Beat the Heat!

Final Report

Uniting Communities in Consortium with:

- Community Data Solutions
- Department of State Development
- Lin Andrews Real Estate
- Low Energy Supplies and Services
- SA Power Networks
- Sustainable Focus – Strategy & Facilitation
- University of South Australia/ Barbara Hardy Institute

A Project of the Low Income Energy Efficiency Program

UNITING COMMUNITIES

Beat the Heat! Final Report

Prepared by Consortium Members

Edited by Kathy Binks, Senior Manager, Community Services

First published in 2016 by
Uniting Communities
10 Pitt Street
Adelaide, SA, 5000
Ph (08) 8202 5111
Email: enquiries@unitingcommunities.org
Website: www.unitingcommunities.org

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Australian Government
Department of Industry, Innovation and Science

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Acronyms and Abbreviations List

Acronym/Abbreviation	Meaning
AC	Air-conditioning
BtH	*Beat the Heat!*
CALD	Culturally and Linguistically Diverse
EER	Energy Efficiency Rating
LARE	Lin Andrews Real Estate
PM	Property Manager
RCAC	Reverse Cycle Air Conditioning
SAPN	SA Power Networks
UC	Uniting Communities

1. Executive Summary

Beat the Heat! was an activity of the Federal Government's Low Income Energy Efficiency Program (LIEEP). *Beat the Heat!* combined energy efficiency and climate adaptation strategies for low-income households in private rental. The project focused on enhancing the resilience and improving the comfort and wellbeing of these households during Adelaide's long, hot summers. The project addressed the barriers of information provision to the client groups, access to capital for improving private rental properties and the landlord-tenant split incentive through a close partnership with one of Adelaide's most progressive property managers.

Funding from the Federal Government totalled $2,192,000 (GST exclusive) over a 32-month timeframe. This considerable grant was supplemented through in kind contributions from the many partners on the project consortium to the value of $625,732, ultimately taking the project's value to $2,828,069.

Project Timing, Scope & Consortium

The project with approximately 200 households, where both the landlord and tenant agreed to participate, took place in South Australia from August 2013 to April 2016. Eligibility of households was determined by income. The project was conducted by Uniting Communities in consortium with: Community Data Solutions, Department of State Development, Lin Andrews Real Estate, Low Energy Supplies and Services, SA Power Networks, Sustainable Focus and the University of South Australia's Barbara Hardy Institute (UniSA).

Interventions

The key project interventions were:

- The installation of a high efficiency reverse-cycle air conditioner (RCAC) and/or ceiling insulation (where necessary)
- A home energy assessment with a written report for both landlords and tenants
- The installation of an in-home display
- 12 month rent freeze

Project Objectives

The *Beat the Heat!* project was developed in response to Adelaide's long hot summers and the negative comfort, health and wellbeing impacts on vulnerable families with low incomes in private rental. The project focused on the provision of improved thermal comfort at a minimum cost for privately rented dwellings through the installation (retro-fitting) of ceiling insulation and/or energy efficient reverse cycle air conditioning (RCAC) in the main living space.

Using a combination of qualitative and quantitate research the project evaluated the comfort levels of the participants together with their energy efficiency knowledge pre-installation, and post participation. Evaluation focused on the effectiveness of this intervention in improving a household's thermal comfort in the summer months rather than an attempt to reduce energy

expenditure. This focus is in recognition of the important role thermal comfort plays in health and wellbeing. Adelaide, is known for its long hot summers and studies have shown the correlation between the extremes of heat and the impact on community health.

> *"Heat-attributable mortality and morbidity are associated with elevated summer temperatures in Adelaide, particularly ambulance call-outs, mental health and heat-related illness."*[1]

At the more acute end thermal comfort saves lives as highlighted in the Severe and Extreme Heat Events National Framework:

> *"Heat events have killed more people than any other natural hazard experienced in Australia over the past 200 years. A number of Australian cities (Melbourne, Brisbane and Adelaide in particular) have experienced significant deaths in heat events since the turn of the century… Making our cities, buildings and infrastructure more resilient to heat events and improving the way we protect vulnerable members of our community is an important public policy issue."*[2]

The project explored barriers associated with split incentives for landlords and tenants whereby the installation occurred at no direct cost to the landlord in exchange for a non-financial contribution in the form of a 'rent freeze' for the property. Central to the project was the 'relationship capital' between the landlord and the Real Estate Agent which was utilised to assist with the take up of the program.

The projects' intervention included a home energy assessment by a qualified energy worker to increase the households understanding of energy efficiency. This was provided to assist in mitigating anticipated increased energy consumption for households who had AC installed. All homes were installed with an in-home display to further decrease informational barriers to energy efficiency.

The program considered the likely impacts of future tariff structures on project participants.

Quantitative & Qualitative Analysis

Quantitative analysis focused on the energy monitoring of the mains and RCAC circuit at 15 minute intervals throughout the project. This was overlayed with household billing consumption obtained for pre-intervention comparison. Households were monitored for the temperature of their main living space for the project period.

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[1] Williams S, et al, Heat and health in Adelaide, South Australia: Assessment of heat thresholds and temperature relationships, Sci Total Environ (2011), doi:10.1016/j.scitotenv.2011.11.038

[2] Commonwealth Government, *Protecting human health and safety during severe and extreme heat events:* A national framework, November 2011 pg 6

Our qualitative analysis for the tenant focused on their perceived comfort levels and their behaviour changes as a result of the program. For landlords the project explored their attitudes to implementing energy efficiency measures in their rental properties.

Findings

The project achieved its aim of addressing the landlord tenant split incentive with over 200 households (tenant and landlord) willingly participating, and it improved comfort within the participating homes whilst not significantly increasing their energy bills.

Our findings indicated co-benefits from improving thermal comfort within households that included increased health and wellbeing, improved sleep, a happier household and increased mobility. Although not speciality extrapolated by the consortium, it is probable that increased thermal comfort in one's household could correlate to increased physical activity, improved mental wellbeing and reduced doctor visits, ultimately contributing advantageously to community wellbeing.

"I used to have to go to bed early in Winter, but can now run it for a couple of hours and stay up in the evening for about the same price as running the old heater."

"I am now able to stay at home rather than spend hours at the shops in their air-conditioning"

Our evaluations of comfort were tenant-focussed given the understanding that perception of comfort is as important as the actual temperature. In-depth post intervention interviews with 50 tenants indicated that air conditioners and/or insulation were found to have made a substantial improvement to comfort in 81% of homes. This perceived increase in thermal comfort is supported by the monitored temperature data, with improved comfort being achieved by 78% of the households.

The key perception from participants was that the intervention had made homes more 'liveable' (25%), meaning that residents did not have to vacate their homes, or restrict their activity during extreme heat. 19% of participants indicated that the initiatives improved their sleep, 10% reported greater incentive to get up in the mornings and 10% reported a noticeable difference in the happiness of their children.

"It helped with sleeping in summer, and more so with mobility, mental health and general liveability in winter".

The same post intervention interviews indicated that 64%of households changed their behaviours as a result of the advice they received. Participants reported a range of further energy-saving improvements they would like to make to their dwellings, suggesting that cost and attaining 'landlord buy-in' remained key barriers to doing so. 50% of households found the In Home Display valuable.

While project focussed on improving comfort with little or no increase in energy usage it was pleasing to note that it affected a slight reduction in energy costs. 66% of households where an existing air-conditioning (AC) unit was replaced experienced either a reduction in overall energy use

or maintained their pre-intervention levels over the summer months. Where a new unit was installed where there was not one previously only 11% experienced an overall reduction in energy use.

Given the projects focus on Adelaide's long hot summers, the energy efficiency findings from the analysis of AC usage is interesting. 86% of households showed a significant reduction in estimated AC energy isolated from other mains use within the home.

When looking at the households where an old air-conditioner was replaced an estimated average 46% reduction in AC cooling energy for the summer months resulted from the AC intervention. When the full year was considered energy consumption was found to be 12% lower than the pre-intervention mains energy. This annual difference of 686kWh when calculated at an average tariff of 32c/kWh represents an annual saving of $220.

Given the focus on improving comfort and wellbeing while not increasing costs, this energy saving represents a significant value add for the program. When coupled with the 12-month rent freeze of on average $300 over the life of an RCAC (12 years) this represented an effectiveness cost ratio of 0.93 when considering the cost of the intervention alone.

Given the variation in rental values throughout the project period the 12-month rent freeze may not have made the significant contribution to the project that we envisaged. However, when asked about the ability to be motivated to invest in further energy saving actions landlords stated that cost benefit ratio was a major motivating factor. Despite that, 72% agreed or strongly agreed that they were more likely to implement actions to help tenants save energy or improve their comfort since participating in *Beat the Heat! This* suggests that awareness of the issue and the opportunity to engage are important factors in motivating energy consciousness among landlords. .

As the National Electricity Market moves towards more cost reflective electricity pricing, the price of electricity will vary across the year and across the day. For South Australia the most expensive times are expected to be summer afternoons. The replacement of old inefficient RCAC with efficient RCAC whilst maintaining consumption patterns reduces energy consumption and reduces electricity bills. However, the projects' modelling - based on the electricity distributor's currently proposed pricing structures – shows that for the majority of households' tariff changes will erode the savings from energy efficiency benefits. A set of case studies (section 5) illustrate the diversity of consumption patterns between households in otherwise similar circumstances. It is clear that education and support initiatives to accompany the transition to more cost-reflective demand based tariffs will need to consider and reflect these complexities.

Recommendations & Conclusions

Given the improvements to comfort and the increased health and wellbeing to low income households there is value in a broader rollout of the project. The project aimed to improve comfort while not increasing energy consumption but surpassed expectations by creating an average

reduction in bills. This is a clear benefit for this low income cohort who have little or no disposable income.

Continuing the recruitment method through the real estate agents will maintain a high uptake of the project as it provides both the tenant and landlord with some trust and security. The interest expressed by landlords and real estate agents not connected to the project suggests there is an appetite for broadening the project.

The rent freeze adequately met the split incentive to encourage participation, but there would be value in further testing what increased contribution by the same method of foregoing income would be acceptable to landlords.

Targeting households with older inefficient air-conditioners for replacement would provide the greatest energy efficiency benefit, but likely greater comfort improvements would come from those without any existing air-conditioning as indicated by the temperature change findings.

Our participants spoke of improved sleep, mobility and reduction in stiffness and pain, improved mental health as a result of the intervention. As days of severe or extreme heat continue to rise there would is merit in further exploring the correlation between improving comfort by installing efficient RCAC and ensuring adequate insulation levels and any increased health benefits. Equally, if not more so, we expect there would be health benefits for increasing comfort in winter. Further research could investigate the health and wellbeing benefits in both summer and winter.

2. Introduction

Extending from August 2013 to April 2016 *Beat the Heat!* was an activity of the Federal Government's Low Income Energy Efficiency Program (LIEEP). This project was funded under the second round of funding with the agreement signed in July 2013 and the final report due in May 2016.

Funding from the Federal Government totalled $2,192,000 (GST exclusive) over a 32-month timeframe. This considerable grant was supplemented through in kind contributions from the many partners on the project consortium to the value of $625,732, ultimately taking the project's value to $2,828,069.

Beat the Heat! combined energy efficiency and climate adaptation strategies for low-income households in private rental. The project focused on enhancing the resilience and improving the comfort and wellbeing of these households during Adelaide's long, hot summers. The project addressed the barriers of: information provision to the client groups, access to capital for improving private rental properties and the landlord-tenant split incentive through a close partnership with one of Adelaide's most progressive property managers.

The project took place in South Australia. It was conducted by Uniting Communities in Consortium with: Community Data Solutions, Department of State Development, Lin Andrews Real Estate, Low Energy Supplies and Services, SA Power Networks, Sustainable Focus and the University of South Australia's Barbara Hardy Institute (UniSA).

2.1 LIEEP objectives and intended benefits

Administered by the Department of Industry, Innovation and Science, the Low Income Energy Efficiency Program (LIEEP) was a $55 million competitive merit-based grants program established to provide grants to consortia of government, business and community organisations. Programme grants were to be used to identify and trial new and innovative approaches to assist low income and vulnerable households overcome barriers to energy efficiency and to better manage their energy use and costs.

The purpose of LIEEP was to produce findings that could be used to inform future policies and programs to assist low-income households become more energy efficient.

Trials under LIEEP aimed to identify effective strategies to overcome barriers to the uptake of energy efficiency measures in low income households, such as information failure, capital constraints and split incentives, which often prevent or restrict low income households from adopting more energy efficient practices.

The improvements in energy efficiency resulting from the projects were intended to achieve a number of benefits including reducing pressure on low income household budgets and promoting health and wellbeing through improved comfort levels and lifestyle.

Around 25,000 households are being directly influenced by the projects that were conducted with Indigenous, disabled, elderly, migrant, unemployed and single-parent households.

The broad objectives of LIEEP were to:

1. Trial and evaluate a number of different approaches, in various locations, that may assist low income households to be more energy efficient; and
2. Capture and analyse data and information to provide an informed basis for future energy efficiency policy and related programme directions.

Additional benefits arising from the LIEEP were to:

- Assist low income households to implement sustainable energy efficiency practices;
- Assist low income households to manage the impacts of high energy costs;
- Improve the health, social welfare and livelihood of low income households;
- Increase the knowledge and capacity of consortium members to encourage long-term energy efficiency among their customers or clients; and
- Increase the capacity of Australian energy efficiency technology and equipment companies by maximising the opportunities for Australian industries to participate in the projects.

2.2 *Beat the Heat!* Trial Approach

The main focus of Uniting Communities' (UC) *Beat the Heat!* project was the provision of thermal comfort at minimum cost for privately rented dwellings through the installation (retro-fitting) of ceiling insulation and/or energy efficient reverse cycle air conditioning (RCAC) in the main living space. As an adjunct to this, all participants were offered a free home energy assessment/audit to educate and assist with the management of their household energy consumption. When a new RCAC was installed specific information in relation to efficient usage was provided. The project also explored the levels of comfort for the participants and their energy efficiency knowledge pre-installation, and post participation in the project. The project tackled issues associated with split incentives for landlords and tenants whereby the installation occurred at no direct cost to the landlord in exchange for a non-financial contribution in the form of a 'rent freeze' for the property.

2.2.1 *Beat the Heat!* Intended Outcomes and Outputs

The intended outcomes of the *Beat the Heat!* project were three-fold:

1. A cohort of some 200 low income households, renting privately, would be supported to become more resilient to long, hot Adelaide summers in ways that support their health through maintained/improved thermal comfort while not significantly increasing their

energy bills. (It was intended that for many households the project would actually result in a reduction in costs.)

2. The project would provide policy makers with an evidence base for a deeper understanding of the potential for passive and active energy efficiency measures and as such contribute to adapting to a future that is expected to deliver even more extreme summer weather events.
3. The project would provide valuable insight into where barriers and opportunities exist in relation to supporting landlords to introduce energy efficiency measures into their rental properties, thus addressing the split incentive challenge of private rental.

The intended outputs of the *Beat the Heat!* project were:

- 200 home energy visits that would generate separate and tailored written reports for both tenants and landlords on actions that could be taken to enhance resilience to summer heat. (Where appropriate the strategies could be tailored to suit specific conditions that make thermal regulation particularly challenging.)
- 200 households would receive installation interventions of either a high efficiency reverse-cycle air conditioner (RCAC) or ceiling insulation or both, where appropriate, for the more efficient operation of the RCAC.
- All households having a RCAC installed would receive a short training session on the efficient operation of the RCAC (for example: filter cleaning, thermostat settings, zoning, etc).
- 200 landlords would receive an installation report on the modifications to their properties.
- 200 households will be monitored for energy consumption post intervention and be provided with a comparison to a baseline established from billing history.
- All households receiving a high efficiency RCAC would have the energy consumption of these units monitored separately.
- 200 Landlords would complete a survey before and after the intervention to gauge their motivations to be involved and action taken as a result of participation in the project.
- 200 households will complete a survey of energy behaviours and level of comfort before and after the intervention, with an additional 50 households selected for in depth interviewing.
- 5 detailed case studies would be prepared highlighting the most significant change stories.
- A final report covering a qualitative assessment of stakeholder experiences (households, landlords, property managers and energy workers) as well as analysis of captured data would be prepared in order to provide an evidence base for the project's ultimate recommendations: How low-income tenants can *Beat the Heat!*

2.3 The Consortium

Uniting Communities was the lead organisation of the *Beat the Heat!* Consortium. All consortium members were selected based on the experience, skills, attributes, resources and support each were able to provide to ensure the delivery of a successful project. All consortium members were allocated clearly defined roles, accountabilities and responsibilities as outlined here:

UNITING COMMUNITIES (UC) assumed responsibility for the performance of the project under the terms of the LIEEP Funding Agreement. Uniting Communities liaised with Lin Andrews Real Estate to engage with landlords and tenants and provide home energy visits to assess the eligibility of participating properties and encourage the implementation of energy efficient strategies and practices. In addition, Uniting Communities was responsible for the energy worker role and activities and for submitting project reports to the Department.

COMMUNITY DATA SOLUTIONS (CDS) developed a tailored online database for the collection and storage of all household data arising during the project. CDS was responsible for managing all IT infrastructure for the database (servers, connectivity, backups and security) and provided training and helpdesk support for all database end users. CDS was responsible for ensuring any external data packages collected through meters or other household devices connect effectively with the database. CDS generated reports in a variety of formats to summarise data as required and provided consultancy support on data mining for the project.

LIN ANDREWS REAL ESTATE (LARE) identified and recruited landlords whose tenants were eligible for *Beat the Heat!* from their current tenant pool. Lin Andrews Property Managers liaised directly with landlords and tenants, promoting the project to them, liaising with them around the interventions and all other aspects of the project. LARE Property Managers provided the initial contact between tenants and Uniting Communities energy workers who then took responsibility for the provision of ongoing support to tenants throughout the project.

LOW ENERGY SUPPLIES AND SERVICES (LESS) were responsible for sourcing, supplying and installing all energy efficiency products for the project including in-home display monitors. LESS managed logistics through their existing South Australian wide network of installers and warehouses and their established team of energy efficiency experts and licensed tradespeople. In addition, LESS provided consultancy services regarding the design and ongoing development of *Beat the Heat!* from their extensive experience in delivering similar projects.

SA POWER NETWORKS (SAPN), South Australia's electricity distributor, provided the project with household meter and consumption data (with participant permission). SAPN's Demand Management Unit shared their experiences and findings with the *Beat the Heat!* project team from their residential load profile study to help assess tariff impacts on residential households.

SUSTAINABLE FOCUS – STRATEGY & FACILITATION (SF) provided technical and strategic support regarding the design and ongoing delivery of the project. Sustainable Focus was responsible for

designing, coordinating and analysing the non-energy consumption data collection relating to households and landlords including pre and post tenant and landlord surveys. The role also extended to co-ordinating the collection of feedback from Consortium members.

THE DEPARTMENT OF STATE DEVELOPMENT (DSD), formerly DMITRE of the South Australian Government provided specialist knowledge concerning energy efficiency activities and offered linkages to well-established programs, such as Energy Friends and Energy Partners. DSD also provided advice with scoping data collection to ensure it complemented and built upon existing data-sets on energy use and affordability within the state. DSD acted as a key contact point with the South Australian Government. DSD provided independent inspection reports for a sample of installations through the Office of the Technical Regulator. As the project developed DSD also provided valuable input in relation to establishing critical implementation pathways, process mapping and monitoring of sequential project activities.

UNIVERSITY OF SOUTH AUSTRALIA (UniSA), through the Barbara Hardy Institute had the lead role in quantitative energy use data collection, monitoring and evaluation. UniSA was responsible for selecting and sourcing of monitoring equipment, reviewing collected data for consistency, analysing data, evaluating energy savings (following the installation of insulation and/or air conditioners), providing independent quantitative reporting and publishing the outcomes in conference and journal papers. UniSA contributed knowledge and experience in relation to monitoring equipment and methodology for energy data collection and analysis.

What worked well for program governance was the deliberate early split of roles between Operations (data, household and intervention) groups and Governance groups. This ensured that the overall strategic matters were being attended to as well as the operational details.

2.4 *Beat the Heat!* Project Details

The *Beat the Heat!* project was focused on improving the summer performance of dwellings and the provision of coping strategies for low income households, in private rental, during hot weather. While many energy efficiency actions can provide benefits year round, such as reducing standby power use and utilising efficient lighting, others have a clear seasonal bias, such as the use of heating and cooling. In this project, the community's sensitivity and potential health and comfort consequences to extreme hot weather created a strategic opportunity to engage with households in relation to the implementation of energy efficiency measures including the installation of insulation and the introduction of energy efficient appliances such as reverse cycle air conditioning. It also provided the opportunity to teach householders energy efficient strategies and practices.

A further impetus for the summer focus for low-income and vulnerable consumers was in relation to energy costs. Electricity market reform in the National Electricity Market is required to deliver more 'cost reflective pricing' which in South Australia will likely mean an increase in the cost of electricity in summer.

Beat the Heat! specifically sought to address the notorious 'landlord-tenant split incentive' barrier as well as the more universal challenges of access to information and access to capital. The project

targeted split incentive in collaboration with a real estate agency by providing access to free energy efficient capital upgrades (i.e. installation of insulation and/or an RCAC) for eligible properties in return for the landlord agreeing to implement a 'rent freeze' on the property for at least 12 months. The project also researched landlord values, attitudes, barriers and motivators in relation to investing in energy efficiency upgrades and the issue of landlord participation, or non-participation, in the project.

Eligible tenants were initially identified from rental records held by Lin Andrews Real Estate (LARE). Records were filtered according to income type, rental amount, location of property and payer of security bond, to provisionally determine low income status. Corresponding landlords were then approached by Lin Andrews Property Managers.

As the project progressed it was identified that, due to the income eligibility parameters, not enough eligible households would be identified through LARE alone. The project therefore also approached two community housing providers to access eligible properties.

Landlords signed a legal and binding agreement regarding the requirement for the 'rent freeze' in return for the capital upgrade to their property. Both landlord and tenant were also required to consent to a metering and monitoring package and an evaluation process for the life of the project.

Participating tenants received a home visit from a Uniting Communities energy worker to confirm property and householder eligibility. The energy worker then conducted a thorough assessment of the home to evaluate:

- Basic building structure;
- Whether there was insulation;
- Whether there was appropriate energy efficient heating and cooling;
- The orientation of the home and whether it had appropriate external and internal window treatments and furnishings;
- Draughts (if any) around doors and windows and any other gaps in the home;
- Zoning of the home including problems and possible remedies associated with open plan layouts; and
- Areas in the house (not specified above) where energy was being lost

In completing initial visit, the Uniting Communities energy worker conducted a thorough assessment of the structure of the house and only recommend the installation of insulation and/or a RCAC where there were demonstrated energy savings and clear benefits to householder health and well-being.

The capital upgrades available included the installation of:

- A high efficiency Reverse Cycle Air Conditioner (RCAC) to a living area, and/or
- Ceiling insulation to a level of R3.

Both capital upgrades were available where required based on the energy efficiency assessment.

Where it was deemed that the benefits of any intervention would be negated by other factors, such as a large west-facing unshaded glass or a significant draught proofing issue, the landlord was required to address the problem prior to the intervention being provided.

Once participation in the project has been formally confirmed, the *Beat the Heat!* project requested the tenant's permission to receive and analyse their energy billing data (gas and electricity) for a 6 month (minimum) period pre-intervention and for one year post intervention (to allow a comparison across the seasons following the project intervention and installation of energy efficient products). Involvement in the project was contingent upon an agreement to participate in monitoring and evaluation

Once the Uniting Communities energy worker determined that a property would benefit from one or both of the capital upgrades on offer, Low Energy Supplies and Services (LESS) confirmed the recommendations of the home energy assessment, sourced the required energy efficiency product(s) and arranged installation by their established team of energy efficiency experts and licensed tradespeople.

A home energy assessment was covered in a subsequent visit that:

- Assessed the tenant's energy use and practices and provided information on energy efficiency;
- Reviewed the tenant's general financial position and explored the households budgeting activities suggesting strategies so that their energy costs maybe better met; and
- Provided financial literacy education and, as appropriate, advice and referral to improve the financial wellbeing of the household.
- Where a property required the installation of an air-conditioner, the energy worker advised on the efficient operation of the unit (in both summer and winter. Proper and efficient usage was explained to ease concerns and the risk that the unit may result in significant increases in electricity costs. Clear information was provided about how much the appliance will cost to run along with information about how to use the unit most effectively and efficiently to minimise costs.

The visit resulted in two reports: one for the tenant that itemised simple changes to practices and any very low or no-cost actions that could be implemented to improve energy efficiency and comfort levels. The second report was tailored for the landlord and itemised higher cost items that, if undertaken, will improve the thermal performance and overall energy efficiency of the dwelling.

Data metering devices were installed by LESS in participating properties to collect real time electricity and temperature data. Monitoring data (total electricity consumption and heating/cooling unit energy consumption) was analysed to provide heating/cooling as a proportion of total energy use for each season.

Not all switchboards were suitable for the installation of a metering device due to the age, type or size of the switchboard. Switchboard upgrade work was required in many cases – an unexpected problem that the Consortium had not initially foreseen. Where a RCAC was to be installed landlords were required to upgrade their switchboards. Where RCAC was not to be installed it was still requested that landlords undertake the switchboard upgrade to allow real time monitoring of data. Where this was not possible usage was monitored via billing data only.

In home Display Units were also installed in the properties by LESS so that tenants could actively participate in the monitoring of their own energy usage. This enables them to make informed decisions about how and when they use energy.

Qualitative and quantitative data was collected throughout tenant and landlord involvement in the project in an attempt to document the human influences on energy consumption (as opposed to technical determinants).

3. Trial Methodology

This Project adopted both qualitative and quantitative data collection and assessment methodologies to meet our three key project objectives.

The key objectives of Beat the Heat's project were to:

1. Assess the impacts on energy consumption and costs of implementing thermal systems that include installing energy efficient reverse cycle air conditioning (RCAC) and/or ceiling insulation in the main living area of the home coupled with associated training for efficient associated use and general household behaviour

2. Investigate the relationship between householders' perception of their comfort level in the home and the implementation of the thermal system during very hot weather

3. Enable an Action Research methodology to be implemented that allows project participants to develop and refine strategies to overcome barriers to energy efficiency for low-income rentals

These key objectives have seven project performance measures associated with them as outlined in the Monitoring and Evaluation Framework (Table 1) below. This framework also provides an indication of the data collection measures/methods for each measure.

Table 1. Monitoring and Evaluation Framework:

OBJECTIVE	PROJECT PERFORMANCE MEASURES	DATA COLLECTION MEASURES/METHODS
1. Assess the impacts on energy consumption and costs of implementing thermal systems that include installing energy efficient reverse cycle air conditioning (RCAC) and/or ceiling insulation in the main living area of the home coupled with associated training for efficient associated use and general household behaviour	1. Corrected (based on impact of climatic differences) difference between energy associated with previous thermal system (from billing data) and energy efficient thermal system (from monitored data and billing data) 2. Extent to which any changes in consumption levels and profiles may be impacted by future tariff options. 3. Extent to which project has influenced behaviour change	• Billing and monitoring data analysis including seasonal trends • Estimation of previous thermal system energy consumption • Interviews/surveys/focus groups with participants,
2. Investigate the relationship between householders' perception of their comfort level in the home and the implementation of the thermal system during very hot weather	4. Extent to which participants perceive they have improved their thermal comfort, contrasted with any changes in energy consumption 5. Comparison of temperature difference (outdoor versus indoor) associated with previous thermal system (from pre-intervention monitored data) and post-intervention energy efficient thermal system (from monitored data)	• Pre intervention participant survey • Post intervention participant survey • Collection of main living area temperature data for a short pre-intervention period and for the life of the project, post-intervention • Collection of geographically appropriate ambient weather data (Bureau of Meteorology)
3. Enable an Action Research methodology to be implemented that enables project participants to develop and refine strategies to overcome barriers to energy efficiency for low-income rentals	6. Extent to which qualitative feedback from each stakeholder group (tenants, landlords, property managers, energy workers) informs the evolution of the project's strategies and informs the findings in relation to overcoming the identified barriers. 7. Development of specific recommendations regarding the role of the property manager than can be applied more broadly.	• Qualitative data collected from stakeholders via interviews/surveys and/or focus groups. • Most significant change stories

3.1 Participants and Eligibility

The *Beat the Heat!* project targeted 200 low income tenants from private or community housing within metro South Australia, where the household income did not exceed the levels set by the National Rental Affordability Scheme. The majority of the participants resided in metro Adelaide, with only 6 referred households located between 50km - 100km of the CBD, and only 3 of these properties engaged in the project.

The project originally targeted low income householders in private rental properties within SA. Low income was initially defined in line with Centrelink's health care card income limits i.e. the income levels that allowed a health care card to be retained (Table 2).

Table 2: Health Care Card Income Limits

Status	Weekly Income	Income in an 8 week period
Single, no children	$663.75	$5,310.00
Couple combined, no children	$1,148.75	$9,190.00
Single, one dependent child	$1,148.75	$9,190.00
For each additional child, add	$42.50	$340.00

Landlords were offered an opportunity to participate in the project and receive capital upgrades to their property in return for offering a 'rent freeze' for a 12 month period. Community housing rent rates are set by Community Housing Rent procedures as outlined by the State Government. This does not allow for an opportunity for a rent freeze. However, Community Housing were able to offer a co-contribution in relation to their Service Charge that covers the water rates. This was discussed with the consortium and a reduction of $4 per fortnight for the 12 month period was negotiated. This is believed to be in line with the private landlord contribution.

3.2 Recruitment

3.2.1 Private Landlords

Lin Andrews Real Estate, a well-known and respected property management company with over 45 years of experience in the South Australian market place, was invited to be part of the *Beat the Heat!* Project. The company manages over 800 privately owned, residential properties many of which are occupied by low income tenants. Following initial discussions with Mr Lin Andrews, Founder and Chair of the company, it was felt that obtaining 200 participating households would be a relatively straight-forward matter.

A comprehensive brochure outlining the objectives and benefits of the project was prepared and produced by the Lin Andrews marketing department. The *Beat the Heat!* project was also widely promoted through the Lin Andrews in-house, monthly newsletter and as part of other routine correspondence to landlords and tenants.

Properties managed by Lin Andrews Real Estate are divided into a series of regional portfolios that are each managed by an individual property manager. It was decided to initially target specific areas within the overall portfolio rather than using a blanket approach that encompassed all properties.

The brochure, with a covering letter, was sent to landlords and tenants inviting them to register their interest. Interested parties were then followed up to establish eligibility in relation to income details and to ensure their property was actually suitable. Assessing responses became difficult and time consuming. It was found that many parties who expressed interest did not actually meet the qualification criteria in relation to income levels and/or because their home already had adequate air-conditioning facilities.

Specific difficulties arose in relation to the precise meaning of "low income" and it was found that various parties had differing interpretations for this term. It became apparent that a clear definition was required and after much discussion a proposal was put forward and subsequently approved by the relevant Government department.

The second round of mail-outs were refined to include a "self-assessment" questionnaire designed to provide an indication of income levels and to give some basic details regarding the property (i.e. did it have an AC unit, if so what type, what age, etc). The additional information (while being quite simple in form and nature) made the screening for eligibility of applications much easier.

Unsuccessful applicants, both landlords and tenants, were notified by letter. Details of successful applicants were forwarded to Uniting Communities for further follow-up.

Some difficulties were experienced in matching the interests of tenants with the desires of landlords, and vice versa. For example, even when a landlord was willing to participate in the project, their tenant may have been unwilling to give access to their home or personal details. In such circumstances property managers were asked to discuss options with both parties, using their long-term, personal relationship with each, to seek a mutually agreeable outcome. Other problems were encountered when a property was part of a strata or community title scheme that had rules requiring approval to be obtained from the Body Corporate prior to any external works (including installation of an AC unit) taking place. Several properties had to be dropped from the project, despite having the approval of both the landlord and tenant, when Body Corporate approval was not forthcoming (or forthcoming in a timely manner).

Despite the best efforts of Lin Andrews' staff the response rates were generally disappointing. It was decided to send out a series of blanket, mail-outs to all property owners and landlords accepting that while there would be a level of duplication the growing awareness and promotion of the project across the company may generate some further response. This was partially successful.

As the recruitment process became more difficult it was agreed to broaden the pool and a company associated with the Lin Andrews Group was invited to participate. Having refined the mail-out processes this was a relatively simple step to take. Problems did however arise in relation to the handling of enquiries that were generated. The second company was keen to handle all enquiries, not wanting their landlords or tenants to have dealings with another company who operated in

competition! In reality the staff of the second company didn't have the knowledge, time or expertise to immediately answer questions that arose. The good relationship between the principals of the two companies enabled this issue to be worked through and an agreement was reached whereby any queries should be referred to the Lin Andrews office. This eventually worked very well.

Obtaining the necessary number of participating households still proved to be problematic and eventually the consortium team used other contacts to ensure that the full number of required participants was obtained. Lin Andrews Real Estate modified the original brochure to facilitate this exercise.

In summary the recruitment of participating households took much longer than anticipated and involved a lot more work than had initially been envisaged. The personal relationship between Lin Andrews staff, landlords and tenants proved to be a key element in the final success of the recruitment process. In particular, Lin Andrews staff members directly contacting potentially interested parties via phone proved more successful than relying on written or email communications.

3.2.2 Community Housing

Due to difficulties accessing the numbers of private rental tenants required, we expanded our recruitment to include low income tenants in community housing. Community Housing properties were eligible as long as the tenants met the eligibility criteria and the landlord was not the state or federal government.

Additional households were sourced through Community Housing Associations to increase the potential pool of eligible properties. Four community housing associations were approached, with a positive response received from two. In these cases Uniting Communities liaised directly with the landlord (namely the Community Housing Association) and one main property manager managed the relationship with UC, LESS & the tenants.

Learning from our experience, both community housing organisations communicated to their tenant about the following:

- The nature of the project
- Information about Uniting Communities
- Benefits of participating
- Eligibility requirements of the project, including informing UC of the existing heating/cooling for the property
- Commitment to the project

Feedback from tenants went back to the property manager, who then collated this information and provided it to UC. Unity Housing and Northern Community Housing both coordinated the structural assessment appointment with the tenants and the UC worker. This meant that the UC worker was ensured access to the property, and kept all stakeholders in the loop. This resulted in a significantly more streamlined recruitment process.

3.2.3 Eligibility

The eligibility income thresholds were revised during the project as many people were excluded due to being just above the income rate. In consultation with the Department for Industry and Science and other LIEEP providers we determined that our income levels were lower than most schemes and it was necessary to adjust the income threshold levels to align with the National Rental Affordability Scheme (Table 3).

Table 3: NRAS tenant Income eligibility

NRAS Tenant Income Eligibility (National Rental Affordability Scheme)	
Household Composition	**Household Income Limit ($)**
One adult	47,289
Two adults	65,378
Three adults	83,466
Four adults	101,555
Sole parent with one child	65,423
Sole parent with two children	81,108
Sole parent with three children	96,793
Couple with one child	81,063
Couple with two children	96,748
Couple with three children	112,433

3.3 Data Collection and Analysis

3.3.1 Baseline data

This project did not utilise a control group. Given the nature of the intervention and the vulnerability of low income households a control group was not considered viable. Instead the project utilised baseline data from gas and electricity billing data for a minimum of 6 months and more commonly 12 months prior to intervention. This data was provided by South Australia's gas distributer, Envestra and electricity distributor SA Power Networks with written consent by the householder.

