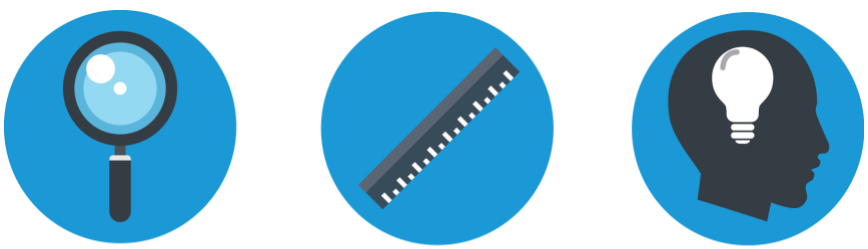
FIRST PERSON CONSULTING

Latrobe Valley Home Energy Upgrades Program Evaluation

Final Report

Prepared for

Sustainability Victoria



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Executive summary

Overview

The Latrobe Valley Home Energy Upgrades (LVHEU) program was an energy efficiency program funded by the Victorian Government. From July 2018 to April 2020, the program delivered upgrades to 1000 low-income households across the local government areas of Baw Baw Shire, Wellington Shire and Latrobe City, to provide energy efficient improvements and renewable energy, while stimulating local employment opportunities.

First Person Consulting (FPC) was engaged to work closely with SV to deliver an external independent evaluation of LVHEU across the life of the program. **This is a summary of FPC's independent evaluation report on the LVHEU program.** The approach taken for this evaluation involved collating and analysing evidence from existing data sources and collecting additional data through interviews and surveys with program recipients, SV staff and other stakeholders.

Findings

Overall, the LVHEU program has been successful, supported by a range of qualitative and quantitative evidence. Among project delivery stakeholders and program recipients there is a clear sense of the range of successes, challenges, limitations, and lessons for the program.

- The program is based on a solid rationale, with literature supporting the approach of achieving multiple aims via energy efficiency improvements for low-income households (see Section 3.1).
- The program successfully recruited 1,000 households. Word-of-mouth was the most effective recruitment strategy (see Section 1.1).
- The program installed 2,706 products across the 1,000 households within budget. The most common upgrade types were hot water systems and reverse split systems (see Section 3.3).
- Program recipients were overwhelmingly satisfied with the program delivery and outcomes with most participants reporting reductions in their energy bills and increased household comfort (see Section 3.4).
- Despite difficulties in obtaining energy data, the limited household electricity data available revealed there was, on average, a reduction in electricity use per household (see Section 3.4).
- The program installed 185 2kW solar PV systems, secured 28 local jobs and created nine new positions (see Section 3.4).
- Overall, the program was delivered in line with the program budget (see Section 3.5).

Recommendations

Based on the overarching evaluation findings and evidence collated throughout LVHEU, we present recommendations for SV. These recommendations encompass the successes, challenges, and lessons of the LVHEU and what could be useful for programs with similar features.

1. Ensure that the objectives and eligibility criteria match the overarching intended outcomes:
    a. Clearly define the target population and who is to be included in the program (e.g. vulnerable people).
2. If improved comfort and well-being are intended outcomes, this should be clearly articulated, and targets set to measure improvements.

3. Include elements of best practice as identified in the literature, and evidenced in LVHEU, for example:
    a. Combine multiple components such as assessments, retrofits, and education.
    b. Understand the target audience and local context.
    c. Make use of social and behavioural theories to promote and deliver lasting behaviour change to maximise efficiency gains of upgrades.
4. Ensure that there is meaningful local involvement in the design, including relevant community groups.
5. If the program is likely to be oversubscribed, consider prioritising based on needs of the household (rather than a first-in basis).
6. Word of mouth was widely recognised as a successful method of promoting the program. Dedicate effort to promoting the program broadly as well as attempting to find trusted and influential community members and agencies.
7. Provide clear communication on the aims, scope, and process of the program, including the range of options available and the potential outcomes.
8. Education should be provided during delivery and include information on how to use energy more efficiently in their homes and potentially, further upgrades or actions that they could implement themselves following on from the program.
9. Greater education and understanding of the likely outcomes would help in framing expectations and understanding how to get the most benefit from the upgrades. This could avoid potential dissatisfaction with outcomes that are less than anticipated.
10. Put processes in place before delivery to ensure that adequate data can be captured: including comprehensive and accurate energy data, in conjunction with information on the condition of housing before and after upgrades, and any changes in use (or additional upgrades or appliances not related to the program).
11. Explore options to build in self-monitoring of household energy use as part of the education and ongoing behaviour change aspect of the program. While this would be more resource intensive it could deliver much greater gains in energy reduction while building from the interest and engagement in upgrades, energy use, and well-being.
12. An overarching recommendation is to ensure clear and consistent lines of communication at all levels. This includes consistency around promotion and eligibility and the purpose and distinction from other energy programs.
13. Prioritise effective and efficient information management by implementing procedures for information collection, storage, and management. This will ensure that consistent information is gathered from each participating household, and all information and data is centrally located and easy to find and use.
14. Documentation could also include real time tracking of delivery processes, challenges, adaptations, and lessons learned along the way.

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Acronyms and definitions

FPC	First Person Consulting
HES	Hills Energy Solutions
HEA	Home Energy Assessment
KEQ	Key Evaluation Questions
LVHEU	Latrobe Valley Home Energy Upgrades Program
PSS	Participation Satisfaction Survey
SV	Sustainability Victoria

1 Introduction

1.1 Overview

The LVHEU Program was an energy efficiency program focused on low-income households in the Latrobe Valley. The program was designed to respond to economic changes in the area after the closure of the Hazelwood power station. The program was delivered by Hills Energy Solutions (HES), a heating and cooling company local to the Latrobe Valley, to provide low-income households energy efficient improvements and renewable energy, while stimulating local employment opportunities.

The program delivered energy efficiency or solar PV energy upgrades to 1,000 low-income households across the local government areas of Baw Baw Shire, Wellington Shire and Latrobe City between July 2018 and April 2020. Specifically, the program included:

- Home Energy Assessments (HEA) of household energy efficiency
- Installation of a range of energy efficiency and renewable upgrades which could include major retrofits such as, a new heating system, reversable split system AC, solar PV system, water heater, or minor retrofits including insulation, energy efficiency lighting, draught proofing, window furnishings
- A quality assurance audit regime, which was conducted in almost 10 percent of homes that received upgrades.

The intended **program outcomes** were:

- Energy efficiency upgrades completed in up to 1,000 homes
- Participant satisfaction with the program and outcomes, including increased comfort and well-being
- Reductions in energy consumption and energy costs
- Reduction in associated greenhouse gas emissions
- Increased employment for contractors involved in implementing the program.

1.2 Objectives and scope

The scope of this evaluation was to work closely with Sustainability Victoria and key stakeholders to independently evaluate the project outcomes at the end of the program. This report responds to evaluation questions including effectiveness, efficiency and appropriateness and the results of this report can contribute to organisational and sector learning.

1.3 Background

Energy efficiency allows us to use less energy to achieve the same outcomes, and is the cheapest way to reduce greenhouse gas (GHG) emissions and increase energy productivity. Energy efficiency is a Federal Government priority, with a target to improve Australia's energy productivity by 40 percent by 2030. While Australia struggles to ensure sustainable energy for citizens, increasing

energy efficiency is a promising strategy.[1] SV's recent On Ground Assessment study identified significant energy saving potentials from energy efficiency upgrades in Victoria's existing housing stock including: 58% of average household gas use savings, 33% of average household mains electricity use savings, and average household greenhouse gas abatement of 41% from energy end-use. Well-designed energy efficiency programs can deliver a favourable return on investment (ROI) while facilitating a decline in GHG emissions and improving resilience to extreme weather events and blackouts. Additionally, at the individual level, energy efficiency can reduce energy bills and usage and improve thermal comfort and well-being.[2]

Among Victorian homes, heating is the largest source of energy consumption, accounting for an estimated 57% of total residential energy consumption, followed by water heating, which accounts for 19% of total residential energy consumption. Therefore, space heating and water heating are key targets for energy efficiency retrofits to reduce costs and emissions, but also to allow improved thermal comfort during colder months, which is particularly beneficial for the health and well-being of those living in low-income households.[3]

1.3.1 Energy efficiency for low-income households

The need to provide energy support to low-income households is paramount, as they continue to face difficulties surrounding energy affordability, ongoing disadvantage, and reduced capacity to access energy efficient houses and improvements. The *Victorian Energy Market Report* reveals that energy prices have been rising steadily over the past years. In Victoria, from 2018 to 2019, 46,976 customers had difficulties paying gas bills, 64,508 customers had difficulty paying electricity bills and 36,245 customers were disconnected from energy services due to non-payment.[4] With the increasing cost of living in Victoria, people on low-incomes are finding it more difficult than ever to manage energy bills.[5] Low-income households often have already low energy consumption and rely on compensatory measures to cope with energy bills, such as minimising the use of heating and cooling.[6] Lack of knowledge, capital constraints and split incentives (for rented properties) are the key barriers obstructing low-income households from adopting energy efficient practices.[7]

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[1] Murray-Leach, R. (2019). "The World's First Fuel: How energy efficiency is reshaping global energy systems". Melbourne, Energy Efficiency Council.

[2] Sustainability Victoria. (2019). "Comprehensive Energy Efficiency Retrofits to Existing Victorian Houses". Melbourne.

3 Ibid.

4 Essential Services Commission. (2019). "Victorian Energy Market Report 2018–19". Retrieved from <https://www.esc.vic.gov.au/sites/default/files/documents/VEMR%20annual%20report%202018-19_Final_20191205.pdf>.

5 Kildonan UnitingCare. (2015). "Energy Efficiency Information for Low Income Households". St Arnaud.

6 Daly D., Halldorsson J., Kempton L. and Cooper P. (2018). "Targeted review of evidence of direct and co-benefits of energy efficiency upgrades in low income dwellings in Australia". Sydney: CRC for Low Carbon Living.

7 Russell-Bennett, R., Bedggood, R., Glavas, C., Swinton, T., McAndrew, R., O'Mahony, C., Pervan, F., & Willand, N. (2017). "Driving Change – Identifying what Caused Low-Income Consumers to Change Behaviour". Final Report. Brisbane: Queensland University of Technology and Swinburne University of Technology.

A study of the Commonwealth Government's Low-Income Energy Efficiency Program (LIEEP) 2013-2016, found that energy efficiency programs targeting low-income households can result in lower bills, lower energy consumption and various important non-economic benefits. The LIEEP study found that different energy efficiency initiatives produced differential changes in average household electricity use. For example, a home energy visit and a minor retrofit (such as draft seals and lighting) reduced average daily household electricity use by 4 percent, while a home energy visit combined with a major retrofit (such as insulation or a new hot water system) produced reductions in average daily household electricity use by 10 percent.[8]

Those living with disability, the elderly, and the unemployed are more likely to live in poor-quality housing and typically spend a greater amount of time at home.[9] While low-income households may appear to be very energy efficient due to having lower energy consumption on average, in reality they may be sacrificing their health and wellbeing to ensure a lower energy bill.[10] Therefore, considering the benefits of energy bill reduction or reduced energy consumption may be an unfavourable measure. It must also be considered that low-income households are the most likely to experience co-benefits (non-energy, or economic related) from energy efficiency upgrades.[11] Co-benefits associated with energy efficiency programs include reduced stress about bills and energy use, increased comfort in the home (with improved thermal conditions or appliance use), and increased knowledge, self-efficacy, confidence and competence regarding energy efficiency.[12,13] It is therefore important for holistic measures to be utilised to ensure that any gains in energy efficiency are not at the consumers' expense. Furthermore, non-appliance upgrades such as insulation, draught proofing and window furnishings can be added to assist with energy reductions, without the risks of increases in cost.

1.3.2 Energy efficiency program design

Successful energy upgrades must be contextually relevant, with a program design that appropriately addresses an identified need. Responding to local needs and context is essential for ensuring the appropriate energy upgrades are undertaken–but is also critical for targeted recruitment, behaviour change approaches, and communications across all elements of the program delivery.

Several key factors have been identified as improving the overall success of energy efficiency programs,[14] including:

[8] Bedggood, R., O'Mahony, C., Pervan, F. and Buergelt, P. (2018) Empowering Low-Income Households: Delving into the Co-Benefits Identified in the Low Income Energy Efficiency Project Reports. Final Report. GEER Australia, Swinburne University of Technology and Charles Darwin University.

[9] Daly et al. "Co-benefits of energy efficiency upgrades".

[10] Ibid.

[11] Ibid.

[12] Ibid

[13] Russell-Bennett et al. "Driving Change"

[14] Russell-Bennett, R., McAndrew, R., Gordon, R., Mulcahy, R. and Letheren, K. (2019). "Effectiveness of Household Energy Efficiency Interventions in Advanced Economies – what works and what doesn't". Final Report. Brisbane: Queensland University of Technology.

- Combining multiple components e.g. retrofits, audits, digital tools (websites or apps), education and behaviour change marketing;
- Developing region and population insights prior to delivery;
- Designing clear aims and objectives from the beginning of the program with methods in place to evaluate, impacts, outcomes, and success;
- Using social and behavioural theories to guide design, implementation, and evaluation; and
- Ensuring interventions are segmented, targeted and tailored to the relevant target population and situational context.

1.3.3 The Latrobe Valley context

SV found that among the 67,000 households in the LV region, there were 16,500 low-income households, of which 8,400 where owner occupied. The Latrobe Valley has been Victoria's electricity centre, with a vast reserve of brown coal fuelling the local economy for the past 50 years. However, with increasing privatisation of the electrical industry in the 1990s and the recent closure of the Hazelwood power station in 2017, Latrobe Valley's community has suffered. The 2016 census revealed that 9.7% of the LV population where unemployed, compared with 6.6% in Victoria, and 28.4% of households where living on low-income (earning less than $650 per week), compared with 20.3 percent in Victoria.[15]

Following the closure of Hazelwood, the Victorian State Government has committed to supporting the LV community through boosting economic development and helping the region to transition away from the fossil fuel industry. The LVHEU program positively reinforces this transition in the region in a just and equitable way, while improving the daily lived experience of those living in low-income households and generating work in the area.

1.4 Approach

1.4.1 Overview of method

FPC have worked closely with SV throughout this consultancy to ensure that our approach and the evaluation report, recommendations and outcomes are fit-for-purpose. This has included working collaboratively to refine our approach to ensure the evaluation both captures the achievements of the LVHEU program and contributes to the improvement of future programs.

