Castlemaine Secondary College Leads the Way

In late 2012 Castlemaine Secondary College took out second prize in the cars section of the Victorian Model Solar Vehicle Challenge. Students from Castlemaine Secondary College competed in the event held at ScienceWorks in Melbourne. The prize winning vehicle, appropriately named 'Whipped', was designed, built and driven by CSC Year 9 students Nick West, Beauden Rinaldi and Will and Peter Hodson. The school took down 12 teams including 3 all girl teams. Five cars made it into the top 16 and 'Whipped' was defeated in the third race of a 'Best of Three' grand final. The team went on to take part in the National Titles and finished sixteenth in a field of thirty-two competitors from around Australia. Experiences such as this demonstrate the value of the Model Solar Car/Boat program to students. As Castlemaine Secondary College Head of Science, Phillip Scoles, said:

"They learn how panels work, they learn about the benefits. But it's about a little bit more than the benefits of solar energy – they're designing cars too, you know. It's also about the physics, the centre of gravity, construction techniques, modern materials like carbon fibre and so on…."

"Innovators In Renewable Energy: Hands-On Intensives Project" Workshops and Schools Investment

The curriculum units and case studies from the model solar car/boat program were taken up by 25 schools from across Victoria at a series of "Innovators in Renewable Energy Workshops" run in four locations in mid 2012. The workshops aimed to raise awareness of the model solar car/boat program and its potential to support learning about solar energy and carbon energy in the classroom. Through hands-on professional development teachers were given the skills and knowledge to begin running a solar car or boat project as part of their curriculum. At each workshop participants had the opportunity to create their own model solar boat, directly engage with the two teachers who developed the unit and access DVD and written case studies.



Inventive students are now branching out into model solar homes.

In the second half of 2012, to promote the take up of the solar car and boat projects, Central Victoria Solar City offered grants of $1500 to ten schools to purchase the materials needed to run the project in their school. CVSC evaluated the schools program in 2012, interviewing and surveying students and teachers.

The student survey indicated that over 1000 students were either directly or indirectly engaged, and benefited from the solar car and boat programs delivered in the schools. Feedback through the survey indicated that these numbers would grow, as schools now had the materials and experience to continue to deliver the program.

The evaluation of the "Innovators in Renewable Energy Hands-On Intensives Project" highlighted the impact of a small materials grant in expanding the reach and impact of the professional development offered to teachers. All but one of the schools involved in the survey indicated that they would not have been able to effectively deliver the program if the school had not received the $1500 grant through the Central Victoria Solar City project. This means that without the further investment, the likelihood that students would have benefitted from their teachers' new skills and knowledge was low.

"Being able to purchase supplies has been fantastic. [Otherwise] we may have only been able to afford to buy a set to show the students."

Claire Duckworth
Sunbury West Primary School

Hume Central Secondary College - Sharing the Benefits of Solar Boats

Hume Central Secondary College used support from CVSC to establish an extra-curricular solar energy program that focussed on the building of both solar cars and solar boats to the specifications required to race them at the State and National championships. The school's Blair Street Campus students also engaged with one of the local primary schools to build model solar boats as an introduction to science and technology. This involved secondary school students dedicating their own time to guide a team of primary school students through designing, building and racing their own solar boats.

As a result, the program was able to be delivered at a school where resources were not otherwise available. It also helped to consolidate the secondary school students' learning as they had to mentor and explain concepts and demonstrate their own learning to younger students.

Engagement of Otherwise Disengaged Students

The combination of hands-on project-based learning with solar energy supported engagement of otherwise disengaged learners. A consistent message from teachers was that the program provided students, who sometimes found traditional delivery models challenging, with improved self-esteem, confidence and enthusiasm for learning. Teachers reported students as being highly engaged and motivated:

"One of my reluctant students has said frequently during the course of building the solar boats that he loves Mondays and couldn't wait to come to school after the weekend."

"The actual hands-on nature of the building projects has appealed to the high number of boys in my class. The activities were practical in nature and allowed for high degrees of interaction between students."

"Children who may not have success in academic activities can excel and are engaged in these activities."

OPPORTUNITIES

Based on the results of the Schools trial, CVSC has identified the following opportunities:

1. Schools with solar PV invest in easily accessible interactive display software that students can use to read and record solar PV energy generation because it's an effective way of engaging students in the science of solar.

2. Victorian schools pursue model solar boat and car program initiatives because they deliver practical, positive learning outcomes for students.

Swan Hill students testing their solar boats.