The project initially assumed that recruitment of 200 households who had been in their property for 12 months would be feasible, however as the recruitment process continued it became evident that due to the transient nature of low income households, it would be necessary to reduce the threshold to 6 months.

As a result of tight timeframes the gas billing data was not analysed as a part of this project to ascertain any variation in winter heating that may have occurred from using the RCAC in place of gas heating.

3.3.2 Energy Monitoring

In terms of monitoring that was required for the purposes of this project, UniSA selected dataloggers that were capable of remotely monitoring electrical energy used for both the entire household (Mains) and the air-conditioner (AC) installed in that household, as part of this project. This datalogger, known as a WASP2-3G-2FL6M, was installed in each house where an intervention occurred. The WASP logger is manufactured by New Zealand company Outpost Central and records the cumulative Mains and AC electrical energy in Watt-Hours (Wh) at 15-minute intervals, from meters with a digital pulse output signal transferring these data to a central database on a daily basis for inspection and later upload by UniSA. Logging by WASP dataloggers commenced, in most cases, at the time an intervention occurred (e.g. installation of an air-conditioner and insulation).

Prior to the installation of the various components of the monitoring system, UniSA staff met with staff from the company - Low Energy Supplies and Services (LESS), responsible for managing equipment installation relating to the project. UniSA produced a guideline document for installing the various energy and temperature monitoring system components.

WASP loggers were installed at the time project interventions were implemented. This part of the monitoring system also required the installation of sensors capable of converting household total Mains electrical energy consumption (LXEM180) and that of the newly installed air conditioner (LXEM145) to digital pulse output signals, which was then recorded by the WASP logger at 15-minute intervals. In the aforementioned UniSA installation guidelines, it was specified that WASP dataloggers should be installed where sufficient 3G telecommunication signal existed to facilitate remote data uploads. These guidelines also detailed the initialisation procedure, which was necessary to force the WASP logger to commence recording and sending data to Outpost Central to allow access by UniSA via a web-based portal.

Where a new air-conditioner was installed as part of a project intervention, models were chosen from those listed in Table 4, below. This table also lists the rated capacity and performance characteristics of these air conditioners.

Table 4: New Air-Conditioner Specifications

New Air Conditioner Model	Cooling Capacity (kW)	Heating Capacity (kW)	Power Input - Cooling (kW)	Power Input - Heating (kW)	Energy Efficiency Ratio, cooling (EER)	Coefft. Of Performance, heating (COP)
Daikin RXS35KVMA	3.5	4	0.97	0.99	3.61	4.04
Daikin RXS25KVMA	2.5	3.4	0.54	0.7	4.63	4.86
Daikin RXS50KAVMA	5	6	1.32	1.47	3.79	4.08
FUJITSU W/S R/C INVERTER	3.5	3.7	0.86	0.81	4.007	4.57
LG P12 AWN 3.5kW	3.5	4	0.862	0.872	4.06	4.59
LG Inverter R12AWN-13 ART	3.5	4	0.9	0.98	3.8	4
LG Inverter R18AWN-13 ART	5	6	0.9	0.98	3.58	3.87
LG Inverter R22AWN-13 ART	6.3	8.65	1.8	1.82	3.5	3.9
LG P09 AWN 2.5kW	2.5	3.2	0.518	0.653	4.83	4.9
LG P18 AWN 5.0kW	5	6	1.24	1.4	4.03	4.29
LG R09 AWN-UB13 2.5kW C	2.5	3.2	0.56	0.73	4.31	4.27
MHI WS INVERTER 5.0kwC	5	5.19	1.55	1.59	3.23	3.65
Mitsubishi SRC25 2.5kW	2.5	3.2	0.575	0.7	4.35	4.57
Mitsubishi SRC35 3.5kW	3.3	4	0.87	0.955	3.79	4.19
Panasonic CU-E12 3.5kW	3.5	4.9	0.83	1.22	4.22	4.02
Panasonic CU-E15 4.4kW	4.4	5.5	1.2	1.47	3.67	3.74
Panasonic CU-E18 4.4 kW	5	6.35	1.3	1.69	3.85	3.76
Panasonic CU-RE12 3.5kW	3.5	4.25	0.94	1.1	3.72	3.86

A comparison between WASP Mains energy data and SAPN Mains data over identical time periods was undertaken to assess data quality. As mentioned in the section entitled "Issues encountered with Data Acquisition System", there was an issue with SAPN Mains electrical energy data where a large number of billing data were estimates rather than actual readings, therefore comparing these with WASP data would be irrelevant. Based on actual, non-estimated data however, only ten households (see Table 5), representing around 5% of the sample, displayed significant discrepancies between data monitored using WASP loggers and that recorded by SAPN. As recorded in Table 5, the magnitude of some discrepancies was consistent, to some degree. Where these discrepancies showed no consistency, such as where SAPN readings for any given period were not always higher or always lower than concurrent WASP readings, the data discrepancy was described as Anomalous.

Table 5: Households with discrepancy between concurrent WASP and SAPN data (2013-2015)

Client ID	Data Discrepancy
71	Anomalous
243	WASP 200-300% higher than SAPN
331	Anomalous
561	WASP consistently 13% lower than SAPN
591	WASP consistently 87% lower than SAPN
681	WASP 72% lower than SAPN
691	Anomalous
787	Anomalous
903	WASP 138% higher than SAPN
931	WASP consistently over 100% higher than SAPN

In relation to analysing the air conditioning usage the difference between Mains and AC energy from one period to another was compared. For the purposes of analysis, it was then assumed that the energy for electrical end-uses, other than the air-conditioner, would be the same for a given period each year, where no data was available prior to an intervention. There are a number of known limitations to this assumption given that other household loads are temperature sensitive, such as refrigerators and freezers, however these have been ignored in this instance. Based on this assumption, the non-AC component of electrical energy for a given period was subtracted from the Mains electrical energy of the same period a year earlier in order to estimate the air-conditioning energy before installation of project interventions. Although these two periods, separated by one year, consisted of the same dates, weather was significantly different between the periods. Adjustments were therefore necessary for estimates of AC energy, prior to a project intervention ("Adjusted Pre-Install AC Energy"). This adjustment was achieved using the Australian Bureau of Meteorology (BOM) 'degree day' method (http://www.bom.gov.au/jsp/ncc/climate_averages/degree-days/index.jsp#how). Using this method, for a given period, each day that has an average temperature above a certain threshold is given a number, representing the number of degrees Celsius that the average temperature rose above 24°C in summer or fell below 18°C in winter. It is estimated that the ratio of the degree days over one period to that over the same period in a different year should represent the difference between the air-conditioning energy needs, provided that there are no other significant differences in a household. For example, if a 3-month period in 2013 had 20% higher degree days compared with the same 3-month period in 2014, then it is expected that the energy required for air-conditioning in the 2013 period would be 20% higher than that for the 2014 period.

3.3.3 Temperature Monitoring

UniSA selected dataloggers that were capable of monitoring indoor temperature within the internal space of a house, where the project intervention was centred (in most cases the main living area). This datalogger, known as an iButtion DS1922, was also installed in each house where an intervention occurred, just prior to the implementation of an intervention. The iButtton logger, manufactured by Dallas Scientific, was programmed by UniSA to record and store indoor temperatures at one-hour intervals, with a capacity allowing temperature data storage for a period of approximately four-months before retrieval was necessary. Due to project cost limitations, the temperature monitoring equipment selected was not capable of transmitting data remotely, unlike

the energy monitoring equipment, instead requiring energy workers, who were already visiting households on a routine basis, to manually download iButton loggers using an NS70 handheld device. Data were collected using the NS70 and stored on an SD card for later use by UniSA staff.

Use of the NS70 handheld device, manufactured by Portuguese Company Newshift Technology, necessitated the use of proprietary software also developed by Newshift Technology, known as IGest.

iButton dataloggers were installed either in the room that would be most affected by an intervention, or in the main living area, at a height of between 1.8m and 2m above ground level. Best attempts were also made to ensure that the location was as far as practicable from anything that would affect the accuracy of measurement, such as sources of heat including electrical or electronic appliances and direct sunlight from windows.

3.3.4 Tenant Surveys

Three pieces of research were undertaken with the tenants:

- Pre intervention comfort and behaviour survey undertaken in a one on one capacity; (these surveys were conducted primarily in paper at the time of visits by energy workers (Jan2014 – April 2015) (details below)
- Post intervention comfort and behaviour survey undertaken by tenants on line or via a telephone interview (between May and December 2015) (details below)
- In depth telephone survey undertaken with 50 tenants post intervention (Sept – Nov 2015) Refer Appendix A).
    - In order to complete 50 interviews, 109 households were called (response rate just under 50%),
    - The interviewees consisted 20 males and 30 females;
    - Of the participants interviewed, 34 had received only an air-conditioner, 12 had received an air-conditioner and insulation, and four (4) had received insulation only.

Comfort and behaviours

A pre intervention 'comfort survey' (Appendix B) was developed and completed by the main participant during the initial structural assessment. This survey captured participants' current energy efficiency knowledge, and current energy efficiency behaviour, as well as capturing their perception of comfort in the property last winter and last summer. A post intervention 'comfort survey' (Appendix C) was completed a minimum of 3 months after the installation of RCAC or CI, asking the same questions as the first survey, as well as additional questions relating to satisfaction with the project and the value of different interventions.

The original comfort survey was requested from the tenant by the energy worker when their property underwent the initial structural assessment, prior to acceptance into the Beat the Heat Project. The second post installation survey was requested either over the phone or during a recent home visit when the energy worker was taking a temperature data reading. All surveys were requested by the UC energy worker or administrative staff.

3.3.5 Landlord Surveys

The vast majority of landlords were private landlords who had a property manager managing their property or properties. However, two of the landlords were Community Housing Providers who provide housing for low income or otherwise disadvantaged tenants on a not for profit basis.

Three surveys were undertaken with the landlords:

- A pre intervention survey undertaken by landlords on line or via a telephone interview ((between June 2014 and February 2015) (Appendix D). Not all of the landlords completing this survey ended up participating, however all responses were included in the analysis as the survey questions related to motivations for participating and attitudes towards energy efficiency.
- A post intervention survey also undertaken by participating landlords on line or via a telephone interview with a random sample (Nov – Dec 2015) (Appendix E)
- A survey for non-participating landlords (Appendix F)

The second survey's aims was to review perceptions of effectiveness, efficiency, impact and ease of the project from a landlord's perspective. The survey also sought information on behaviour change that had occurred during or as a result of the respondent's involvement in the project.

The landlord survey for non-participating landlords sought to understand the main reason for not participating in the project, if they have previously undertaken capital upgrades to improve the energy efficiency of their rental properties, the most significant barrier to implementing energy efficiency, and their perception of role of property managers in assisting landlords and tenants with energy efficiency. There were very few responses to this survey which was administered via post from Lin Andrews.

3.3.6 Consortium Members

Periodically throughout the project, focus group style conversations were facilitated with the governance group, energy workers and property managers. The aim of these conversations was to capture lessons from implementation of Beat the Heat; and, where possible; integrate these into ongoing implementation (Action Research approach). The timing of these conversations enabled the key lessons to be captured before they were forgotten.

The theme of the conversations with the governance group were:

- Lessons about the recruitment phase
- Lessons gleaned from the implementation of the energy efficiency measures
- Lessons from data collection methodology and processes; and
- Overall lessons from the project from the perspective of tenants, landlords and governance

In May 2015, a focus group was conducted with Property Managers from Lin Andrews regarding their involvement in the project. A focus group was facilitated with energy workers in November 2014; and final interviews were also conducted with energy workers in February 2016, again to better understand their involvement.

3.3.7 Assumptions

Surveys were undertaken to reach a large number of participants in an effective and timely manner. As a preferred tool, surveys were also chosen to assist the team to seek feedback via a number of modes namely online, via email, over the telephone, and via face-to-face interview. Further to this, the anonymity[3] afforded to respondents made the use of surveys attractive. Interviews and focus groups were adopted to allow the research team to probe more deeply into qualitative aspects of the findings.

Amongst our assumptions were

- Energy consumption will not reduce post intervention
- The level of interest in energy efficiency savings would increase over time
- A correlation would exist between thermal comfort and energy efficiency instalments
- That quantitative and qualitative data would be recorded in a manner to allow for matching of participant's ID and trend analysis over time
- That data integrity (i.e. the accuracy and consistency of data over its entire life cycle) would be in place

The surveys of both tenants and landlords also incorporated questions relating to **barriers** to the adoption of energy efficiency behaviours as well as whether the project had resulted in **improved knowledge** of energy efficiency strategies and practices.

In addition, the data collection methods queried participants in relation to their **satisfaction** with the project. This included:

- Changes in energy consumption
- Increase thermal comfort throughout the year
- Changes in behaviour to assist with thermal comfort
- Actively seeking information on how to save energy in the home
- Effectiveness of project interventions
- Satisfaction with the project
- Likelihood of recommending the project and or participating in further similar project

3.3.9 Additional Data

The Beat the Heat project collected Household Dwelling details, including location, tenure, age of the property, housing structure & household income. Data was also collected on the age and gender of the main participant, the composition of the household (eg, 2 adults, 2 children), education level of the main participant, and other demographics including if they identify as Aboriginal and Torres Strait Islander, the main source of income for the participant, household and weekly income and the main language spoken at home.

Throughout the project, any changes in household composition were recorded. Where a household exited the project, the reason for this was obtained from the landlord or tenant and recorded. The

[3] Tenants were provided an ID number

Landlord's names were known to the interviewer only and findings presented as composites

number of households exiting the project was 30 representing 15% of the total participating households.

3.4 Data Storage

There were three primary data storage mechanisms utilised for the purposes of data analysis and reporting.

- The CDS database for
    - occupant demographics and behaviour
    - appliance information
    - monitoring equipment identification
    - energy billing data
    - house construction information
    - details of project interventions
    - survey data.
- The Outpost Central website for all WASP post-intervention, 15-minute interval household Mains and AC energy data.
- The IGest database for all iButton, hourly interval household temperature data.

Community Data Solutions (CDS) provided a secure and remotely accessible Client Relationship Management (CRM) solution tailored to the *Beat the Heat!* project. The database was the central repository of all qualitative and quantitative information collected during the project. Access to the database was restricted to select consortium members and then only after a police check had been provided and the privacy and confidentiality notices had been signed and returned to UC.
The database can only be accessed with a valid Username and Password and each Username is allocated to specific Roles within the database solution which determines the extent of client data they can view, edit and delete.

Being a cloud deployed solution it is important to note that the data is stored in Sydney to meet requirements under the National Privacy Principles And, provide high level, industry standard, Secure Socket Layer (SSL) encryption of data transmitted between a Users web-browser and the server.

Upon termination of the contract (completion of the project) all copies of the customer data will be deleted. This includes information stored on production, staging and testing environments. And, a copy of the database will be supplied to Uniting Communities.

Participant demographics and intervention data were collected by energy workers and uploaded to the Home Energy CRM Database. Data was entered from the initial structural assessment visit and energy assessment and from any subsequent visits or contacts. Demographic and household data were collected during the initial structural assessment. Any changes to the household or demographic data that was advised.

3.5 Demographics

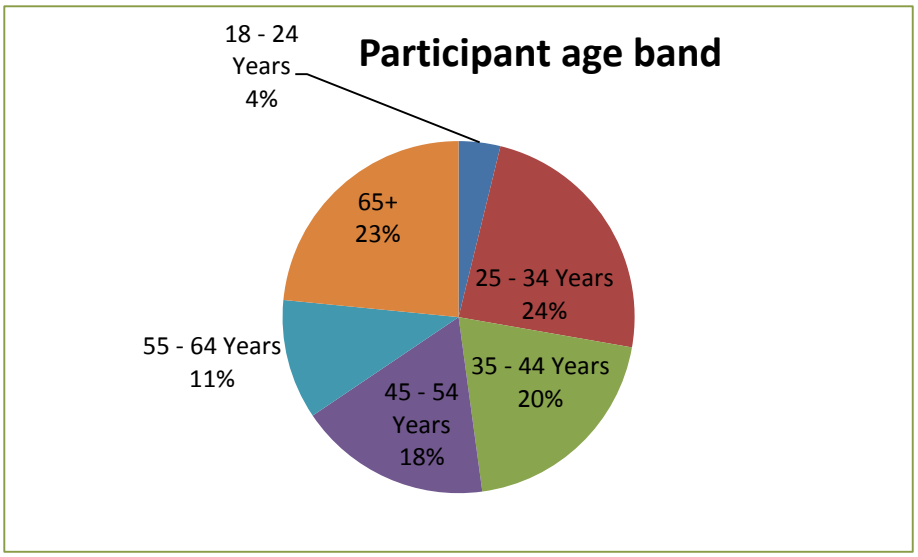
A summary of the participant demographics follows:

Place of birth
All participants reported being born in Australia, with the exception of two households who reported United Kingdom as the place of birth and one household each whose reported place of birth was:

- Nepal
- China
- South Africa
- England
- Iran
- Philippines
- Belarus
- Zimbabwe

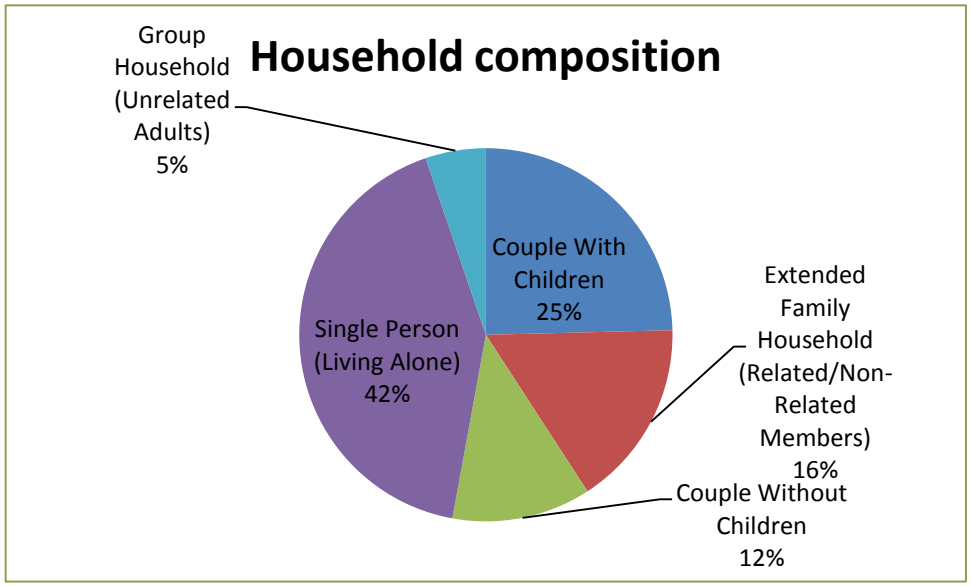
Aboriginal / Torres Strait Islander
Four people (households) identified as Aboriginal.

Age range
The age range of participants was spread amongst a number of different bands, with only 4% under 25 years of age. Nearly one quarter were aged 25-34 years, and a similar number aged (23%) over 65.



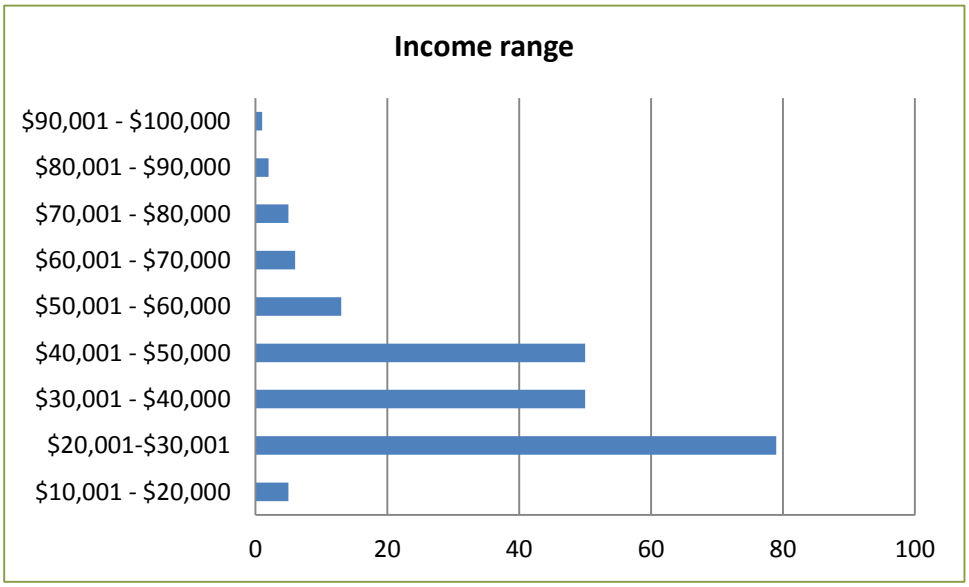
Household composition

In terms of household composition, the largest cohort of participants was single people living alone (42%), followed by couples with children (25%)



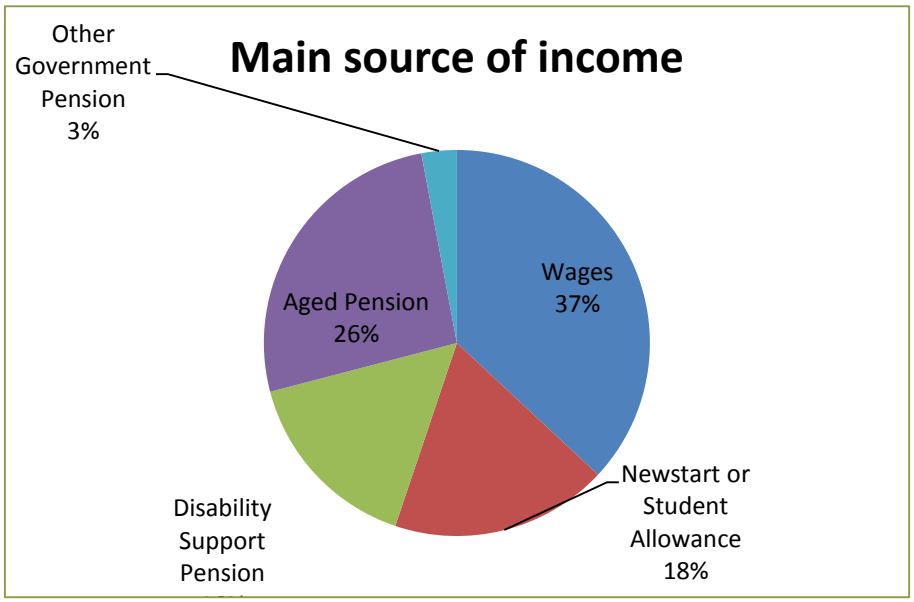
Household income

Over one third (37%) of households were in the income range of $20,001 to $30,000 and nearly half of participants (48%) had a household income of between $30,001 and $50,000. A very small proportion had incomes over $60,000 (7%).



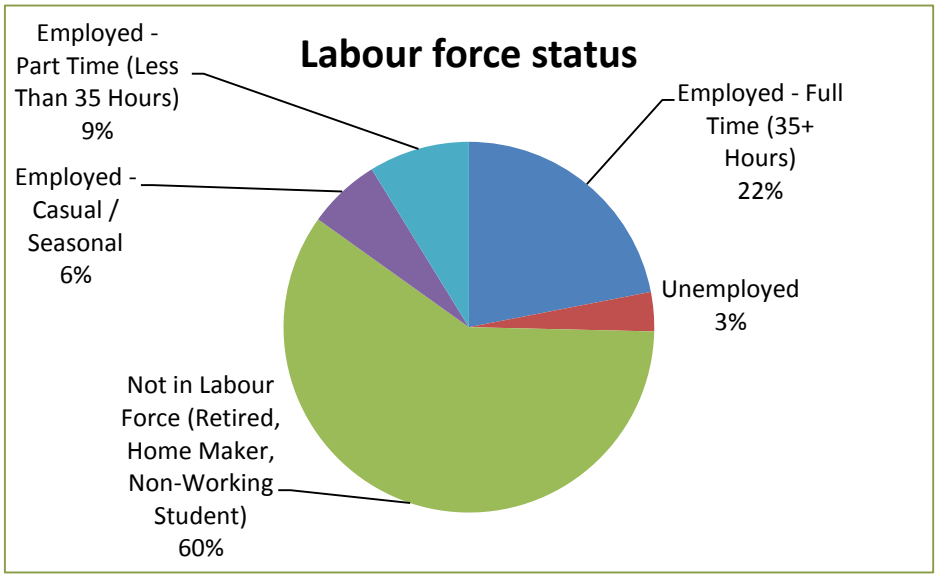
Main source of income

Wages were identified as the main source of income for 37% of participants and 26% recorded the aged pension. The remainder were in Newstart or student allowance (18%) and Disability support pension (16%) or another pension.



Labour force status

The majority of participants reported being not in the labour force, and only 22% were working full-time.



The correlation between energy consumption and demographics are explored in section 4.1.3.

4. Results

The actual outputs of the *Beat the Heat!* project were:

- 209 home energy visits were conducted with separate and tailored written reports for both tenants and landlords on actions that could be taken to enhance resilience to summer heat.
- 119 households had a high efficiency reverse-cycle air conditioner (RCAC) installed
- 23 households had only ceiling insulation installed (insulation was not installed where existing insulation was adequate
- 64 households had both high efficiency reverse-cycle air conditioner (RCAC) and ceiling insulation installed
- All households having a RCAC installed received a short training session on the efficient operation of the RCAC (for example: filter cleaning, thermostat settings, zoning, etc.)
- 201 households were fitted with an interval energy consumption data logger with all households receiving a RCAC having the energy consumption of these units monitored separately (limitations in collecting this data addressed in section 6.5.2)
- 196 households received In Home Displays
- 195 households provided consent for the project to access their historical energy consumption via billing data (limitations in collecting this data addressed in section 6.5.3)
- 207 households were fitted with temperature i-buttons to monitor temperature in the main living area (limitations in collecting this data addressed in section 6.5.4)
- 178 households completed the pre intervention comfort & behaviour survey
- 117 households completed the post intervention comfort & behaviour survey
- 50 households were interviewed about their involvement in the project, their perceived comfort levels and their energy efficient behaviours.
- 86 Landlords completed the pre intervention survey
- 35 Landlords completed the post intervention survey
- 7 landlords who didn't participate in the projects were interviewed about their decision
- 3 Property Managers were interviewed about their involvement in the project

The *Beat the Heat!* project's Results relate to the 7 Key Measures we sought to address as outlined in Table 1.

4.1 Changes in Energy Consumption

This section considers the corrected (based on impact of climatic differences) difference between energy associated with previous thermal system (from billing data) and energy efficient thermal system (from monitored data and billing data).

4.1.1 Electricity Data Analysis

Summary

The post-intervention average annual electricity consumption was found to be 7% lower than pre-intervention, based on a comparison of equally sized, approximately one-year long pre and post-intervention data sets for all available households regardless of pre intervention AC status. The proportion of average annual heating and cooling energy from the air-conditioner interventions was 22.3% of post intervention annual electricity consumption. The previous figure related to all households, regardless of their pre-intervention air-conditioner status. For households with available data that had an old, reverse cycle air-conditioner prior to the intervention where a new air-conditioner was installed, the post-intervention average annual Mains energy was found to be 12% lower than the pre-intervention Mains energy. This annual difference of 686kWh when calculated at an average tariff of 32c/kWh represents an annual saving of $220.

When an old AC was replaced with a new RCAC electricity consumption was reduced by 12%. This represents an annual saving of $220.

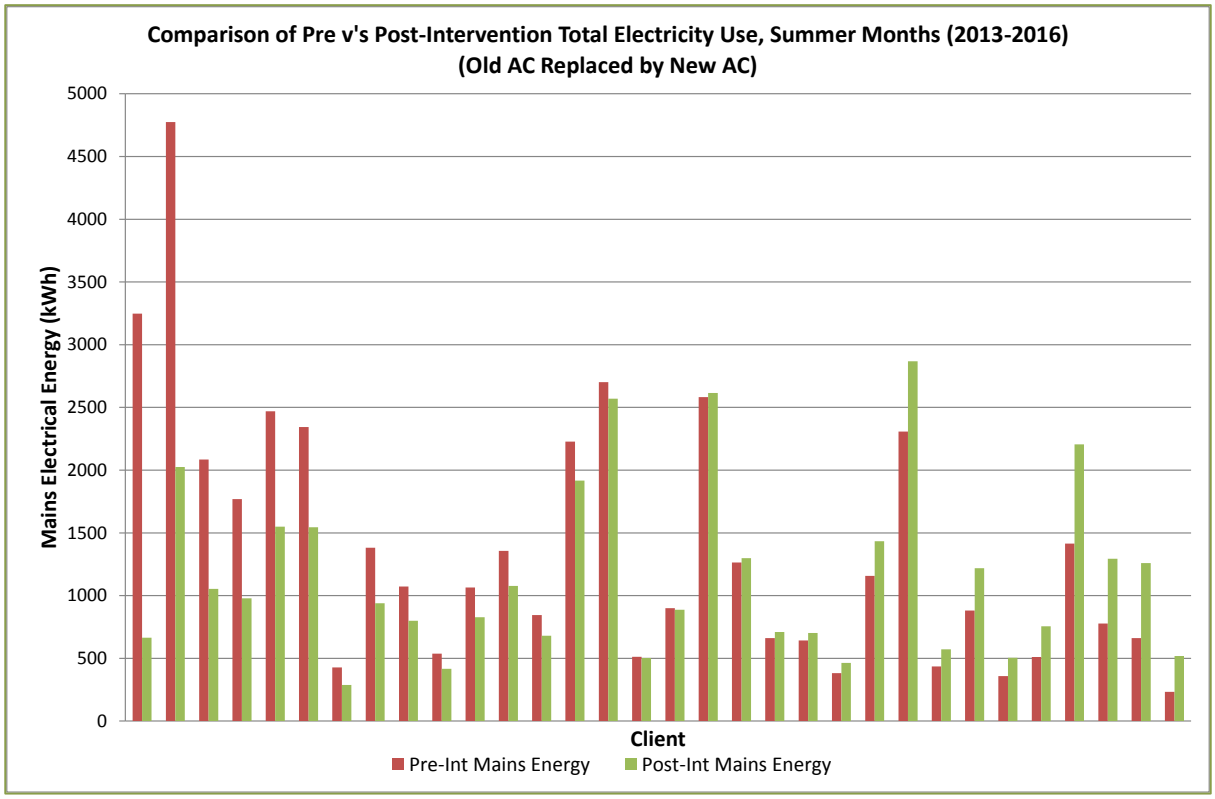
Summer Consumption - Old AC replaced by RCAC Intervention

For the 32 households (with available data) where an old AC was replaced with a new one it can be seen that over 53% of households experienced an overall drop in post intervention energy use. In total 43MWh of pre-intervention Mains energy was consumed, compared with 37MWh of post intervention mains energy over the approximately three-month summer periods each year. This equates to an overall 16% post-intervention reduction in Mains energy for those houses.

The post versus pre-intervention energy ratio data is charted below in Figure 1. This figure highlights that approximately 66% of households experienced either a decrease or an increase of no more than 10% in post intervention total mains electrical energy consumption over the summer months.

The results show that for 9 out of the 13 households that experienced a post intervention increase this was below 50%. Those houses experiencing larger increases started with a relatively low baseline before the intervention. (Details in Appendix G)

Figure 1 Comparison of pre versus post-intervention total electricity use in summer (cooling) months for Households with old air conditioners (2013-2016)

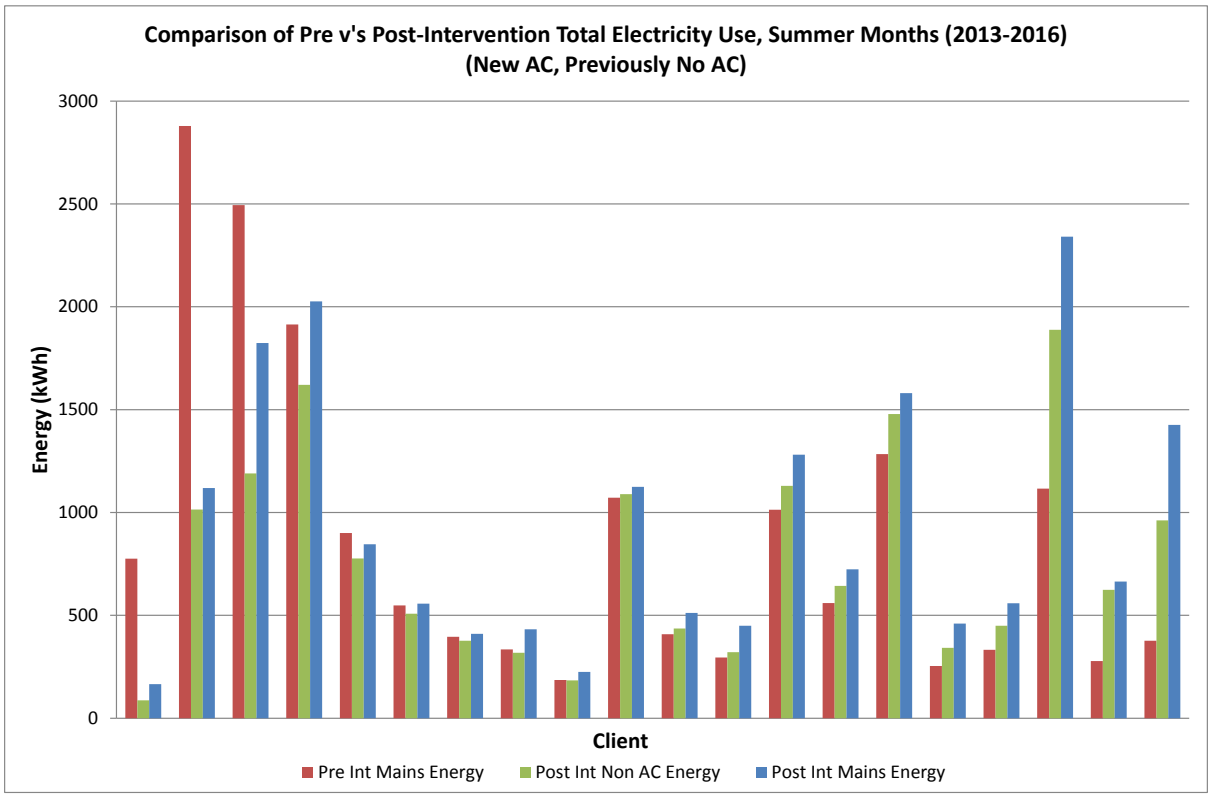


Summer Consumption - No AC prior to RCAC Intervention

For the 18 households (with available data) which had no functioning air-conditioner (i.e. "No AC") prior to the intervention where a new AC was installed, only 11% experienced an overall drop in post intervention energy use. In total 14MWh of pre-intervention electricity was consumed, compared with 17MWh post intervention over the approximately three-month summer periods each year. This equates to an overall 21% post-intervention increase in electricity for these houses.

Figure 2 charts the post and pre-intervention mains energy, along with the difference between monitored Mains and monitored AC (Post-Int. Non-AC Energy) for these households. This figure highlights the impact that aspects other than the installation of insulation and AC, such as education, change to household composition or the introduction of new appliances have had on project participants. 39% of households have reduced their non-air conditioning related energy consumption. It should be noted that, in terms of non-AC related energy for the 18 households, in total 13.8MWh of pre-intervention Mains energy was consumed, compared with 14.3MWh of post intervention, non-AC related mains energy over the approximately three-month summer periods each year, which equates to an overall 4% post-intervention increase in non-AC related electricity usage for these households. This result indicates the relative stability of the average non-AC related energy consumption of the households under investigation in consecutive years.