Our approach to this evaluation involved collating and analysing evidence from existing data sources (quantitative data relating to energy efficiency upgrades and actual energy savings), as well as collecting additional data through interviews and surveys with program recipients, SV staff and other stakeholders.

Key components included:

- Project plan
- Progress report
- Mid-term evaluation report

[15] Australian Bureau of Statistics. (2016). "Latrobe Valley 2016 census QuickStats". Retrieved from <https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/20504>.

- Five summary reports
- End of program evaluation
- Summit Workshop.

A set of key evaluation questions (KEQs) were already developed by SV. The original table of KEQs, responsibility, timing and methods is attached in Appendix 1.

1.4.2 Sources of evidence

Below is the list of sources used for this evaluation, and for those used frequently, the abbreviation used to show which data source is being drawn upon.

Key existing data sources:

- HES upgrade progress reports and HES final report
- Program records, including household upgrade master sheet.

Data provided:

- Evidence of pre- and post-upgrade electricity usage data from 46 households.

Additional data collection:

- **Online participant satisfaction survey (PSS)** conducted by FPC with 185 program recipients who received upgrades.
- **Semi-structured interviews** conducted by FPC with:
    - 20 program recipients who received household upgrades
    - One (1) council staff from a participating council
    - two (2) SV staff involved in program design and delivery
    - three (3) external stakeholders.
- **Collaboration with the SV team** throughout the evaluation:
    - Sharing of internal documents, e.g. SV lessons documentation
    - Progress meetings throughout the evaluation
    - Mid-term report feedback
    - Quarterly progress reports detailing activities and updated results
    - LVHEU Summit feedback and discussion, with 14 stakeholders.

1.4.3 Data collection process

The data collection throughout the project is broadly split into the following:

- Receipt of data collected by HES
- Collection of primary evaluation data from program stakeholders (e.g. SV and HES) and program participants
- Receipt of data from the energy distributor.

Detail on these components is provided below:

HES collected contact information for participants, including consent for FPC to contact them directly for follow up data collection.

A key element of the work conducted by FPC was the collection of primary data from program stakeholders and participants. This data captures evidence for various process components of the program (e.g. satisfaction), as well as program design components (e.g. effectiveness and reach of the program to vulnerable households).

Data collection methods included:

- Surveys and interviews with participating households
- Interviews with HES staff
- Interviews with SV staff and other stakeholders.

Surveys / interviews with participating households

Collecting robust data directly from the households participating in the program allowed for analysis of energy consumption profiles and financial outcomes, as well as comfort, health and wellbeing outcomes and satisfaction with program delivery. Using a combination of interviews and surveys facilitated the collection of both qualitative and quantitative data.

Energy data from distributors

The energy usage data from participating households is the final key piece of monitoring data. Ideally, data would be sought from 500[16] households and include electricity and gas data. However, this was not possible and electricity data was only able to be collected from 46 households.

1.5 Limitations

A range of limitations should be considered in relation to this evaluation:

- FPC were unable to gain access to energy data for most households. Though the initial consent form requested access to energy data, an additional consent form was required from AusNet to gain electricity data. Furthermore, gas data could only be provided by each gas energy retailer. Obtaining consent forms from households is not easy or straightforward. Not all consent forms were completed correctly, and half of the consent forms were rejected when they were uploaded for data requests. Additionally, some of those households where the energy data could be accessed had months of missing energy data. Without considering both electricity and gas data, a full picture of energy usage could not be ascertained.
- Self-reported data collected from participating households may have been biased. Consumer self-report measures may overestimate the perceived benefits of energy efficiency.[17] If the participant had an overall positive or negative experience of the program it may have influenced their report on energy usage and costs.
- FPC were unable to determine key findings relating to the program's return on investment, cost-benefit analysis, and emissions reductions. We have provided data for some upgrades, based on the SV 2015 report *Energy Efficiency Upgrade Potential of Existing Victorian Houses*, which was measured by SV and has been complemented by actual pre- and post-upgrades usage data. The evaluation considers extensive qualitative and self-reported data

[16] The target in the Monitoring Framework is 50% of participant homes' total energy data collected (gas & electricity)

[17] Russell-Bennett et al., "Effectiveness of Household Energy Efficiency".

from the perspectives of SV staff, external stakeholders, and program recipients to triangulate evidence.

- Other data limitations include:
    - The impacts of COVID-19 on energy consumption data after energy upgrades, impacting the reliability of pre- and post-upgrades data, where program recipients were likely spending more time at home.
    - Limited post-upgrades data provided by HES in a consistent and useable format.
    - Limited stakeholder data as there were only four stakeholder interviews completed (although this was complemented by the input of 14 stakeholders at the summit workshop, feedback from program staff, and the final report from HES).

1.6 Report structure

This report is structured to first present the overarching findings and recommendations of the evaluation of the LVHEU program in **Section 2**. Then in **Section 3**, we present more in-depth evidence to support these findings and recommendations.

2 Key findings and recommendations

2.1 Key findings

This evaluation focuses on each of the LVHEU program domains—including design, recruitment, delivery, and outcomes. Here we present our overarching evaluative conclusions and key findings in relation to these areas.

Overall, the LVHEU program has been successful, as supported by a range of qualitative and quantitative evidence. Among program delivery stakeholders and program recipients there is a clear sense of the range of successes, challenges, limitations, and lessons for the program.

While there is limited evidence available to comprehensively demonstrate the energy outcomes of the program, this does not indicate lack of improvements—but reflects the difficulty in gathering energy data and in attributing outcomes to the program.

Design

- The program is based on a solid rationale, with literature supporting the approach of achieving multiple aims via energy efficiency improvements for low-income households. This was a unique program that aimed to reduce energy use and greenhouse gas emissions, as well as address equity considerations by reducing financial stress, and improving the living conditions and well-being of vulnerable and low-income households (see Section 3.1).

Recruitment

- The program successfully recruited 1,000 households. Word-of-mouth was the most effective recruitment method. Most participants recruited into the program were not those most in need (see Section 1.1).

Delivery

- The program installed 2,706 products across the 1,000 households within budget. With a broad range of offerings, HES determined what would be best for each household based on the household condition and householder needs. The most common upgrade types were hot water systems and reverse split systems (see Section 3.3).

Outcomes

- Participants were overwhelmingly satisfied with the program delivery, including the information provided, the upgrades received and the professional approach of HES. The majority of participants reported decreases in their energy costs and increases in their household comfort. Similarly, stakeholders were satisfied with the outcomes of the program while identifying challenges and lessons (see Section 3.4).
- While there were limitations with the household electricity meter data collected, there was evidence of meaningful reductions in electricity use where data was available. The average change recorded per household was -452 kWh equating to an average yearly change of -479 kWh. The total change in electricity for the available data timeframe was -20,807 kWh. Based on the calculations per household this was an 11.1% reduction in electricity use (see Section 3.4).

- The program also installed 185 2kW solar PV systems in the Latrobe Valley region and secured 28 jobs, producing 9 new positions including 3 additional apprenticeship/trainee positions (see Section 3.4).

Efficiency

- Overall, the cost per house was in line with what was budgeted. The average household cost across the 1,000 households was $4,324 and the majority of households received upgrades worth between $4,001 and $5,000. The full health and social benefits cannot be calculated from the data, however, there is evidence of substantial improvements to wellbeing. There were a number of efficiencies identified in the delivery and some inefficiencies that may be addressed in future (see Section 3.5).

2.2 Recommendations

These recommendations encompass the successes, challenges, and lessons of the LVHEU and what could be useful for programs with similar features.

Design

1. Ensure that the objectives and eligibility criteria match the overarching intended outcomes:
    b. Clearly define the target population and who is to be included in the program (e.g. vulnerable people).
    c. If comfort and well-being are key components then these outcomes should be clearly articulated in relation to other outcomes (e.g. is there a hierarchy of outcomes that can help to guide eligibility, delivery and assessments of effectiveness).
    d. Consider setting targets for comfort and well-being and set up to measure these equally (or in proportion to the importance placed upon them for the program).
2. Include elements of best practice as identified in the literature, and evidenced in LVHEU, for example:
    a. Combine multiple components such as assessments, retrofits, and education.
    b. Understand the target audience and local context.
    c. Make use of social and behavioural theories to promote and deliver lasting behaviour change to maximise efficiency gains of upgrades.
3. Ensure that there is meaningful local involvement in the design, including relevant community groups.
4. Revisit the budget per household to determine whether greater outcomes can be achieved with a higher budget or provide a contingency fund for homes requiring substantial safety upgrades or preparation before undertaking installations.

Recruitment

5. If the program is likely to be oversubscribed, consider prioritising based on needs of the household (rather than a first-in basis).
6. Word of mouth was widely recognised as a successful method of promoting the program. Dedicate effort to promoting the program broadly as well as attempting to find trusted and influential community members. Recognise that this takes time and was most effective when others could see the installations underway.

7. Make use of trusted agencies to give legitimacy to the program in a sector where there is suspicion about being approached or sharing details. This may also include identifying individuals for invitation into the program. Agencies could include local government, Centrelink, and community groups.

Delivery

8. Provide clear communication on the aims and process of the program, the range of options and potential outcomes. This includes an understanding of the upgrade selection process, and demonstrating the appropriate combination of upgrades for each household within the scope of the program.
9. Education during delivery should include ensuring that participants have information on how to use energy more efficiently in their homes, and potentially further upgrades or actions that they could implement themselves following on from the program.
10. Greater education and understanding of the likely outcomes would help in framing expectations and in understanding how to get the most benefit from the upgrades. This could avoid potential dissatisfaction with outcomes that are less than anticipated.

Outcomes

11. Put processes in place before delivery to ensure that adequate data can be captured, including comprehensive and accurate energy data in conjunction with information on the condition of housing before and after upgrades, and any changes in use (or additional upgrades or appliances not related to the program).
12. If health and well-being are core components of the program, ensure that these are defined and measure these outcomes more systematically.
13. Explore options to build in self-monitoring of household energy use as part of the education and ongoing behaviour change aspect of the program. While this would be more resource intensive it could deliver much greater gains in energy reduction, while building from the interest and engagement in upgrades, energy use, and well-being.

Efficiency

14. As with recruitment and word of mouth, there may be efficiencies gained by recruiting and delivering in one location with multiple (and potentially similar) houses. Investigate whether this is possible and aligns with the objectives of the program and aim to coordinate delivery geographically or in similar housing situations.
15. Provide links between programs, based on a big picture understanding of what is offered by different programs. There may be scope to incorporate other programs into the education component or refer on to more appropriate programs for those at the registration stage.

Project management, communication, and engagement

16. An overarching recommendation is to ensure clear and consistent lines of communication at all levels. This includes consistency around promotion and eligibility and the purpose and distinction from other energy programs.
17. Prioritise effective and efficient information management by implementing procedures for information collection, storage, and management, so that all information and data is centrally located, easy to find and use, and consistent information is gathered from each participating household.
18. Documentation could also include real time tracking of delivery processes, challenges, adaptations, and lessons learned along the way.

3 Results in detail

3.1 Design

3.1.1 Overview

This section presents an overview of the program design and objectives.

Summary:

Overall, it is evident that the program is based on a solid rationale, with literature supporting the approach of achieving multiple aims via energy efficiency improvements for low-income households. This was a unique program that aimed to reduce energy use and greenhouse gas emissions, as well as address equity considerations by reducing financial stress, and improving the living conditions and well-being of vulnerable and low-income households.

3.1.2 Design

As noted in the introduction, the LVHEU Program was an energy efficiency program focused on low-income households in the Latrobe Valley. The program was delivered by a local service provider (Hills Energy Solutions) to give low-income households energy efficient improvements and renewable energy.

The **program deliverables and objectives included**:

- Energy efficiency upgrades completed in 1,000 homes
- Participant satisfaction with the program and outcomes, including increased comfort and well-being
- Reductions in energy consumption and energy costs
- Reduction in associated greenhouse gas emissions
- Increased employment for residents involved in implementing the program.

The table below presents the best practice principles as outlined in the Introduction (Section 1.3.2). This provides an overview of the LVHEU design and delivery against these general principles, highlighting alignment as well as areas identified for improvements or lessons learned from this approach.

Table 1. Features for best practice low-income energy efficiency programs with examples and lessons or ways this could have been improved in the program.

Feature	Examples/ Evidence	Lessons/improvements
Combining multiple components e.g. retrofits, audits, digital tools (websites or apps), education and behaviour change marketing	The program successfully combined multiple components, such as major and minor retrofits, home energy assessments, auditing and education. However, there was indication that some components could be strengthened e.g. building knowledge and behaviour change, and additional components could be added e.g. using digital tools such as websites and apps	Since behaviour change is a low cost and potentially high impact tool, this could have been an effective way to promote additional changes. While some participants mentioned that they were informed of ways to reduce their bills e.g. running AC a few degrees warmer, others mentioned that they were not offered any advice in this regards and some commented that they believe the program could be improved with the provisions of increased education and awareness raising.
Developing region and population insights prior to delivery	Prior to delivery, scoping work was undertaken to detail the regional demographics and needs of the area. Local supplier contracted (HES) with an understanding of the region, housing, and upgrade types.	The program used HES as a local supplier for the delivery partner. Earthworker is a local business who could have supplied hot water systems however, due to the timing and costs, it was not feasible for this program. There could be further work on understanding trusted and influential individuals, groups, and agencies to assist with promotion and recruitment.
Designing clear aims and objectives from the beginning of the program with methods in place to evaluate impacts, outcomes, and success	The program aimed to achieve a 10% reduction in energy, reduction in bills, GHG emission abatement and improve comfort.	While the program had quite clear-cut objectives to reach regarding energy efficiency, it could have benefited from having more comprehensive comfort and well-being objectives with measurable targets.
Using social and behavioural theories to guide design, implementation, and evaluation	Involved Behaviour Works Australia to look at recruitment and messaging. HES had education as a pillar of their delivery and expressed a commitment to education	Social and behavioural theories could be used to ensure that comfort or well-being outcomes are considered from a public health perspective. Additionally, social, and behavioural theories could be used to target those more vulnerable people more effectively and to implement a behaviour change

	and raising the understanding of how to use upgrades for maximum benefit.	component to the program, to further help participants reduce their energy usage or bills.
Ensuring interventions are segmented, targeted, and tailored to the relevant target population and situational context	The target population and context were identified, and the program designed for their needs. Flexibility was built into the program to meet the needs of households, although there were constraints due to budgets and scope of works.	Further scope was identified for understanding the local population/context and particular target group, including housing condition.
The most effective energy efficiency interventions include home retrofits, digital tools, and workshops/training to support positive energy efficiency outcomes.	See the first point above.	Home retrofits were utilised through the program, more emphasis could have been placed on having a workshop/training element to ensure that householders know how to use their products most efficiently.