9. FINANCE

9. FINANCE

BACKGROUND

Central Victoria Solar City is a $42 million project funded by the Australian Government through the Department of Resources, Energy and Tourism. Other funding supporters included Sustainability Victoria and the Victorian Government Sustainability Fund, and the Central Victoria Solar City Consortium.

Sustainable Regional Australia, lead proponent of CVSC, is a special purpose entity established by the Central Victorian Greenhouse Alliance to deliver the project on behalf of the consortium.

BUDGET EXPENDITURE

Final program expenditure is set out below in Table 9.1.

DISCUSSION

As part of the design and delivery of the Central Victoria Solar City project a number of observations with regard to the project's financing can be made.

Do Incentives Alone Work?

During the life of the CVSC project participants were offered incentives in the form of federal government feed-in tariffs, CVSC sign-on bonuses, performance bonuses and discounted products from external sources such as consortium partner Origin Energy. Over the term of the project, participants were exposed to changing market conditions eg. variations in the price, quality and choice of products and as well as changes to government subsidies.

Central Victoria Solar City Program Expenditure						
	Expenditure to 30/06/13					Total
	2008/09	2009/10	2010/11	2011/12	2012/13 (forecast)	
Consortium Cash/In-Kind	$ 1,478,675	$13,400,243	$1,620,146	$1,743,158	$5,536,697	$23,778,919
DRET (formerly DCCEE)	$936,357	$2,304,701	$4,099,855	$3,675,069	$3,924,006	$14,939,989
SV/SF	$380,219	$859,781	$556,603	$272,677	$430,7211	$2,500,000
Other State Govt/ In-Kind	-	-	-	$300,000	$450,000	$750,000
Life To Date Totals	$ 2,795,251	$16,564,725	$ 6,276,604	$5,690,905	$10,641,423	$41,968,908

Table 9.1 : Central Victoria Solar City Program Expenditure

A key observation made by the CVSC project team was that tariff incentives and rebates were a strong driver in leading participants to purchase solar hot water and solar PV. Each time a reduction in feed-in tariffs or rebates approached there was a sharp rise in the number of enquiries from participants keen to purchase before rebates changed, and following each reduction the number of participant enquiries dropped. Whilst the CVSC project team believes that incentive payments distributed as part of the household package supported customer engagement, it does not believe that incentives alone are always sufficient to entice participants to stay until the end of a long term project. Where time, investment and action was required to secure purchase, delivery and installation of a product, and fill in numerous research surveys, participant numbers dropped off. From the CVSC project team's perspective, other engagement mechanisms above and beyond financial incentives are needed to support each participant commitment through to project completion.

The Value of Consortium In-Kind Contributions

The CVSC project was delivered by a multi-sector consortium committed to better understanding consumer energy use behaviour. Each consortium member demonstrated significant support to the project through cash and in-kind contributions. Above and beyond the value of upfront financial contributions made, the CVSC project consistently leveraged the wealth of expertise to achieve its outcomes.

The Bendigo and Adelaide Bank were major supporters of the Solar Parks' finance packaging. As well as this they contributed astute business acumen, brokered access to key regional networks and hosted many project meetings and events at their head office in Bendigo. Powercor Australia provided invaluable technical support and expertise in relation to the delivery of the project's solar PV and IHD products and they also advanced the rollout of smart meters in the CVSC region to ensure that the project could collect half hourly interval data.

Origin Energy assisted with the sale and installation of the project's solar PV product. In particular, their $200,000 in-kind contribution through a mail out to their central Victorian customers around the solar PV offer helped drive product engagement. They also worked, together with Powercor, to support many of our solar PV customers in receiving the Premium Feed-In Tariff before it was phased out in late 2011. The project also negotiated a put option with Origin for the sale of the Solar Park assets should the transfer of the Parks to community ownership not be commercially viable.

The Central Victorian Greenhouse Alliance provided invaluable access to its councils generally, and particularly to economic development officers, sustainability officers, CEOs and mayors. This access was significant throughout the life of the project, with many of the research sub-trials relying on council advocacy, buy-in and promotion for their success. Without these significant financial and in-kind contributions made by each consortia member, the dollar value for delivery of the CVSC project would have been exorbitant. The value of consortia in delivering robust, practical trials that deliver real world solutions around energy use cannot be underestimated.

Consortium

SRA Sustainable Regional Australia

Powercor Australia

Bendigo Bank generation green

origin

Central Victorian greenhouse alliance

Funding Partners

Australian Government Solar Cities

Sustainability victoria State Government Victoria

Sustainability Fund State Government Victoria

Research Partner

University of Ballarat Learn to succeed