Figure 2: Comparison of pre versus post-intervention total electricity use in summer (cooling) months for households without Air Conditioners prior to intervention (2013-2016)



Summer Consumption – Evaporative cooling prior to RCAC Intervention

In considering the 8 dwellings (with available data) which had some form of evaporative cooling (fixed or portable), prior to the intervention 13% experienced an overall drop in post intervention energy use. In total 7.3MWh of pre-intervention Mains energy was consumed, compared with 7.1MWh of post intervention mains energy over the approximately three-month summer periods each year. This equates to an overall 3% post-intervention decrease in Mains energy for these households. (Details in Appendix G)

National Comparison

A recent report to the Australian Energy Regulator[4] stated that in 2013, near the time this project was most active, the average South Australian household consumed 5289 kWh and nationally the average household consumed 5915kWh. Based on post-intervention electricity data collected from 69 households throughout the course of the project, the average annual household electrical energy

[4] ACIL Allen 2015, Electricity Bill Benchmarks for Residential Customers: A Report to the Australian Energy Regulator, http://www.aer.gov.au/system/files/ACIL%20Allen_%20Electricity%20Benchmarks_final%20report%20v2%20-%20Revised%20March%202015.PDF

consumption was found to be 4510 kWh/yr, which is 15% lower than the State average and 24% lower than the National average. 45% of participants were single households in part explaining the less than average consumption, despite that this variation highlights the kind of energy poverty that made project participants eligible for interventions implemented through this project.

Actual Versus Perceived Electricity Usage Change

Table 6 below, shows that there are some significant discrepancies between perceptions and measurements of changes to electricity bills. This table shows that there were nine clients (16%), within this data set, who accurately perceived this change, according to available data. The remaining clients in this data subset either demonstrated inaccurate perception or a lack of awareness regarding any changes in their electricity bills following the project interventions.

It would appear that the largest drop in energy bills was experienced by Client 71, however based on the results of data quality checks, it has been indicated that these results relate to anomalous data, which is supported by their associated survey response, which indicated a perception that their bill stayed the same. Neither the cause or source of this anomalous data is known, therefore it has still been included in Table 6 but excluded from analysis. It is interesting to note that this client also stated that they experienced a rise in summer comfort, though temperature measurements collected for this household during the associated months indicated comfort temperature conditions only for 41% of the time that their air-conditioner was in use (see Table 6).

Table 6; Actual versus perceived change in total electricity consumption (2013-2016)

#	Client ID	SAPN Mains Energy (kWh)	WASP Mains Energy (kWh)	WASP AC Energy (kWh)	Post v's Pre Int. Mains Energy Ratio	Int. Group	Post Int. Bill Perception (Survey)
1	495	4774	2024	485	0.42	ins ac	#N/A
2	251	3248	664	252	0.20	ac	Gone up
3	**991**	**2879**	**1119**	**104**	**0.39**	**ins ac**	**Gone up**
4	351	2085	1054	550	0.51	ac	#N/A
5	491	2469	1550	520	0.63	ins ac	#N/A
6	337	2494	1824	634	0.73	ac	#N/A
7	195	2343	1545	391	0.66	ac	#N/A
8	193	1769	978	390	0.55	ac	Unsure
9	1071	1434	757	309	0.53	ins ac	Gone down
10	349	1381	940	351	0.68	ac	#N/A
11	**71**	**776**	**165**	**79**	**0.21**	**ins ac**	**Stayed the same**
12	281	2702	2570	512	0.95	ac	Stayed the same
13	293	2227	1917	190	0.86	ac	Unsure
14	45	1072	800	214	0.75	ac	Unsure
15	1053	1357	1077	191	0.79	ins ac	Gone down
16	271	1064	827	104	0.78	ac	Gone down
17	169	1914	2026	405	1.06	ins ac	Gone down
18	929	726	622	150	0.86	ac	#N/A
19	59	845	680	69	0.81	ins ac	Gone up
20	1073	576	493	143	0.86	ins ac	Stayed the same

21	287	538	417	80	0.78	ac	Unsure
22	1095	661	710	219	1.07	ac	Stayed the same
23	479	759	606	13	0.80	ins ac	Gone down
24	605	436	572	284	1.31	ac	Stayed the same
25	741	643	702	206	1.09	ac	Stayed the same
26	363	428	288	4	0.67	ac	#N/A
27	399	1096	1004	52	0.92	ac	Gone down
28	275	900	846	69	0.94	ac	Gone down
29	455	1264	1298	138	1.03	ac	Unsure
30	917	513	503	89	0.98	ac	Unsure
31	411	548	557	49	1.02	ac	#N/A
32	633	900	887	12	0.99	ins ac	Stayed the same
33	847	1157	1433	297	1.24	ac	#N/A
34	39	396	410	34	1.04	ac	#N/A
35	209	2582	2614	49	1.01	ins ac	Gone down
36	895	334	432	114	1.29	ins ac	Gone up
37	1099	186	225	41	1.21	ac	Unsure
38	1101	359	505	148	1.41	ac	#N/A
39	**903**	**198**	**488**	**288**	**2.46**	**ac**	**#N/A**
40	1093	240	358	114	1.49	ins ac	Gone down
41	333	1072	1125	36	1.05	ac	#N/A
42	1133	382	463	61	1.21	ac	Stayed the same
43	93	295	449	128	1.52	ac	Gone down
44	967	408	511	76	1.25	ac	#N/A
45	339	2307	2868	495	1.24	ac	#N/A
46	43	560	724	81	1.29	ac	#N/A
47	921	254	460	118	1.81	ins ac	#N/A
48	845	1013	1281	151	1.26	ac	0
49	901	332	559	109	1.68	ins ac	#N/A
50	487	1008	1265	84	1.26	ins ac	Gone down
51	*173*	*510*	*756*	*66*	*1.48*	*ins ac*	*#N/A*
52	89	661	1260	417	1.91	ac	#N/A
53	565	233	518	102	2.22	ins ac	Stayed the same
54	407	1284	1581	102	1.23	ac	Stayed the same
55	95	1531	2065	325	1.35	ins ac	Gone down
56	191	1415	2205	467	1.56	ac	#N/A
57	69	278	664	40	2.39	ac	#N/A
58	715	777	1294	114	1.67	ins ac	Gone down
59	1131	377	1425	464	3.78	ac	Unsure
60	345	1116	2341	453	2.10	ac	Unsure

N.B. House with Solar PV in italics & Anomalous Data in bold

4.1.2 Air Conditioning Energy Data Analysis

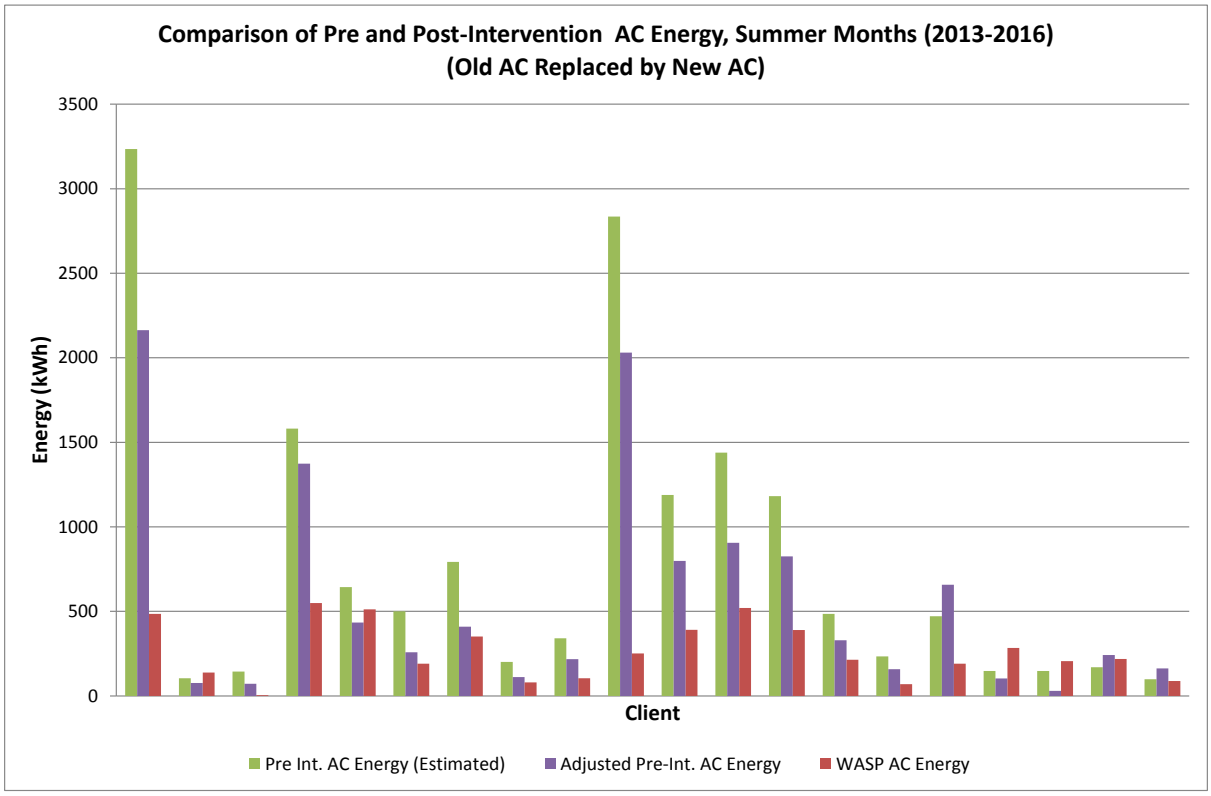
Reduction in Electricity Consumption

In considering households that had their AC replaced as project intervention in the following summer months, 80% of the 20 households that yielded useable data showed a significant reduction in estimated AC electricity consumption. For these 20 households in total 11.4MWh of estimated pre-intervention AC energy was consumed, compared with 5.2MWh of post intervention AC energy in relation to the same summer periods each year. This equates to an overall 54% post-intervention decrease in estimated AC energy for these households. Further details in Appendix G.

For households where an AC was replaced they experienced an overall 54% reduction in energy consumption for their air-conditioning.

It should be mentioned that the number of degree days (as outlined in section 3.3.2), for the summer period from November 2013 to March 2014 (214), was 50% higher than the number of degree days for the summer period from November 2014 to March 2015 (143), which is considerably lower than the number of degree days (181) for the already much shorter summer period from November 2015 to January 2016, when energy monitoring ceased. Figure 3 illustrates the differences between pre-intervention AC energy, with and without adjustment to incorporate the impact of climatic difference, and post-intervention AC energy for households where a new AC replaced an old AC. When comparing pre and post-intervention AC energy, whether relating to weather adjusted or unadjusted pre-intervention AC, we are seeing a substantial savings in energy use for AC, which can be directly attributed to the intervention.

Figure 3: Comparison of pre-intervention to post-intervention AC energy, for summer months, where an old AC was replaced by a new AC (2013-2016)



It should be noted that, due to the fact that each intervention was carried out at a different date, in comparison to pre-intervention climate, the post intervention climate ranged from considerably milder to significantly more severe. This explains why Figure 3 shows an increase in adjusted pre-intervention AC energy for some households and a decrease for others.

Avoided electricity consumption

Additionally we were able to calculate the estimated avoided electricity consumption for the summer months (Nov '14 – Mar '15) when an old AC is replaced by a new one. On average an estimated 46% reduction in electricity used for cooling resulted from the AC intervention. These data also yield that an average of 276kWh of AC cooling energy per household was therefore avoided as a result of the intervention from November to March. This correlates to an average saving of approximately $88 of avoided electrical energy costs per summer, based on an average tariff of 32¢/kWh for the cooling months[5] .

Avoided energy costs by replacing an AC with the more efficient model resulted in an average saving of approximately $88 of avoided electrical energy costs per summer

All households show that AC energy was avoided, which relates to the fact that all AC interventions involved the installation of an air-conditioner that had a higher Energy Efficiency Ratio (EER) than the old AC. The cooling load ("Estimated New AC Load") was estimated through multiplying WASP monitored AC energy for a given household by the rated EER of the new air conditioner. 'Estimated New AC Load' was converted to an estimate of what the AC energy would have been over the same period, if the intervention was not implemented ("AC Energy Without Int."), by dividing the old air-conditioning energy use by the EER. Based on the data in Table 7.

[5] Commonwealth Government, *Protecting human health and safety during severe and extreme heat events:* A national framework, November 2011

Table 7: Modelled AC Energy Without Intervention for Summer (Cooling) Nov 2014 – Mar 2015

#	Client ID	New AC Cooling Energy	Estimated New AC Load (using EER)	Predicted AC Energy Without Int. (using EER)	AC Cooling Energy Avoided	AC Cooling Energy Difference	AC Energy Avoided	Estimated Cooling Energy Cost Saving
		(kWh)	(kW)	(kWh)	(kWh)	(%)	(kWh/day)	($/day)
1	45	267	1015	474	207	44%	1.37	$0.44
2	209	45	170	126	81	64%	0.54	$0.17
3	455	95	382	196	101	52%	0.67	$0.21
4	343	65	249	111	46	41%	0.31	$0.10
5	195	472	1651	821	350	43%	2.32	$0.74
6	191	745	2667	1159	415	36%	2.75	$0.87
7	271	147	590	294	146	50%	0.97	$0.31
8	495	430	1744	868	438	50%	2.90	$0.92
9	351	338	1212	603	264	44%	1.75	$0.56
10	287	132	475	241	110	45%	0.73	$0.23
11	491	597	1928	959	362	38%	2.40	$0.76
12	293	263	1271	645	382	59%	2.53	$0.81
13	59	76	289	100	24	24%	0.16	$0.05
14	211	275	1275	647	372	57%	2.46	$0.78
15	349	549	2081	1035	486	47%	3.22	$1.02
16	193	449	1606	698	250	36%	1.65	$0.53
17	199	333	1265	699	366	52%	2.42	$0.77
18	363	46	166	84	38	45%	0.25	$0.08
19	339	383	1238	579	195	34%	1.29	$0.41
20	147	377	1431	774	397	51%	2.63	$0.84
21	281	853	3243	1613	760	47%	5.03	$1.60

If the data contained in Table 7 was expanded to include data for the additional 54 households that were originally excluded due to missing an average of 93 days of data over the same 151 day period, a 49% average reduction in AC cooling energy would be predicted for the summer months (Nov ’14 – Mar ‘15) resulting from the AC intervention.

4.1.3 Energy Consumption and Demographics

Table 8 below lists the average daily electrical energy consumption of project households, grouped by client education status. This table shows no strong correlation between levels of average daily Mains and AC energy consumption and the level of education of the client. This observation is based on the fact that the least and the most educated have very similar average daily summer energy consumption and associated patterns of use.

Table 8 Average daily summer energy consumption by education status (2014-2016)

	Average Daily Electrical Energy (Summer)		
Client Education Status	**AC (kWh/day)**	**Mains (kWh/day)**	**No. of Clients**
Primary school	1.7	5.2	27
High school - Year 10	2.4	10.7	97
High school - Year 12	2.4	10.4	21
TAFE	3.4	11.4	8
Tertiary	1.2	6.2	9
Overall Avg Daily (Summer)	***2.3***	***9.6***	***162***

Table 9 below lists the average daily electrical energy consumption of project households, grouped by the annual household income. This table shows a distinct jump in Mains and AC energy consumption where annual household income rises above $30,000. This jump, which relates to energy poverty within low income households, is highlighted by Figure 4, which is a graphical representation of Table 9, for household incomes between $10,000 and $60,000. It should be noted that this has not been correlated with household size.

Table 9: Average daily summer energy consumption by annual household income (2014-2016)

	Average Daily Electrical Energy (Summer)		
Annual Household Income	**AC (kWh/day)**	**Mains (kWh/day)**	**No. of Clients**
$10,001 - $20,000	1.9	5.6	3
$20,001-$30,001	1.9	6.8	65
$30,001 - $40,000	2.8	11.5	39
$40,001 - $50,000	2.1	11.1	33
$50,001 - $60,000	3.6	13.0	8
$60,001 - $70,000	2.3	11.1	4
$70,001 - $80,000	2.6	12.2	5
$80,001 - $90,000	4.4	9.1	1
$90,001 - $100,000	1.0	9.1	1
Unknown / Not Stated	1.1	8.2	1
N/A	1.9	7.7	2
Overall Avg Daily (Summer)	***2.3***	***9.6***	***162***

Figure 4: Average daily (summer) electrical energy consumption for households, grouped by annual income (2014-2016)

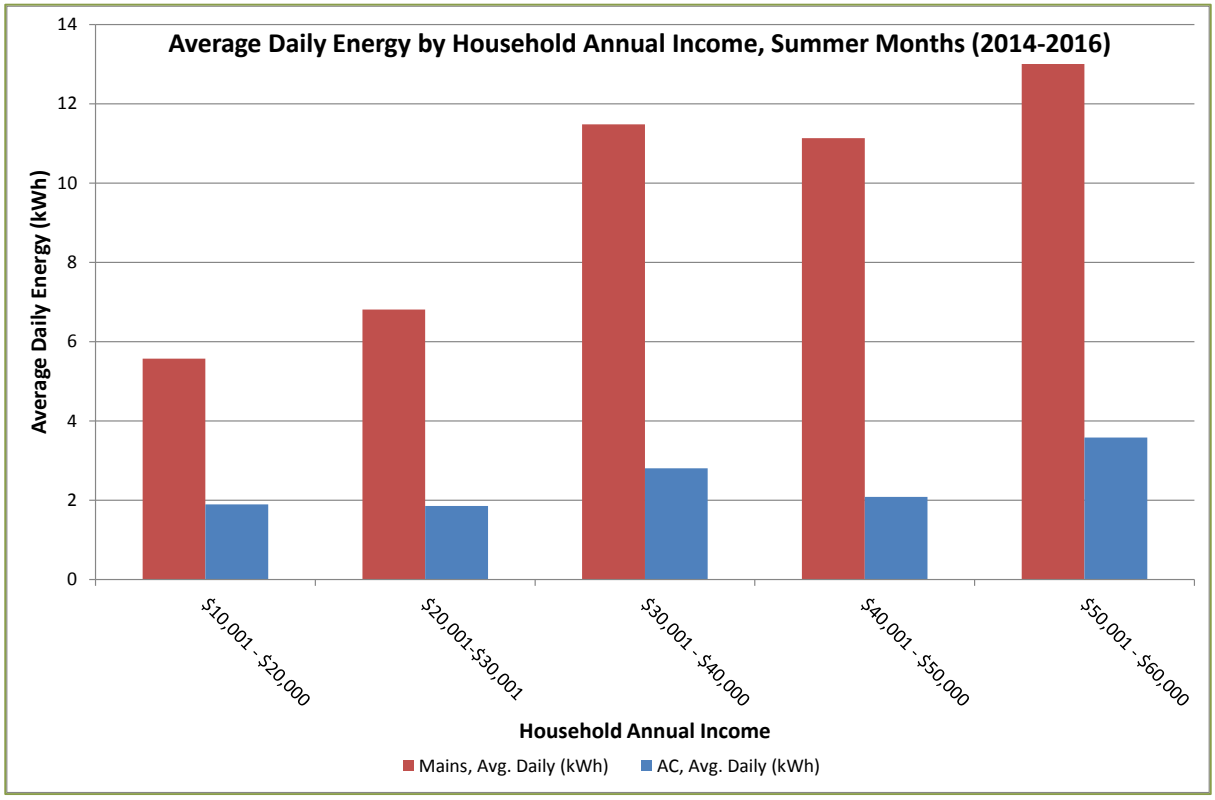
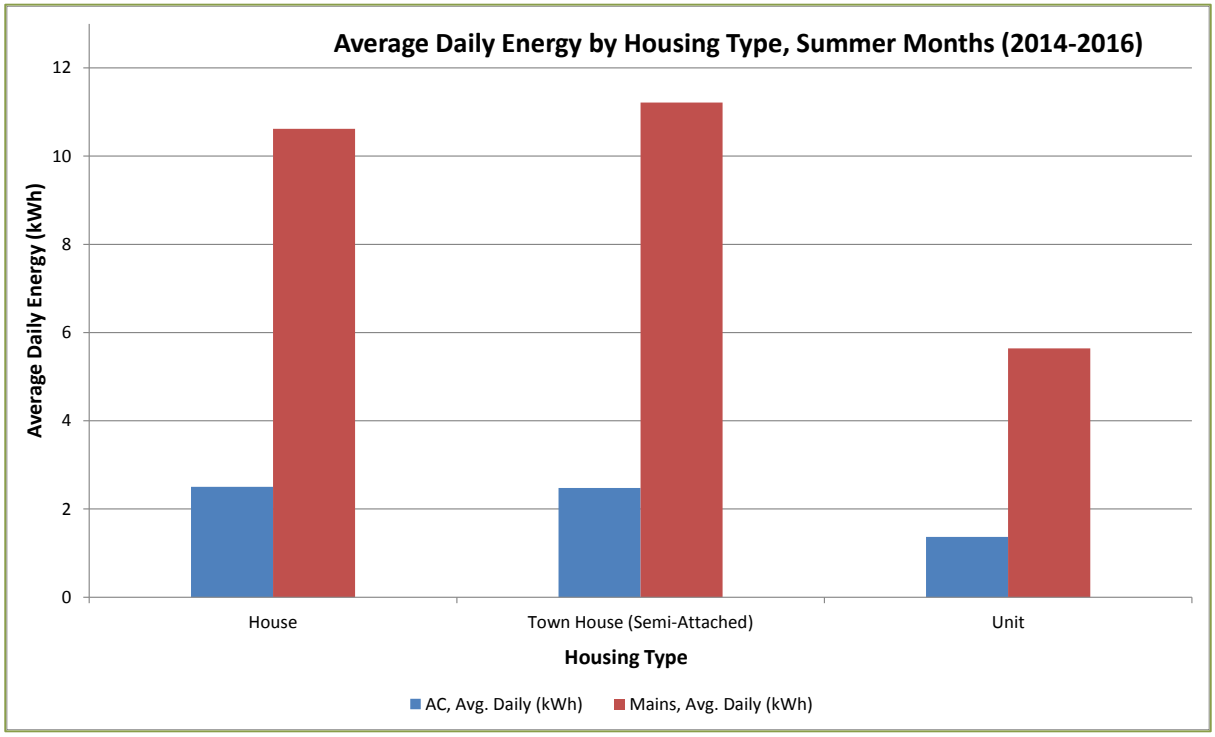


Table 10 below lists the average daily electrical energy consumption of project households, grouped by housing type. This is highlighted by Figure 5 for housing types: house, townhouse and unit. Other housing types listed in Table 10 were excluded from Figure 5 due to the relatively small number of clients in these groups.

Table 10: Average daily summer energy consumption by annual housing type (2014-2016)

	Average Daily Electrical Energy (Summer)		
Housing Type	**AC (kWh/day)**	**Mains (kWh/day)**	**No. of Clients**
Flat	3.5	9.0	2
Flat (top floor)	1.6	3.6	2
House	2.5	10.6	116
Town House (Semi-Attached)	2.5	11.2	7
Unit	1.4	5.6	34
Overall Avg Daily (Summer)	***2.3***	***9.6***	***162***

Figure 5: Average daily (summer) electrical energy consumption for households, grouped by housing type (2014-2016)



The values of total daily Mains energy consumption, listed in Figure 5 above, represents the average total daily summer load profiles shown below in Figure 6. This figure demonstrates that there are not only large similarities in the total Mains and AC electrical energy used daily within each of these housing types, but there are also significant similarities in the patterns of use. Furthermore, this figure highlights the significant difference between the House and Townhouse types in comparison with the Units, which have a similarly shaped average pattern of Mains energy use, but around half the overall summer daily Mains and AC energy consumption. In comparison to Houses and Townhouses, the low energy consumption of Units is partly attributable to their smaller average floor area, but may also relate to the fact that units will have indoor, perhaps air-conditioned, spaces with walls adjacent to neighbouring units, thus on average reducing external heat gains/losses and associated AC energy requirements. This assertion is supported by the fact that the peak of the Units average load profile, which on average is heavily influenced by air-conditioning load, is considerably flatter than that of the House and Townhouse.

Figure 6: Average daily load profiles for summer months by housing type (2014-2016)

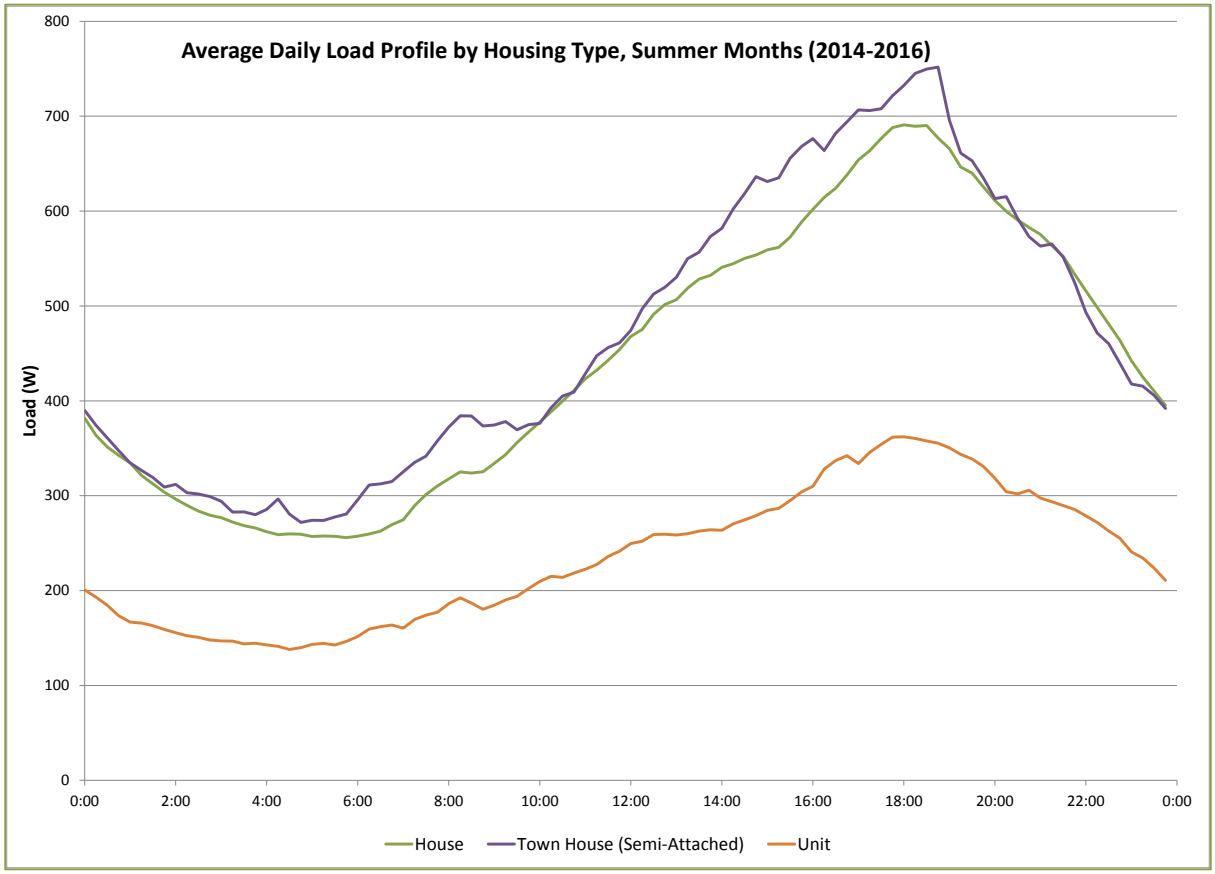


Table 11 below lists the average daily electrical energy consumption of project households, grouped by house construction type. Based on these data, it appears that for 99% of households (Brick Veneer, Double Brick and Weatherboard) the external construction type has little impact on the average daily air conditioning energy. It is therefore highly unlikely that the differences between electrical energy consumption for different types of construction relate to differences in the house construction types.

Table 11: Average daily summer energy consumption by annual house construction type (2014-2016)

	Average Daily Electrical Energy (Summer)		
Construction Type	**AC (kWh/day)**	**Mains (kWh/day)**	**No. of Clients**
Brick Veneer	2.4	9.6	67
Double Brick	2.3	9.5	89
Other	0.7	5.1	1
Stone	1.1	7.1	1
Weatherboard	2.1	14.3	4
Overall Avg Daily (Summer)	***2.3***	***9.6***	***162***

4.2 Future Tariff Options

This section explores the extent to which any changes in consumption levels and profiles may be impacted by future tariff options.

This component of the project seeks to understand the implications of network tariff reform on BTH participants. Under recent changes to the National Electricity Rules, electricity network tariffs for households and small businesses must become more cost-reflective from 2017[6]. This is expected to involve a change to interval metering (from 2018) and network tariffs based on monthly peak demand as well as total consumption. Network charges, on average, comprise half of a household's total electricity bill.

It was not possible to collect interval data prior to the interventions and hence the changes in consumption patterns are not able to be assessed. However, it is possible to analyse the impacts of changes in tariffs for this sample as a group of households with relatively high-efficiency air conditioners and good levels of insulation. Intuitively, these households should fare reasonably well under tariffs intended to reward good summer demand performance. However, the significant diversity in consumption patterns leads to diversity in tariff outcomes. A more comprehensive report is attached at Appendix H.

SA Power Networks has had a residential demand tariff available since July 2014. The preliminary analysis is based on the published 2015-16 prices. It is noted that the final tariff design for the period 2017-20 is the subject of a formal regulatory process – the Tariff Structure Statement that is being reviewed by the Australian Energy Regulator (AER)[7].

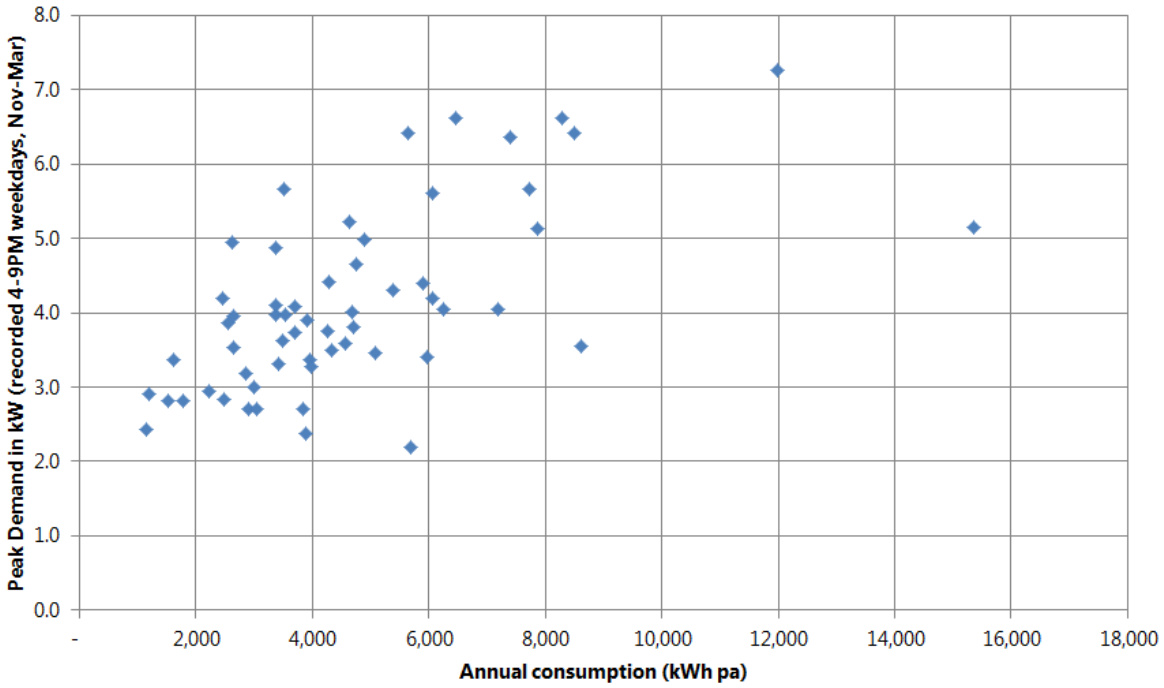
The data collection as part of BTH has provided a unique opportunity to examine the impacts of tariff options on the consumption profiles of a range of households where there is also a degree of knowledge about some key attributes of the households in question. Low-income renters are a cohort of interest for policy makers as they are often identified as being vulnerable to energy and housing costs. This is an important opportunity to develop detailed customer impact case studies (see Section 5) for consideration in the further development of cost-reflective network tariffs.

The demand tariff option introduces a charge based on the peak demand recorded between 4PM and 9PM any day of the week. A higher rate applies between November and March than for the rest of the year. Currently, network charges are based on aggregate consumption between meter reads. In order to understand the impacts of such changes, the consumption patterns of these 58 households have been contrasted between the existing tariffs and SA Power Networks new demand based tariff.

Figure 7 below illustrates the diverse combinations of summer peak demand and annual consumption recorded for the sample:

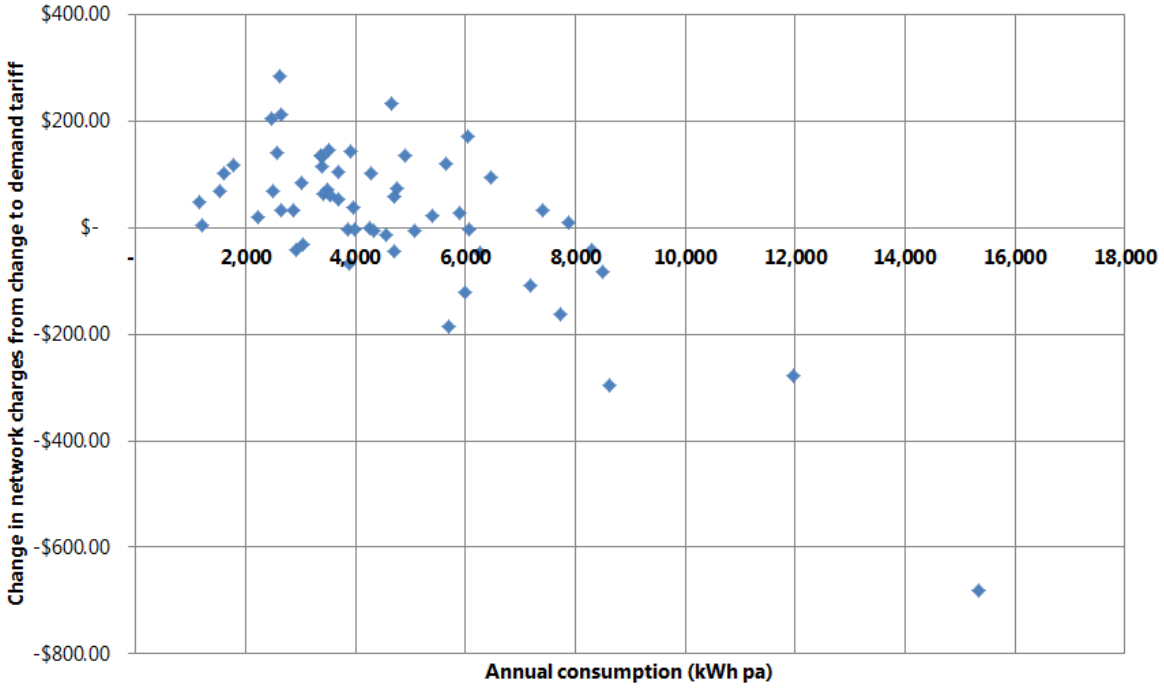
[6] http://www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements
[7] https://www.aer.gov.au/node/42356

Figure 7: Summer Peak Demand vs Annual Consumption – illustrating diversity across tenant sample



For each household, network charges were calculated for both the SAPN standard residential tariff and the new demand tariff. In summary, the majority of households would experience an increase in network charges as shown in Figure 8. However some households, especially those with higher levels of consumption (6,000 kWh and above), would experience substantial reductions.