3.2 Recruitment

3.2.1 Overview

This section covers the process of recruitment into the program and an assessment of who was reached.

To what extent were the different targeted recruitment strategies effective at attracting and retaining the most vulnerable people in the LV?

- *What evidence is available on attribution of effectiveness of different strategies?*
- *Which strategies were effective for attracting participants?*
- *Which strategies were effective for retaining participants?*
- *To what extent did the program reach the most vulnerable?*
- *Who wasn't reached by the program?*
- *What has been learnt about how to make the program more inclusive?*

Summary:

The program successfully recruited 1,000 households. A range of recruitment methods were used, though word of mouth between participants was the single most effective recruitment method. It was noted that time between registration and a call back for the home energy assessment was a factor that impacted participant retainment. Further, while the program aimed to reach those households who were most in need, there were insufficient strategies in place to ensure that this was the case.

The table below (Table 2) shows the number of estimated eligible households across the LV region, the residents contacted after registration, eligible registrants, number of HEA complete and households upgraded. Table 3. Households upgraded per LGA area, including the goal of households and the actual number of households. reveals the number of households included in the program by LGA area, including the goal number of households (determined by the LGA population) and the actual number of households recruited from each LGA. Baw Baw Shire were overrepresented in the program, with an additional 141 households receiving upgrades than originally intended and Wellington Shire were underrepresented in the program, receiving 121 less upgraded households than intended. To achieve an equitable distribution among LGA areas, the program aimed to achieve 45% of upgrades in Latrobe City, 29% in Baw Baw Shire and 26% in Wellington Shire. However, it achieved 43% in Latrobe City, 43% in Baw Baw Shire and 14% in Wellington Shire.

Table 2. Recruitment, engagement, and reach including upgraded households.

Recruitment	Count
Estimated eligible potential participants	16,500
Residents contacted	1,462
Residents eligible	1,194
Home Energy Assessments complete	1,027
Homes upgraded	1,000

Table 3. Households upgraded per LGA area, including the goal of households and the actual number of households.

LGA area	Goal	Actual	Difference
Upgrades in Baw Baw Shire	290	431	+141
Upgrades in Latrobe City	450	430	-20
Upgrades in Wellington Shire	260	139	-121

3.2.2 Recruitment strategies and method

From December 2016 to January 2017, SV introduced the program to stakeholders, including Latrobe City, Wellington Shire and Baw Baw Shire councils, Gippsland Trade and Labour Council, Vic Trades Hall, Gippsland Health Service, Federation University, Federation Training, Anglicare, Good Shepard, Kildonan Uniting Care, Brotherhood of St Laurence, Clean Energy Council, Australian Solar Council, Energy Efficiency Council and Clean Energy Finance Corporation. SV and local government promoted the program locally through using a combination of avenues including:

- Advertising the program on local government websites and materials e.g. newsletters
- Letterbox drops
- Presentation at a multicultural group
- Presence at local community events such as Monday Tucker and public schools
- Noticeboards at the local supermarket and Centrelink
- Spreading the word through RSL clubs, veteran affairs, and healthcare services
- Targeted engagement with AGL hardship customers via energy and water retailers
- Promotion via welfare agencies such a Quantum and Berry Street NGOs.

To be involved in the program participants had to register their interest online via the LVA website. Alternatively, potential participants could contact LVA or HES, who would input their details into the online registration form. The list of potential participants was passed on to HES, who then contacted households to explain the program, to determine eligibility, and to book in the Home Energy Assessment (HEA) visit.

3.2.3 Attracting and retaining participants

Word of mouth was the most effective strategy for attracting participants to the program, this finding was supported by both program stakeholders and participating households. Word of mouth was a simple, accessible, and useful channel for the target population. This method was particularly successful among residents in Lifestyle Villages towards the end of the program. The importance of clearly stating that it was a government program was also noted, in order to attract participants and avoid community fear and distrust of the program.

Stakeholders identified time between registration and the initial phone call from HES as a factor affecting retention of participants, where in some cases there was up to two years with no contact and participants would have moved to a new house, become uncontactable or become ineligible.

AGL hardship customers were specifically targeted from the outset of the program. These potential participants were the most difficult to engage and despite a high degree of effort to recruit them, there was very little uptake among this group. SV attempted to engage 91 hardship customers, however, only 41 of households from this group participated in the program.

3.2.4 Reaching those most in need

Stakeholders and participants commented that the elderly, people with low-literacy, busy parents, renters, those who are disconnected from the community or government, and people with disability were not reached as successfully by the program. Most participants were homeowners, who may have been cash poor but asset rich, and the program failed to reach those with lower overall financial security. Stakeholders and participants alike attested that they did not feel that the program reached those who were most in need. The program design served on a first-come, first-served basis. The eligibility criteria required participants to hold a healthcare card, concession card or be receiving hardship assistance. The eligibility criteria or HEA did not attempt to filter participants by those who were most vulnerable or most in need. Furthermore, while stakeholders agreed that the mass Lifestyle Village recruitment assisted the program with efficient recruitment and delivery, this group were not originally the intended recipients of the program, or the most in need.

3.2.5 Recruitment challenges and lessons

Some key challenges arose during the recruitment phase regarding program messaging, engagement and the broad approach taken.

- The program messaging was inconsistent across different websites and some messaging suggested that households would receive solar and energy efficient upgrades, rather than solar, or other energy efficiency upgrades. This led many participants to perceive that the LVHEU was a solar program, resulting in confusion and disappointment among some participants from the outset. Having clear and consistent messaging from the outset is critical to ensure that potential participants have an accurate understanding of what the program is from the beginning.
- The timeframe between registration and call back from HES was a challenge. Some householders commented that regular follow-ups via email, SMS or phone call could have overcome this issue.
- 193 program registrants did not provide an email address, which made following up with potential participants more difficult and highlights the barriers of using an online registration method among a population who may not be very technology or computer literate.
- There was research undertaken on different recruitment scripts and a spreadsheet documenting registration for the program, including how people heard about the program. However, from documentation available for the evaluation, it is not clear how this was used over time to adapt recruitment activities based on what was more or less successful. While it is evident that the delivery was adapted, there was not easily accessible data on the implementation of recruitment strategies and processes for the program as a whole. This may have been beneficial in drawing lessons about the different strategies and processes. A

system for capturing adaptations and lessons in real time could be part of a project management database (if not already in use).

- Not all councils were equally engaged. For example, a member from Wellington Shire council commented that they did not know about the program until they were contacted by SV to explain they were not reaching recruitment targets in that area. This may be an issue of staff continuity. However, maintaining close engagement with all councils from program design and throughout delivery could have improved the efficiency of reaching those in need.
- Additionally, it could have been beneficial to have more clarity and consistency of stakeholders' roles during the recruitment phase.
- There is potential to utilise the word of mouth approach to target key community members, key community venues and events using a staged approach to ensure that the right households are being reached, and widening the scope as needed and as funding allows.
- Particularly vulnerable groups were more difficult to reach and engage. There could be more investment into communication and engagement to ensure that there is a strong strategy at the start to target those groups more e.g. scope to have more tailored recruitment for people with disabilities through healthcare services.
- The registration form could include additional eligibility questions so that households could be ranked on most vulnerable to least and prioritised accordingly.

3.3 Delivery

3.3.1 Overview

This section covers

How well did the program deliver against objectives and outcomes?

- *How many upgrades of each type were delivered?*

What did the broad product offering mean for effectiveness and efficiency of the program, and perceptions of the program?

- *What is the cost to install different upgrades?*
- *What was the process for deciding on most appropriate upgrades?*
- *How was this presented to participants? Were they satisfied with the decision process?*
- *Were there any difficulties or confusion in choosing between options?*
- *What were the benefits of a broad offering?*

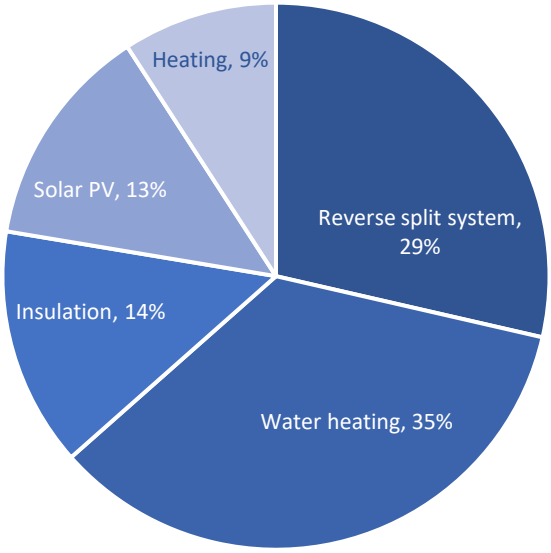
Summary:

The program installed 2,706 products across the 1,000 households within budget. With a broad range of offerings, HES determined what would be best for each household based on the household condition and householder needs, and this approached allowed flexibility to accommodate for each unique household. Some challenges arose selecting upgrade types when homes were in particularly poor condition and safety works had to be prioritised over energy efficiency. There were also some challenges negotiating upgrades and managing the expectations of householders.

3.3.2 Upgrades

The program installed 2,706 products across the 1,000 households from August 2018 to May 2020. The overall cost for the installation of upgrades and labour associated with installations, decommissioning and safety work was $4,323,638 (see Table 4). The upgrades were further broken down by major upgrade types.

Hot water systems were the most installed upgrade type accounting for 35% (488/1,399) of all major upgrades installed



(see

- Figure 1). There were four different types of hot water systems installed including: instantaneous gas water heating (259/488), gas water storage (121/488), heat pump (105/488) and solar water heaters (3/488).
- Reverse split systems were the second most installed major upgrade type, accounting for 29% (400/1,399). Reverse split systems containing both heating and cooling functions, ranged in size from a 2.0 kW system to a 9.5 kW system. The most common size was 6kW (100/400), followed by 2.5kW (91/400) and then 4.6kW (60/400).
- Insulation was the third most installed major upgrade type and included ceiling insulation, underfloor insulation and less commonly, wall insulation. The insulation installed was generally top up insulation.

Table 4. List of upgrade types, counts and costs. *Solar PV cost includes costs of PV cells and safety equipment for installation. **Average cost was estimated without total number of upgrades due to limitations with the data.

Upgrade type installed	Count	Average cost
Solar PV	185	$4,233*
Split system	400	$2,458
Gas heater	128	$2,944

Water heater	488	$2,209
Insulation	198	$1,541
Enabling works (e.g. gas line upgrades)	472	$547
Switchboard Repair/Upgrades & electrical inspections	120	$264
Smoke/CO testing	76	$113
Decommissioning	32	$159
Draft seals	59	$142**
Ducting replacement/service	17	$629**
Exhaust fan covers – self closing damper	18	$105**
Window furnishings	126	$1,700**
Lighting upgrade	156	$313**
Shower head replacement	43	$133
Appliance service	90	$143**
Upgrade return air	24	-
Non-appliance repairs and/or maintenance	48	-
Inverter replacement	2	-
Totals	**2,706**	**$4,323,638**

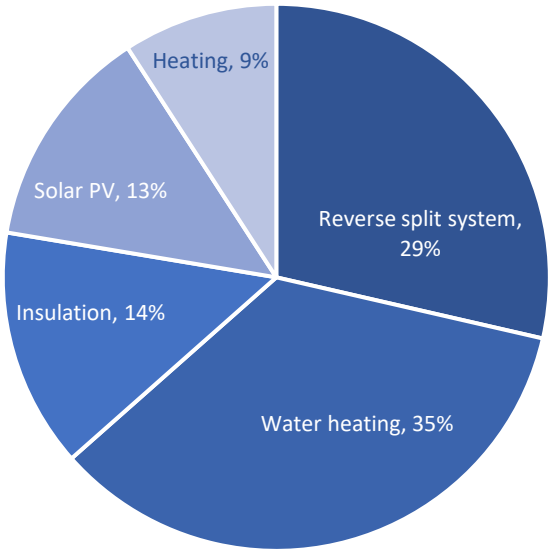


Figure 1. Proportions of major upgrade types (n=1,399).

3.3.3 Selection of upgrade types

The LVHEU program was very complex, offering over 20 different categories of upgrades types, services, and safety procedures (see Table 4), with different combinations for 1,000 different households. HES used their comprehensive experience and decision-making framework to select the most suitable upgrade for each household, also considering the condition of the house and the householder needs. The selection of upgrade types was relatively straightforward in most cases. However, some difficulties arose when upgrading homes in particularly poor condition and managing communications and expectations more broadly.

- HES considered that insulation was the most effective upgrade type, which could be paired with more efficient heating or cooling to improve comfort.
- For homes in very poor condition, the sum of $4,500 was insufficient. In some cases, rather than attempting to make the whole home more energy efficient, HES focused on making one room more comfortable.
- Some homes were not safe and required prioritisation of switchboards, wiring, gas leaks and gas pressure over energy efficiency or thermal comfort upgrades.
- Some houses were best suited to receive insulation but after the roof was inspected it was found that they needed electrical upgrades before the insulation could be installed, which the budget did not allow for.
- Safety was the number one priority, and in some cases, there was not enough budget to make the homes safe enough let alone efficient and comfortable, resulting in decision making challenges.

Difficulties selecting upgrade types also arose from the perspective of the householder. HES had to play a key role in explaining the program to householders during the HEA stage, as householders were uncertain of the upgrade types and the scope of the project. For example:

- Many participants were under the impression that the program was a solar program, so they expected to get solar panels rather than other upgrade types.
- Some participants requested upgrades or services beyond the scope of the project. For example, they wanted double glazed windows, or they wanted to add in their own money to get additional upgrades.
- Some participants anticipated getting a particular combination of upgrades that exceeded the $4,500 budget allocated.
- Some perceived the program to be a grant, where each household was allocated a sum that they could spend as they liked.

Contractors had to explain that this was not a solar program and that households did not get to choose how to spend the money, but rather HES were responsible for determining what would provide the best energy efficiency and comfort for each house. This led to some households being disappointed from the outset of the program. The consent form had very high-level messaging including costs and different upgrades. However, the consent forms were provided at a late stage, after potential participants had seen or heard different messaging and had already made up their minds about what the project was.

There were also difficulties negotiating upgrade types where people would talk to their neighbours who were also involved in the program and compared upgrade types and spending. This led to instances where some participants were disheartened when they perceived that a neighbour got more upgrades or better upgrades.

The broad range of offerings made the program more complex, but it also allowed the program to be more flexible and to meet the needs of all participants. The broad range of offerings allowed all eligible households who registered to take part in the program. Although a house may have an efficient split system or solar panels, they were still able to get something that could be of assistance to them.

Figure 2 attempts to capture the complexity of the different combinations of upgrade types. The major upgrade types are shown with coloured squares (and boxed out labels for the more common upgrades). The size of the squares also related to the number of that type of upgrade delivered. Smaller dots are the individual households (1000) and the uncategorised services that were delivered (including checks, reports etc). The upgrades that are closer together were more commonly delivered together. For example, solar PV was rarely delivered with other major upgrade types (apart from safety rails for installation). Insulation is very central and also close to split systems, indicating a large degree in overlap in delivery.

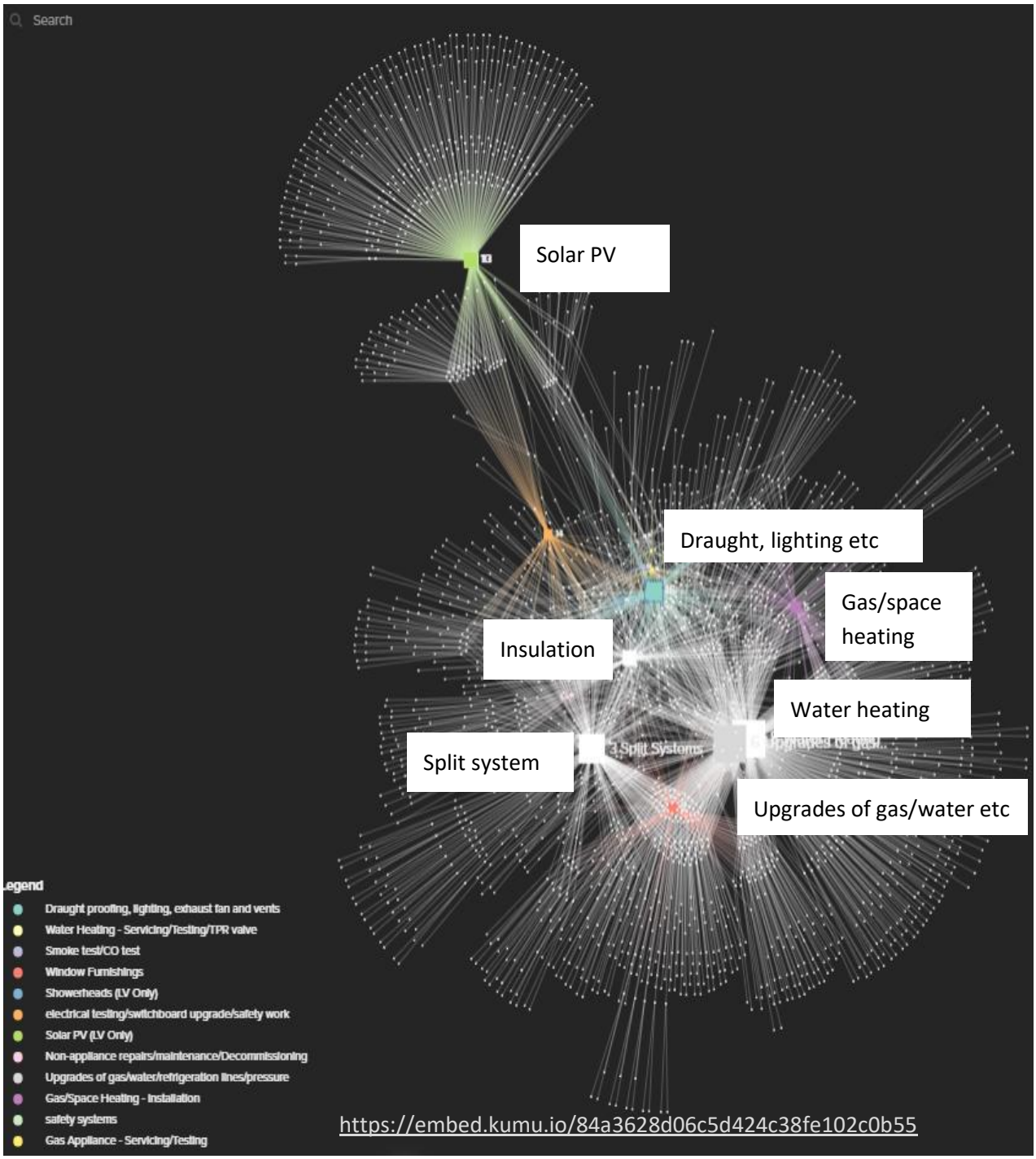


Figure 2. Network map of major upgrade types showing upgrades more commonly delivered together.

3.3.4 Lessons on upgrade types

Through more consistent and more accurate messaging, the challenges of selecting upgrade types with the householder may have been overcome. For example, through using the same project

description through all recruitment materials, and ensuring that those involved in the program could speak with participants directly and answer questions and ensure that they understand the program properly. While the program was mostly passed through word of mouth, without clear and consistent messaging there is the risk of the message being distorted. Similarly, the program was promoted through the LVA website who were advocating strongly for solar at the time and the Solar Victoria program launched during the LVHEU delivery phase, resulting in confusion between the two programs. Another stakeholder commented that rather than competing with Solar Victoria–participants who took part in LVHEU were ineligible for Solar Victoria–the program could have linked up with Solar Victoria to ensure maximum benefit to participants.

3.3.5 Participant satisfaction

The participant satisfaction surveys, completed by 185 recipients of the program revealed that participants were very happy overall with the upgrades and the outcomes relating to reduced utilities costs and usage and increased comfort within the home. Furthermore, participants also reported high levels of satisfaction throughout the program relating to communication, information, and the professional approach of installers.

Additional, follow-up interviews were carried out with 20 PSS respondents in October 2020 to gain greater insights into their experiences of the program, and particularly into how the program could be improved.

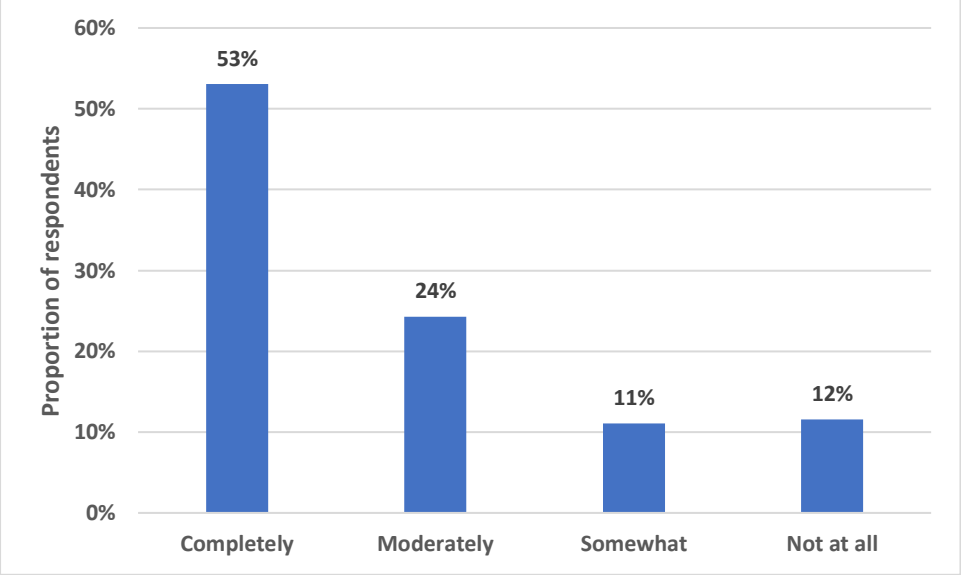


Figure 3. Respondents' level of satisfaction with the communication from Sustainability Victoria after registering to the program (n=181).

Just over half (53%, 96/181) of the respondents were completely satisfied that there was adequate communication from SV after registering to the program. 24% (44/181) of respondents were moderately satisfied with the communication from SV, while 23% (41/181) were either somewhat or not at all satisfied (see Figure 3). In both the PSS and the interviews, participants indicated that the process from registration to finding out that they were eligible, was a very long

process with little or no communication. Several respondents commented that they did not hear anything from SV and that the next point of contact following their registration was from HES. In some instances participants reported that the time between these two points was over two years. Some participants reported that they would have appreciated more follow-up from SV and regular updates.

> *To get the whole thing up and running I had to ring around a lot of different people. I did the application form and then they lost it and I had to do another one. I just kept getting passed around to different people. It took over a year to get it done (Interview respondent).*

> *It took a while to hear back. Maybe a 3-6 monthly update would have been good, so I wasn't left wondering (Interview respondent).*

> *[There was] no contact. I continued to ring every couple of months over a year and a half roughly, to make sure I was still registered and that I didn't need to do anything (PSS respondent).*

Overall, majority of participants were completely satisfied with the information provided by the program when HES called to book the energy assessment, and when information was provided about upgrades prior to installation and following installation. Participants were most satisfied initially, with 83% (151/183) of respondents being completely satisfied when HES called to book an energy assessment. 79% (141/179) of respondents were completely satisfied with the information provided about the upgrades before installation and 70% (126/180) were completely satisfied with information about upgrades post-installation. Furthermore, information about upgrades following installation received the highest number of participants who were not at all satisfied, at 8% (14/180) (see Figure 4).

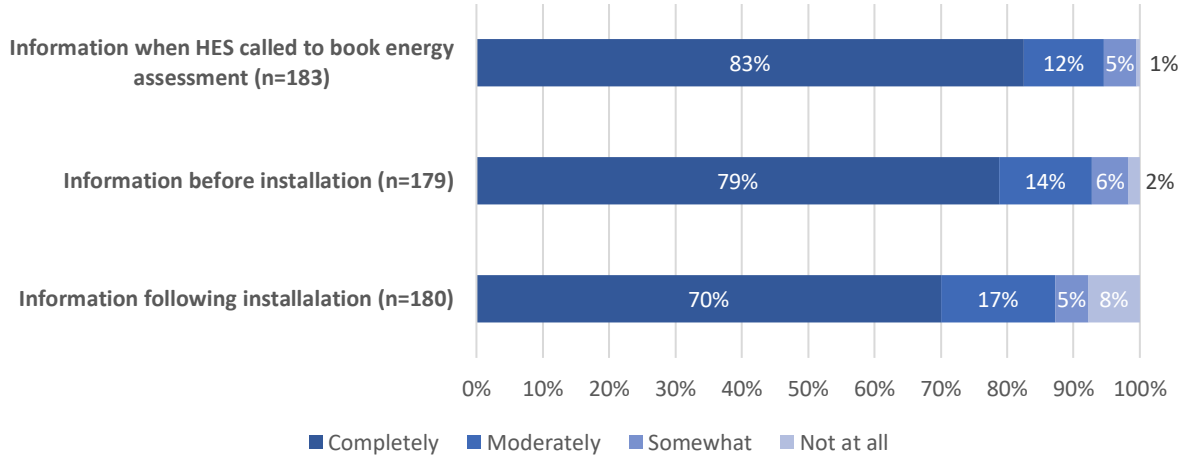


Figure 4. Respondents' level of satisfaction with the information provided by the program at time points including, when HES called to book respondents energy assessment, before installation and post-installation.

Among the 20 participants interviewed, one participant who received solar panels as part of the upgrade commented that there should be more information provided regarding the changes to electricity costs with the installation of solar panels. Another recipient of solar panels commented that it would have been beneficial for HES to provide more information on how to use solar panels

for increased cost savings. Other participants commented on not being informed of what was available as part of the upgrades and the budget allocated. Some participants were also initially informed that they would receive several upgrades, however when the installations were carried out, they missed out on an item with little explanation.

> *Hills need to explain a lot better and tell customers that there will a price increase in power, because power companies have a different rate for solar. There was no mention of this from Hills, the first indication was a $200 jump in power cost (Interview respondent).*

> *As far as energy is concerned, I am pretty happy. This probably has been provided and I missed it, but being educated better. For example, I'm using the solar allocated in the morning to run the washer, if someone said to use it for a cheaper rate at midnight, I would do that. I tried reading the bills and it's impossible to work out ways to use the solar better. So, more information about how to save money using solar (Interview respondent).*

> *We weren't informed about the total budget available, the grade of the insulation or the remaining budget and how that might best be expended (from PSS). The program was going to install R4 rated insulation – that was the wrong rating and was not substantial enough to deal with the cold in our zone. Our zoning requires R5 insulation. I insisted on this and we got R5 (from interview - Interview respondent).*

91% (160/176) of respondents reported that they were completely satisfied with the professional approach of the installers, 7% (12/176) were moderately satisfied and 2% (4/176) reported that they were only somewhat satisfied (see Figure 5). Furthermore, 90% (84/93) of respondents were either completely or moderately satisfied with the approach of the professionals during the post installation audit (see Figure 11). A lot of positive feedback was provided on the PSS regarding the installers, including:

> *They worked on one of the hottest days in summer they were very efficient and friendly at all times (PSS respondent).*

> *The two men who came to replace the hot water system and clean the gas heaters were the best two workers I have ever had! (PSS respondent).*

However, follow-up interviews revealed that **more communication, flexibility, and time was needed from the installers in some situations.**

> *Communication could be improved a lot. Tradies just turned up without notice, walked through my house and said that they would be back in a week and then just rocked up and did it. I grew up in the system, and I'm now a social worker so I am used to it but I think the tradies just see people with disability or in the low-income sector and they don't treat you as well (Interview respondent).*

> *More notification would be good. One day a guy showed up and put heater in the backyard and let me know that he would be back in a couple of days. Same with the insulation they just dropped it off in the backyard and then came back later and put it in (Interview respondent).*

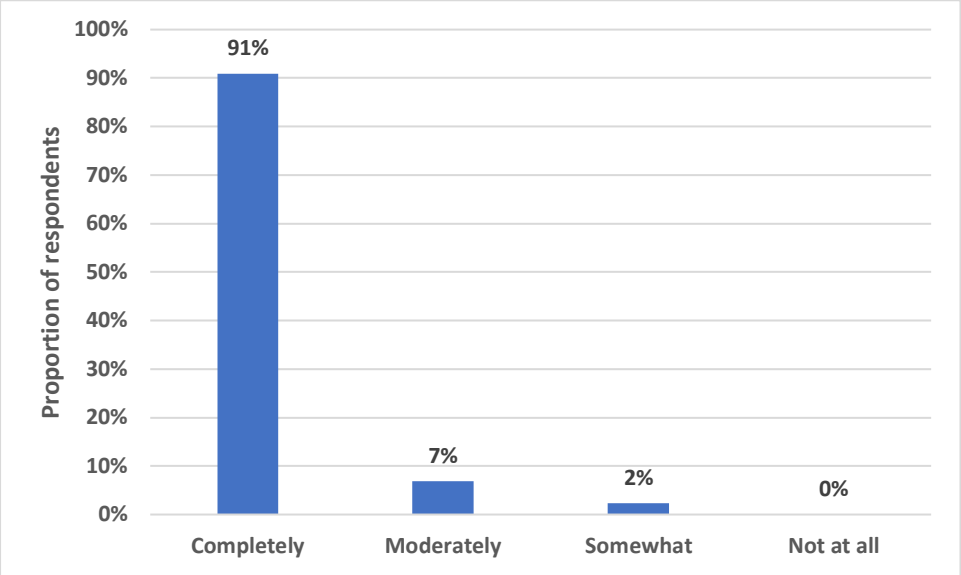


Figure 5. Respondents' level of satisfaction with installers professional approach (n=176).