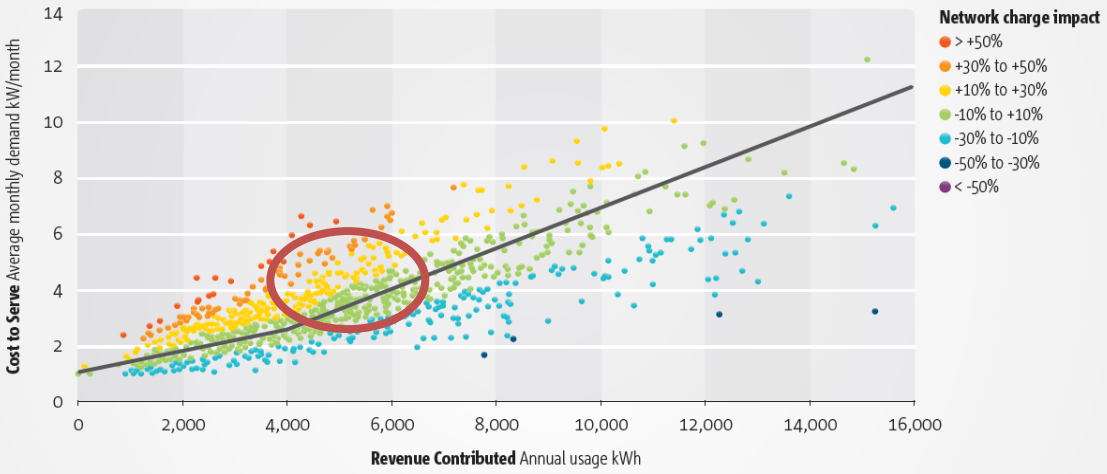
Figure 8: Estimated difference in network charges between tariff options (demand; standard) vs Annual Consumption



These results are similar to those indicated by SA Power Networks in their Tariff Reform Consultation Paper (September 2015)[8]. In SA Power Network's Figure 9, the red oval highlights the consumption range of most BTH Participants (around 2,000 to 6,000 kWh pa) and that most of these experience an increase in network charges.

Figure 9: 'Residential without PV' customer sample

'Residential without PV' customer sample, showing impact of cost reflective network prices vs current prices. Network costs are about half of the retail bill. Break-even line shown in black.



The median annual usage for residential customers is 4,000 kWh pa (x-axis measure). Such a customer has an annual retail bill of about $1300 pa to $1500 pa depending on which retailer they use. A 40% network price change/20% retail price change would be about $280 pa.

The case studies of Section 5 however provide examples of households that would experience increases and decreases. Households #45 and #925 would both expect a reduction in network charges of 10-15%. Both of these have what is referred to as good "load factors": the ratio of average to peak demand. Household #633 provides a case study of a household who can expect a significant increase in network charges (approx. 14%, around $80 pa). In this case, the household has a load factor of around 10% and can be seen to incur 'demand charges' from short-term spikes in demand likely to be related to electric cooking.

This component of the project seeks to understand the implications of network tariff reform on BTH participants. Under recent changes to the National Electricity Rules, electricity network tariffs for households and small businesses must become more cost-reflective from 2017[9]. This is expected to involve a change to interval metering (from 2018) and network tariffs based on monthly peak demand as well as total consumption. Network charges, on average, comprise half of a household's total electricity bill.

[8] Available from http://talkingpower.com.au/your-views/tariff-structure-statement-consultation/

[9] http://www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements

SA Power Networks has had a residential demand tariff available since July 2014. The preliminary analysis is based on the published 2015-16 prices. It is noted that the final tariff design for the period 2017-20 is the subject of a formal regulatory process – the Tariff Structure Statement that is being reviewed by the Australian Energy Regulator (AER)[10].

4.3 Behaviour Change

Extent to which project has influenced behaviour change

The consortium acknowledged from the outset that behaviour change is historically difficult to measure but viewed it as an important element of the project, and worthy of qualitative research of a significant scale to provide a robust assessment. The project undertook in depth interviews with 50 tenants to assess behaviour change and changes in comfort as a result of this project. Sustainable Focus conducted these interviews asking a series of predetermined, open ended questions. It was found that health and cultural elements and other demographic influences as well as values and attitudes towards energy efficient practices were key drivers and barriers to adopting and investing in energy efficient products, appliances and capital improvements.

Tenants

In-depth post intervention interviews with 50 tenants indicated that sixty-four (64%) of respondents self-assessed to making changes to their energy-related behaviours after the energy visit. The most frequently-reported changes included turning appliances off at the switch, not over-using the air conditioner, sealing drafts, closing doors and not running the air conditioner too cold in summer and warm in winter.

Table 12 Energy Related Behaviours Implemented

Recommendations implemented	No. of mentions
Turn appliances off at the switch	14
Close doors	7
Don't over-use the air conditioner	5
Close the curtains	5
Seal drafts	5
Don't run the a/c too high/low	5
Wash clothes in cold water	3
Short showers	3
Check the energy monitor	3
Use the sun's warmth	2
Turn a/c off when desired temp. reached	2
Use energy-saver globes	2
Close old a/c vents	1
Dress warmly	1
Screen door fitted	1
Awnings installed	1

[10] https://www.aer.gov.au/node/42356

"I would like to get some blinds for the kitchen against the afternoon sun, but they have to be approved so I can't just go and get the ones that are on special"

Participants also indicated a range of further energy-saving improvements they would like to make to their dwellings, suggesting that cost and attaining 'landlord buy-in' remained key barriers to doing so. Most frequently these included purchasing solar panels, upgrading appliances, getting awnings and repairing wall and ceiling cracks.

Other responses included new door frames, roller shutters, double glazing, more doors, insulation, getting a fan, changing windows, getting blinds, changing to gas, getting a better shower rose, solar water heating and erecting a veranda.

In reporting barriers to saving energy, participants routinely mentioned "getting the landlord to fund the improvements" as the key sticking point, as well as the cost of any improvement they decide to make themselves. Health, age and comfort were also presented as key barriers. One respondent who had made energy-saving improvements to a previous home asked "why would I spend the time and money doing something that's really just going to benefit the landlord? I would if there could be some arrangement like a rent reduction".

"I'm not going to do all those things when it's someone else's place".

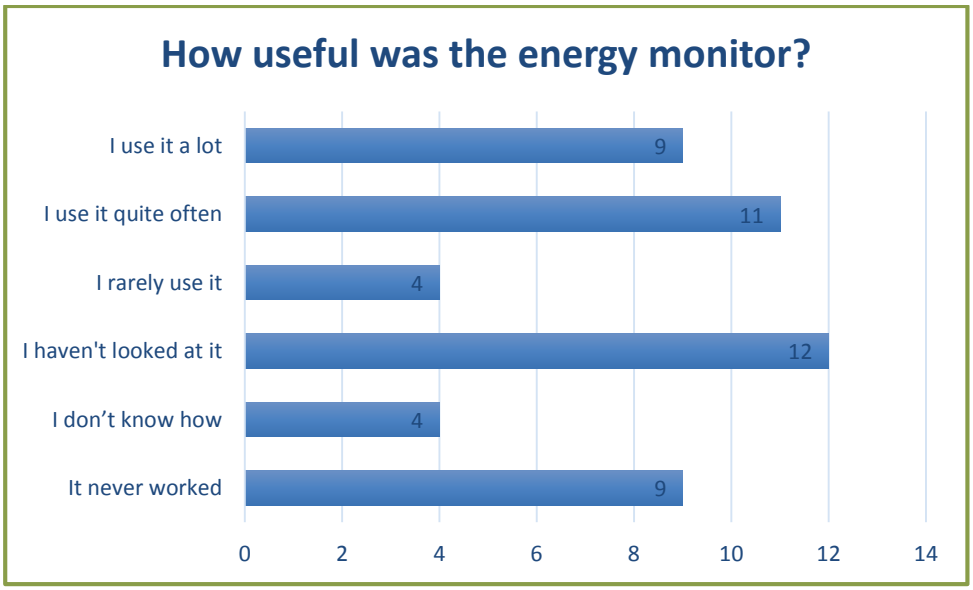
Eighty percent (80%) of surveyed tenants commented that they felt either a little bit or a lot more confident in successfully taking action to reduce energy use in their home as a result of being involved in *Beat the Heat!*.

In Home Display

Beat the Heat! also utilised an In Home Display as a way of encouraging behaviour change. Fifty percent (50%) of respondents did not use their energy monitor at all (18% stated it never worked and 8% said they do not know how to use it). One respondent reported having read an alarming article about problematic radiation emitted by smart meters that convinced her to turn hers off.

Forty percent (40%) of respondents reported using the device quite often, or a lot.

Figure 10 How Useful was the In Home Display



For respondents who found the monitor 'useful' (referred to it quite often) and 'very useful' (referred to it a lot) key benefits included its educational value as outlined in Table 13.

Table 13: Key Benefits of the In-home Display for those who found it useful

Key Benefit of the In-home Display	No. of mentions
'taught them which appliances use the most power', and how to manage their use to maintain appropriate usage levels	13
the mere presence of the monitor (e.g., walking past it in the kitchen) serves as a reminder to turn off unused appliances	7
it shows 'a little effort makes a difference', and that it can inform appliance upgrades.	1
more comfortable about the 'unknown' of the new air conditioner in that she could see its effect on power usage rather than 'waiting to be surprised by the bill'	1

Landlords

86 landlords completed the survey to provide the following insights into their actions and motivations.

Outside direct actions that were undertaken as part of the project, a modest number of landlord (only 1/3 of those who answered related questions) indicated additional actions taken to improve the energy efficiency of their rental properties. Many cited financial constraints as being the main impediment for making further changes, together with perceptions of the tenants currently 'being happy' (i.e. there was no impetus for making further change(s)).

Landlords completing the first survey identified up-front cost as the biggest **barrier** to implementing energy efficiency. Table 14 indicates the main motivation for landlords in participating in the project. 21% of landlords states that they were motivated to participate because of the 'win win outcomes' of the program suggesting the felt that the landlord split incentive had been appropriately addressed. Interestingly the benefit to the tenants was the main response at 42% which was either more important that the split incentive, or the split incentive was adequately addressed to be overridden as the main motivator.

Table 14: The main motivation landlords reported for participating in the project

Main Motivation for Landlord Participation in the Project	No. of mentions
Benefits to tenants (improved comfort and/or lower energy costs)	36
Win-win outcomes (benefits to both tenant and landlord)	18
Free/reduced cost air conditioner; capital upgrades to property	12
Energy saving (or similar, such as helping the environment)	14
Encouragement by land agent	8
Request by tenant	5
Make property more attractive in future for tenants (easier to rent out)	3

Overall, the respondents indicated a strong level of satisfaction with the project and perceived it as an additional benefit that their property was able to offer to tenants.

Further to this, in general terms, participants indicated that the recommendations on further actions on how to save energy in my rental property were useful; and 72% agreed or strongly agreed that they were more likely to implement actions to help tenants save energy OR improve their comfort since participating in *Beat the Heat!*.

For those landlords who had undertaken some actions to improve the energy efficiency of their rental property, the key areas of focus had been on reviewing the hot water service, focus on minimising the loss of heat / entry of heat through replacing window covering and adding internal doors.

A number of respondents highlighted that the project had increased their knowledge of energy efficiency and how to save energy. For others, the process was perceived to be positive and worthwhile, and some noted with enthusiasm that they would like to be involved in any similar projects in the future.

The project team was able to gather feedback from a small sample of landholders (totalling seven (7) in number) who chose not to partake in the *Beat the Heat!* Program. The results of the survey are noted below:

Hearing about the project
When asked about whether they recalled hearing of the project from Lin Andrews Real Estate 100% of the seven (7) participants noted that they did.

Rationale for not participating
When asked about the main reason why they chose to NOT participate, the most common reason landlords gave was that they had already made energy efficiency improvements in their rental properties (50% of those who answered the question).
Two other reasons most commonly cited by landlords for non-involvement were:

- The rent freeze variable embedded in the BTH project
- That they couldn't see any personal benefits

A number of other reasons were also noted:

- That the landlord will be demolishing the house
- That the property was new
- That the landlord was abroad and not likely to be interested in the project

Capital upgrades
When asked specifically about if they had previously undertaken capital upgrades to improve energy efficiency in their rental properties 50% of landlords stated they had and 50% stated that they had not.
(Note: only 6 of the 7 participants answered this question).

Barriers to implementing energy efficiency
Interestingly, the most significant barrier for implementing energy efficiency in their properties was not perceived to be upfront cost, but that landlords don't have time to think about the issue.

Perceptions of the role of property managers to assist with energy efficiency

Of the five (from seven) participants who answered the question relating to perceptions of the property manager in assisting landlords and tenants with energy efficiency, 80% (four participants) stated they did not. The remaining one participant (20% of responses) stated that they did.

4.4 Comfort

This section explored the extent to which participants perceive they have improved their thermal comfort, contrasted with any changes in energy consumption

Household comfort information, which was collected throughout the course of this project, was obtained through both household surveys, relating to their perceptions, and iButton dataloggers recording hourly temperature in the household space where interventions would have the greatest impact.

The column of Table 15 entitled "Summer Comfort Change (Survey)" represents a numerical comparison between survey responses to a question asking about how comfortable householders were before and after the intervention. This numerical representation relates to each response being given a number of points from 0 to 4, namely:

Response	Score
"I was never comfortable"	0
"I was rarely comfortable"	1
"I was comfortable about half the time"	2
"I was moderately comfortable"	3
"I was very comfortable = 4"	4

By this rationale, an increase in comfort by one level is represented by positive one and a decrease in comfort by one level is represented by negative one.

It should be noted that temperature data were collected for 209 households with varying degrees of project participation, and post-intervention temperature data, during summer months, were successfully collected for 107 clients. Due to the various challenges associated with the temperature data collection process, data for 36 out of the 107 clients were excluded from Table 15, based on the fact that less than two weeks of post-intervention summer data were available.

Data in the column of Table 15 represents a comparison between all available temperature readings for clients during the summer months from November to March, inclusive. These data are for the 66 clients where at least two weeks of post intervention summer data were available. The value is the percentage of the total number of temperature readings where the air-conditioner was in use, as an indication of household occupancy, and the temperature was below 27°C, a commonly used threshold for summer thermal comfort. Data in this table also show the way a client perceived that their electricity bill had changed since the intervention and also the type of intervention: "ac" = Air-conditioner; "ins ac" = Insulation and an Air-conditioner.

Most of the tenants who perceived that their power bills had “gone down” following the intervention also perceived that their level of comfort had increased by an average of 1.7 points. If it is assumed that each positive point represents an ‘increase in comfort’ of 20%, this would correlate to a 34% increase in perceived thermal comfort. This increase in thermal comfort appears to be supported by the monitored temperature data, with comfort achieved in an average of 70% of recorded temperature readings throughout the summer months.

It is interesting to note that for two out of the total three project clients from this data subset, who identified a perceived reduction in their thermal comfort, living area temperature readings were less than 27°C (i.e. comfortable) for over 99% of recorded measurements.

Finally, for all project clients in this data subset who identified some improvement in thermal comfort, the average increase was found to be 2.4, which based on the assumption that each positive point represents an ‘increase in comfort’ of 20%, would represent a 48% increase.

Table 15: Summer comfort data from surveys and iButton temperature loggers (2014-2016)

Client ID	Summer Comfort Change (Survey)	Post Int Elec Bill Change (Survey)	Comfort % (iButton)	Intervention Type	Post v’s Pre Int. Mains Energy Ratio
95	-1	Gone down	99	ins ac	1.35
691	No Response	Gone down	96	ins ac	N/A
169	3	Gone down	87	ins ac	1.06
487	0	Gone down	87	ins ac	1.26
93	3	Gone down	83	ac	1.52
271	4	Gone down	69	ac	0.78
1063	No Response	Gone down	53	ac	N/A
275	1	Gone down	53	ac	0.94
485	0	Gone down	39	ins	N/A
835	1	Gone down	34	ac	N/A
451	3	Gone down	32	ins ac	N/A
715	2	Gone down	15	ins ac	1.67
771	3	Gone down	4	ac	N/A
567	-2	Gone up	100	ac	N/A
147	2	Gone up	99	ac	N/A
649	3	Gone up	67	ins ac	N/A
59	3	Gone up	47	ins ac	0.81
251	-1	Gone up	42	ac	0.20
907	3	Stayed the same	99	ac	N/A
883	2	Stayed the same	99	ac	N/A
739	2	Stayed the same	97	ac	N/A
943	2	Stayed the same	97	ac	N/A
933	3	Stayed the same	95	ac	N/A
931	2	Stayed the same	83	ac	N/A
905	3	Stayed the same	77	ac	N/A
515	2	Stayed the same	64	ac	N/A
949	2	Stayed the same	61	ac	N/A
57	No Response	Stayed the same	49	control	N/A

71	2	Stayed the same	41	ins ac	0.21
281	4	Stayed the same	41	ac	0.95
199	No Response	Stayed the same	36	ac	N/A
293	1	Unsure	95	ac	0.86
193	2	Unsure	94	ac	0.55
725	2	Unsure	93	ins ac	N/A
45	0	Unsure	91	ac	0.75
797	4	Unsure	87	ins ac	N/A
697	0	Unsure	83	ac	N/A
215	No Response	Unsure	78	ac	N/A
917	1	Unsure	75	ac	0.98
731	2	Unsure	23	ins	N/A
455	No Response	Unsure	12	ac	1.03
495	No Response	No Response	100	ins ac	0.42
597	No Response	No Response	100	ins ac	N/A
951	No Response	No Response	100	ac	N/A
903	No Response	No Response	99	ac	2.46
735	No Response	No Response	99	ins ac	N/A
191	No Response	No Response	98	ac	1.56
927	No Response	No Response	97	ac	N/A
337	No Response	No Response	96	ac	0.73
919	No Response	No Response	95	ac	N/A
491	No Response	No Response	95	ins ac	0.63
967	No Response	No Response	89	ac	1.25
607	No Response	No Response	88	ins ac	N/A
901	No Response	No Response	87	ins ac	1.68
1047	No Response	No Response	82	ins ac	N/A
627	No Response	No Response	82	ins ac	N/A
769	No Response	No Response	71	ac	N/A
39	No Response	No Response	65	ac	1.04
145	No Response	No Response	58	ins	N/A
845	No Response	No Response	52	ac	1.26
789	No Response	No Response	45	ins ac	N/A
351	No Response	No Response	39	ac	0.51
195	No Response	No Response	37	ac	0.66
343	No Response	No Response	32	ac	N/A
339	No Response	No Response	31	ac	1.24
681	No Response	No Response	16	ac	N/A

Perceived Comfort

As previously discussed fifty (50) residents were interviewed, providing feedback on how the air conditioner and/or insulation installed on their premises had impacted upon their comfort, lifestyle and finances, as well as the broader impact of participation in the project on their energy-related behaviours. 81% of responses indicated a self-reported improvement in comfort.

"The insulation has made a huge difference in that now when she heats or cools the place the temperature stays comfortable for longer."

"It just means you're not limited by discomfort in terms of what you can do at home."

The interview participants reported a greater increase in comfort in winter. However, it must be noted that many participants did not have their air-conditioner/insulation installed in time for use last summer and as a result summer feedback is distorted.

Air conditioners and/or insulation were found to have made significant improvements to comfort in a majority of homes. Specifically, they were pervasively found to have made homes more 'liveable', meaning that residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons.

"It just makes life feel like a bit less of a struggle when you're that bit more comfortable."

Winter Comfort scores

- Average WINTER Comfort Score for the full sample BEFORE interventions was **2.1.**
- Average WINTER Comfort Score BEFORE interventions for the sample completing BOTH surveys was also **2.1.**
- Median was 2 (i.e. "I was comfortable about half the time").
- Average WINTER Comfort Score AFTER interventions for the sample completing BOTH surveys was **3.1.**
- Median was 3 (i.e. "I was moderately comfortable").

Summer Comfort scores

- Average SUMMER Comfort Score for the full sample BEFORE interventions was **1.7.**
- Average SUMMER Comfort Score BEFORE interventions for the sample completing BOTH surveys was also **1.7.**
- Median was 2 (i.e. "I was comfortable about half the time").
- Average SUMMER Comfort Score AFTER interventions for the sample completing BOTH surveys was **3.2.**
- Median was 3 (i.e. "I was moderately comfortable").

"It is more comfortable for the children for sleeping and bathing. I have a child who gets up very early when it is freezing, so the warmth of the a/c has kept me sane!"

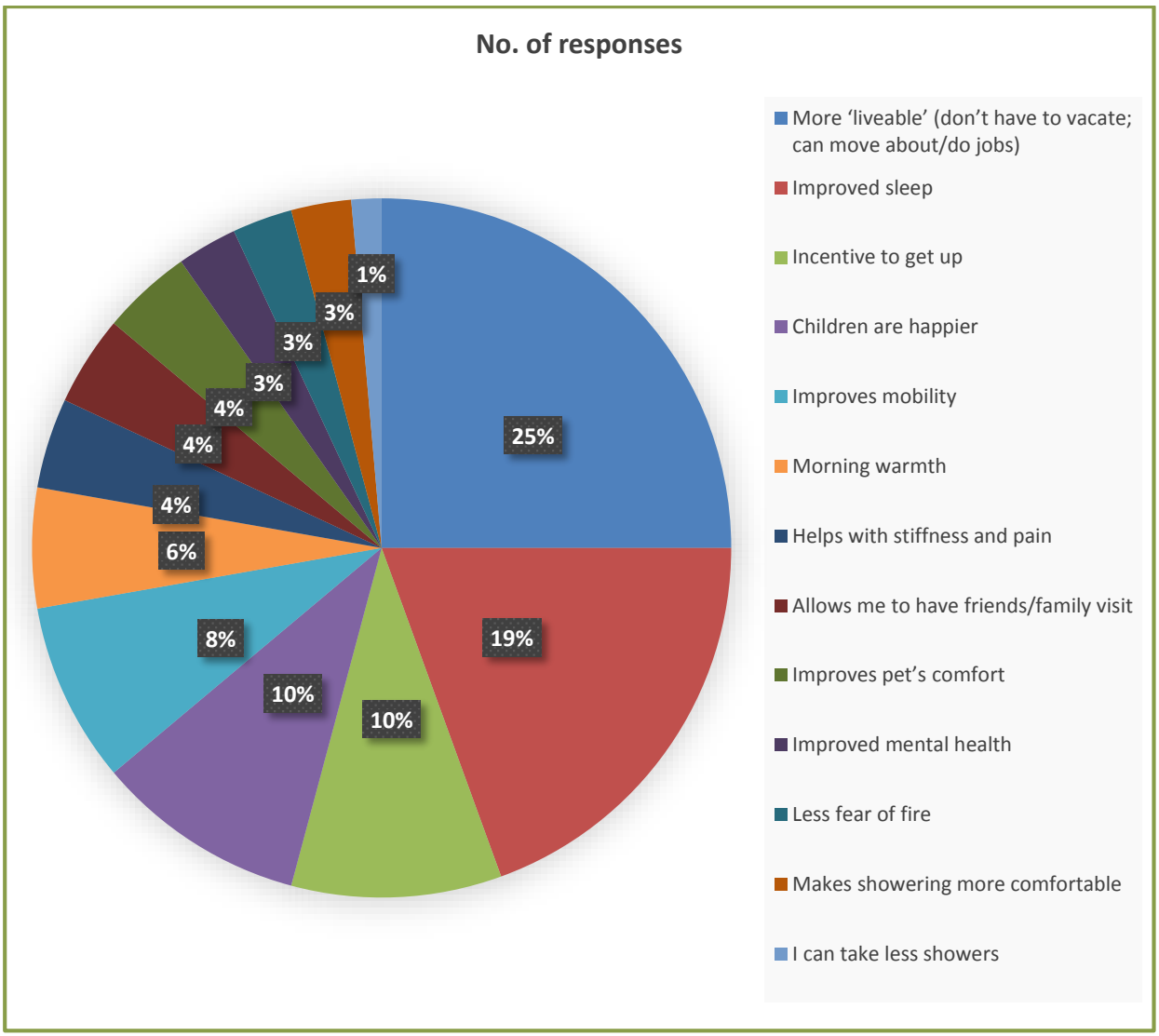
The vast majority of participants (92%) were satisfied with the air-conditioner and/or insulation they received. Indeed, 76% reported high satisfaction levels. Only two (2) participants registered dissatisfaction, while one felt 'neutral'.

For respondents who registered high levels of satisfaction (76%), key drivers included affordability, increases in effectiveness and efficiency, greater sense of "liveability" and comfort, and a perception that activities need not be dictated by the weather. A small number of participants felt dissatisfied and cite issues including a lack in 'noticeable changes in comfort' and a waste of time as deterrents for project involvement.

The participant responses to the ways in which their comfort increased since the installation of their air conditioner/insulation are seen in Figure 11.

"It means you can still be sociable on the stinking hot days"

Figure 11: Responses to Ways In Which Comfort Has Increased - Telephone Survey (50)



Air conditioners and/or insulation were found to have made significant improvements to comfort in a majority of homes. Specifically, they were pervasively found to have made homes more 'liveable', meaning that residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons.

Residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons

Only half of respondents had noted an increase in their energy use in the period since the installation of their air-conditioner/insulation. The same number noted a decrease in use, while the other half had noted no difference or had not yet received a bill. Nearly half of all participants had been actively trying to save energy over the relevant period.

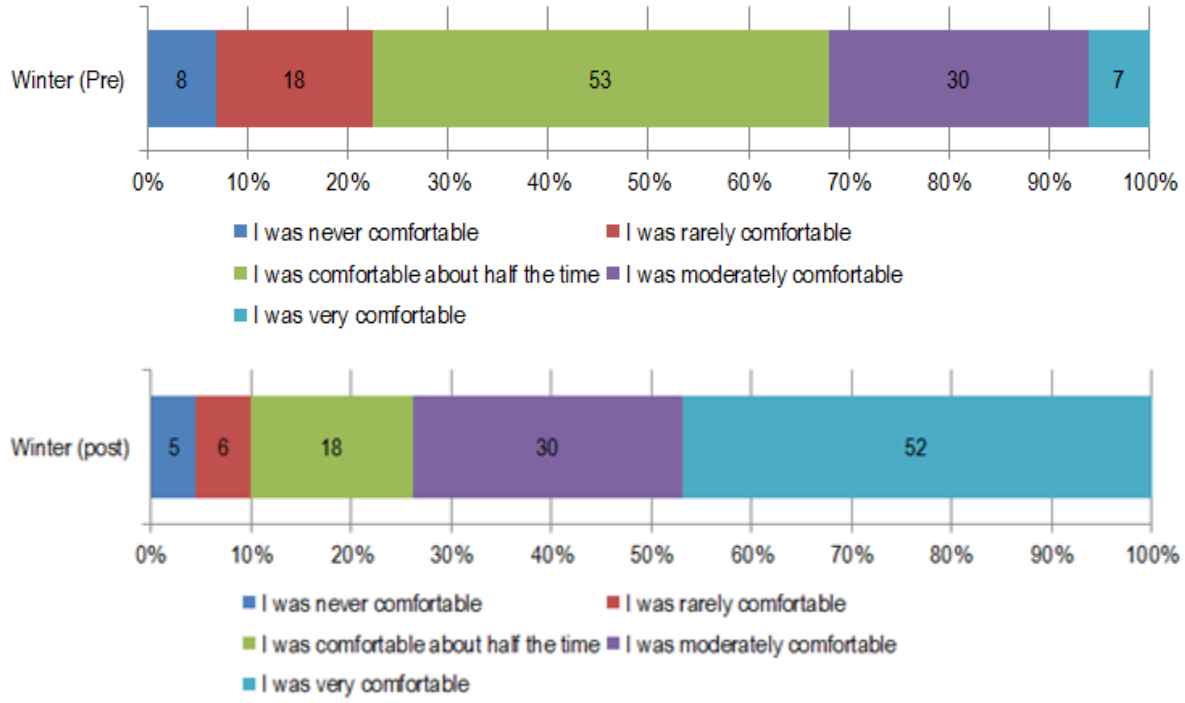
Overall changes in energy use (either positive or negative) were regarded as "very small". Importantly, only two participants reported a marked increase in their energy use since the installation of their air conditioner.

> *"In winter it helps me get up and it means I can do things in the evening without having to wear heavy layers."*

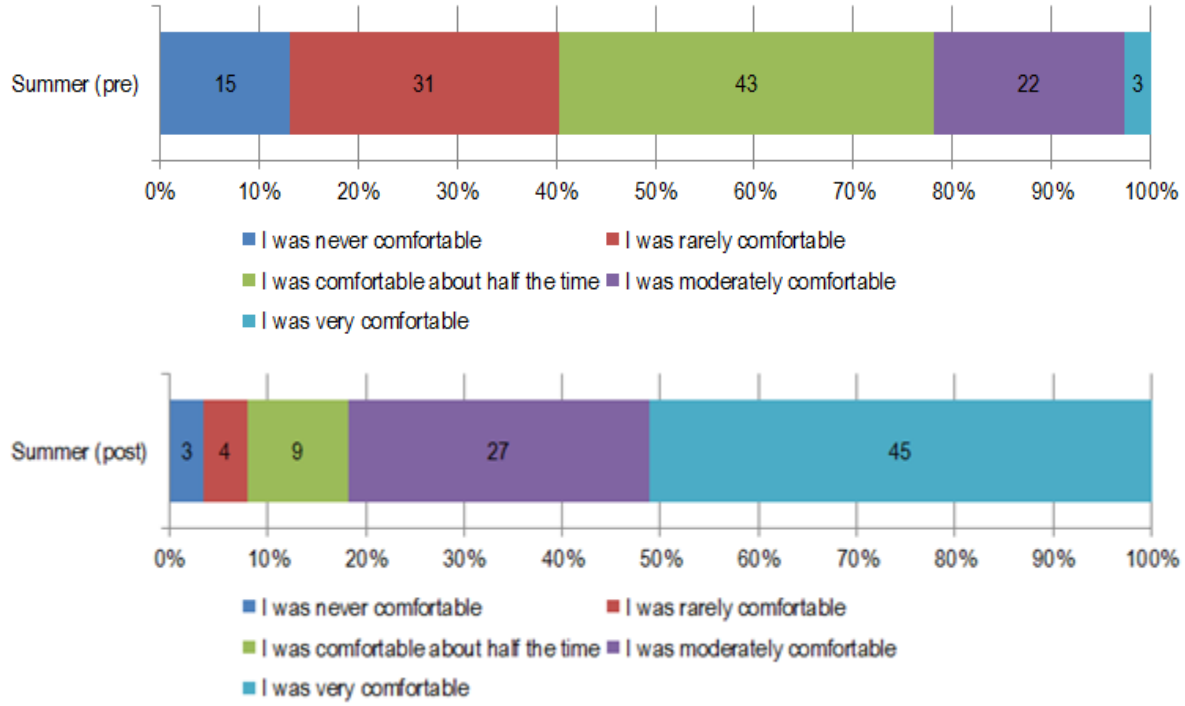
Tenant Pre and Post – Intervention Surveys

The tenant survey responses (see Appendices A and B) revealed lower levels of comfort in summer than winter prior to the project. 117 of the original 178 survey respondents also completed a post-project survey that asked identical comfort questions. The sample size has become too small for definitive statements but the responses suggest that comfort improved in both summer and winter but to a greater extent in summer. Further, it suggests that the tenants have achieved a more 'year round' level of comfort compared to the clearly lower levels of summer comfort reported in the original survey.

Q1: **Thinking about the TEMPERATURE in your home, how comfortable were you in your home last WINTER?**



Q2: Thinking about the TEMPERATURE in your home, how comfortable were you in your home last SUMMER?



Landlords

When asked specifically about whether tenants were happier since the *Beat the Heat!* interventions, just over 1/3 of the landlords agreed, 16% strongly agreed and just under half (44%) were unsure. However, when asked about whether the comfort of their tenants was important to them 92% landlords stated that it was.

4.5 Temperature

This section explores measure 5: Comparison of temperature difference associated with previous thermal system and post-intervention energy efficient thermal systems.

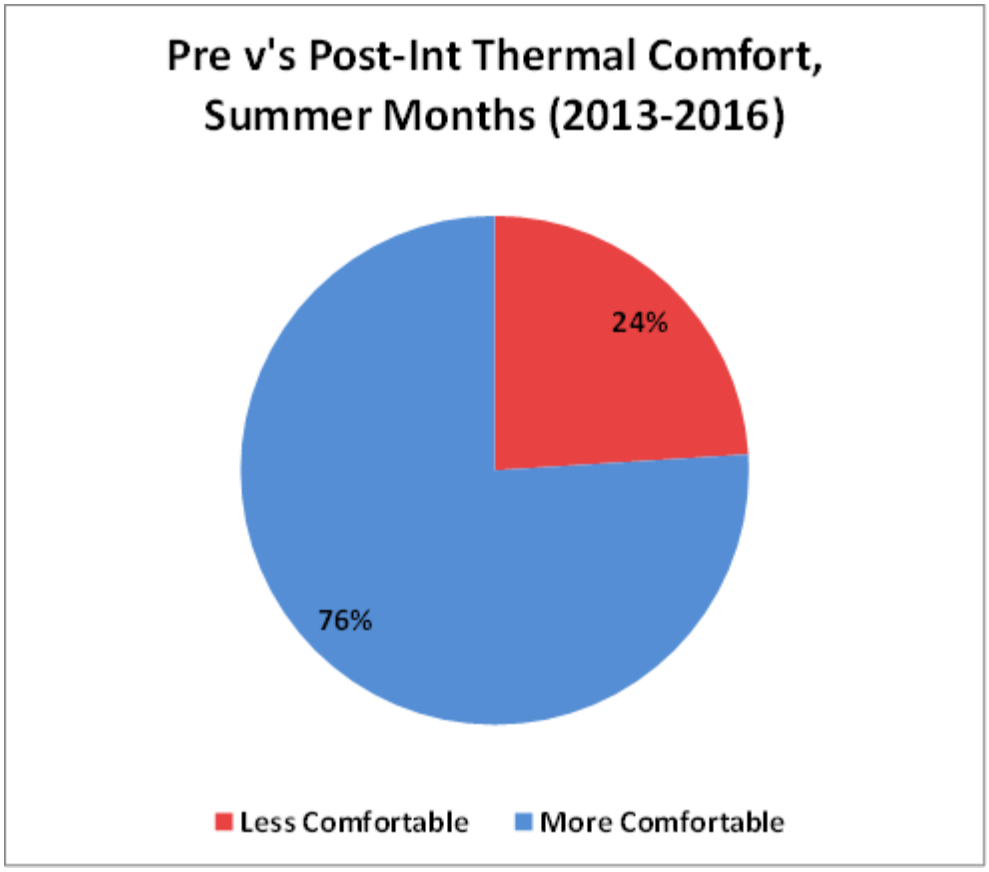
Unexpected delays to the project start date coupled with the need to meet intervention milestones early on resulted in a variation in methodology regarding measuring temperature data. Originally the project hoped to have 50 households that didn't receive the intervention for a full summer but had the temperature and monitoring equipment installed early in the 2013-14 summer. Due to time constraints this was not possible and the program was modified to try to capture more households with i-Button temperature dataloggers to record the temperature in their main living areas. This larger sample was designed to enable the project to ensure that households are either maintaining or improving comfort levels in the home.

Pre and post intervention temperature data was collected during summer months between November and March for comparison of the impact of intervention on thermal comfort in 93 households. It was found that, in total, the number of hours where thermal comfort was achieved

following the interventions was 7% higher than that prior to interventions, with 88% of all monitored temperatures being below the 27°C comfort threshold. On average for each household, 93 days of pre-intervention temperature data was compared with 133 days of post intervention temperature data, to calculate the aforementioned improvement in thermal comfort. It should be noted that out of the 93 households, 76% experienced an increase in their overall percentage of thermal comfort (Figure 12), with a further 4% experiencing a slight (<1%) change.

In order to investigate why a number of households had worse comfort temperature results after the intervention, the degree days method was used to evaluate the impact of the weather conditions during the monitoring period for all the houses with decreased comfort. It was found that for these less comfortable households, the average daily degree days were over 90% higher in the post intervention period. In other words, the weather was considerably hotter during the post intervention temperature monitoring period.

Figure 12: Changes in post-intervention comfort for summer months (2013-2016)



Further analysis of comfort based on the type of cooling system in place prior to the intervention demonstrates that for those houses with no AC installed prior to the intervention, 80% (24 out of 30 households) had improved thermal comfort (with an average 12% increase from 76% to 88% for all 30 households). For households where thermal comfort decreased after the intervention, it was found that all of these experienced more severe weather in the post intervention period, represented by a 94% (1.94 times) average increase in the cooling requirement, based on degree days.

For all houses where some form of AC was installed prior to the intervention (i.e. old AC, portable or ducted evaporative), 76% (44 out of 58 households) had improved post-intervention thermal comfort (with an average 6% increase from 83% to 89% for all 58 households). For households where thermal comfort decreased after the intervention, it was found that all but one of these experienced more severe weather in the post intervention period, represented by a 117% (2.17 times) average increase in the cooling requirement, based on degree days.

4.6 Stakeholder Group Feedback

This section discusses the extent to which qualitative feedback from each stakeholder group (tenants, landlords, property managers, energy workers) informs the evolution of the project's strategies and informs the findings in relation to overcoming the identified barriers.

Because the project was based on adaptive learning, the ability to evolve and respond to feedback and project discoveries was particularly important.

4.6.1 Process Mapping

One specific practice that was applied by the project team was *Process Mapping*. Ideally this would have been initiated prior to the project starting but given time constraints it was something that was undertaken as the project reached a high level of intensity.

Feedback from the Uniting Communities' staff noted that the process mapping exercise undertaken at various intervals of the project was perceived to be valuable. The *Process* Mapping created opportunity to clarify timelines, clarify the process, consider accountability and recognised that the project process needed to be particularly fluid in the early project phase.
In the words of one staff members:

The concept of the process was brilliant and I'm very glad that we did it!

Over a period of months, through the *Process Mapping* practice data was revisited and readjusted as new information, project challenges and preliminary findings came to light.

One of the challenges that the Process Mapping generated for the project management team was the subsequent need to adjust and update the project plan, including anticipated outcomes and timing.

4.6.2 Consortium Communication

The consortium had scheduled meetings from the start of the project with the Governance Group, Operations (data, households and intervention) Groups all meeting monthly or bi-monthly depending on the phase of the project. These meetings provided an excellent opportunity to explore what elements of the project were working well and where modifications and improvements were needed.

We could bring to these meetings the feedback we were receiving from our project participants including matters like the tenants letting us know that it was confusing being contacted by many different people, causing us to reassess and alter our communication methodology.

Energy workers attended operational and governance meetings as appropriate to share their 'experiences on the ground' and find out more about the overarching aims and rationale behind the project.

The Governance Meetings also provided us with a platform to regularly review and monitor Risk Assessment Register and methodologies. The register was updated on many occasions as a result.

4.6.3 Participant Feedback Loop

In addition to the feedback received during the project the interviews with landlords and tenants provided invaluable feedback for future projects. The nature of the qualitative data amassed through the interview process resulted in a rich understanding of participants' motivation, reflections on their involvement with and opportunity for improvement within the project.

Tenants

In-depth post intervention interviews with 50 tenants noted opportunity for improvement to future projects including having explicit discussions about participant expectations prior to commencement, actively facilitating the landlord/tenant relationship, and differentiating the information and materials provided for participants having different levels of technological and physical ability.

Suggestions around improvement to *Beat the Heat!* from tenants also included the need for more information and support regarding air conditioner maintenance and use of the energy monitors Ninety-four percent (94%) of all tenants interviewed indicated that their involvement in *Beat the Heat*! had been a positive experience overall.

Participants listed a range of improvements they would like to see made to their homes if money, time, and their landlord's approval were no object. Most frequently these included purchasing solar panels, upgrading appliances, getting awnings and repairing wall and ceiling cracks.

Other responses included new door frames, roller shutters, double glazing, more doors, insulation, getting a fan, changing windows, getting blinds, changing to gas, getting a better shower rose, solar water heating and erecting a veranda.

Landlords

Post intervention surveys with landlords indicated a strong level of satisfaction with the project and a general perception that the project added benefit for tenants.

In general terms, landlords indicated that the recommendations received relating to energy savings in their rental property were useful. The recommendations make it more likely that they would and

that they were more likely to implement actions to help tenants save energy OR improve their comfort since participating in *Beat the Heat!*.

An overwhelming majority of landlords completing the second survey indicated that they considered offering *Beat the Heat!* project an 'additional benefit' to the property management services provided.

4.6.4 Consortium Feedback for Future Improvements

Sustainable Focus conducted the following Focus Groups:

- Staff Group (Appendix I)
- Property Managers (Appendix J)
- Governance on Recruitment (Appendix K)
- Governance on Stakeholder perspectives (Appendix L)
- Governance on Data Collections (Appendix M)
- Governance on Governance Lessons (Appendix N)

These focus groups provided the project with a rich amount of information about what worked well and what could be improved. The key message that came through time again and from all stakeholder groups was the need to plan more at the start of the project, however the need to meet milestone targets immediately was a real or perceived barrier to more up-front planning. Other key lessons related to communication with potential participants as well as streamlining processes.

4.7 Property Manager Role

Development of specific recommendations regarding the role of the property manager than can be applied more broadly.

The ability to have strong buy in to the project from the Property Managers was a critical success factor for the project. A significant factor in this is the strength of relationships – or relationship capital that the property managers have with their landlords and tenants. This gave the project traction with advertising and promotion, follow up on outstanding matters and provide greater detail around the value of switchboard upgrades were needed.

Feedback from the Uniting Communities' staff highlighted a few areas where property manager's engagement with the BTH project may have been strengthened:

- Stronger and clearer communication from the project team at the project's inception relating to expectations and likely input required.
    - For example, it was felt that in some cases the property managers might have been more expedient in passing information on to the project team such as a tenant moving out and or new tenants moving in. Many hours were spent following up with tenants who had moved out of the listed properties.
    - Another example cited was that of property managers offering names and contacts of possible tenant participants who were not eligible for financial reasons (This

resulted in income eligibility being reviewed and better defined as previously outlined).

- Such examples highlight the need for adequate screening of potential households before referral. There is a need for a dedicated person to do pre-assessments and be committed to follow up.
    - Get all the paperwork / consents in place at one time – a lot of energy is taken up chasing people for switchboard upgrades; landlord agreements, etc.
- Staff (on ground project team members) also expressed a view that perhaps the property managers did not appreciate the imposition that the project may cause the tenants, with regard to the regular visitations for information, installation and monitoring. A Role Playing session / day with property managers was suggested by one staff as a mechanism to increase this awareness.
- Because the project benefited most strongly from regular feedback and input from the property managers to the project team, one option for future projects is to consider the placement of a team member with the property managers to strengthen communication and information exchange.

Sustainable Focus ran a focus group, at the end of the installation period, with the Property Managers (PM's) that had involvement in the *Beat the Heat!* project to gain their perspective. It was interesting to see the level of interest from the PM's in the project, and that overall, they wanted more involvement in the process. This was not what had originally occurred when the project started.

It is suggested that improvements for the implementation of future projects could include:

- Ensuring that the PM's fully understand the aims of the project and how it will be delivered and what role they will play, etc.
- Ensure that the PM's know how the energy efficiency information regarding using the new appliance will be passed onto the tenant, and know where they can refer the tenant if they indicate that they are having trouble, or didn't receive particular information or required training.
- Consideration as to the role of the PM or landlord in the location of the RCAC unit. This would need to be carefully considered as it would add another layer of complexity to this process, but would ensure that the PM and landlord were fully informed and aware of what was happening in their property, giving them more ownership of the process. *'An owner expects us to have a running history on their property – so we need to know everything that has happened'.*

Other aspects for improving the program from the PM's perspective included:

- Ensuring that a copy of the instructions for the RCAC are sent to the PM's, along with laminated instruction sheets for the tenants as well as energy efficiency guidelines, ensuring that all PM's have access to the proof of purchase/warranty,
- Ensuring that the PM's have a copy of the energy efficiency recommendations given to the tenant and landlord, advising the PM's of properties where energy consumption increases.

The PM's had a few incidents where the installation did not occur as well as expected, this included roof sheets not being put back on properly and issues with old switchboards. One person was

worried about the installation of insulation due to the well-publicised issues associated with the last government insulation scheme.

The PM's also identified that many tenants and landlords were initially nervous, thinking that there would be a 'catch' to the project. When they realised that it was for their benefit, most were supportive of the project. One tenant raised concerns with the PM regarding the metering requirements but decided to participate and was happy with the project as it proceeded. The PM's also raised the number of visits required as part of the program and felt that this was an issue for the tenants - they are like 'really, do I have to keep doing this?'

The PM's recognised that participation in the project was beneficial for LARE:

- *'Yes. Other landlords have found out about it and wanted to be part of it'*,
- *'As a company it gives us another point of difference".*
- *We are not just about profit. It's working for the benefit of the community.'*

The PM's also noted that *Beat the Heat!* involvement would potentially increase the likelihood of a tenant staying (i.e. renewing their lease) which was generally seen as a real benefit for the landlord.

5 Case Studies

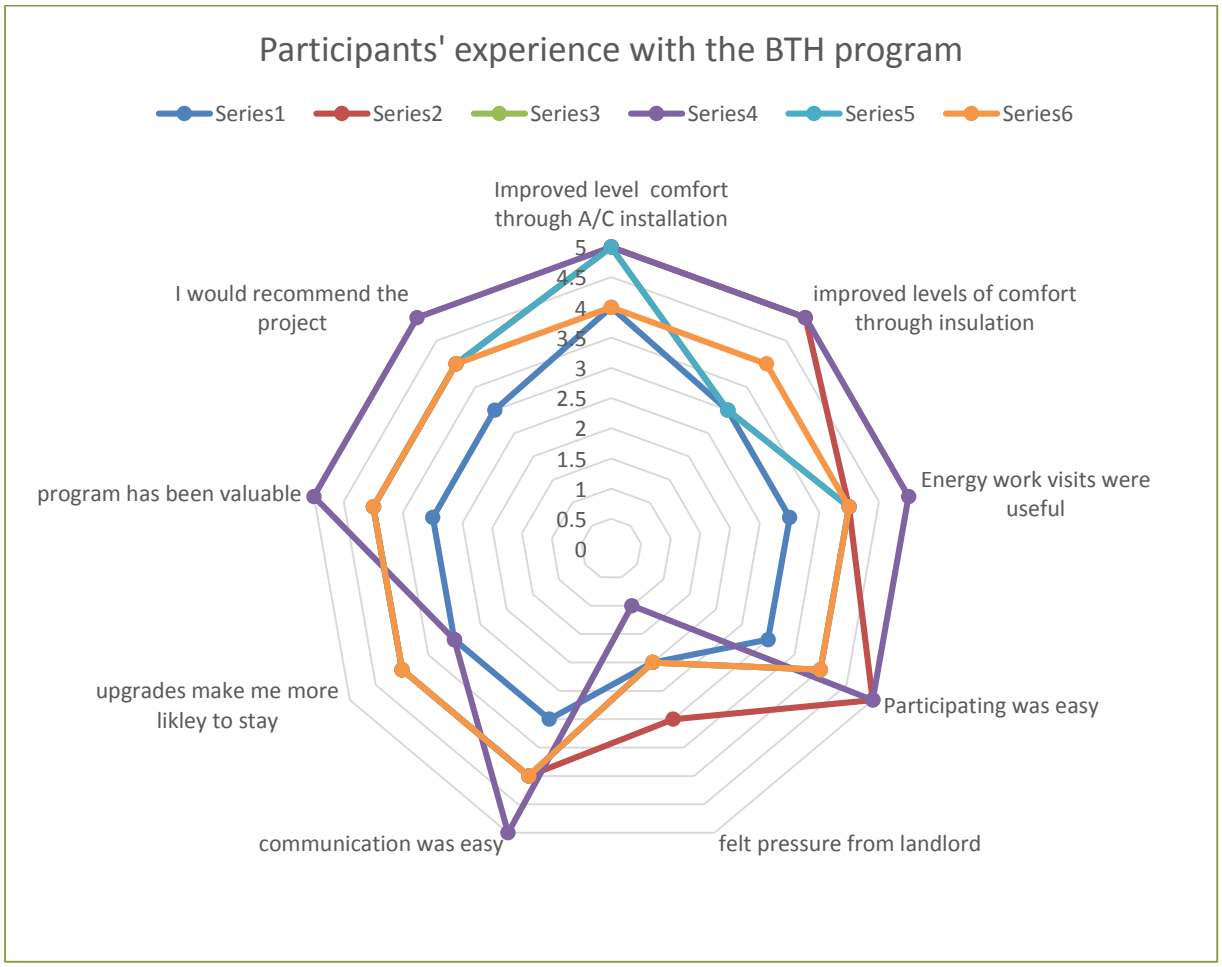
5.1 Household Case Studies

It is clear from the data analysis that the needs, expectations and outcomes for participants are quite diverse for a range of reasons. Six case studies of households have been chosen as a complement to the qualitative and quantitative results presented.

The case studies consolidate the survey responses, interviews and energy data for these households in order to illustrate the diversity of household situations and the impact the Project has had.

When asked about their experience with the project the participants illustrated consistency with their answers. This is evident in diagram 1 below.

Diagram 1: Participants' experience with the BTH project



CASE STUDY 1 - Household # 45

Demographics	Household income of $40,001 - $50,000 (Disability Support Pension)	 Couple with one Child
Energy consumption	Electricity Consumption 2015 = 3,900 kWh (10.6 kWh per day)	Gas connected
Health concerns	None identified	
Dwelling	Single storey house (Brick) approx. 35 years old	
Intervention	RCAC replacement. Existing insulation was in good condition and was therefore maintained.	
Results – energy reduction	Summer Billing data – daily consumption reduced 25% Weather corrected summer air-conditioning energy usage = 35% reduction	
Impact of Network Demand tariff	For 2015, Network component of bills would **reduce** 11% from $631 to $561 pa. Summer peak demand = 2.2 kW, load factor = 16%	
Actions as a result of energy visit	None identified	
Actions taken in last 3 months to reduce energy consumption (POST INTERVENTION)	• Change the temperature settings of air conditioner for heating • Taking shorter showers • Use the clothes line instead of a clothes dryer • Wash clothes in cold water • Remove/switch off second fridge or freezer • Purchase energy efficient appliances • Minimise use of electrical equipment	

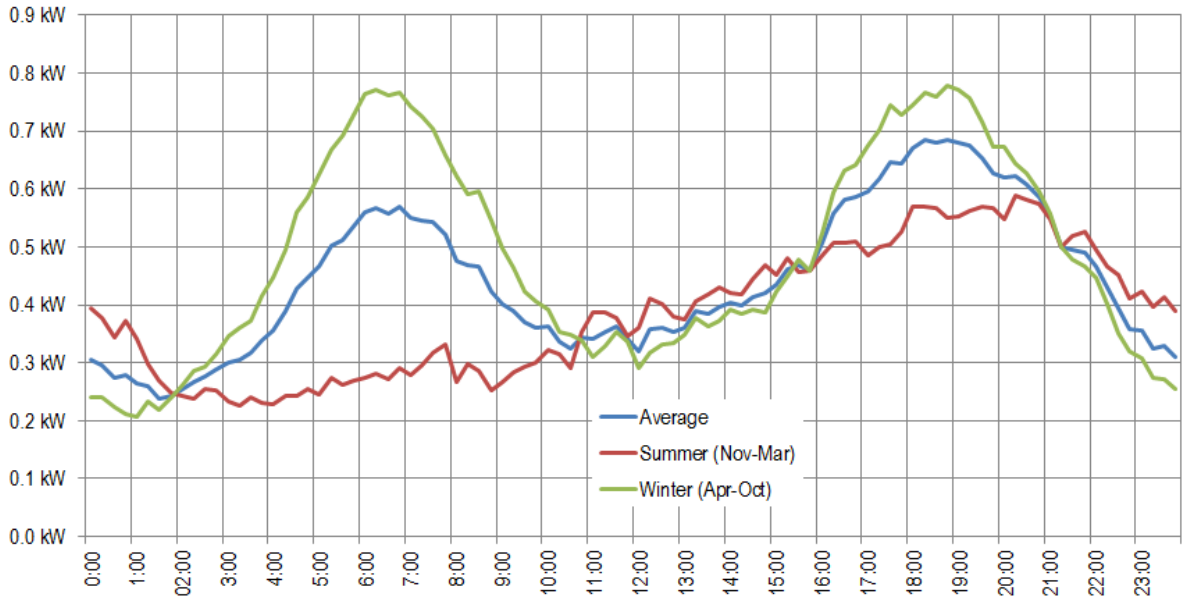
Other information about this household

- The participant had experienced financial difficulties because of an energy bill prior to participating in Beat the Heat
- The participant is pleased that the cooling worked well and hasn't 'blown out costs' stating that it is 2 or 3 times cheaper to run than a ducted system in his previous house
- The household had previously sought information about how to save energy in their home The major barrier to them taking action to reduce energy use on the home is financial
- On the really hot nights in summer they would move their matrass into the lounge room where the A/C is.
- A new fridge was recommended but they stated that "we can't afford it"
- The participant feels 'a lot' more confident to take action to reduce energy use in their home as a result of being involved in Beat the Heat

"It has meant we can sleep in summer! We move the mattress into the lounge and only use the room with the A/C."

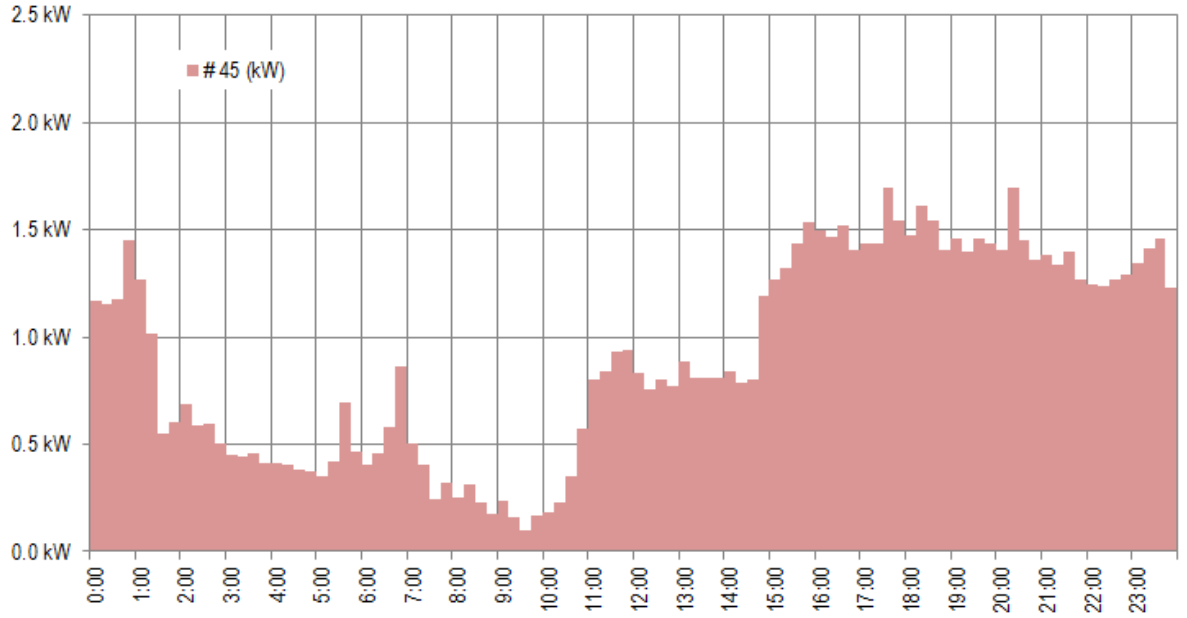
Household # 45 - Load Profiles

This household can be seen to display a load profile biased toward winter consumption with both morning and evening peaks. The timing of the winter peaks indicating the use of heating predominantly sits around school hours (i.e. before 9 and after 3). This household has a 'load factor' (ratio of summer peak to average annual demand) of 16% and analysis suggests this household would be better off under SA Power Networks demand tariff.



Household # 45 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to be sustained at around 1.5kW from mid-afternoon until the early hours of the morning.



CASE STUDY 2 - Household #59

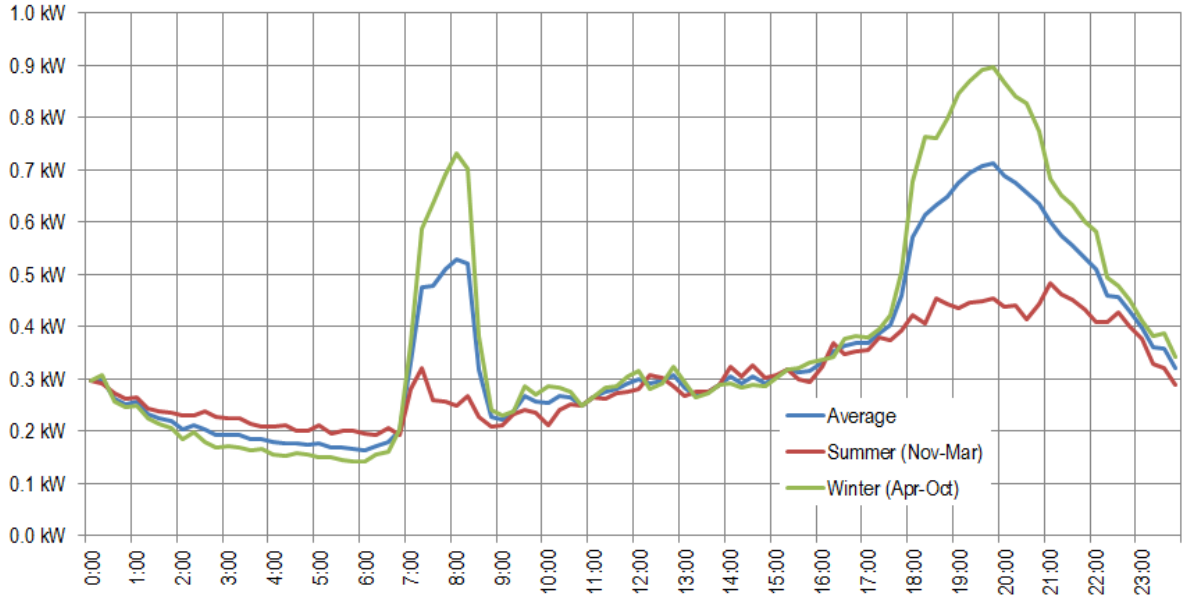
Demographics	Household income of $50,001 - $60,000 (wage earners)	 Two housemates (not related)
Energy consumption	Electricity Consumption 2015 = 3,100 kWh (8.3 kWh per day)	Gas connected
Health concerns	None identified	
Dwelling	Single storey house (Brick) approx. 55 years old	
Intervention	RCAC replacement and insulation	
Results – energy reduction	Summer Billing data – daily consumption reduced 19%	
Impact of Network Demand tariff	For 2015, Network component of bills would **increase 4%** from $516 to $536 pa. Summer peak demand = 2.6 kW, load factor = 12%	
Actions taken in last 3 months to reduce energy consumption	• Change the temperature settings of air conditioner for heating • Use the clothes line instead of a clothes dryer • Wash clothes in cold water • Switch off lights • Turn off appliances at the wall - such as TV and stereo • Minimise use of electrical equipment	

More information on the household

- High energy bills were a key concern and the participant had experienced financial difficulties because of an energy bill prior to participating in Beat the Heat
- The participant 'strongly agrees' their levels of comfort have improved "It has made the main living areas liveable and comfortable."
- She previously had an ineffective a/c in her lounge, but cooking and cleaning was still unbearable in the extremes of hot and cold. She says that in the extremes of the seasons her house was very uncomfortable without it. "I'm able to take better care of myself"
- She noticed the impact of the insulation straight away in that any heating or cooling used had a longer effect on the temperature even after she turned it off, which meant she only had to use the new a/c for shorter bursts.
- She finds the new a/c quiet ("it's not one of those blaring ones")
- The participant feels 'a lot' more confident to take action to reduce energy use in their home as a result of the program
- The participant uses the energy monitor and finds it useful for managing energy use "It just made it clear that you could keep it down it you made the effort".
- Participant stated that there could be a lot of energy improvements made to the dwelling including sealing drafts and floorboard cracks, installing blinds outside sunroom but stated "I'm not going to do all those things when it's someone else's place

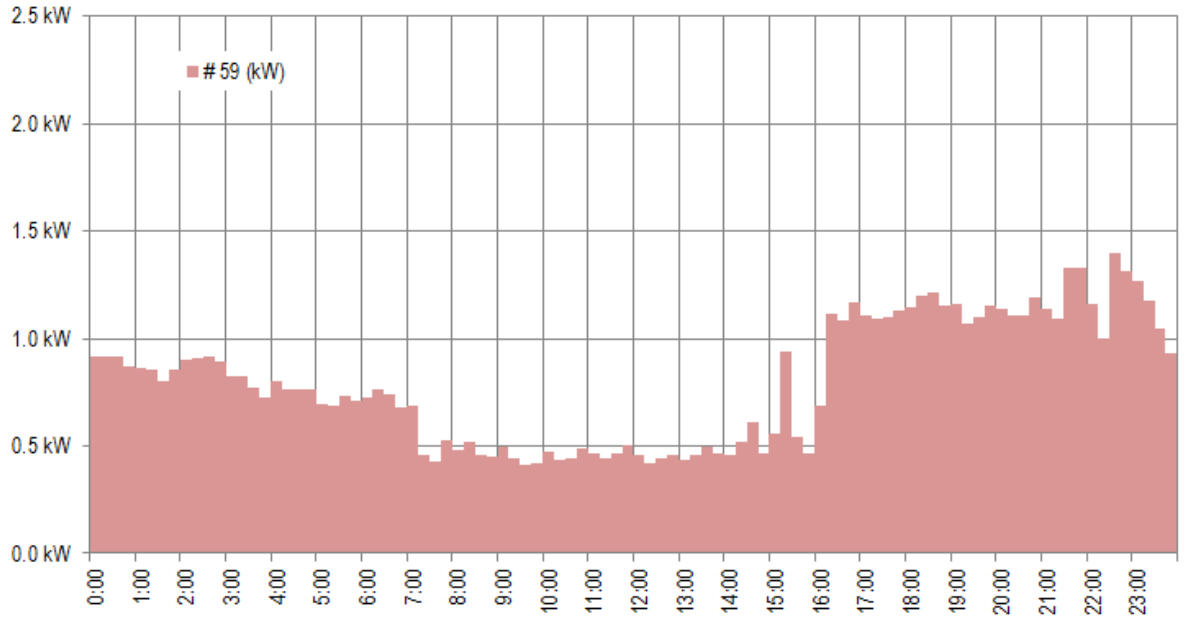
Household # 59 - Average Load Profiles

This household displays average load profiles consistent with being away from home during the workday (9-5PM). Predominant winter peaks indicate the regular use of heating supplementary to the installed RCAC. Due to relatively high peaks and modest overall consumption, this household has a 'load factor' (ratio of summer peak to average annual demand) of 13% and analysis suggests this household would not be better off under SA Power Networks demand tariff.



Household # 59 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to be sustained at around 1.0 to 1.5kW from mid-afternoon until around midnight.



CASE STUDY 3 - Household #193

Demographics	Household income of $40,001 - $50,000 (wage earners)	 Two adults
Energy consumption	Electricity Consumption 2015 = 4,000 kWh (10.9 kWh per day)	Gas connected
Health concerns	One of the tenant's grandson often stays for extended periods and has asthma.	
Dwelling	Single storey house (Brick veneer) approx. 45 years old	
Intervention	RCAC replacement Existing insulation was in good condition and was therefore maintained.	
Results – energy reduction	Summer Billing data – daily consumption reduced 45%. Weather corrected summer air-conditioning energy usage was a 53% reduction	
Impact of Network Demand tariff	For 2015, Network component of bills would **reduce** 1% from $657 to $650 pa. Summer peak demand = 3.0 kW, load factor = 14%	
Actions as a result of energy visit	None identified In his last rental he did some upgrades for the landlord and 'didn't even get any rent relief in return' which makes him reluctant to try improvements again.	
Actions taken in last 3 months to reduce energy consumption	• Change the temperature settings of air conditioner for heating • Use the clothes line instead of a clothes dryer • Wash clothes in cold water • Switch off lights • Minimise use of electrical equipment	

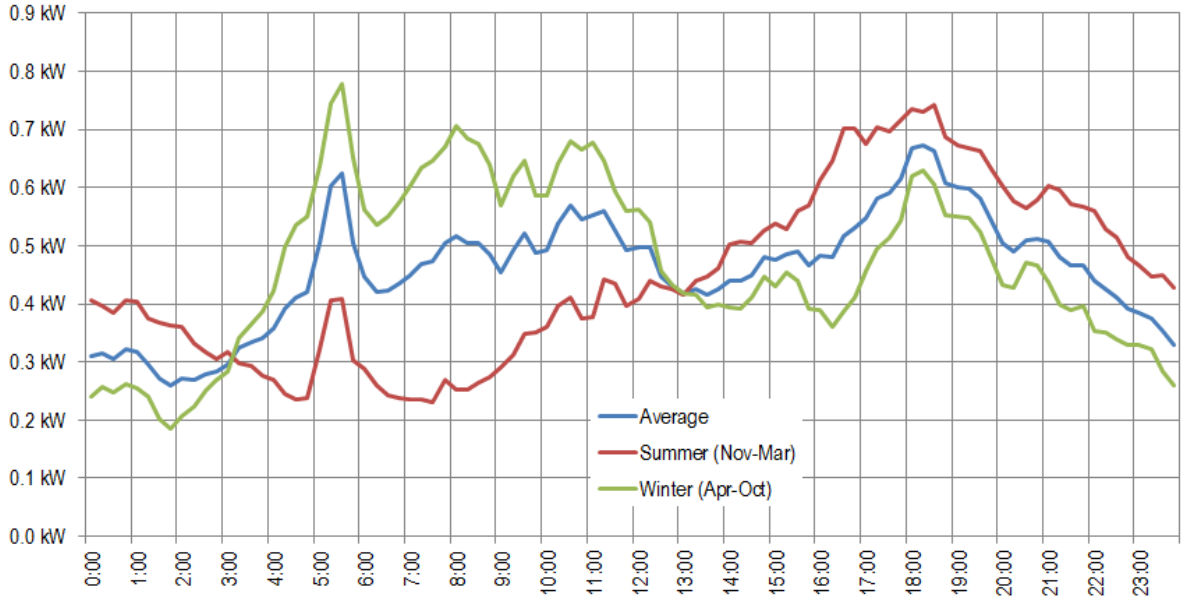
More information on the household

- No financial difficulties because of an energy bill prior to participating in Beat the Heat however high energy bills were a concern
- The participant feels 'a little bit' more confident to take action to reduce energy use in their home as a result of being involved in Beat the Heat. He feels he is 'doing ok as the bill is under $300 a quarter'. Doesn't see a real incentive to change behaviour.
- The participant 'strongly agrees' their levels of comfort have improved
- The RCAC has helped with the grandson's comfort and health, especially in winter
- In summer they use the RCAC less utilising passive cooling methods more
- The participant stated that they had made energy efficiency improvements in a previous rental property but 'didn't even get any rent relief in return' which makes him reluctant to try improvements again.
- No change in actions taken in last 3 months between pre-intervention and post intervention

"RCAC has generally done a great job and been cheaper than other heating and cooling methods we used previously."

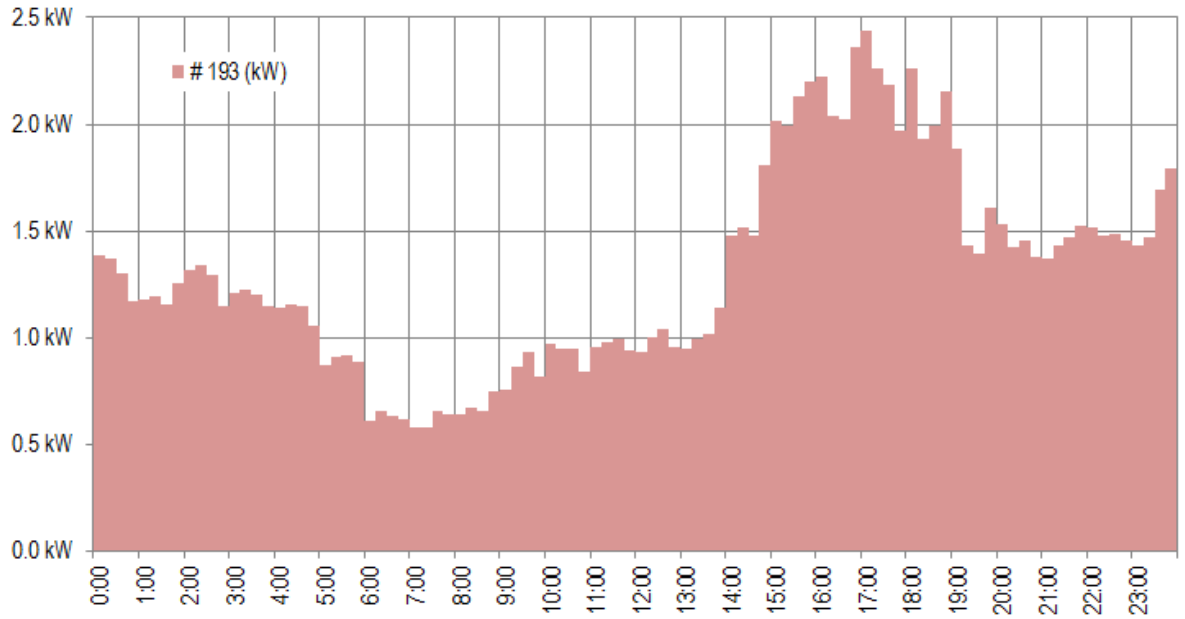
Household # 193 - Average Load Profiles

This household displays average load profiles consistent with being at home most days. Predominant winter peaks indicate the regular use of heating supplementary to the installed RCAC. This household has a 'load factor' (ratio of summer peak to average annual demand) of 14% and analysis suggests this household would not be much better or much worse off under SA Power Networks demand tariff.