Overall, 83% (146/175) of respondents were completely satisfied with the upgrades that they received (see Figure 6). In the follow-up interviews 6/20 participants commented that they were happy with the upgrades received, and did not have any negative feedback. 7/20 said that they were happy with the upgrades, but they also had additional concerns with the upgrades or the service. S**ervicing issues, negative experiences with HES, issues with the hot water system, increases/no reduction in costs, not installing all upgrades originally promised and other factors were described as reduced overall satisfaction of the upgrades**.

> *It was good getting a new AC to replace the old one. It works great but it's not strong enough for room size. The lighting was alright as well but I didn't get roof insulation, which was promised. The roof installer didn't want to put it in cause, it would take too long (Interview respondent).*

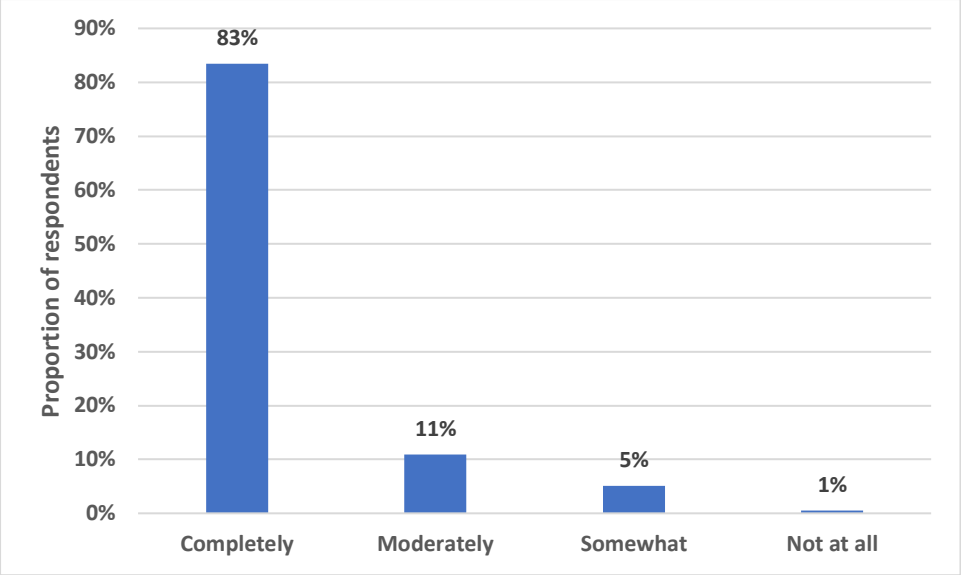


Figure 6. Respondents' level of satisfaction with the upgrades that they received (n=175).

3.3.6 Lessons for communication and satisfaction

Program delivery provided key lessons around communication and expectation management, selecting upgrade types within budget in different housing contexts and providing energy efficiency education.

Firstly, considering communication and expectation management, if participants did not receive all upgrades that were originally promised, this led to high levels of dissatisfaction. Therefore, there needs to be greater communication with participants about what is possible and feasible from the initial HEA. If a certain upgrade cannot be followed through with, there should be greater communication and explanation about why this is not possible and how participants could potentially go about addressing certain issues. There could also be greater emphasis during the HEA that the upgrade types suggested are the possible types, ensuring that participants to not feel that these upgrades are set in stone.

Furthermore, HES stakeholders commented that there were issues surrounding the budgeting and that there could be a surplus balance in cases where houses were deemed very unsafe. Additionally, a risk matrix could have been developed to assist with making decisions when there is not enough budget to ensure that all the safety measures can be implemented.

Finally, while HES decision making framework included an education component, this could have been strengthened. Some participants commented that they found this aspect helpful while others commented they did not receive any education about how to use their appliances more efficiently and that this would have been useful. Education and behaviour change can be an effective and low-cost energy efficiency tool. Therefore, more effort and consistency should go into ensuring that participants have information for how to use energy more efficiently in their homes and potentially, further upgrades or actions that they could implement themselves following on from the program.

3.4 Outcomes

3.4.1 Overview

This section covers the key outcome measures in relation to the program objectives.

How well did the program deliver against objectives and outcomes?

- *How satisfied are participants with the upgrades and outcomes?*
- *How satisfied are stakeholders with the outcomes?*
- *How satisfied were participants?*
- *To what degree did participants feel that the project met their needs?*
- *What are the reductions in energy use attributed to the program?*
- *What is the GHGe reduction attributed to the program?*
- *What is the kW RE generation capacity attributable to the program?*
- *How many jobs were created?*
- *How many longer-term jobs created?*

Summary:

Most participants were completely satisfied with the upgrades that they received, including the communication from HES at all stages and their approach during installation. Most participants were also completely satisfied that the upgrades had increased comfort within their homes and resulted in large (22%) or small (50%) reductions in their energy bills.

Overall, stakeholders were very satisfied with the LVHEU program. Though a small number of stakeholders engaged with the evaluation, there was a high level of satisfaction with the LVHEU economic, social, and environmental outcomes. The success of the program was identified by participants as creating more jobs in regional and rural areas, improving comfort within participants homes, contributing to energy efficiency, and getting community engaged with energy efficiency.

While there were limitations with the household electricity meter data collected, **there was evidence of meaningful reductions in electricity use** where this was available. The average change recorded per household was -452 kWh equating to an average yearly change of -479 kWh. While there were a substantial number of houses that had an increase in electricity use (likely due to the installation of Split Systems, replacing gas heaters), for those that had a *decrease*, the reduction in electricity equated to 1436 kWh on average. The total change in electricity for the available data timeframe was -20,807 kWh. Based on the calculations **per household this was an 11.1% reduction in electricity use.**

The average household electricity reduction of 479 kWh from this sample can also be scaled up to the 1000 homes of the whole program. **This equates to a yearly reduction for the program of 479 mWh.**

The **GHGe reductions** for electricity use can also be calculated with the same assumptions. Based on average per house from the sample, the electricity reduction of 479 kWh equals a reduction of approximately 512kg CO2 emitted per year. Scaled up to the program level with 1000 houses, this is 512 t CO2 per year.

The program installed 185 2kW solar PV systems in the Latrobe Valley region. With the average output for a typical 2kW system in the Latrobe Valley at around 2000kWh per year,[18] this results in an overall capacity of 370MWh/year.

The LVHEU committed 19 jobs and secured 28 jobs, producing 9 new positions including 3 additional apprenticeship/trainee positions.

3.4.2 Participant satisfaction

The majority of respondents believed that the upgrades would help to reduce energy usage or costs, with 48% (83/173) and 35% (61/173) either completely or moderately expecting that the upgrades would lead to reductions in usage or costs respectively (see Figure 7). **Furthermore, 72% (108/149) of respondents surveyed in the PSS reported that they had experienced a decrease in their energy bills following installation of the upgrades.** 10% (15/149) reported that there had been no change to their energy bills and 17% (26/149) of respondents stated that they had experienced increases in their energy bills (see Figure 8**Error! Reference source not found.**). Of the 20 participants interviewed, half (10/20) of them stated that they had experienced reductions in their utilities bills, three (3/20) explained that there was no difference in their bills, three (3/20) said that their bills had increased and three (3/20) said that it was difficult to tell whether their bills had increased or decreased following the installation of the upgrades. Two (out of 20) of those interviewed commented that the reductions in their bills was lower than they were expecting, and another commented that they had to pay for additional works to prepare for the upgrades.

> *We had to pay $8,000 out of pocket to get the ceilings prepared for the new insulation… We live in an old 1950's house, and for ceiling insulation in this area, they must take the coal dust, cavity cleaning and black wiring into consideration (Interview respondent).*

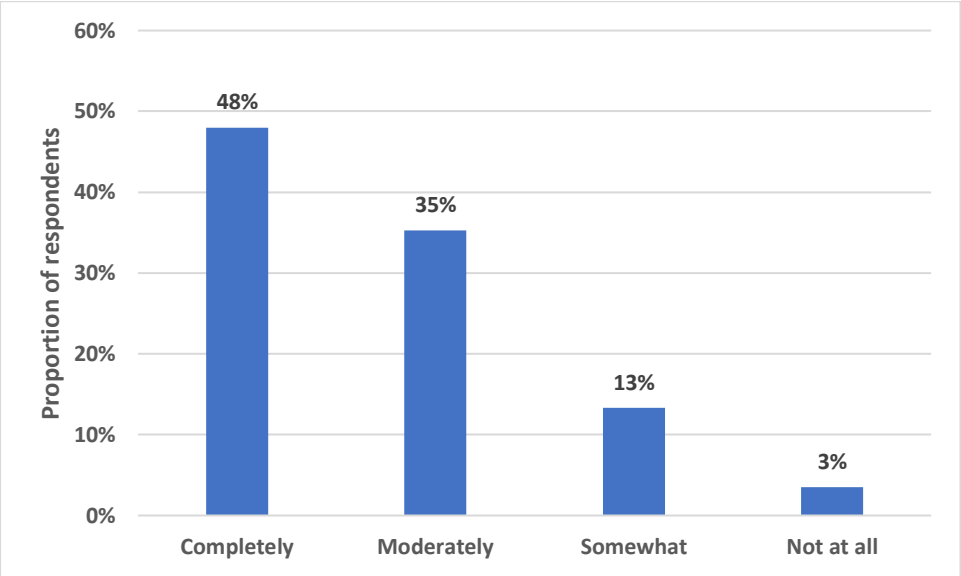


Figure 7. Respondents' level of expectation that the upgrades will help reduce energy use or costs (n=173).

[18] https://pvwatts.nrel.gov/pvwatts.php

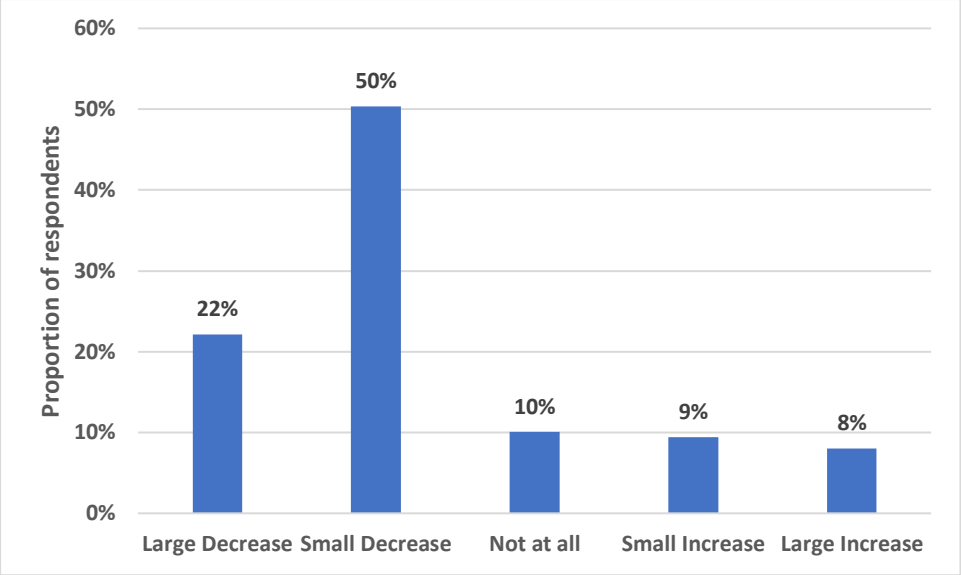


Figure 8. Respondents' reported changes in energy bills since installation of the upgrades (n=149).

Just over half of participants (58%, 101/174) reported that they were completely satisfised that the home upgrades had made their home more comfortable. Meanwhile, 33% (58/174) reported that their homes were either moderately or somewhat more comfortable and 9% (15/174) reported that their homes were not at all more comfortable due to the upgrades (see Figure 9). Of these 9% (15/174) who reported that their homes were not at all more comfortable, four (out of 15) only had solar installed and seven (out of 15) had a gas hot water system or hot water pump installed, with some commenting that the program was only to reduce bills, or "hot water is hot water". During the interviews, 14/20 reported that the upgrades made their home more comfortable due to the temperature, 2/20 said that their home was more comfortable having hot water and 4/20 said that there was no change to their comfort. Those who reported no change to their comfort had either a hot water system (2/4), a split system (1/4) or solar (1/4) installed through the program.

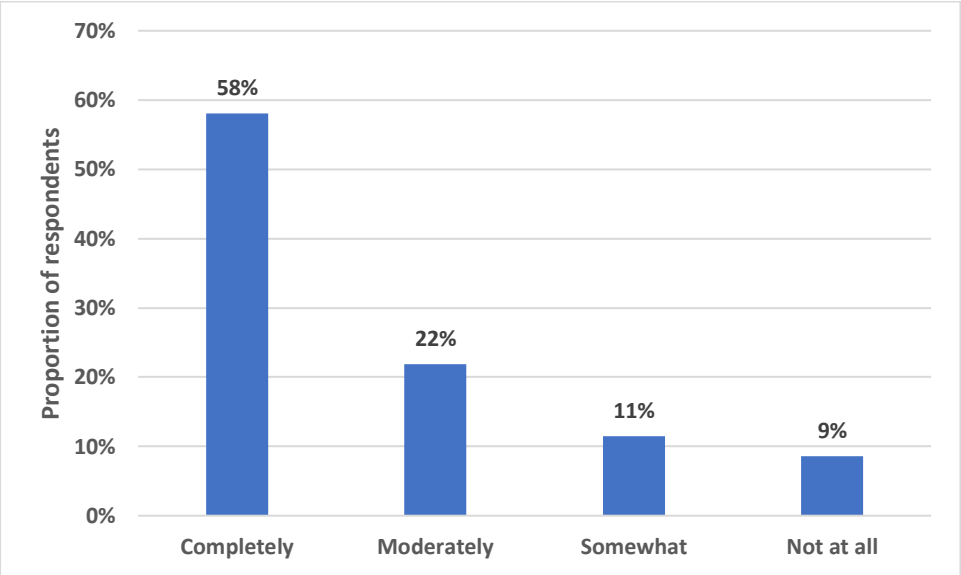


Figure 9. Respondents' reported changes in levels of comfort in their home following the upgrades (n=174).

About half (51%, 88/173) of the respondents said that the home energy upgrades would completely meet their needs. 30% (52/173) reported that the upgrades would moderately meet their needs while 16% (28/173) said that the upgrades would somewhat meet their needs. 65% (41/63) of those who provided an additional comment in the PSS reported that further energy efficiency upgrades were needed in their homes and 13% (8/63) said that they need further money savings. During the interviews the majority of participants (12/20) said that they either want or need to make further energy efficiency upgrades in their home. Furthermore, 4/20 said that they have made additional upgrades and 4/20 reported that they plan to get further efficiency upgrades.

> *Depending on availability of resources we must get our windows replaced. They don't open and they make the house extremely cold. If the windows aren't wrapped with bubble wrap, it is unliveable. The house gets cold and we get wet walls, which is also dangerous for our health (Interview respondent).*

Of those interviewed 20% (4/20) of them had investigated further energy programs, 20% (4/20) said that they would consider other programs, 40% mentioned that they wouldn't consider other programs because they don't know of any and the remaining 20% said that they wouldn't consider other energy efficiency programs because they did not believe they needed it.

The HES report provides the decision-making framework used to select which upgrades were most appropriate. Firstly, it interrogated water heating and recommended a water heater upgrade if the previous system was older than 10 years and three or less energy efficiency stars, otherwise a service was quoted. Next the decision-making framework recommended a heating and/or cooling upgrade or service. If hot water, heating, and cooling were all relatively new and efficient then solar PV was offered, if participants did not already have solar. If participants received hot water, heating/cooling or solar, they were also offered water saving showerheads, lighting, insulation, draught proofing, and window furnishings, depending on the household conditions and the remaining budget.

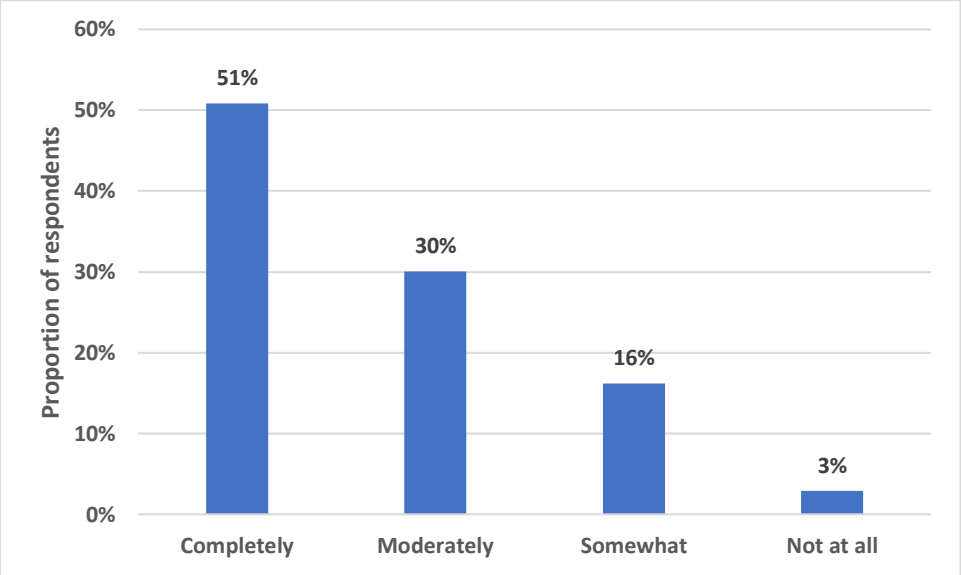


Figure 10. Respondents' level of satisfaction that the home upgrades will meet their needs (n=173).

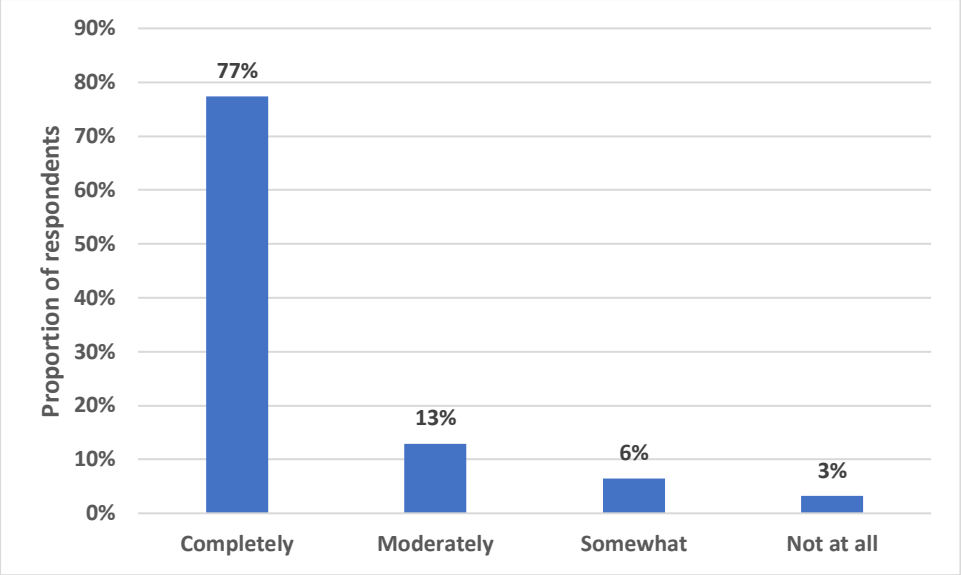


Figure 11. Respondents' level of satisfaction with the professional approach of those carrying out the post-upgrade audit (n=93).

Vignette - Interview respondent

I'm on a healthcare card and low-income, so I wanted to look at AC and stuff anyway and [the program] was a good opportunity. I have multiple sclerosis and my body isn't good with extreme temperatures but there is no support for that. So, this was a something that could help. I am also passionate about sustainability and reducing emissions and I thought this would be good. Everything works but there hasn't been any reduction to costs necessarily. I don't pay exorbitant prices, it would probably be $50 per month in summer, which is more now but it's because I now have AC. The house is definitely more comfortable.

[During the assessment] they talk about lots of things. So since then, we are looking into saving for better windows. Our windows are very thin glass. So, [the program] definitely got us thinking about what we are going to do when we do renovations. I have spoken to Gippsland Solar already and we have just removed a few trees nearby hoping to get solar installed now. I think that they could have made notes at the assessment of other upgrades that the house could use and give an energy assessment of the property and what different upgrades would do. If they gave a list of information about what upgrades would be good for you, I would look into that further.

If specifically targeting people with a health care card, disability or aged pension, and if was an ongoing program that wanted to do real support in that area, it should have a support person to follow up about other programs that are available. For most people on healthcare cards and single parents, it's hard to find the time and energy to follow that stuff up. The people that the program is trying to reach are vulnerable around accessing resources or might not be savvy with reading, so it could provide more support that way. If it was ongoing, people like financial support officers could make referrals or even Centrelink. It should be more inclusive - if you are eligible, they should let you know.

3.4.3 Stakeholder satisfaction

Stakeholders reported being highly satisfied with the outcomes of the program from social, environmental, and economic perspectives. Stakeholders were pleased with the outcomes that the program had on the householders' experiences and improved comfort and well-being outcomes. Stakeholders were also pleased with the economic outcomes of the program, through the creation of local jobs and stimulation of local business. Finally, although the energy data did not have a lot of standalone weight without the gas data; most stakeholders were satisfied that the program achieved energy efficiency outcomes and it had gotten households across the valley talking about energy efficiency. One stakeholder responded during the Summit:

> *We should be spending money because it's a good thing to do rather than focusing on the payback. There is a role for the government to help people who can't afford it and it's important to focus on low-income households and health issues but also important to do something about housing stock more broadly. We need to think more creatively to find and target the worst of the worst housing stock. This area needs more thought.*

3.4.4 Meeting the needs of vulnerable people

The earlier section on recruitment addressed whether vulnerable people in the Latrobe Valley were reached by the program. There was also a question of whether the program met the needs of vulnerable people. Given the commentary above on the challenges and limitations of reaching the most vulnerable, this section mainly focuses on how needs were met generally.

There were, however, features in the design of the program that did address the needs of vulnerable people, including the wide range of upgrade options and the requirement to address comfort, well-being, and bill savings as well as energy efficiency or generation. The combination of upgrades was chosen to give the greatest benefit to the residents. There were also health, safety and general home improvement benefits delivered, especially to those in lower quality housing. Moreover, there were some very dramatic improvements for people living without basic necessities such as hot water or heating in winter.

Stakeholders agreed that the program was beneficial for those who received upgrades but that some houses were in such poor condition, the cost allocated was not sufficient to ensure that the house was both efficient, or safe and comfortable. Stakeholders also identified a range of groups who were more vulnerable and less engaged in the program. Some commented that the program more successfully reached those who were income poor but asset rich and there were many others in the LV who were left behind.

3.4.5 Energy use

Limitations and scope

As previously noted, there were several limitations in the energy data that could be obtained for use in the evaluation. In particular, these limitations include:

- Only electricity usage data (not gas)

- A limited number of households due to the process of collecting consent (and approval) and some lack of individual meter data
- Missing data within households and the difficulty of matching data pre- and post- upgrades accounting for seasonal effects.

The results presented should be considered as examples, although calculations are provided that scale these results up to the full scope of the program. These would hold if the sample of electricity data received is a representative sample of all households. This can be estimated to some extent in terms of similarity of upgrade types, but the underlying condition of homes and energy use/behaviours is not known. While the type of upgrades generally match those of the program as a whole, one difference is that there is little data from the later stages of the program which concluded in May 2020 (leaving as little as 5 months post upgrades at the time of analysis) and included a large number of residences in Lifestyle Villages.

There are also challenges in attributing changes directly to the upgrades and the program due to the complex nature of household energy use and drawing causal conclusions over time. It is evident that there were a range of influences on household energy use. It is important to note that many of these are outside the program and difficult to monitor or account for in attributing any changes in consumption to the program itself. Furthermore, with data limited to electricity meter records, we cannot calculate all changes in energy consumption. This is particularly relevant given that some upgrades included decommissioning gas heaters and installing efficient air conditioners. Table 5 below outlines some of these considerations as an illustration of the complexity of the measuring changes in energy use and attributing this to any given source.

Table 5. Range of factors affecting energy use.

	Factors reducing energy use	Factors increasing electricity use (higher costs)	Other considerations
Attributable to program	Higher efficiency	Additional appliance (e.g. no previous hot water)	Increased comfort
	Behaviour change	Upgrades switch from gas to electricity	Safety of existing materials and installs
	Other upgrades (e.g. solar installed at same time but not part of program)	Rebound effects (with Solar PV etc)	Increased knowledge, increased self-efficacy (monitoring bills and energy use more), looking into other energy efficiency options, increased energy security at household level
Outside the program	Weather	Weather	Different condition of houses
	Other upgrades	Change in energy prices	

	Factors reducing energy use	Factors increasing electricity use (higher costs)	Other considerations
	Other factors e.g. long absence, change in number of residents	Other factors e.g. household renovations, illness, change in number of residents, global pandemic	

Method

Changes in electricity use were measured by downloading household meter data. FPC provided AusNet consent forms to households inviting them to nominate FPC as a Customer Authorised Representative for the purpose of downloading their meter data for the evaluation. For the most part, these were posted to households who had received upgrades (along with the paper version of the survey), and in the later stages they were given to participants by HES at the time of delivery, along with a reply-paid envelope addressed to FPC.

The signed consent allowed FPC to request up to 2 years data from AusNet. Ideally, the aim was to gather data 1 year before and 1 year after the upgrade date. This was then calculated as electricity use (kWh) per month, before and after the upgrade date for a comparison of use for the same month across the years (e.g. March 2018 to March 2019). This was then summed for the difference in use before/after for that period of time. Positive numbers below indicate an increase in electricity use over that period, whereas negative numbers indicate a decrease in consumption.

Electricity Data Results

In total, electricity meter data was accessed for 46 households. Many of the households where consent forms were provided to FPC were rejected in the data download process due to incorrect details. While the reasons were not explicitly stated, they could include details not matching exactly with the account holders' details (such as exact name, billing address, NMI etc).

Overall, there were 20 households that had an increase in electricity use and 26 that had a decrease electricity use. The graph below (Figure 12) shows the percentage change in electricity use per household and the change in kWh use over the equivalent of one year (due to the different lengths of time that data was available for different households). While there were many increases as well as decreases, this graph captures how the decreases were much larger in kWh than the increases.