Household # 193 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to peak at around 2.0 to 2.5kW from mid-afternoon until the early evening.



CASE STUDY 4 - Household #633

Demographics	Household income of $30,001 - $40,000 (aged pension)	 Two adults
Energy consumption	Electricity Consumption 2015 = 3,400 kWh (9.2 kWh per day)	Gas NOT connected
Health concerns	Both participants suffer from arthritis	
Dwelling	Single storey house (Brick) approx. 55 years old	
Intervention	RCAC replacement and insulation	
Results – energy reduction	Summer Billing data – daily consumption stayed the same (fell 1%)	
Impact of Network Demand tariff	For 2015, Network component of bills would **increase** 14% from $558 to $636 pa. Summer peak demand = 3.6 kW, load factor = 10%	
Actions as a result of energy visit	• Switching off lights/ Make sure we only have one light • Using less hot water.	
Actions taken in last 3 months to reduce energy consumption	• Change temperature settings of air conditioner heating and cooling • Taking shorter showers • Use the clothes line instead of a clothes dryer • Wash clothes in cold water • Remove/switch off second fridge or freezer • Purchase energy efficient appliances • Switch off lights • Turn off appliances at the wall - such as TV and stereo • Minimise use of electrical equipment	

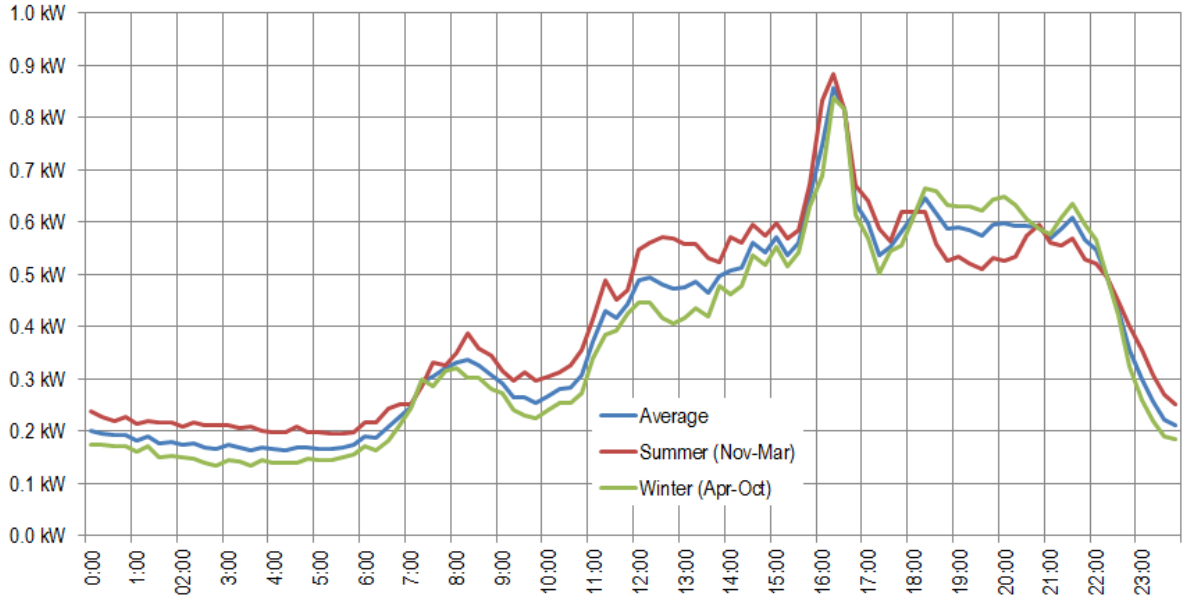
More information on the household

- The tenant had previously received energy information from Government/Council
- Participant reported no financial difficulties because of an energy bill prior to participating in Beat the Heat
- Participants are continuing to use their evaporative cooler in summer
- Participants 'strongly agree' the interventions have improved their level of comfort
  - Tenant used to have to go to bed early in Winter *"It has made a huge difference in winter in that I can stay up in the evenings yet it costs no more than running my old heater."*
  - The insulation has meant the 'cool stays in' which means he can spend more comfortable time at home in Summer "the insulation has doubled the benefit"
- The tenant reports feeling 'a little bit' more confident to take action to reduce energy use in their home as a result of being involved in Beat the Heat

"Cannot recommend the scheme highly enough. We are very grateful, it has made a hell of a difference."

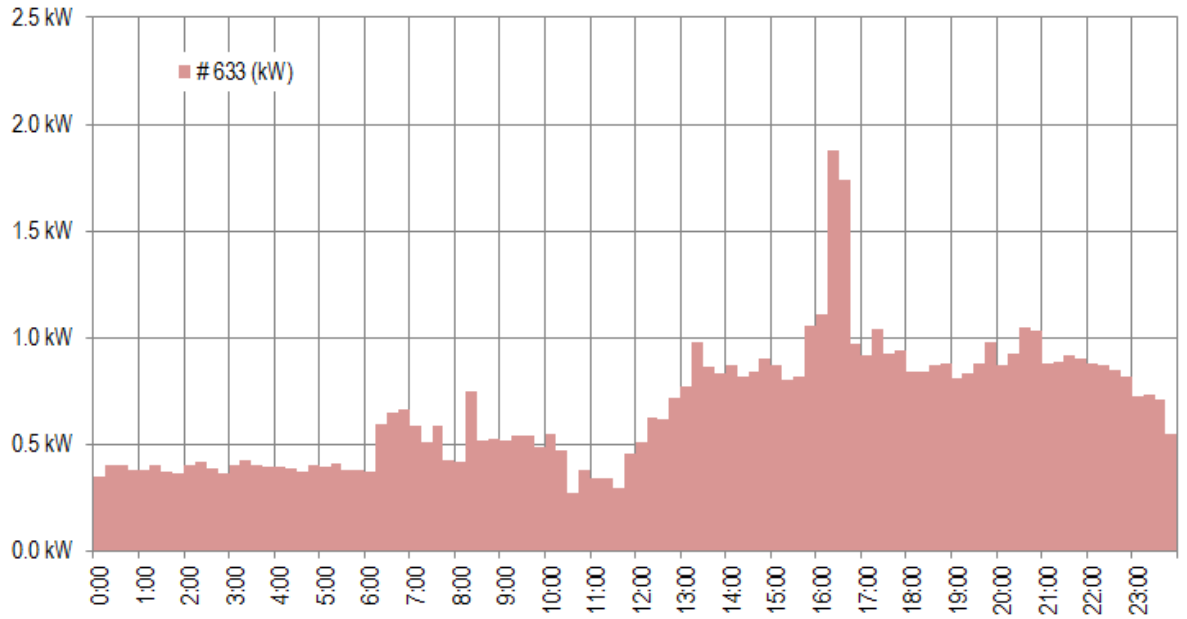
Household # 633 - Average Load Profiles

This household displays average load profiles consistent with being at home most days. Compared to the other case study load profiles, the consistency between summer and winter is notable. The regular 'spike' between 4 and 5 PM indicates the use of electric cooking (there is no gas connected to the premises). This household has a 'load of 10% and analysis suggests this household would not be better off under SA Power Networks demand tariff.



Household # 633 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to be sustained at around 1.0kW from early afternoon until almost midnight. The household has quite modest consumption (averaging less than 1kW) but, again, the 4-5PM spike is clearly evident and is the basis for demand charges under SA Power Networks demand tariffs (highest 30 minute interval across the 4-9PM period).



CASE STUDY 5 - Household #917

Demographics	Household income of $30,001 - $40,000 (aged pension)	 Couple
Energy consumption	Electricity Consumption 2015 = 2,000 kWh (5.5 kWh per day)	Gas not connected
Health concerns	None identified	
Dwelling	Single storey unit (Brick) approx. 50 years old	
Intervention	RCAC replacement. Existing insulation was in good condition and was therefore maintained.	
Results – energy reduction	Summer Billing data – daily consumption stayed the same (fell 2%) Weather corrected summer air-conditioning energy usage = 46% reduction	
Impact of Network Demand tariff	For 2015, Network component of bills would **increase 3%** from $361 to $370 pa. Summer peak demand = 2.1 kW, load factor = 10%	
Actions as a result of energy visit	• Sealed drafts • Shading in early summer • Lowered A/C temp in Winter and make better use of big windows to allow passive heating. (Initially they ran the A/C at 22 in Winter, but energy worker recommended 19 degrees which they now use) • turn off appliances • Wash in cold when can (although have a separate laundry meter).	
Actions taken in last 3 months to reduce energy consumption	• Change the temperature settings of air conditioner for heating • Use the clothes line instead of a clothes dryer • Wash clothes in cold water • Purchase energy efficient appliances • Switch off lights • Turn off appliances at the wall - such as TV and stereo	

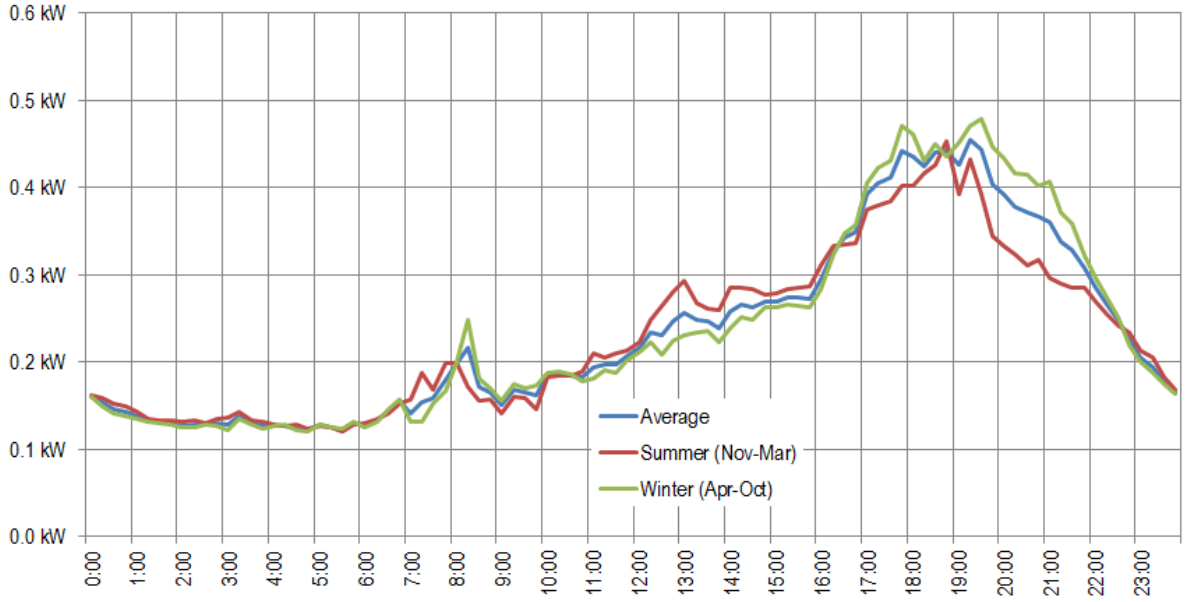
More information on this household

- No financial difficulties because of an energy bill prior to participating in Beat the Heat
- The air-conditioner has greatly increased the comfort particularly in the summer but also winter, they had ‘always struggled to keep the house cool in summer’.
- The property has floor-to-ceiling windows, and the tenant has always struggled to cool the house in Summer and heat it in Winter. She says the A/C has been invaluable in this regard and made the house 'much more liveable'.
- Knowing that the A/C would increase their power use, they aimed to limit their reliance on it, and to implement other passive heating/cooling strategies including sealing drafts, letting the sun in when it is cold and shading early in Summer.

- The major barrier to improving further action to improve energy efficiency is the cost of purchasing new appliances
- The participant found the energy monitor to be extremely useful and that she 'looks at it all the time'. 'The monitor has really shown me which appliances chew up the power, so I'm more mindful of that now'.
- The participant feels NEITHER MORE NOR LESS confident to take action to reduce energy use in their home as a result of being involved in Beat the Heat

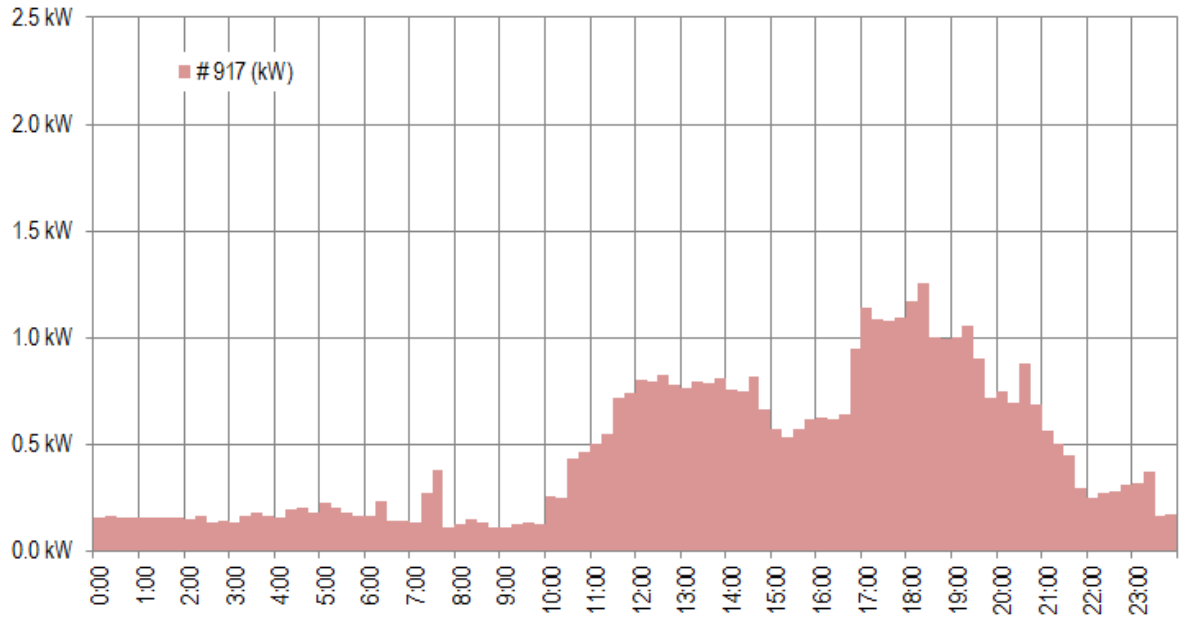
Household # 917 - Average Load Profiles

This household displays average load profiles with consumption focussed on the late afternoon and early evening . Compared to the other case study load profiles, the consistency between summer and winter is notable. The regular 'spike' between 4 and 5 PM indicates the use of electric cooking. This household has a 'load factor' (ratio of summer peak to average annual demand) of 10% and analysis suggests this household would not be better off under SA Power Networks demand tariff.



Household # 917 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to be quite modest and only increase to around 1.0kW from midday until the evening.


2.5 kW
2.0 kW
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1.0 kW
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917 (kW)
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CASE STUDY 6 - Household #925

Demographics	Income: aged pension Household income of $20,001 - $30,000	 Single person
Energy consumption	Electricity Consumption 2015 = 4,400 kWh (10.6 kWh per day)	Gas connected
Health concerns	Asthma (NOTE: participant is now on oxygen)	
Dwelling	Single storey house (Brick) approx. 70 years old	
Intervention	RCAC and insulation replacement	
Results – energy reduction	Summer Billing data – daily consumption reduced 38%	
Impact of Network Demand tariff	For 2015, Network component of bills would **reduce** 15% from $678 to $575 pa. Summer peak demand = 2.1 kW, load factor =21%	
Actions as a result of energy visit	None identified *"Everything I can do to save energy is already happening anyway."*	
Actions taken in last 3 months to reduce energy consumption	None identified	

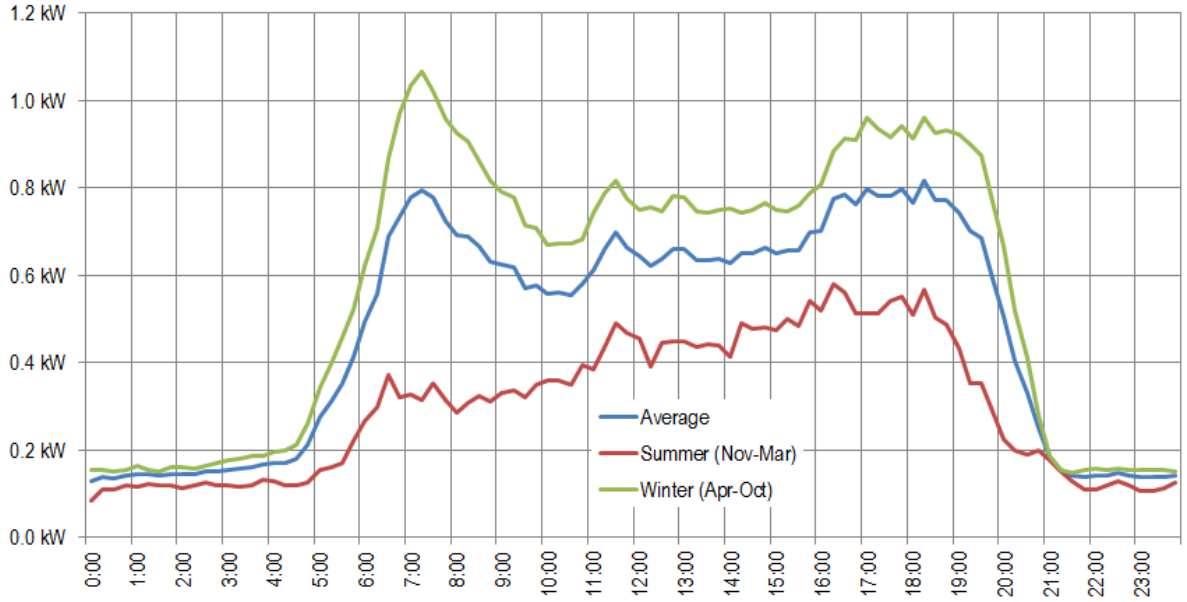
More information on the household

- No financial difficulties because of an energy bill prior to participating in Beat the Heat
- The air-conditioner has greatly increased mobility and comfort in the cold mornings, he suffers from arthritis.
- The participant did not find the energy monitor useful and does not use it
- No discernible new actions taken to save energy since receiving a home visit from an Energy Worker during the Beat the Heat project
- Feels he is 'too old' to make big changes, and needs to use heating and cooling to maintain good quality of life.
- The participant feels A LITTLE BIT MORE CONFIDENT to take action to reduce energy use in their home as a result of being involved in Beat the Heat

"Means I have been comfortable in the mornings (previously had decreased mobility in the cold). Better than a radiator because I can move about the whole room rather than sitting by the radiator getting warm, but getting stiff."

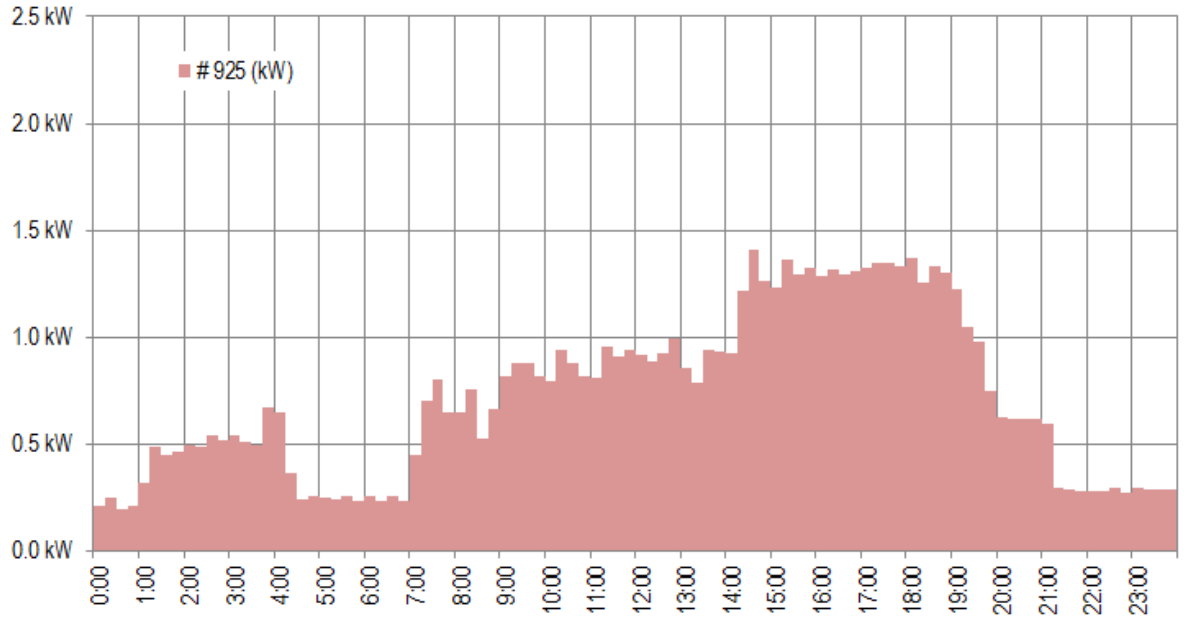
Household # 925 - Average Load Profiles

This household displays average load profiles consistent with being at home most of the day. This household's consumption is clearly biased towards winter. This household has a 'load factor' (ratio of summer peak to average annual demand) of 21% and analysis suggests this household would likely be better off under SA Power Networks demand tariff.



Household # 925 - 16-19 December 2015 Heat Wave Load profiles

The following chart is an average profile across the four-day heatwave in Adelaide between 16 and 19 December 2015. Daytime temperatures exceeded 40°C each day. For this household, demand can be seen to be sustained at around 1.0 to 1.5kW from mid afternoon until the early hours of the evening.



5.2 Energy Consumption Case Studies

In these case studies the energy consumption of 4 individual households is compared with the temperature in the main living area illustrating the impact of the intervention in specific situations.

Household # 567

The following two charts relate to client no. 567, a house which had no air-conditioner prior to the intervention. The first chart shows the pre-intervention indoor temperature on a hot day. The second chart shows the post-intervention indoor temperature and associated Mains and AC energy for a similarly day with similar maximum temperature. It can be clearly seen that, prior to the project intervention, indoor temperatures were considerably uncomfortable, being well over 27°C for most of the day and approaching the outdoor temperatures. Following the intervention, the occupants turned on the air conditioner as the temperature started rising with the indoor temperature being significantly lower than - 27°C for the remainder of the day, indicating that thermal comfort was achieved through use of the air-conditioner.

Figure 13: Pre-intervention indoor temperature for client 567 (No AC pre-intervention) on a hot day

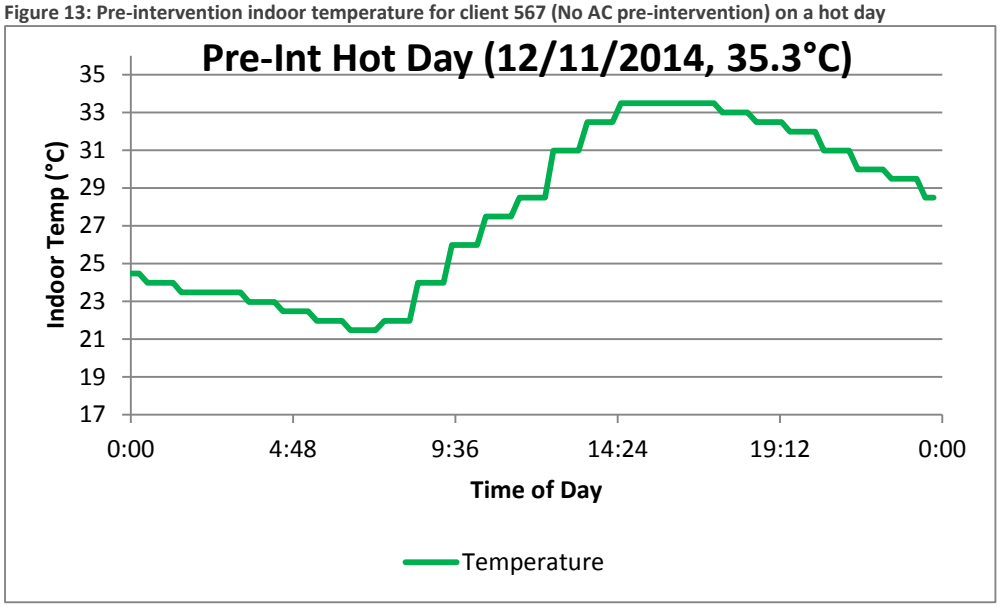
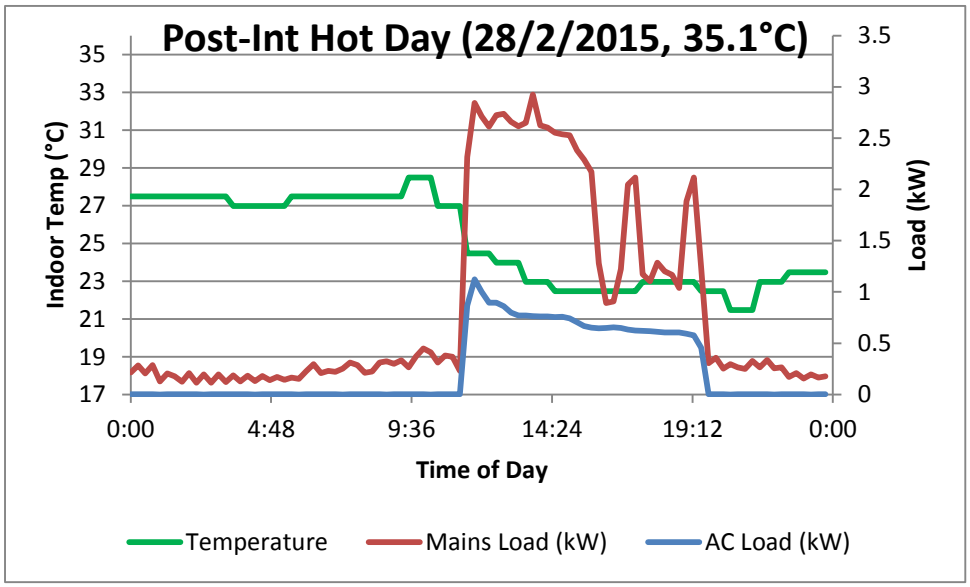


Figure 14: Post-intervention indoor temperature, Mains and AC energy for client 567 on a hot day



Household # 907

The following two charts relate to client no. 907, a house which had an old air-conditioner prior to the intervention. The first chart shows the pre-intervention indoor temperature on a hot day. The second chart shows the post-intervention indoor temperature and associated Mains and AC energy for a similarly day with the same maximum temperature. It can be clearly seen that, prior to the project intervention, indoor temperatures were considerably uncomfortable, being well over 27°C for a significant proportion of the day, even though the old air-conditioner was clearly in use, demonstrated by the cycling of indoor temperature. Following the intervention, the indoor temperature was below 27°C for the whole day, showing that thermal comfort was achieved through use of the air-conditioner.

Figure 15: Pre-intervention indoor temperature for client 907 (Old AC pre-intervention) on a hot day

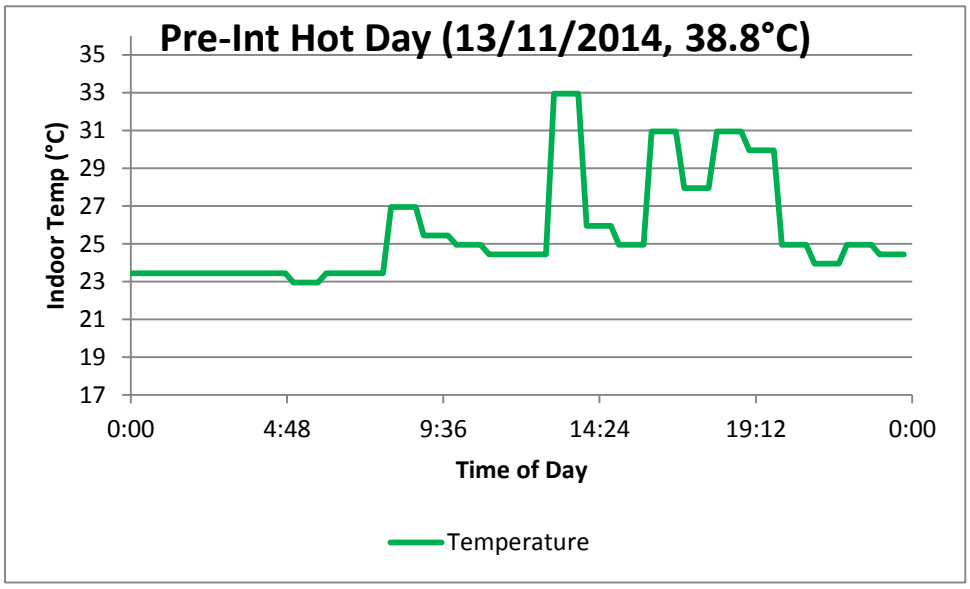
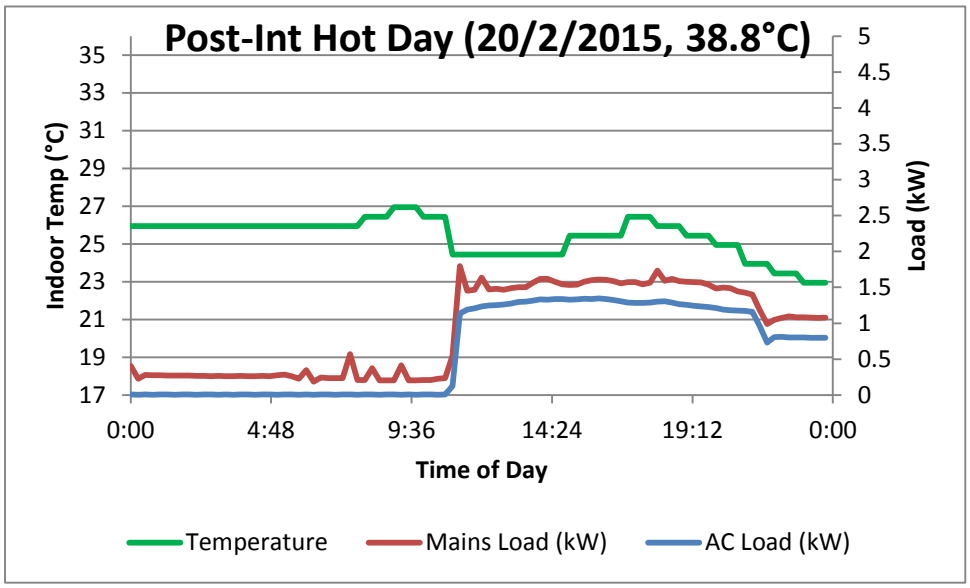


Figure 16: Post-intervention indoor temperature, Mains and AC energy for client 907 on a hot day



Household #903

The following two charts relate to client no. 903, a house which utilised a portable evaporative air-conditioner for cooling prior to the intervention. The first chart shows the pre-intervention indoor temperature on a hot day. The second chart shows the post-intervention indoor temperature and associated Mains and AC energy for a similarly day. It can be clearly seen that, prior to the project intervention, indoor temperatures were considerably uncomfortable for a significant proportion of the day, even though the old air-conditioner was clearly in use, demonstrated by the cycling of indoor temperature. Following the intervention, the indoor temperature was below 27°C for most of the day, showing that thermal comfort was achieved through use of the air-conditioner.

Figure 17: Pre-intervention indoor temperature for client 903 (Portable Evap AC pre-intervention) on a hot day

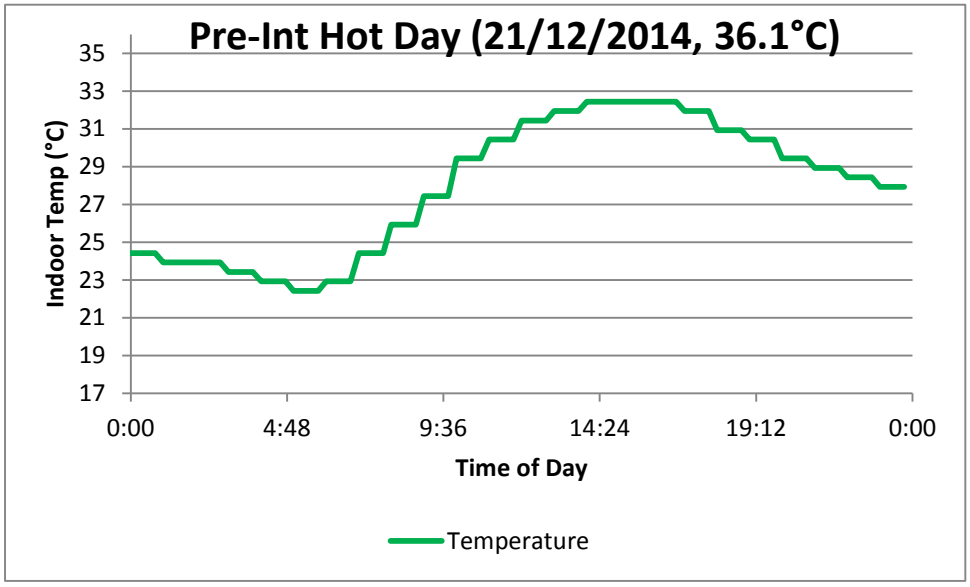
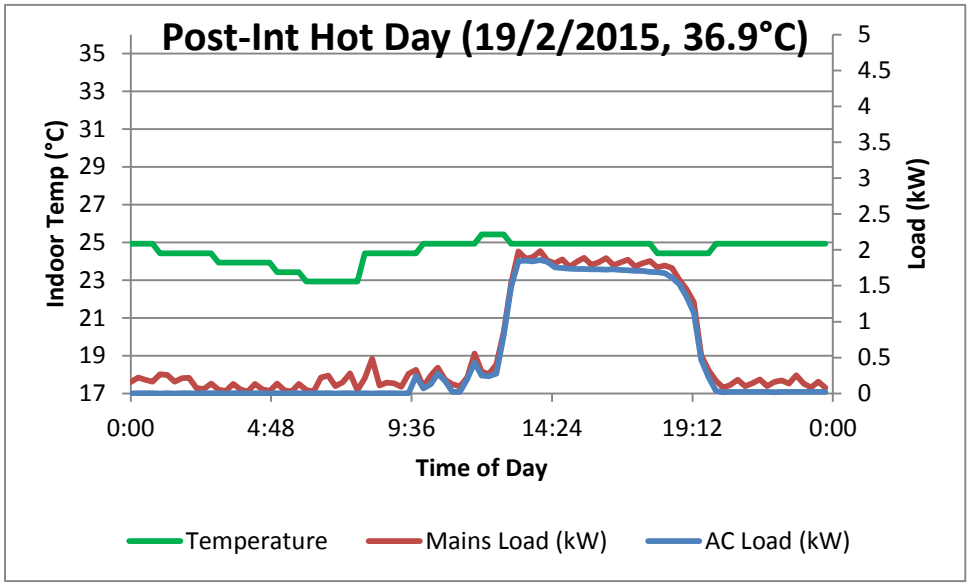


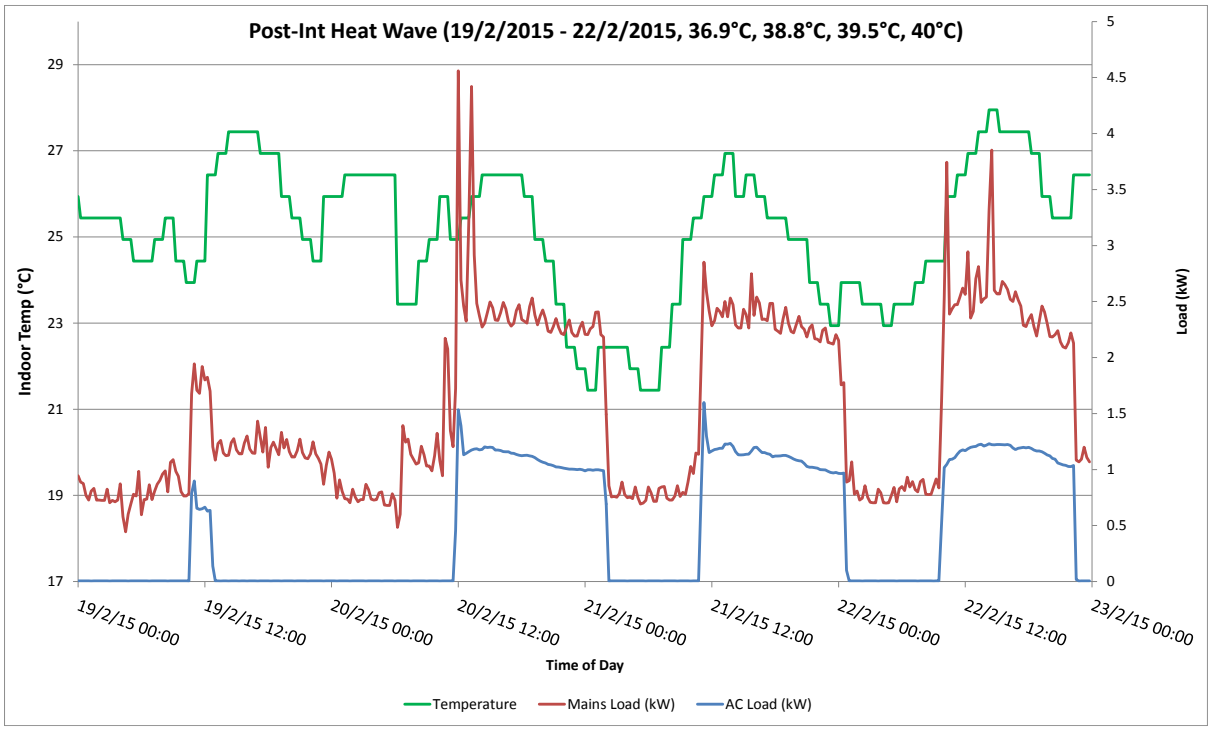
Figure 18: Post-intervention indoor temperature, Mains and AC energy for client 903 on a hot day



Household # 607

The following chart shows the indoor temperature, Mains and AC energy for client no. 607 over a four day long heat wave, where extreme maximum temperatures were experienced. It can be clearly seen that the indoor temperature was below or very close to 27°C throughout most of the heat wave, showing that thermal comfort was achieved through use of the air-conditioner.