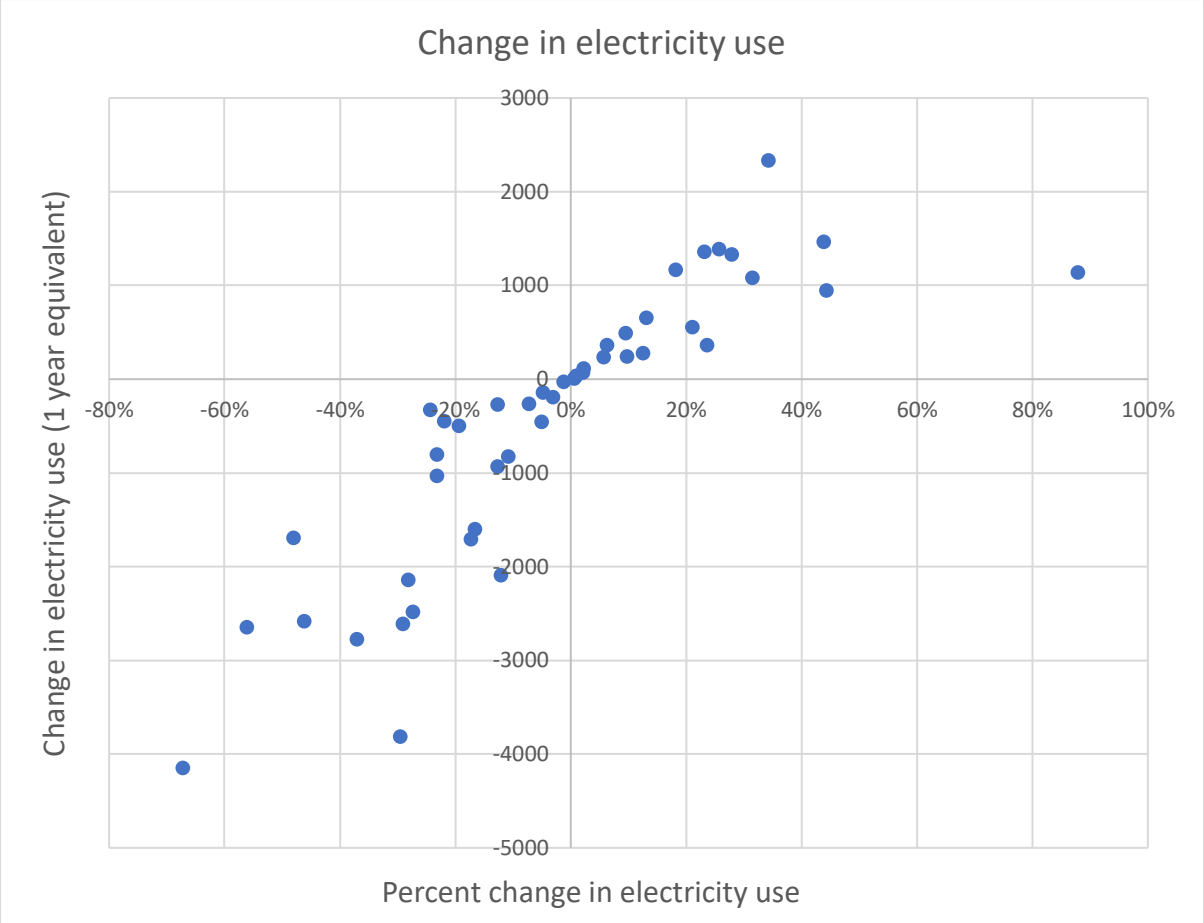


Figure 12. Change in electricity use in kWh and percentage.

Overall, this accounts for a substantial reduction in electricity use for this sample. The average change recorded per household was -452 kWh. With 9 months of useable data on average, most households had the majority of a year covered for the before and after upgrade comparison. The actual observed meter data was scaled up to the equivalent of 1 year based on the proportion of the year covered by that house's data. This equated to an average yearly change of -479 kWh.

The total change in electricity for the available data timeframe was 20,807 kWh. **Based on the calculations per household this was an 11.1% reduction in electricity use.**

As noted, while only just over half of households had a decrease, the decreases were much larger than the increases. For those that had an *increase* in electricity use, the average change was 765 kWh per house. On the other hand, for those that had a *decrease*, the reduction in electricity equated to 1436 kWh on average.

Total benefits scaled up across the Program

The average household electricity reduction of 479 kWh from this sample can also be scaled up to the 1000 homes of the whole program. **This equates to a yearly reduction for the program of 479 mWh.**

This calculation is based on the houses in the sample and to hold across all the houses would require broadly similar upgrade types, housing stock, etc to deliver similar average reductions. While there is

likely to be substantial variation, the upgrades types are similar over the rest of the program, although again, the other variables cannot be accounted for.

This is also not taking into account any changes in gas consumption (although in total there were only 132 gas space heaters installed compared to 401 split systems, as some indication).

The **GHGe reductions** for electricity use can also be calculated with the same assumptions. Based on average per house from the sample, the electricity reduction of 479 kWh equals a reduction of approximately 512kg CO2 emitted per year. Scaled up to the program level with 1000 houses, this is 512 t CO2 per year.

Energy use – link to upgrades

For each upgrade type, the table below (Table 6) sets out what proportion of households had a decrease versus an increase in electricity use. Given this covers 16 different upgrade types, and only 46 houses, each upgrade type may have a small number of installs (e.g. only 1 from this group with Window Furnishings). There were some differences in upgrades for those that had a reduction vs increase (although conclusions are limited by only having electricity data). Decreases were associated with gas space heating installation and solar PV, which make sense given the clear reduction in electricity needs. Increases in electricity use were associated with split system installation (although there were 28% of installs that also had electricity decreases), water heating servicing and testing, and non-appliance repairs/maintenance/decommissioning.

Table 6. Percentage of households with an increase or decrease in electricity use who had each type of upgrade. (Note this is based on only 46 houses and numbers per upgrade type can be very small.)

Type of upgrade	Total number of installs	% installed with decrease	% installed with increase
Thermal shell (insulation)	13	38%	62%
Window furnishings	1	0%	100%
Split systems - installation	18	28%	72%
Gas appliance - servicing/testing	10	30%	70%
Gas/space heating - installation	7	100%	0%
Upgrades of gas/water/refrigeration lines/pressure	10	50%	50%
Water heating - servicing/testing/TPR valve	4	0%	100%
Water heating - installation	20	55%	45%
Showerheads (LV Only)	6	50%	50%
Solar PV (LV Only)	7	86%	14%
Non-appliance repairs/maintenance/decommissioning	3	0%	100%

Type of upgrade	Total number of installs	% installed with decrease	% installed with increase
Smoke test/CO test	9	33%	67%
Safety systems	9	89%	11%
Electrical testing/switchboard upgrade/safety work	6	67%	33%
Split system/air-con service	1	0%	100%
Draught proofing, lighting, exhaust fan and vents	30	50%	50%

An extreme example of the link between the upgrade type and electricity use is seen in the largest electricity increase in the available meter data. This was an 88% increase in electricity use after the upgrade, compared to the same timeframe beforehand (although it should be noted that this was still one of the lower consumption levels in the sample, even after the increase). The installations for this house included disconnecting and removing the gas heater and installing a Daikin split system AC.

3.4.6 Savings

The household savings due to changes in energy use/efficiency can be estimated from electricity use but this varies depending on the upgrade types as above (and other factors). Savings are also dependent on pricing and there may be benefit in further communication around the possibility of price increases.

While household billing data is not known, a midway figure for retail electricity cost in Victoria is 28c per kWh. For the average household electricity reduction of 479 kWh from this sample, this would work out to **a saving of $134.10 over a year.**

Recalling that there were increases in electricity use for many households (likely accompanied by decreases in gas use, not available here), if only looking at the houses where there was a decrease in electricity, this would equate to a saving of $402 a year on average.

Regarding **electricity generation** from solar PV, the total capacity installed was 185 2kW solar PV systems. With the average output for a typical 2kW system in the Latrobe Valley at around 2000kWh per year,[19] this results in an overall capacity of 370MWh/year.

3.4.7 Other outcomes

The LVHEU committed 19 jobs and secured 28 jobs, producing 9 new positions including 3 additional apprenticeship/trainee positions. As can be seen in the table below, this at least met the targets for the program and often exceeded them. In addition, HES undertook training for staff above and beyond what was required, to deliver a better service from their perspective.

[19] https://pvwatts.nrel.gov/pvwatts.php

Table 7. Employment committed and secured through the LVHEU program.

Jobs	Committed	Secured	Difference
Existing jobs	11	11	0
Existing apprentices/ trainees	1	1	0
New jobs	6	12	+6
New apprentices/ trainees	1	4	+3
Total	**19**	**28**	**+9**

3.4.8 Lessons for outcomes and measurement

The key lessons for the outcomes are around the prediction of energy reductions, communication and expectations of change, and the monitoring and collection of data.

While respondents were highly satisfied in general, there were some who were highly dissatisfied due to the expectation that they would receive reductions in their energy bills. Where they raised this with HES, it was noted that discussion of their situation led to an understanding of why this occurred (price changes or increases in use through additional appliances etc). As such, **greater education and understanding of the likely outcomes would help in framing expectations and in understanding how to get the most benefit from the upgrades** (for well-being and efficiency).

Regarding the program evaluation and understanding of what works and the return on investment, it would be beneficial to **have comprehensive and accurate energy data, in conjunction with information on the condition of housing before and after upgrades, and any changes in use** (or additional upgrades or appliances not related to the program).

It would also be beneficial to **measure the well-being outcomes more systematically** if this is a core component of the program.

As outlined earlier, there are many factors that combine to determine energy use and change. More accurate data will give a better indication of where the changes are occurring although there will always be unknown elements. For this reason, **there is value in residents being as engaged as possible, to monitor and be aware of their own behaviour and energy use**.

3.5 Costs and efficiency

3.5.1 Overview

This section covers costs of delivery per household and reflections on delivery efficiency.

Did the project achieve its objective efficiently?

- *What was the delivery cost per participant?*
- *Were there efficiencies identified or achieved through delivery of the project (in context of achieving objectives incl inclusiveness and opportunity for involvement)?*

Summary:

Overall, the cost per house was in line with what was budgeted. The average household cost across the 1,000 households was $4,324 and majority of households received upgrades worth between $4,001 and $5,000. The full health and social benefits cannot be calculated from the data but there is evidence of substantial improvements to well-being. There were some efficiencies identified in the delivery and some inefficiencies that may be addressed in future.

3.5.2 Household costs

Each eligible household was able to receive upgrades worth a total of $4,500. The average household cost across the 1,000 households was $4,324 and majority (590/1,000) of households received upgrades worth between $4,001 and $5,000. However, there were also some clear outliers where the minimum household spend was $810 and the maximum household spend was $7,790 (see Table 8).

Table 8. Upgrade costs per household.

Average cost	Min cost	Max cost	<$2000	$2001-3000	$3001-4000	$4001-5000	$5001-6000	>$6000
4,324.39	**810.00**	**7,789.90**	5	65	177	590	157	6

The one house that received upgrades close to $8,000 was reported to have been in very poor condition and SV were not notified by HES of the overspend.

This led to changes in the process where HES was required to contact SV for approval for households with a large excess and towards the end of the program SV required HES to collect photo evidence of each upgrade installed and the safety documents before payments were made. Prior to that they were using random audits to confirm that everything proposed was installed.

It was also apparent that this was an issue when speaking with participants during the phone interviews. One participant said that were satisfied with the appliances but dissatisfied that HES did not do everything that they had agreed to initially.

> *I was given an AC to replace the old one and downlights. The AC works great but it is not quite strong enough for the room size and the lighting is alright. However, I didn't get roof insulation which was promised at the start. The roof installer didn't want to put it in because I have a low-pitched roof and he thought it would take too long. I'm disappointed about the insulation. (Interview respondent).*

Overall, the cost per house was in line with what was budgeted, or just under.[20] To some degree the cost of energy/GHGe reduction can be estimated from electricity data, although this is an

[20] Note: the scope of the evaluation does not include an analysis of the overall program costs.

incomplete picture of the benefits delivered and is also based on a small sample of electricity data only. The average cost per household of $4324 delivered an electricity reduction of 479 kWh per year or approximately 512kg CO2 emitted per year. This would also need to be scaled up over the lifetime of the upgrades, and also does not include broader program delivery and administration costs. **The full health and social benefits cannot be calculated from the data but there is evidence of substantial improvements to wellbeing.** These additional benefits would need to be accounted for to understand the full benefit of the program.

3.5.3 Efficiency of delivery

There were some efficiencies identified in the delivery and some inefficiencies that may be addressed in future. Promoting the program within Lifestyle Villages towards the end of the program was a key efficiency. While the Lifestyle Villages were not the key target audience for the program, it increased efficiencies for HES workers where many households were in proximity to each other, many households were similar and it was a very effective way to promote the program. Other efficiencies identified included HES training their own staff to install insulation, as this way they could regulate the process and operate without having to rely on subcontractors.

An important consideration in looking at efficiency is that safety was the number one priority. This necessarily made some installations more expensive, and perhaps delivered less in terms of energy efficiency, but this should not be regarded as *inefficient* from a delivery point of view.

Similarly, the wide range of upgrade options made the delivery more complicated and at times produced some confusion or dissatisfaction for participants who did not receive desired items. However, this was a key component of the program and made the delivery more flexible for households and provided more appropriate and better outcomes.

There were also administrative complexities, within and between organisations, partly due to the scale, target audience, and scope of the interventions. For example, the administration undertaken by HES was at a scale that they had never encountered before, and it took a considerable amount of time and effort for both HES and SV to streamline the processes as best possible. However, some administrative procedures such as data consent forms, were never managed to the level required. While these are not easily anticipated, there were adaptations put in place and further opportunities to streamline some areas in future. These are outlined in the section below, including clear administrative and data requirements specified from the outset and recorded systematically in a shared system. This would reduce duplication of recording and request to find and organise data in different ways.

4 Other challenges and lessons

4.1 Roles, structure, and communication

Establishing very clear roles, program structure and communication from the beginning of the program would have been beneficial. There was some confusion about where responsibilities lay between SV, local government and HES. Including more local government, social services, community groups and tradespeople from the design phase of the program may have alleviated tensions and assisted the program to run more smoothly. Developing trust and understanding between SV and HES allowed HES to better understand the contract and provided them with more autonomy during program delivery. One stakeholder commented that those involved in the program initially were long-term bureaucrats and those with academic backgrounds, with a great understanding of the science and policy but lacking the practical and regional or rural background. There was greater opportunity to understand and involve the local market and the local industry that the program was seeking to assist.

Additionally, there needed to be better understanding of how and when the program would engage with eligible people, registrants, and participants. An initial expression of interest was released when the Minister announced the scheme. However, following this announcement the program still had to tender for a service provider, determine eligibility and scope and recruit, which typically takes approximately 12 months. After HES were selected, there was a further 6-month delay in the program while HES upgraded their OH&S systems to meet the program requirements. Therefore, there were already considerable lag times between participants registering their interest via the LVA website and HES contacting registrants via phone to confirm eligibility. In some cases, registrants were not contacted for up to two years following registration. During the PSS surveys some participants commented that there was no communication from SV at all during the time between registering and initial contact. Having a clearer understanding of roles and protocol for providing feedback to registrants could have alleviated these communication issues.

4.2 Adaptations

The program adapted and evolved over the course of the three years. The close collaboration between HES and SV meant that they could implement changes along the way. For example, SV employed an external quality assurance auditor who detected a high percentage of non-conformance among sub-contractors installing ceiling insulation (69% non-conformance). Staff were able to adapt the program delivery following this finding so that HES staff were trained to install insulation and the non-conformance was reduced to 16%, demonstrating a marked improvement. The Lifestyle Villages also provided a great efficiency, where many households were in close proximity for fast and efficient installations, although stakeholders agreed that this approach was not targeting those who needed the program most. Another stakeholder commented that the program should have flexibility built in, so other programs could be added in overtime e.g. Solar Victoria Program.

4.3 Local involvement

Due to the context of the area, it is important to ensure that there is meaningful local involvement. It was noted that people from the area often feel that money is thrown at them without meaningful conversation and there is a feeling that 'Melbourne is coming in again'.

HES are a local company and have operated in the Latrobe Valley for 30 years successfully tended for the program, employing local people and using many local providers. However, some negative tensions persisted with members of the community feeling that local community groups were not involved enough, local products were not used and that the program touted itself as 'local' but did not follow through. Involving local community groups in the design phase would improve community acceptance. While having a more community approach takes time and resources, it would be very valuable in this context to prioritise local consolation. Similarly, there is a need to ensure that the program is delivered equitably across different towns and shires to provide access to all locations, and this should be prioritised from the beginning of the program to gain best results. A community approach should involve community groups and local industry. Furthermore, there needed to be an understanding of the local people, but also the local houses and infrastructure available.

4.4 Data collection and information management

There was a clear need for more comprehensive data collection on pre- and post-upgrade house condition, outcomes of upgrades installed and additional use and benefits as related to the program. Originally it was intended that a Residential Efficiency Scorecard (scorecard) would be used to determine each house's energy efficiency score prior to the upgrades and following the upgrades. This element of the program was not very successful. The program budgeted for 250 scorecards at approximately $120 per house. However, the typical cost would be between $400 and 500 per house. **The scorecard can potentially collect more data, by looking at existing appliances and installed appliances with an education component.** However, it was not practical or used effectively in this program due to the lack of experience completing scorecards by HES staff and the budget allocated for it. Additionally, while the scorecard looks at the components of the house, it does not consider how they are used or their condition.

Issues arose with information collection, storage, and management. These could have been better overcome by implementing procedures for information collection, storage, and management, so that all information and data was centrally located, easy to find and use and consistent information was gathered from each participating household. SV would often have to request information from the contractor which increased administrative burden. This also applied to the collection and sharing of data for the evaluation, with some double handling or lack of connection between various data sources. It was suggested that a CRM (or other database) would assist with this if established early with all necessary data fields. Ideally this would include data on interest in the program, registration, delivery, upgrade types, outcomes, and feedback (within privacy constraints). This would reduce time, cost and potential inaccuracies or lost (and unknown) data.

Appendix 1 Approach in detail

Table 9. Original M&E data table with key evaluation questions, responsibility, timing and methods.

Key Evaluation Questions	WHAT evidence will be collected	WHO will collect the evidence	WHEN will the evidence be collected	HOW will the evidence be collected	End use*
Effectiveness					
How well did the program deliver against objectives and outcomes?	Number of upgrades delivered.	Hills Energy	Throughout program	Hills Milestone reporting	Mid-term review End of project evaluation Ministerial opportunities Report to Sustainability Fund (first 100 homes)
	Calculated reductions in energy use and GHGe emissions.	SV Program Lead	Sept 2018 May 2020		
	Stakeholder communications & Participant satisfaction surveys.	SV Senior Project Advisor & Hills Energy	Participant survey is ongoing Stakeholder communications	Participant survey Stakeholder communications	
	Jobs and training information	Hills Energy			
	kW RE generation	Hills Energy	Throughout program	Hills Milestone reporting	
	Information packs received	Hills Energy	Throughout program	Hills Milestone reporting	
To what extent were the different targeted recruitment strategies effective at attracting and retaining ***the most vulnerable people in the LV?***	Recruitment and retention figures for different methods of recruitment	Hills Energy	Throughout program, at time of delivery;	Hills Energy Milestone reporting;	Mid-term review End of project evaluation SV internal learning
	Recruitment strategy information – held by Senior Project Advisor, Sustainable Homes	Evaluation partner TBC	Sept 2018 May 2020	Qualitative interview with Senior Project Advisor – Sustainable	

				Homes	
	Stakeholder perceptions of whether program reached 'most vulnerable'	Evaluation partner	End of project – May 2020	Interviews with stakeholders (including Hills Energy)	
What did the broad product offering mean for effectiveness and efficiency of the program, and perceptions of program?	EE contribution of different upgrades compared with cost to install different upgrades.	Evaluation partner will calculate from data provided by Hills Energy in Milestone reports	Calculations in May 2020 based on data provided throughout program	Hills Energy Milestone reporting	End of project evaluation SV internal learning
	Participant satisfaction survey	Hills Energy	Throughout the program	Hills Energy Milestone reporting	
	Stakeholder perceptions	Evaluation partner	End of project – May 2020	Interviews with stakeholders (including Hills Energy)	
	Operational costs of program, compared with operational costs of single product program.				
(sub-question) What did various upgrade items contribute to achieving program EE outcomes?	Energy and GHGe- reductions across the different types of upgrades and their contribution to overall program outcomes	Evaluation partner will calculate from data provided by Hills Energy in Milestone reports	Calculations in May 2020 based on data provided throughout program	Hills Energy Milestone reporting	
Efficiency					
Did the project achieve its	Delivery cost per participant	Hills	End of project – May 2020		End of project

objective efficiently?	Cost Benefit Analysis (cost per emissions reduction achieved or energy saved)	Michael Lambden	End of project – May 2020	Project accounts, Workshop with LV project team	evaluation SV internal learning
Appropriateness					
How did delivery meet the needs of vulnerable people in the Latrobe Valley?	Stakeholder perceptions	Evaluation partner	End of project – May 2020	Interviews with stakeholders (including Hills Energy)	End of project evaluation SV internal learning
	Participant perceptions of project meeting needs.	Hills & Evaluation partner	End of project – May 2020	Satisfaction survey Interviews with % of participants???	
	Participants informed of tariff options	Hills	Throughout the program		
How did contextual factors influence program delivery (particular regional factors; delivery partner's approach, capacity and internal skills/knowledge; and SV's approach)?	Stakeholder perceptions	Evaluation partner	End of project – May 2020	Interviews with stakeholders (including Hills Energy)	End of project evaluation SV internal learning

Appendix 2 Additional evidence against evaluation questions

Table 10. Key evaluation questions and sub questions with summary of findings against each.

Key Evaluation Questions	WHAT evidence was collected	Summary of findings
How well did the program deliver against objectives and outcomes?	Number of upgrades delivered	The Program delivered 2,706 upgrades across the 1,000 households. Water heaters were the most commonly installed upgrade with 488 products installed, followed by reverse cycle, split system ACs with 400 installations.
	Calculated reductions in energy use and GHGe emissions	While there were limitations with the household electricity meter data collected, **there was evidence of meaningful reductions in electricity use** where this was available. The average change recorded per household was -452 kWh equating to an average yearly change of -479 kWh. While there were a substantial number of houses that had an increase in electricity use (likely due to the installation of Split Systems, replacing gas heaters), for those that had a *decrease*, the reduction in electricity equated to 1436 kWh on average. The total change in electricity for the available data timeframe was -20,807 kWh. Based on the calculations **per household this was an 11.1% reduction in electricity use.** The average household electricity reduction of 479 kWh from this sample can also be scaled up to the 1000 homes of the whole program. **This equates to a yearly reduction for the program of 479 mWh.** The **GHGe reductions** for electricity use can also be calculated with the same assumptions. Based on average per house from the sample, the electricity reduction of 479 kWh equals a reduction of approximately 512kg CO2 emitted per year. Scaled up to the program level with 1000 houses, this is 512 t CO2 per year.

	Stakeholder communications	Overall, stakeholders were very satisfied with the LVHEU program. Though a small number of stakeholders engaged with the evaluation, there was a high level of satisfaction with the LVHEU economic, social and environmental outcomes. Through creating more jobs in regional and rural areas, improving comfort within participants homes, contributing to energy efficiency and getting community engaged with energy efficiency.
	Participant satisfaction surveys	Most participants were completely satisfied with the upgrades that they received, including the communication from HES at all stages and their approach during installation. Most participants were also completely satisfied that the upgrades had increased comfort within their homes and resulted in large (22%) or small (50%) reductions in their energy bills.
	Jobs and training information	The LVHEU committed 19 jobs and secured 28 jobs, producing 9 new positions including 3 additional apprenticeship/trainee positions.
	kW RE generation	The program installed 185 2kW solar PV systems in the Latrobe Valley region. With the average output for a typical 2kW system in the Latrobe Valley at around 2000kWh per year, this results in an overall capacity of 370MWh/year.

To what extent were the different targeted recruitment strategies effective at attracting and retaining the most vulnerable people in the LV?	Recruitment and retention figures for different methods of recruitment	Word of mouth was the single most effective strategy for attracting participants to the program. The strategies used to recruit households varied from council to council but included: advertisement on the LVA website, letter drops and promotion at community venues and events such as RSL clubs, veterans' affairs, rotary events such as Monday Tucker, through healthcare services and local schools. The program gained a lot of interest from the community. Time was a key factor which affected participant retention. While the program registration opened up two to three years before the program delivery began, there was decreased retention rates for those who had registered earlier on without any follow-up.
	Stakeholder perceptions of whether program reached 'most vulnerable'	All stakeholders agreed that this program did not reach those who were most vulnerable and stated that low-income parents, elderly, those living with disability, renters and people who were disconnected from the government and the community were not successfully reached through the program. The eligibility criteria established for this program did not strive to reach those 'most vulnerable' but rather to include those who were eligible (ie must have a healthcare or concession card, or be receiving hardship assistance). To make the program more inclusive more communication and engagement work needs to be undertaken to strategically target those who are more vulnerable and less able to access the program themselves. For example, through community events, healthcare services, social services and other community groups such as rotary clubs. Further, additional eligibility criteria could be added to determine those most in need.

	EE contribution of different upgrades compared with cost to install different upgrades	The average cost of different upgrade types included: • Reverse cycle split system - $2,458 • Heater - $2,944 • Water heater - $2,209 • Insulation - $1,541 • Solar PV - $3,486
What did the broad product offering mean for effectiveness and efficiency of the program, and perceptions of program? * effectiveness * efficiency * perceptions	Participant satisfaction survey	To determine the most appropriate upgrades, HES contractors used a decision-making framework focusing on high investment high impact upgrades such as water heating, heating and cooling and solar PV followed by low-investment high impact options including insulation, lighting, draft proofing and window furnishings and lastly education and behaviour modification. Some participants reported being informed of all options while others commented that they were not. There was a lot of miscommunication and misunderstanding among recipient household before the program began. Participants had difficulties understanding the scope and design of the program, where many expected that it was a solar program, or wanted upgrades beyond the budget or scope of the program (eg double glazed windows). This barrier was overcome through communication when HES attended for the home energy assessment. Most participants were very satisfied, but some were disappointed from the outset due to these misunderstandings.
	Stakeholder perceptions	HES experience delivering energy efficiency units, their practical home energy assessments and comprehensive decision-making framework made making upgrade choices relatively easy. Complications did arise when houses were in very poor condition and there was not enough budget to make the house safe and comfortable. For example, there were cases when

		insulation was the best option but due to dangerous electrical wiring it was not possible with budget allocated. The benefits of a broad offering meant that the program was flexible and could be flexible and tailored to the specific needs of each household. This made the program very complex, but it also made the program more inclusive, so all households who were eligible could get upgrades which would be most beneficial to the household.
	Operational costs of program, compared with operational costs of single product program.	Focus on lessons for running this type of program.
	Energy and GHGe- reductions across the different types of upgrades and their contribution to overall program outcomes	*See above*
What did various upgrade items contribute to achieving program EE outcomes?	Delivery cost per participant	The average cost of upgrades per household came out at $4,324 achieving the average cost of $4,500 per household. Getting the lifestyle villages involved in the program was a key efficiency. While the lifestyle villages were not the key target audience for the program, it increased efficiencies for HES workers where may households were in proximity to each other, many households were similar and it was a very effective way to promote the program. Other efficiencies identified included: HEs training their own staff to install insulation, this way they could regulate the process and operate without having to rely on subcontractors. The full health and social benefits cannot be calculated from the data

		but there is evidence of substantial improvements to wellbeing. There were some efficiencies identified in the delivery and some inefficiencies that may be addressed in future.
Did the project achieve its objective efficiently?	Stakeholder perceptions	Stakeholders agreed that the program was beneficial for those who received upgrades but that some houses were in such poor condition, the cost allocated was not sufficient to ensure that the house was both safe and comfortable or efficient. Further, stakeholders identified a range of groups who were more vulnerable and less engaged in the program. Some commented that the program more successfully reached those who were income poor but asset rich and there were many others in the LV who were left behind.
	Participant perceptions of project meeting needs.	While participants were satisfied overall with the program, just over half of the participants (51%) agreed that the program completely met their needs. It was apparent through the PSS and the interviews that participants had other outstanding energy efficiency needs that had not been met through the program and in most cases additional work was needed but they could not afford it.
How did delivery meet the needs of vulnerable people in the Latrobe Valley?	Stakeholder perceptions	The contextual factors were very relevant to program delivery. These are referenced in multiple sections including: Design (importance of local knowledge), Delivery (local supplier committed to quality and a focus on individual households), and Lessons (SV understanding where variations are being undertaken, requesting information and OH&S requirements).

How did contextual factors influence program delivery (particular regional factors; delivery partner's approach, capacity and internal skills/knowledge; and SV's approach)?	Stakeholder perceptions	The contextual factors were very relevant to program delivery. These are referenced in multiple sections including: Design (importance of local knowledge), Delivery (local supplier committed to quality and a focus on individual households), and Lessons (SV understanding where variations are being undertaken, requesting information and OH&S requirements).