Figure 19: Post-intervention indoor temperature, Mains and AC energy for client 607 during a heat wave, Summer 2015



It should be noted that for all clients where charts showing actual daily indoor temperature profiles have been included in this report (client no.s 567, 607, 903 and 907), a post intervention comfort increase has been recorded, in comparison to pre-intervention comfort measurements. The charts also demonstrate the dominant impact of air conditioners on the overall energy use pattern during hot days. However, the additional demand due to air conditioning was mostly around 1kW which is rather small in comparison with typical domestic air conditioning loads.

6. Discussion

6.1 Outcomes

The *Beat the Heat!* project was developed in response to Adelaide's long hot summers and the comfort, health and wellbeing impacts these can have on vulnerable families, namely low income households in private rental. Given that, *Beat the Heat!* focused on the provision of improved thermal comfort at a minimum cost for privately rented dwellings through the installation (retro-fitting) of ceiling insulation and/or energy efficient reverse cycle air conditioning (RCAC) in the main living space.

The project explored the levels of comfort for the participants and their energy efficiency knowledge pre-installation, and post participation in the project. With a focus on the effectiveness of this intervention rather than an attempt to reduce energy expenditure.

The project tackled issues associated with split incentives for landlords and tenants whereby the installation occurred at no direct cost to the landlord in exchange for a non-financial contribution in the form of a 'rent freeze' for the property. This project focused on engaging households through the landlord, by drawing on the relationship capital between the landlord and the Real Estate Agent as a way of increasing take up of the project.

6.1.1 Improving Comfort While Not Increasing Energy Consumption

It is clear from the temperature monitoring that the intervention improved comfort in the home. When considering thermal comfort, based on the type of cooling system in place prior to the intervention demonstrates that for those houses with no AC installed prior to the intervention, 80% had improved thermal comfort with an average 12% increase. For all houses where some form of AC was installed prior to the intervention 76% had improved post-intervention thermal comfort with an average 6% increase. Where comfort was reduced it was shown that this was due to the post intervention data relating to a significantly hotter period of time (based on degree day methodology).

The telephone surveys of 50 households found that 81% indicated that they were more comfortable as a result of the intervention. This was backed up by the temperature data that showed that comfort was achieved in an average of 70% of recorded temperature readings throughout the summer months.

Utilising comparative comfort scores for householders in summer prior to the intervention the average score was 1.7 and post intervention 3.2. In winter the comfort score prior to intervention was 2.1 and post intervention 3.1. (2 equates to "I was comfortable about half the time" and 3 to "I was moderately comfortable").

The similar increased in comfort in winter to summer suggests that there would also be would be health benefits for increasing comfort in winter. The Gasparrinin et.al. study show that the "Most of

the temperature-related mortality burden was attributable to the contribution of cold"[11] This would be worthy of further research in the South Australian context.

Householder's responses when asked for the ways in which comfort has increased provide an interesting insight into what comfort means for this cohort. Specifically, they were pervasively found to have made homes more 'liveable', meaning that residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons.

The key responses to the ways in which participant's increased comfort since the intervention has impacted on them include:

- More 'liveable (25%)
- Improved Sleep (19%)
- Incentive to get up (10%)
- Children are happier (10%)
- Improves mobility (8%)
- Helps with stiffness and pain (4%)
- Improved mental health (3%)

Numerous health and wellbeing benefits are highlighted in this list including improved sleep, improved mobility and reduction in stiffness and pain, improved mental health as a result of the intervention. Coupled with these participant perceptions is our knowledge from previous studied of the public health benefit of improved thermal comfort. At the more acute end thermal comfort saves lives as highlighted in the Severe and Extreme Heat Events National Framework:

> *"Heat events have killed more people than any other natural hazard experienced in Australia over the past 200 years. A number of Australian cities (Melbourne, Brisbane and Adelaide in particular) have experienced significant deaths in heat events since the turn of the century… Making our cities, buildings and infrastructure more resilient to heat events and improving the way we protect vulnerable members of our community is an important public policy issue."*[12]

Adelaide, where the *Beat the Heat!* project occurred is known for its long hot summers and studies have shown the correlation between the extremes of heat and the impact on community health.

> *"Heat-attributable mortality and morbidity are associated with elevated summer temperatures in Adelaide, particularly ambulance call-outs, mental health and heat-related illness."*[13]

Such studies indicate that there would be financial benefits for governments in implementing programs that improve comfort to reduce spending on health and related matters.

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[11] Gasparrini, A, Guo, Y, Hashizume, M et al. Mortality risk attributable to high and low ambient temperature: a multicountry observational study. *Lancet*. 2015; (published online May 21.)http://dx.doi.org/10.1016/S0140-6736(14)62114-0.

[12] Commonwealth Government, *Protecting human health and safety during severe and extreme heat events:* A national framework, November 2011 pg 6

[13] Williams S, et al, Heat and health in Adelaide, South Australia: Assessment of heat thresholds and temperature relationships, Sci Total Environ (2011), doi:10.1016/j.scitotenv.2011.11.038

Beat the Heat! was successful in improving comfort for low income households further research could be done into the direct health benefits of such an initiative to increase comfort in low income households.

Energy Cost

From the outset, *Beat the Heat!* Outlined that the project was not expecting energy consumption reductions, rather it is seeking to improve household's comfort while not significantly increasing energy consumption. The project found that 66% of households where an existing Air-conditioning unit was replaced experienced either an overall reduction in energy use or roughly maintained their pre intervention levels over the summer months. Where a new unit was installed where there was not one previously only 11% experienced an overall reduction in energy use.

The key energy efficiency findings of our project stem from the analysis of excluding air conditioner usage from other mains use within the home. In the summer months following an intervention, 86% of households with useable data showed a significant reduction in estimated AC energy. For these 28 households alone a total 15MWh of estimated pre-intervention AC energy was consumed, compared with 7MWh of post intervention AC energy in relation to the same summer periods each year. This equates to an overall 54% post-intervention decrease in estimated AC energy for those households.

When the entire year, including the winter months are also included the annual reduction of energy costs for households where a new energy efficient air conditioner replaces an old inefficient model equate to 686kWh/yr.

A recent report to the Australian Energy Regulator[14] stated that in 2013, near the time this project was most active, the average South Australian household consumed 5289 kWh and nationally the average household consumed 5915kWh. Based on post-intervention Mains energy data collected from 69 households throughout the course of the project, the average annual household electrical energy consumption was found to be 4510 kWh/yr, which is 15% lower than the State average and 24% lower than the National average. 45% of participants were single households in part explaining the less than average consumption, despite that this variation highlights the kind of energy poverty that made project participants eligible for interventions implemented through this project.

Avoided Costs

When looking at the (21) households with an unbroken subset of post-intervention, AC energy data (for the summer cooling months) where an old air-conditioner was replaced as part of the project intervention, on average an estimated 46% reduction in AC cooling energy for the summer months resulted from the AC intervention. These data also yield that an average of 276kWh of AC cooling energy per household was therefore avoided as a result of the intervention from November to

[14] ACIL Allen 2015, Electricity Bill Benchmarks for Residential Customers: A Report to the Australian Energy Regulator, http://www.aer.gov.au/system/files/ACIL%20Allen_%20Electricity%20Benchmarks_final%20report%20v2%20-%20Revised%20March%202015.PDF

March. This correlates to an average saving of approximately $88 of avoided electrical energy costs, based on an average tariff of 32¢/kWh for the cooling months[15]. When the whole year consumption is included this correlates to an average annual saving of approximately $202 of avoided electrical energy costs, based on an average tariff of 32¢/kWh[16].

If the data for households with a replacement AC was expanded to include data for the additional 54 households that were originally excluded due to missing an average of 93 days of data over the same 151 day period, a 49% average reduction in AC cooling energy would be predicted for the summer months (Nov '14 – Mar '15) resulting from the AC intervention.

In-depth post intervention interviews with 50 tenants indicated that sixty-four (64%) changed their behaviours as a result of the suggestions they received. Participants indicated a range of further energy-saving improvements they would like to make to their dwellings, suggesting that cost and attaining 'landlord buy-in' remained key barriers to doing so.

Amongst the project approaches that proved effective in informing participants about energy efficiency and promoting energy efficiency were:

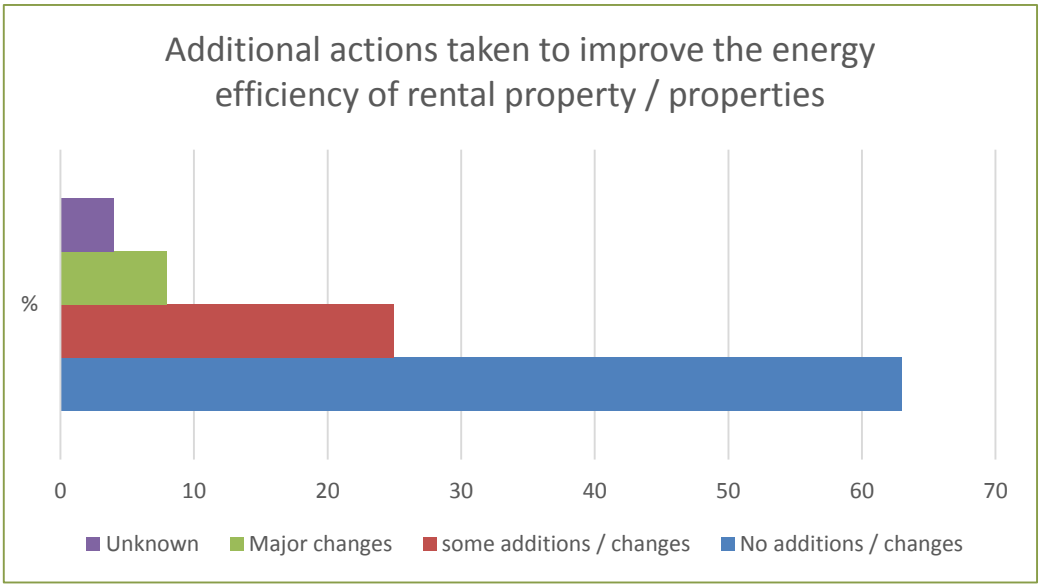
- Making personal contact with participants
- Making the process of installation and maintenance of equipment easy for participants
- Providing energy efficiency appliances at no or low cost
- Making it easy for participants to know / understand the energy cost of using equipment and applicant in their home

Additional actions

Just under half of the landlord respondents answered the question relating to additional actions taken to improve the energy efficiency of rental properties. Of these

- One (or 4%) did not know
- Two (or 8%) were undertaking major changes
- Six (or 25%) had undertaken some changes
- 15 (0r 63%) had not undertaken any changes

[15] Commonwealth of Australia (Department of Industry, Innovation and Science) 2016, Consultation Regulation Impact Statement – Air Conditioners and Chillers, Equipment Energy Efficiency Program, Canberra.
[16] Commonwealth of Australia (Department of Industry, Innovation and Science) 2016, Consultation Regulation Impact Statement – Air Conditioners and Chillers, Equipment Energy Efficiency Program, Canberra.



Major Changes (8% of respondents)

Major changes cited by the respondents included Reviewing hot water service: examining the ability to install instantaneous hot water service at all properties and undertaking undertook Utilities Training (offered by Uniting Communities).

Some Changes (25% of respondents)
Just over one quarter of the respondents highlighted some additional / changes that they had undertaken. These included

- Installing an additional internal door where there wasn't one.
- Adding another air conditioner at their own expense
- Replacing window coverings

No *Changes* (63% of respondents)
Interestingly over sixty percent (15 of 24) of the landlord respondents cited that they had undertaken no actions / changes since being involved in the BTH program.
For some this decision was generate from the fact that the tenant was happy / content and that there was no perceived need to make changes. Noted comments included:

Haven't done anything as tenant was happy
None. Didn't perceive a need
There has been none... we just went ahead and did the project... it's been a painless process
As it's not a big property and not that old there hasn't been a need to upgrade anything else

6.1.2 What are the impacts of future tariff changes

Under recent changes to the National Electricity Rules, electricity network tariffs for households and small businesses must become more cost-reflective from 2017[1]. Network tariffs make up 40-50% of most electricity bills. This reform is expected to involve a change to interval metering (from 2018) and network tariffs based on monthly peak demand as well as total consumption. Our analysis is based on the SA Power Networks residential demand tariff that is being reviewed by the Australian Energy Regulator (AER) [2].

While it was not possible to collect interval data prior to the interventions and hence the changes in consumption patterns are not able to be assessed, *Beat the Heat!* provided an opportunity to analyse the impacts of changes in tariffs for this sample as a group of households with relatively high-efficiency air conditioners and good levels of insulation (i.e. post-intervention). Intuitively, these households should fare reasonably well under tariffs intended to reward good summer demand performance.

The majority of *Beat the Heat!* households analysed (approx. 60%, n=58) are likely to experience an increase in energy bills as a result of moving from existing price structures to the cost reflective tariffs. However, the significant diversity in consumption patterns leads to a diversity in tariff outcomes. Of particular note are those with higher levels of consumption (6,000 kWh and above), who would experience substantial reductions.

The case studies of Section 5 provide examples of households that would experience increases and decreases. Households with good "load factors": the ratio of average to peak demand will tend to fare better under cost reflective pricing while those with a poor load factor can expect an increased bill. Household #633 provides a case study of a household who can expect a significant increase in network charges (approx. 14%, around $80 pa). In this case, the household has a load factor of around 10% and can be seen to incur 'demand charges' from short-term spikes in demand likely to be related to electric cooking.

This highlights that a number of factors will contribute to a household's ability to maintain electricity bills to a manageable level. While good insulation and an energy efficient air-conditioner will assist with this, the diversity of impacts and diversity of total consumption between the groups are important considerations for education and support initiatives as part of the transition to more cost-reflective demand based tariffs.

6.1.3 What were the major barriers to participants improving energy efficiency?

Tenants

The recruitment process proved to be more difficult than had been initially anticipated. The slow initial recruitment of eligible households into the project resulted in a 'Push' rather than a 'Pull'

[1] http://www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements
[2] https://www.aer.gov.au/node/42356

approach which unfortunately had an impact on the potential for participants to improve their energy efficiency. Slow initial recruitment resulted in the need to accept anyone who was eligible, rather than being able to focus on the tenants and landlords who were particularly engaged with the process. It is considered that a number of tenants and landlords have participated for reasons other than principally to improve the overall energy efficiency of the property, and as such there was a lesser uptake of participants undertaking energy efficiency measures.

The timing of the referrals and installations meant that there were at times not enough resources to ensure that all households were offered, or undertook, their home energy efficiency visit within the most appropriate timeframe (ideally within 2 weeks of installation). It is believed that this time lag between acceptance into the project, installation and follow up impacted tenant satisfaction and their sense of understanding and engagement. In many case tenants were not kept engaged with the momentum of the project and subsequently were less engaged in the energy efficiency component of the project.

Sustainable Focus have identified during the tenant interviews that many have indicated that 'they already knew' most of the energy efficiency suggestions recommended to them. This indicates the importance of a project focusing around motivation and removal of barriers.

In reporting barriers to saving energy, participants routinely mentioned "getting the landlord to fund the improvements" as the key sticking point, as well as the cost of any improvement they decide to make themselves. Health, age and comfort were also presented as key barriers. One respondent who had made energy-saving improvements to a previous home asked "why would I spend the time and money doing something that's really just going to benefit the landlord? I would if there could be some arrangement like a rent reduction".

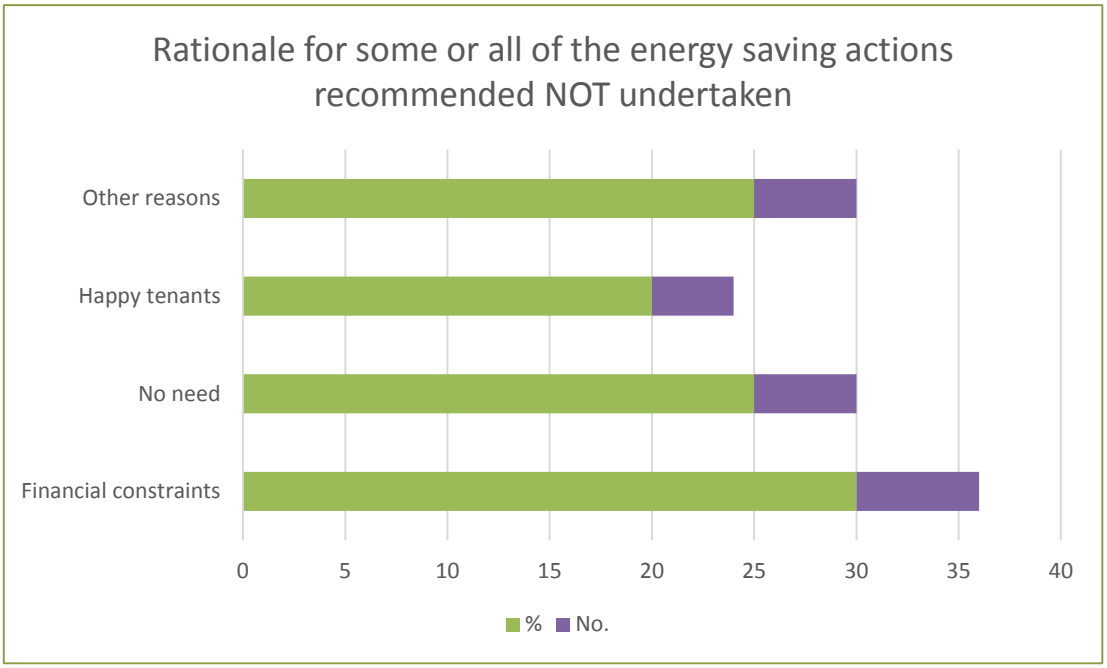
Given only 16% of households accurately predicted the correct change in consumption pattern during the intervention, it would appear assistance is required to monitor changes in consumption. The inclusion of the **In Home Display** in the project had some impact in contributing to removing the informational barrier to energy efficiency. However, further consideration of the role of in home displays as a mediator to people managing their consumption is required, given 50% of responders indicated they did not use the supplied in home display energy monitor. Those who did frequently remarked upon its usefulness in educating them around energy consumption, and indicated that it had informed a change in their behaviours.

<u>Landlords</u>

Landlords completing the first survey identified up-front cost as the biggest **barrier** to implementing energy efficiency. (Addressing split incentive is discussed further below)

When asked to respond to why landlords may <u>not</u> have undertaken all or some of the recommended energy savings, answers were generally clustered into four key themes:

- Other reasons (5 respondents, 25%)
- Happy tenants (4 respondents, 20%)
- No need / didn't feel compelled respondents, 25%)
- Financial constraints (6 respondents, 30%)



When asked about the ability to be motivated to invest in further energy saving actions, cost benefit ratio presented as a main decider.

> *We would consider solar both for electricity and hot water if it was financially beneficial*
> *The opportunity to continue cost savings / cost efficiencies ... The project is good for the environment too! (but $ are the main driver)*

While this related to the availability of funds for some, for others investment would be attractive if they could see an increase value of the property as a result of the venture. One respondent highlighted a desire to see more subsidies for improvements / capital investment.

Amongst the other answers was a desire to see the process linked with 'reputable (well recognised)' tradesperson(s), and better communication and or advertising about the project and anticipated benefits.

A small number of respondents also noted they would be motivated to invest further if their tenant(s) indicate a desire to do so.

6.1.4 Addressing Landlord Tenant Split Incentive

At the time of designing the project a 12 month rent freeze was considered a significant cost for the landlord to test their willingness to participate in the project. As the project started the rental market in South Australia slowed meaning that many landlords would not have expected a high rental increase during the life of the project, minimising their financial commitment from that intended at the outset.

The 12 month rent freeze that represented forgoing future income rather than making an upfront investment was appealing enough to find over 200 landlords willing to participate in the project. 21% of landlords when asked for their main motivation for participating said that it appeared to be a 'win win' situation indicating that the split incentive barrier had been overcome.

It was interesting to note the level of interest for this cohort of landlords in supporting their tenants with 42% stating that they were interested in being involved in the program due to the improved comfort and lower energy costs it would provide for their tenant.

When asked about the ability to be motivated to invest in further energy saving actions landlords stated that cost benefit ratio presented as a main decider. Despite that 72% agreed or strongly agreed that they were more likely to implement actions to help tenants save energy OR improve their comfort since participating in Beat the Heat!.

Outside direct actions that were undertaken as part of the project, a modest number of landlord (1/3 of those who answered related questions) have indicated additional actions were taken to improve the energy efficiency of their rental properties. Many cited financial constraints as being the main impediment for making further changes, together with perceptions of the tenants 'being happy' (i.e. there was no impetus for making further change).

Recruitment

- LARE commented that on their original simultaneous approach to landlords and tenants, the tenants usually came back to them more quickly and with greater frequently. It was noted that tenant agreement provided a good lever to gain landlord consent.
- LARE as a consortium member invested significant time in the recruitment which was effective.
- Whilst working with a real estate agent was an effective household recruitment method, the project plan underestimated the number of people requiring to be approached to gain the required number of eligible households. Around 50% of referrals were eligible at Visit one, then around 30% converted to installation.

Landlord's relationships with tenants

The recruitment approach highlighted that there is a potential risk associated with landlords requesting (or pestering) tenants to participate. There was also an issue from the tenants' perspective that the private landlord (generally) is getting value (funding from the government) particularly where the landlord has previously shown that they are not prepared to spend money on the rental property (i.e. for basic upgrades and maintenance work).

Tenant feedback to LARE, Community Housing and UC indicated that the installers were always cordial and polite.

A number of tenants were reluctant to participate and many proved to be 'passive' and difficult to engage with. Tenants expressed that they;

- 'Want to know why landlords should get benefits when they are not good landlords and won't fix other things', and,
- 'It's not my property, why should I engage with this?'

Some tenants expressed that they felt harassed into participating, and the power imbalance between tenant and landlord was made clear during these conversations, particularly with lower income household who had a direct relationship with their landlord. Some tenants expressed that they didn't really want to participate but felt that they had to because the landlord wanted it, and they didn't want to upset the landlord because of other factors, such as, they owed money to their landlord (usually rent or water) and the landlord was letting them catch up in instalments, or their lease was soon to be up for renewal, and they didn't want to 'rock the boat'.

The installers involved in the BTH project found some households difficult to deal with. Many of the properties were found to be run down and with poor quality electrical infrastructure, which resulted in unpredictable work for the installers.

The installers identified a clear difference with their interactions with the various household types. It was found that community housing tenants were almost 100% appreciative, whereas they received a mixed response from private tenants. In addition, the tenants tended to be longer term tenants in community housing.

A number of private rental tenants (as opposed to community housing tenants) were very reluctant to participate (10-15%). This was in contrast to previous projects that LESS have worked on, where people had to ask to participate and the project was not chasing participants (Push not Pull).

The PM was able to get the landlord to agree to a more modest rent increase. A few landlords also queried the brand of the RCAC and expressed concern to the PM that is would break down. Learnings from this indicate that an emphasis on the quality and brand of the items being installed would be useful for landlords.

6.2 Cost Benefit/Effectiveness Analysis

For cost benefit analysis, due to constraints in resources and time frame as all LIEEP projects have to be finalised by 30 June 2016, social and other economic benefits could not be fully captured and translated into dollars. Therefore, this report has focused on qualitative research and case studies demonstrating the social and economic benefits that resulted from the project.

Despite a key aim of the *Beat the Heat!* project the key aim of the project being to improve comfort without increasing energy costs the project did see financial benefits for tenants. The project results in an average overall reduction in energy bills when an old inefficient air-conditioned was replaced with a new one. This coupled with the reduced rent provided by the rent freeze provides a financial bonus to the low income renters, who typically have little or no disposable income.

The annual reduction of energy costs for households where a new energy efficient air conditioner replaces an old inefficient model equate to 686kWh/yr. This correlates to an average saving of approximately $220 of avoided electrical energy costs, based on an average tariff of 32¢/kWh per annum[17].

The cost effectiveness analysis has been conducted considering the financial savings to the tenant. This includes the reduced energy consumption over 12 years (minimum life expectancy of the RCAC) when an old air conditioner is replaced with a new one plus the savings due to the rent freeze. Calculated at various levels.

N.B. The cost effectiveness analysis below is based on cost reductions for tenants that represent an additional benefit to the improved comfort levels that the project was looking to ascertain. It is important to note that the cost benefit below does not accurately represent the project as a whole.

[17] Commonwealth of Australia (Department of Industry, Innovation and Science) 2016, Consultation Regulation Impact Statement – Air Conditioners and Chillers, Equipment Energy Efficiency Program, Canberra.

COST EFFECTIVENESS ANALYSIS Calculations

Effect
$220 per year for 12 years (minimum life of RCAC) Plus $300 rent freeze
Effectiveness = $2,940 per householder

Direct Trial Approach (Level 1)		
a) Cost of delivering the trial approach to a participant	• Installation of RCAC & Insulation $520,523 • In Home Displays • Home Energy Visits - $114,570	TOTAL $635,093 Per participant - $3,175
Effectiveness Cost Ratio: 0.93		

Trial Component (Level 2)		
a) Cost of delivering the trial approach to a participant	Level 1 PLUS • Landlord Engagement - $75,916	TOTAL – $711,009 Per participant - $3,555
b) Costs associated with: a. Recruiting a participant b. Maintaining a participant		
Effectiveness Cost Ratio: 0.83		

Trial Component (Level 3)		
a) Cost of delivering the trial approach to a participant	Level 1 & 2 PLUS • Office Expenses - $17,264 • Motor Vehicle Expenses - $23,233 • ICT - $21,476 • Project Management - $56,826 • Rent - $48,453 • Salary & On Costs - $367,206	TOTAL - $1,245,467 Per participant – $6,227
b) Costs associated with: a. Recruiting a participant b. Maintaining a participant		
c) Cost of running and organisation to do the above		
Effectiveness Cost Ratio 0.47		

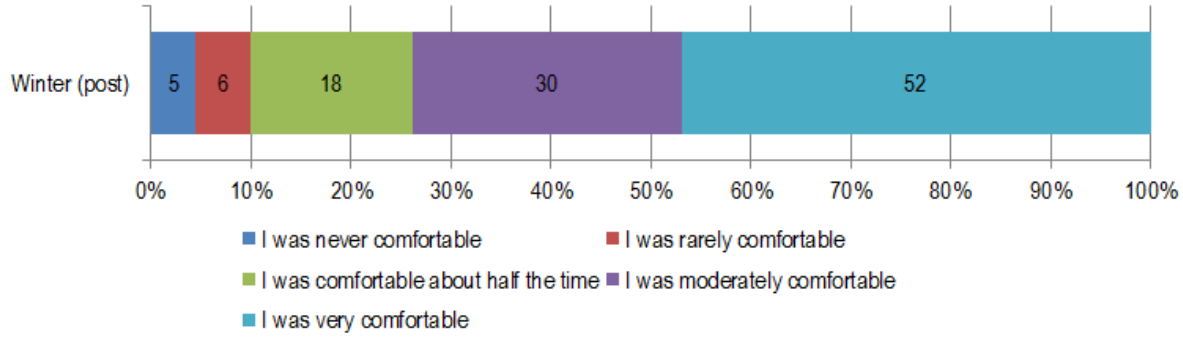
Trial Component (Level 4)		
a) Cost of delivering the trial approach to a participant	Levels 1, 2 & 3 PLUS • Monitoring & Evaluation - $606,418 • Database - $270,450 • Landlord follow up - $75,150 • Billing data - $59,000 • Professional advice – $42,925 • Installation Assistance – $36,579 • Monitoring Equipment - $278,544 • Motor Vehicle Expenses - $23,233 • Project Management - $180,653	TOTAL - $2,818,419 Per participant – $14,092
b) Costs associated with: a. Recruiting a participant b. Maintaining a participant		
c) Cost of running and organisation to do the above		
d) Cost of participating in a government funded trial		
Effectiveness Cost Ratio 0.21		

6.3 Unintended Benefits

The most significant unintended outcome was to improve the comfort of tenants in **winter**.

Comfort scores

- Average WINTER Comfort score for the full sample BEFORE interventions was **2.1.**
- Average WINTER Comfort score BEFORE interventions for the sample completing BOTH surveys was also **2.1.**
- Median was 2 (i.e. "I was comfortable about half the time").
- Average WINTER Comfort score AFTER interventions for the sample completing BOTH surveys was **3.1.**
- Median was 3 (i.e. "I was moderately comfortable").



Safety

Two participants from the 50 interviewed commented that the new RCAC made them feel much safer one stating that *"I now don't need to worry about starting a fire with my bar heater"*

6.4 Successes, Challenges & Learnings

A number of lessons have been learnt during the implementation of the trial project. To identify key lessons Sustainable Focus undertook a number of 'learning reflections' with the Governance Group, Property Managers and operational staff. This has ensured that we captured the learnings identified after the closure of the main aspects of the project.

6.4.1 Recruitment

Real Estate Agents

Lin Andrews Real Estate (LARE)

The main approach to recruitment was via real estate agents, with the focus initially on utilising the customer base of Lin Andrews Real Estate. LARE's approach to recruitment was initially to utilise a specific PM's to identify potential eligible participants within a specific area. That PM would then assist with the recruitment of any potentially eligible participants. Unfortunately, this approach didn't prove successful due to lack of engagement by the relevant PM's arising from the time constraints they were under to cover other duties. This lead to one PM being appointed to take responsibility for the recruitment of LARE participants, and it was initially agreed that approx. 10 eligible households per month would be referred to UC.

During this time the UC energy worker was an individual with great technical energy experience who also came from a CALD background. The worker reported a number of occasions when tenants would hang up the phone when he called them to organise the structural assessment. This was raised with LARE who confirmed that tenants believed that it was a telemarketer, so they just hung up.

After this issue was identified, UC then organised for administration support to make these calls and book the structural assessments. At this stage in the proceedings, referrals were coming in spasmodically, and no 'double check' of eligibility was occurring. This resulted in a large amount of time wasted where the energy worker attended the property and undertook the structural assessment, only to find out that the tenant's income was too high or that they hadn't lived in the property a minimum of 6 months or that they intended on vacating the premises within the next 12 months. When this issue was realised, UC developed eligibility questions that the UC administration worker could ask when she spoke with the tenants to organise the structural assessment.

This new step helped reduce the issue of ineligibility due to high household income and the residency issue. Unfortunately, we were still receiving referrals where the household already had appropriate heating/cooling systems in the main living area and/or appropriate ceiling insulation. This led to a revised list of questions for the administration worker booking visits, which involved upskilling her in the different types of heaters and air conditioners, so that she could get an understanding of the type and age of the appliances in the home. During this process, UC was feeding back to LARE the lack of eligible households that were coming through to the project. The involvement of an administration worker to make bookings added considerable UC in kind support to the project.

A staffing change occurred within LARE and a new project manager was appointed to the BTH project. This lead to a sudden influx of referrals, as the PM organised for bulk mail outs to occur (to both the tenant and the landlord) with information about the project provided, and a request for expressions of interest. Once these were received, the PM matched those households where both tenant and landlord provided consent, and followed up with the other party where only one party expressed an interest in participating. Unfortunately, due to the pressure of generating referrals in a short time frame, a large number of these referrals were also ineligible, requiring additional work at UC's end to 'weed' these out. At this time, UC and LARE had discussions regarding the current recruitment approach and it was agreed that phone calls may help speed up the recruitment process, and ensure that more eligible households were being referred into the project. Unfortunately, due to time pressure, the PM found that this was not a workable approach.

A sudden influx of referrals (at various times) put pressure on UC's process for including the household in the project, which involved uploading details to the database, the generation of tenant and landlord letters and the development of the Landlord Agreement. At time these issues resulted in a considerable lag between when the participants expressed an interest and when they received information from UC about the next steps.

Near the end of the recruitment process, another staff change at LARE resulted in a new Property Manager overseeing the project. The approach of this PM was very different and highlights the

challenge of staff working to a personal style rather than a project protocol. Her 'direct contact' approach proved to be exceedingly effective as it helped resolve 'outstanding' issues where one party had indicated interest, but we were waiting for the other to make a decision regarding involvement. The PM was also able to speak directly with the potential participants and explain the project, and the benefits of involvement for them, as well as being able to answer any questions that they may have had.

Other Real Estate Agents

During the recruitment phase, other real estate agents heard about this project from their landlords and/or a tenant who had heard about the project and wanted to participate. As this interest from other real estate agents occurred well into the recruitment phase, we were able to provide the PM's a very clear list of items that were required for eligibility. The work of making sure that these requirements were met were pushed back onto the relevant PM. This significantly reduced the administrative work required by UC and resulted in much better referrals into the project. The downside to this approach was that the PM's didn't have an opportunity to gain as good an understanding of the project as the LARE PM, and the ongoing relationship was not as developed, resulting in less co-operation in chasing up new tenant details, etc.

Private Landlords with direct tenant contact

During the recruitment phase a number of private landlords also heard about the project and approached UC for details of the project. This interest was early in the recruitment phase and was viewed favourably. UC checked with LARE to ensure that they were comfortable with UC accepting referrals from private landlords (which they were) and the UC project manager coordinated the inclusion of these households into the project.

Private landlords had a mixed response to their responsibilities within the project, with some being very organised and helpful, and others ending up being very difficult to contact after the initial recruitment into the project and the installation of the intervention. It was also noticed that the pressure on tenants appeared to be greater with this cohort, with a number of tenants indicating (as mentioned above) that they felt that they had to participate due to pressure from their landlord. When it was explained to them that there was no obligation for them to participate, they mentioned the negative impact that they felt it would have with their relationship with the landlord if they refused. A number of the private landlords were also perceived to be 'pushier' in relation to inclusion of households in the program, but this may have been because there was not a third party in the form of PM to manage expectations and this relationship. In this way, the PM acting as a contact point was very helpful in reducing the administrative burden on UC in terms of answering basic questions about the project and the progress of the installation.

Community Housing

Recruitment via community housing had two very different approaches. The smaller of the two associations was very keen to participate, and wanted to come on board quite quickly. The second association that was much larger, had a much stricter process to follow to allow for the establishment of this partnership.

Overall, the recruitment process with Community Housing went very smoothly, with all tenants being eligible in terms of income and, with this cohort having a particularly stable rental history, all tenants were eligible in terms of residency criteria. All coordination went via the selected PM, which also made the process easier. The PM was also able to coordinate the structural assessments and home energy visits, reducing the administration work required.

Approaching the community housing sector for multiple households was a time effective method of recruiting low income vulnerable households, whilst still addressing the split incentive.

What worked well with Recruitment?

It was identified that personal contact works best. Contact coming from the property manager (PM) worked well, with tenants and landlords trusting the PM's who in turn was able to give a level of endorsement to the project. This contact provided reassurance to the landlords and meant that the PM was able to answer questions as well as provide a clear outline of the cost benefits. For the tenants, the provision of simple information worked well. However, as noted elsewhere, initial time constraints and a sense of urgency to 'get the numbers' during recruitment phase resulted in the need to adopt a bulk mail out approach, rather than relying on individual contact that was much more time consuming to implement.

A single point of contact was also identified as being of value. Having one contact person at LARE made it easier for UC and for participants. The key contact person at LARE was responsible for co-ordinating the involvement of other PM's. This approach also helped in ensuring that the information provided to landlords and tenants was consistent (quality control) – this was seen as being particularly import due to the complexity of the project and the associated risk of misinformation or differing information being provided to tenants and landlords from different sources (i.e. if several PM's were providing information to tenants and landlords). The key contact person at LARE liaised with other PM's as required.

As was to be expected it was great when both landlord and tenant were interested in the BTH project – when this occurred the recruitment process was easiest and least time consuming.

Program Requirements / Eligibility / Screening

A major learning arising from the project was the need for very clear and simple guidelines on eligibility, and associated adequate screening of potential households prior to any referral into the project being initiated. There was a need for a dedicated person to do pre-assessments and be committed to follow up activities. LARE lost 'relationship capital' during this process as people thought that they could be involved only to subsequently discover that they weren't eligible. There was also some initial misunderstanding between LARE and UC with regards to eligibility, particularly what was meant by the term 'low income. This contributed to the high number of ineligible households referred into the project.

In hindsight knowing the potential issues that may occur, such as the high need for switchboard upgrades, a more stringent process could have been put in place regarding the concurrent gathering of all paperwork and consents at the same time. A lot of time and energy was used chasing people

for switchboard upgrade consent, signed landlord agreements, etc. This type of issue both added complexity to the management of the installation process, and contributed to the number of factors which potential held up the installation.

The sharing of participant contact details also proved challenging and problematic. Participant contact information was not always provided with referrals to the project, particularly in the case of landlords. This lack of access to information resulted in a lot of 'double handling' where UC had to go back to LARE for additional details, particularly for Kevin Hodges Real Estate (KHRE) clients, where there was the additional complexity of KHRE being hesitant for LARE to have access to their client details (despite there being a long term relationship between the companies). In addition, a lack of understanding from the consortium as to how this information would be used (i.e. what communication approach the project would take) led to a lack of consistency with what contact details were provided. This lack of consistency resulted in additional administration time, (i.e. a lack of email addresses meant that the project was unable to send an email to all participants, which would have been a quick and easy way of distributing information). If the avenues of communication had been identified and clearly defined prior to recruitment, collection of necessary contact details could have been built into the communication with participants.

When the Northern Community Housing Co-operative join the project (late in the recruitment process) the PM designed a survey that its members needed to complete to determine eligibility. This was a very successful approach, and helped assist with tenant buy in to the project.

As a result of difficulties with recruitment into the project, the eligibility criteria was changed (with Departmental approval). The eligible household income level was lifted from being aligned with eligibility for a Centrelink Health Care Card, to the National Rental Affordability Scheme (NRAS) income threshold. This resulted in additional work for the project as all ineligible households needed to be reconsidered under the new guidelines, a process that caused a degree of confusion for the participants (landlords and tenants) who had previously been advised that they were ineligible for the project.

The 'Pitch' / Knowing the audience

All communication to the landlords and the tenants' needs to be properly 'pitched', this includes being simple enough to understand, but not so simple that important information is left out. It was apparent at an early stage that people were not rushing to take up involvement in the project - it seemed that most were considering the old adage 'If it sounds too good to be true maybe it is…'. This surprised UC staff, as UC's experience with low income households (generally Centrelink recipients and other fixed low income households) shows that often these households are more aware, and accepting, of government offers or projects. It appeared that those persons in a slightly higher income bracket seemed to be very wary of this offer and much more hesitant to participate in the project.

This project would have benefited from trialling and testing approaches to tenants and landlords to see what information would have the best response from potential participants. Unfortunately the time-frames associated with the trial project precluded any provision for such preliminary work to

be implemented. For landlords to be interested in participating in the offer, it is suggested that they require simple information on the cost benefit of participation. The initial brochure promoting the project was too complex, and it is suggested that it could have been much simpler, with a catchy message.

The demographic being targeted through LARE was quite different to UC's usual client profile. UC clients are generally more used to receiving assistance and so possibly more responsive to 'offers' such as BTH. This could be seen in the difference in uptake and receptiveness of the Community housing cohort, who it is believed are more likely to participate in free government projects, than those in private rental. There was a lot of interest in tenants from the community housing agencies, and a marked willingness to participate, such as being available for home visits, completion of the paperwork, etc.

Organisational values

The values of the property manager will impact on how much assistance is provided by individual staff members. LARE has a strong commitment to 'adding value' for tenants and landlords and actively promotes this through their staff. More detailed evaluation would be needed to determine the actual benefit to the property manager and individual staff members in terms of increased job satisfaction and improved client (and potential client) perceptions arising from the property manager's r engagement with the project. The benefit of having a not for profit as the main face of the project was seen in the fact that UC was clearly not involved for their own benefit or commercial interest.

A number of recruitment strategies were undertaken during this project, and as highlighted above, personal contact with the landlord or tenant from the real estate agent was seen to be much more effective than emails or letters.

6.4.2 Installation & Housing Matters

Beat the Heat! encountered a number of challenges relating to the housing stock both in relation to quality and variability. One of the key issues was the need for switchboard upgrades slowed down implementation and proved a barrier to some in participating. While we were able to provide landlords with a reduced rate for a switchboard upgrade and the property managers were often able to sell the benefit of this to the landlord, unfortunately for some the need to replace the switchboard was enough for them to withdraw from the project. Once we started encountering older switchboards we put in place an additional step to screen the switchboards from a photo taken at the first visit.

There were a couple of houses that had older and electrical infrastructure that either required additional or delayed the process while the landlord rectified the situation.

In general the location of the RCAC was problematic in some cases increasing the time required to complete the job. Some of the intricacies regarding how and where to place a RCAC were not understood and discovered by the UC energy workers and the complications discovered when the electrician came out to install the unit.

This was particularly challenging in some of the Community Housing Properties where a single dwelling had been split into two. An additional complication not considered at the start was the need to involve strata about permission to install and the placement of RCAC in some properties. Strata approval processes can be quite slow and cumbersome.

One other issue that was encountered related to the booking of appointments. It was found that often tenants were are work during normal office hours. UC had to schedule after hours calls that added extra pressures (and costs) to the project. This problem surprised UC as most clients in other projects are home based and not actively involved in the workforce on a full time basis.

6.5 Issues Encountered with Data Acquisition System

There were a number of challenges with data within the *Beat the Heat!* project.

6.5.1 CSIRO Requirements

The time it took to finalise the CSIRO requirements was challenging and meant that many aspects of data collection had to be organised from an operational perspective prior to the final data set being provided. This resulted in additional changes and confusion for staff who were collecting the data. This also proved to be a very costly as multiple changes to the database were required as the project was underway. It is highly recommended the required data set be finalised well prior to project commencement in any future projects.

That said our interactions with the CSIRO were productive and it was found that CSIRO staff members were easy to communicate with.

6.5.2 WASP Dataloggers

Numerous issues were experienced throughout the implementation and operation of the data acquisition system, relating to the WASP dataloggers. Significant issues are discussed in the following sub-sections.

Incorrect Manufacturer Configuration

In total, 26 WASP datalogger were supplied by the manufacturer and installed with an incorrect configuration, where only one out of the two channels (Mains and AC) was able to collect data. The fault affected 26 households was not immediately evident to either the installer or UniSA. The first of these loggers was installed in late October 2014. This fault was discovered and rectified on the 23rd of January 2015 and consequently, resulted in an average of 38 days of data lost per affected household.

Faulty Equipment

One faulty WASP datalogger was supplied by the manufacturer and, as such, the logger did not collect any data. The fault did not, however result in appreciable data loss as the associated household (Client ID 1135) did not proceed with the project.

Poor 3G Communications Signal

A small number of WASP dataloggers were installed in locations where unreliable or insufficient telecommunications signal was available throughout the course of the project. This caused various ongoing issues with remotely acquiring data and resulted in varying degrees of data loss for most affected loggers. The fact that, in most of these cases, the issue was experienced intermittently meant that finding the cause of the issue was impossible, given resources available to the project. This could have been the cause of certain loggers failing to initialise, an issue that will be discussed in the next section.

Failed Initialisation

A total of 17 WASP dataloggers were not successfully initialised at the time of installation, for reasons that remain unknown. Ordinarily, the WASP logger would inform the installer responsible for initialisation that this process was unsuccessful, using a red light and a specific tone, requiring the installer to repeat the necessary process either until success was indicated or a faulty logger was identified, as per the UniSA installation guidelines. This initialisation failure meant that not only did the loggers fail to commence collecting data following the installation of an intervention, but it also meant that UniSA were not alerted to expect data from the loggers in question through established communication channels. As such, an average of 131 days of data were lost for the aforementioned 17 loggers.

Overall Data Quality

A number of inconsistencies exist with the way data was collected throughout the monitoring period. One such inconsistency included the fact that, for certain WASP loggers, 15-minute interval data were not collected for one or more days in a row due to failures in communication or equipment, causing 'gaps' to exist in the load profile of a given household. In some cases the data were lost altogether, most likely in relation to this situation causing the logger data storage capacity to be exceeded. In other cases, although no data was recorded at 15-minute intervals for one or more days, for the 15-minute reading immediately after the end of this period, a very large number was recorded, which in most cases matched the expected cumulative energy use over the period. These large data spikes caused significant problems for the creation of average electrical load profiles. Other issues with overall data quality are discussed in following sections of this report.

6.5.3 Electricity and Gas Billing Data

A number of tenants had issues in providing correct NMI data to allow us to access SA Power Networks (SAPN) billing data. This occurred for a number of reasons, including bills only being sent electronically and/or tenants not keeping copies of their bills. This meant that there was a delay in accessing billing details. We also had situations where the bill was not in the tenants name – this problem generally arose in shared accommodation where the main tenant who had the bill in their name had left, and the name on the bill hadn't been updated. As a result the details between the Energy Retailer and SAPN did not match. These issues were mainly resolved through persistent work with both the tenant and SAPN, but this follow up trying to get correct details from the tenant and

then match these with SAPN's data took time and resources that we were not expecting. SAPN also found the data requirements of the project took more time than they had originally anticipated.

Due to the nature of billing data and difficulties intrinsic to their collection, a large number of SAPN Mains energy data were estimated for households, over different periods. This was usually based on the inability of a 'meter reader' to physically access the electricity meter for various reasons. Where an estimate was made, the SAPN data is very unlikely to represent the actual energy consumed in the given billing period, with values usually representing energy consumption from the same period in the previous year. Differences in weather, behaviour and composition of household occupants, appliances and numerous other less common factors mean that using these data is highly undesirable for assessing the impact of project interventions.

Throughout the course of the project, a number of different data files were supplied by SAPN as ongoing billing data became available for project clients with valid consent forms. Several of these files were eventually found to contain a critical data error. This caused incorrect values of a critical data field, entitled 'DATASTREAM_NO', to be inserted. The aforementioned information was critical to identify whether a row of data represented energy consumed by a household, therefore informing UniSA whether it was useable for the purposes of this project.

Accessing Australian Gas Network billing data was reasonably straight forward and simple. There were no issues with the collection of this data from AGN's end. There were a few households that had shared gas metering, which we were unable to get consent from all parties to include. We also had similar issues as above with regards to accessing MIRN numbers.

6.5.4 iButton Dataloggers

The only issues experienced, specifically relating to the iButton dataloggers, was that some appear to have been lost. Loss of iButtons could have occurred because: they are so physically small; the method of attachment to a household wall failed; the device was tampered with by a household occupant or visitor or a combination of these or other reasons. It should be noted that iButtons were simply installed using double-sided adhesive tabs, specifically manufactured for this purpose, therefore a number of aforementioned issues could have arisen in relation to their lack of permanent attachment.

Handheld Probes (NS70 and NS71)

One issue encountered during the process of importing temperature data, collected using handheld probes, was the fact that there was no way of connecting the raw data files stored on the SD card to a given iButton or household. Once uploaded onto the database, the IGest software deletes the data files and inconsistencies were identified between the number of data files uploaded and the number of new data files shown by the software. This could relate to duplicate downloads being discarded during the upload process, which was found to have happened in certain cases, but could also relate to data corruption and/or loss during the upload process, with no means of confirmation available.

A number of temperature data files that were collected were improperly named by one of the NS70 handheld probes, for reasons unknown to UniSA or the manufacturer. This caused the files to be unrecognisable by the IGest software when attempts were made to upload these data into the database.

One of the 1Gb SD cards purchased specifically for use in a handheld probe appeared to fail and corrupt all associated data, for reasons unknown. As such, associated data collected using this SD card was lost and furthermore, based on the fact that there was no way to ascertain which iButtons had been downloaded using this particular device, it was never ascertained which households data had been lost.

IGest Software

This was the first use of IGest software by UniSA for collection of iButton temperature data, a process previously executed many times with no difficulty, presented many difficulties. Throughout the project, based on many issues, it was eventually determined that the software interacted adversely with the operating system and other installed projects utilised by the PC on which it was first installed. This

As previously mentioned, inconsistencies were identified between the number of data files uploaded and the number of new data files shown by the software. The reasons for this are unknown and although this has resulted, in certain cases, from duplicate records being discarded during the upload process, based on the limited amount of available temperature data and other problems experienced through the use of IGest, it is suspected that this is not a complete explanation. During the project, the IGest softwares database was programmed with the information of 320 iButtons to allow associated data collected during the project to be uploaded. Despite informing the supplier and manufacturer of UniSA's intention to utilise hourly data for such a large number of iButton temperature loggers over a period of years, Newshift Technologys temperature data acquisition system, incorporating the IGest software was recommended as the most cost effective and robust method to satisfy cost constraints of the project. In retrospect, it can be seen that this recommendation was made naively, given that numerous problems with the Newshift system were encountered, the most problematic of all being that early on in the project, the database began to reach maximum optimal capacity. It should be noted this factor was only ascertained in the latter half of the project, based on the software becoming progressively slower to perform previously quick tasks. This eventually descended to the point where the software would 'hang' idly for several days before either completing a simple upload of multiple data files or having to be restarted without knowledge of whether data files had been successfully imported, corrupted or otherwise.

Countless attempts were made by UniSA to remedy these issues through ongoing contact with the Portugese Manufacturer and the local distributor, utilising different operating systems to house the software on various virtual and physical PC's. As previously mentioned, this lead to the eventual use of a 'purpose built', dedicated PC, containing no other software other than that absolutely necessary to collect iButton data.

Using the dedicated PC for iButton data collection, a day was eventually reached where the database would accept no more data. Through ongoing consultation with the manufacturer, a temporary fix was identified, whereby the database file had to be manually removed from the relevant software folder, repaired and compacted using another database application, replaced within the software folder, then the software had to be manually reconfigured to recognise the altered database file, at which point data upload could recommence for a single cycle, where no more than five data files could be uploaded before this time-consuming process needed to be repeated. The end life of this temporary fix was reached several months after it was first used and, at this point, it was decided that the only tenable solution would be to manually delete a large proportion of the data. It should be mentioned at this point that early on in the project, the IGest database and associated software functionality had also become relatively inoperable, presumably based on the issue of database overcapacity, therefore all data were manually removed from the IGest database to another, with significant assistance from the CDS team members and the requirement for additional work outside the original project budget.

6.5.4 Community Data Solutions Database and Associated Data Collected

The development of the Community Data Solution Database was another part of the project that suffered from not having enough planning time at the start of the project. With multiple parties both inputting and extracting data from the database a more coordinated approach to the original database design would have resulted in fewer changes throughout the project and more effective data extraction methods implemented.

With the database being developed at the same time as the monitoring equipment was chosen and purchased determining how to include this data into the database occurred much later in the project than was ideal.

The changes in requirements from the CSIRO had significant implications with our CRM database, which was developed based on the initial CSIRO data set. Many of these items were made redundant, and additional items added on an ‘ad hoc’ basis during the life of the project. Some of these changes occurred due to changes with the CSIRO data set, while other changes became necessary due to the changing requirements of the project.

In addition to the costs associated with making these changes the end result was a database which has many unnecessary elements and that created unnecessary confusion for those working with it due to the fact that many fields were no longer required.

Uniting Communities energy workers were responsible for collecting large volumes of household data with varying degrees of complexity, relating to occupant demographics and behaviour, appliances, monitoring equipment, energy bills, construction and project interventions. The importance of this information to UniSA was paramount, especially in relation to household energy monitoring equipment and billing data, but extraction was not always straightforward. It was critical to be able to identify the household where a given WASP logger and iButton logger were installed in order to allocate data to the correct household for subsequent analysis. The same was true in

relation to the identification of billing energy data, which otherwise could not be allocated to the correct household. Some of the main issues faced are summarised below:

- Monitoring equipment identification incorrect or non-existent
- NMI numbers entered incorrectly
- Monitoring equipment (WASP and iButton) identification data being inserted into different sections of the database, often within strings of text
- Other critical household information, for a specific parameter, being inserted into different sections of the database for different households, sometimes within strings of text

One critical piece of information required by UniSA for AC energy data analysis was specifications for both the old and new air-conditioner, which was replaced as part of an intervention. This proved extremely difficult, in most cases, in relation to the 'old' air-conditioner for numerous reasons, which meant that little information was provided to UniSA. For most households, the only useable information collected was a photograph of the old air-conditioner. UniSA utilised staff with considerable historical experienced in the domestic air-conditioning testing and maintenance sectors and advice from Lloyd Harrington (Energy Efficient Strategies) to generate a table in their database of estimated capacity and performance characteristics for every old air conditioner that was replaced as part of an intervention. This table utilised information relating to the age and associated average performance characteristics of Australian Air Conditioners, from a Commonwealth Government report (DEWHA, 2008)[18]. In a small proportion of households, a default air conditioner was assumed, represented by the most common domestic air-conditioner in terms of age and performance, namely a 1.5kW capacity unit with a COP/EER of 2.01. It should also be noted that the performance of old air-conditioners was reduced, where applicable, based on UniSA research relating to performance degradation of various types of domestic air-conditioners, over time.

In relation to the various different new air-conditioners installed as part of project interventions, associated data were far more accurate, with only a few errors requiring investigation in order to confirm which system had been installed. From this information, details for the performance and capacity were found from manufacturers' websites (see table 4).

6.6 Project administration, operation and processes

There were a number of challenges in managing this project. The complexity of the project, the data requirements and number of consortium members (with different understandings and different aims for the project) created challenges that had to be overcome.

6.6.1 Initial Delays & Milestone Requirements

Beat the Heat! experienced delays from the start of the project that provided compounding challenges throughout the life of the project. Our tender proposal was written with the intention that the project would run for a full three years through to June 2016. There were initial delays in

[18] Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008, Energy Use in the Australian Residential Sector, Commonwealth of Australia

negotiating and executing the agreement and receiving sign off from all parties. At this early stage it became evident that project activities would need to be completed well ahead of June 2016 for the final report to be submitted in mid-May 2016.

The initial stage of developing the data plan and subsequently having the data plan approved by the CSIRO created a significant delay that was not expected. While our project methodology was uncertain it was difficult to proceed with many elements of the project. This created delaying in recruiting and starting interventions in households but with the need to still meet our existing milestone arrangements with the exception of a small delay.

As discussed below once the Consortium was in a position to start the project it found that there was extreme pressure to get started prior to finalising a lot of the planning that in hindsight should have implemented. This resulted in the whole project being an attempt to make up lost ground, meet incredibly challenging timelines and compromise in date collection and methodology along the way. As mentioned previously due to not being able to recruit 50 households prior to the first summer there was a need to forego the opportunity to have pre intervention temperature data for this subset of houses.

The inclusion of indicators around the number of installations, especially so early in the project timeframe lead the project to be dynamic in its development, with new processes implemented to respond to challenges. This led to some lack of clarity about project structure and responsibilities. The importance of having up-front time to plan and document implementation policies and procedures cannot be over stated. Sadly the Milestone Indicators failed to recognise this fact and made no reasonable provision for this to occur.

6.6.2 Project management / project governance

The complexity of this project has highlighted the need for greater project design at the outset, and the importance of spending time with all stakeholders to ensure that everyone is on the same page and to define processes and procedures. With the focus on 'getting numbers' for recruitment into the project for reporting purposes, the initial decisions and processes were not well documented. If processes and procedures had been in place prior to recruitment commencing, and clearly documented it would have made it easier when staff changed within the consortium group for everyone to understand processes and why specific processes had been chosen. More focus on getting all of the consortium and staff working on the project on the same page early in the process to ensure consistent messaging, streamlined processes etc. is seen as critical. It has also been highlighted that from the beginning of the BTH project there was not enough focus and consideration of technical issues and the establishment of a clear system for resolution of unforeseen problems, such as the need for switchboard upgrades. The resultant complexity of the project, and the additional, unanticipated work load that came from this, meant that staffing allocations were inappropriate, with more operational work often required than initially expected. More focus on project planning would have also allowed for better opportunities to review the project implementation, and could have addressed the required process changes as the delivery evolved. These inevitable changes need to be factored in, especially in relation to the issue of database design.

The project could have been streamlined through full upfront project management documentation including process maps, statements detailing roles and responsibilities, change control documents, work breakdown structure, recording of decisions for organisational history, etc. The lack of visibility in project progress early in the project meant it was only conceptualised mid-way through the project. The lack of thorough overview of process resulted in operational staff being focused on getting the work done – resulting in process/procedure changes or modifications on an ad hoc basis. Whilst this process was improved as a result of the work of DSD during the project, valuable time was lost and human resources were not utilised as effectively as they could have been in the early stages.

Whilst the 'not for profit' involvement has been identified as being important for participants' trust in the project, more involvement from the installer at the beginning of the project would have resulted in better, more accurate assessments of individual properties and their specific structural requirements. Better specifications as to the paperwork, consents and application forms that participants were required to complete to prove eligibility, would reduce the amount of administration required by the project. It would also help reduce the lag time between approval and installation which became an issue of concern for the project due to a lack of resources. The number of households in the project was not enough to scale up resourcing. With the issue of tenants feeling 'pushed' into this project, the question of whether or not an initial approach to the tenant would be more beneficial was raised, however, it was noted that a project in Victoria has previously utilised this approach and had poor outcomes. Perhaps this highlights the vital role of the Property Manager as a mediator in this process.

What worked well for project governance was the deliberate early split of roles between Operations (data, household and intervention) groups and Governance groups. This ensured that the overall strategic matters were being attended to as well as the operational details. The focus on having these meetings regularly with the ability to call ad hoc meetings as required greatly assisted the project governance as well as consortium confidence in the project.

From the tenants perspective it would have been better to streamline our approach to communication. There would be clear advantages to having only one party whether that was LESS or UC with responsibility for all contact with the client including appointment making.

It would have also been far preferable to be able to provide a clear, specific timeline for installation, but due to the rushed nature of the project towards the end a backlog occurred leaving tenants wondering if they had been forgotten of if they had been excluded from the project.

6.6.3 Risk Management

The Governance Group was responsible for general oversight of the project and as such managed risk and compliance. Reviewing the risk management plan was a standing agenda item for this group and the plan with new items being added as matters arose and different scenarios presented themselves.

Shortly into the project we introduced an incident register to log any incidents or near missed that occurred and utilise the opportunity to review our procedures and make any necessary changes. Thankfully there are few items on this register and no critical incidences.

6.6.4 Consortium

Our Consortium was a real strength of the project. This project was made up of 8 consortium members, with another stakeholder Australian Gas Networks also needing to be involved in the delivery of billing data.

The role of each consortium partner was outlined at the start of the project (as broadly outlined in the introduction), but as the project progressed there were a number of areas, most specifically in relation to communication and data analysis that required further definition. The consortium was made up of not for profit, government, university and private business and not surprisingly there were differing understandings about some elements of the project and how it would work on the ground. The consortium members came to the project with;

- Different levels of experience in working with low income households,
- Different expectations of what 'low income' actually was, and
- A lack of comprehension about the 'normal' behaviour of the targets group. (For example some consortium partners were concerned that tenants would book in for a home visit and then cancel, or not be home at the time. This is usual in Uniting Communities experience, even with all of the reminders in train. However, it does highlight the different understandings and expectations of the group.)

The importance of relationships was highlighted during the recruitment phase of the project. During this trial project there was some confusion as to who 'owned' the participant relationship – was it UC or LARE? This relationship was undefined and multiple people were therefore contacting households. Often participants had a number of *Beat the Heat!* (BTH) project consortium members making contact with them (i.e. UC, LARE, installers and Sustainable Focus (SF), etc.) leading to misunderstanding and confusion. The management of these relationships and clarity about who will take what role would be useful in helping reduce confusion in future projects. It was also suggested that a single point of contact be provided to the tenant and landlord (i.e. 'Welcome to the project. Your contact person is ….').

Due to the work flow of the project, there was at times a lag between referral and tenants and landlords getting further information. Due to the limited number of UC staff available to implement these roles this was particularly so when large numbers of referrals came in at the same time. There were also difficulties in making contact with tenants who work and were therefore unavailable during working hours. Again, this issue highlighted the slightly different demographic of clients - UC's usual clients, who may not work, or only work part time, are generally more time available during work hours than LARE clients in the private rental market who are more likely to be in some form of employment. In addition, the tenants seemed to have a preference for going back to the Property Manager with whom they have an existing relationship, rather than contacting UC as an outside agency. It is suggested that another project of this type may be embedded within a Property Management company with all personal contact coming from the PM.

During the 3 year project, there were a number of staff changes within the consortium group. This included operational staff within Uniting Communities (UC). These changes meant that information on decision making outcomes was often lost as it had not been well documented. As a result the new staff member did not have a clear understanding of what had occurred previously, essentially having to 'start from scratch'. All members of the consortium group were expected to get their heads around the project however with the time pressure building to meet milestones, work regularly continued without all consortium members developing a solid, unified understanding of the project's processes and procedures and the role that each member would play for the duration of the project. This lack of pre-planning mean that much of the project was developed "on the run", and changes were made to a process, as the current staff did not understand or like the way that the process was working. This caused more confusion and work as CDS was requested to make many database changes to be able to accommodate the changes in process, data collection, etc. Managing the implications of staff turnover is important to implementation of the project, requiring roles and responsibilities to be revisited periodically.

As mentioned, it was important to clarify early exactly which elements of the project each consortium member was doing data analysis and in turn report writing on. In order to better facilitate this a data management tool was developed that clearly outlined all members' responsibility.

Having the diversity of skills within the consortium to ensure that we received both good qualitative and quantitative data was a real strength to the project. Given the technical nature of the project the qualitative data needed to be collected and analysed by a team with expertise in energy efficiency that UniSA have, while equally the social science research skills of Sustainable Focus provided the project with robust qualitative analysis.

Communication is key to an effective consortium relationship. This occurred well in the majority of situations, but as with any collective process there is a tendency to focus on one's own work and not readily share where things are up to with other members of the group. This caused some tension within the data group at times. More clearly articulating the expectations of what would be communicated at various stages of the project from the start could have assisted to alleviate this tension.

Feedback from the Property Managers highlighted the need for good communication and information sharing, although it was as the project developed that this became important to this group. From the PM's perspective, an ideal project would bring everyone 'onto the same page' at the beginning, with many PM's feeling that they were out in the field, but didn't know what was going on. One option would be the introduction of a more user friendly database, where levels of access could be set so that the individual PM's could check on their own properties. This would avoid all responsibility falling to the one dedicated PM, noting that it was incredibly time consuming for this worker to go through the whole database to identify which household belongs to which PM so that follow up could take place as and when required. Using PM's more actively in recruitment would have been valuable, especially as it was identified that the blanket mail out was not effective.

It was noted that the central office did originally approach PM's to be involved in the recruitment of participants and then a lack of recruitment/interest in this strategy led to the mail out.

Many of the PM's also suggested that it has increased their interest and/or understanding of energy issues, but also expressed that they would have liked to have been supplied with energy efficiency information so that they could then assist clients with questions. This raised the issue of only one main PM as the contact point, with many receiving calls from their tenants and the PM feeling that they had to say 'don't know, don't know'. Many PM's felt that there was an opportunity to continue to raise energy efficiency awareness amongst tenants after the end of the BTH project and one PM reported that one of their tenants, even with a solar system installed, still received a quarterly bill of $600. 'If I had a little bit more understanding I would be able to help'.

If this project were to be run again, information sessions on energy efficiency could be offered to the property managers to develop their skills and so allow them to better help when questions and issues arise.

Uniting Communities (UC) and other consortium team members are now in a better position to undertake future projects. There have been many learnings in relation to governance matters, the establishment, management and co-ordination of the consortium and, from an operational perspective, how to best undertake future projects of this nature.

6.6.5 Working with Stakeholders

Overall the consortium had a good working relationship with the Department for Industry and Science. Initially there appeared to be a reluctance to discuss alternatives to the trial methodology to overcome barriers and challenges but as the project progressed there was a greater willingness to work together to look for ways to ensure the project's success.

The key challenges in relation to working with the department and CSIRO occurred in the initial phases of the project as mentioned above. It is recommended to Commonwealth that, for future trial projects, scheduling of time-frames should make adequate provision for Milestone 1 to include project documentation, testing message and systems, etc. It is believed that implementation of this approach will result in better overall project outcomes and reduce the unexpected administrative burden that is placed on projects when unexpected processes need to be undertaken.

The shifting of reporting timelines and uncertainty about what impacts this may have on the viability of the project was a very challenging element of the trial. At a time when all the Consortium's efforts should have been going into recruitment and implementation there was a need to give consideration to how to maximise the benefits of data collection and analysis with radical changes to timelines proposed. Data collection time for the project was shortened to meet the CSIRO's data collection and report writing requirements. This compromised data collection which, when coupled with delays at the start made it impossible to obtain a full 12 months of data post intervention. While this is obviously detrimental to the trial it was also very demoralising for the staff involved in the trial.

6.7 Budget

Given the size of the project and the considerable unknowns at the start the project has tracked fairly well according to budget. The human resources required have been greater than expected and almost all consortium members have contributed in kind more to this than anticipated.

Given it was necessary to estimate at the outset the number of homes that would require RCAC, insulation or both it was not surprising to experience a small overrun in the cost of interventions.

The one area that we did not budget for adequately was the electrical work in installing and removing the metering devices, particularly given the number of properties that had inadequate switchboards and required multiple visits.

The in-kind support provided to the project was 18% greater than originally expected. This was mostly due to the greater complexity of the trial elements of the project and to some extent the need to commence the project prior to all of the planning being complete resulting in further work later on it the project.

6.7.1 Final Budget & Expenditure

Beat the Heat! BUDGET						
1/6/2013 - 31/6/2016	**Actual**	**In Kind Actual**	**Total Actual**	**Budget**	**In Kind Budget**	**Total Budget**
RECEIPTS						
LIEEP Funding	2,192,000		2,192,000	2,192,000		2,192,000
In Kind Support		625,732	625,732		530,900	530,900
Interest Received	10,337		10,337			-
TOTAL INCOME	**2,202,337**	**625,732**	**2,828,069**	**2,192,000**	**530,900**	**2,722,900**
EXPENDITURE						
Client Costs	766		766	10,794		10,794
Consortium Partners:						
Monitoring & Evaluation	255,600	263,545	519,145	240,600	259,000	499,600
Database	177,000	103,050	280,050	177,000	85,000	262,000
Landlord engagement	103,000	47,300	150,300	103,000	42,500	145,500
Research & Evaluation	62,000	25,273	87,273	64,200	21,400	85,600
Billing Data		59,000	59,000		60,000	60,000
Prof. & Technical Advice		42,925	42,925		39,000	39,000
Installation Assistance		36,579	36,579		-	-
Project Management Support		48,060	48,060		24,000	24,000
ICT	21,476		21,476	28,355		28,355
Legal Expenses	1,919		1,919	-		-
Minor Plant and Equipment	3,919		3,919	4,000		4,000
Monitoring Equipment	278,544		278,544	256,400		256,400
Motor Vehicle Expenses	46,466		46,466	47,266		47,266
WHS	401		401	750		750
Office Expenses	3,228		3,228	3,430		3,430
Printing & Publications	1,734		1,734	11,050		11,050
Project Insurance	6,063		6,063	8,550		8,550
Project Manag. Costs	189,419		189,419	144,389		144,389
Rent	48,453		48,453	39,779		39,779
Retrofit Items & Install	520,523		520,523	500,000		500,000
Salary - Energy Audits	187,277		187,277	213,207		213,207
Salary - Admin & Support	207,234		207,234	212,718		212,718
- Annual Leave	19,375		19,375	37,793		37,793
- Long Service Leave	6,688		6,688	8,230		8,230
- Staff Recruit. & Training	16,533		16,533	8,899		8,899
- Superannuation	32,086		32,086	42,550		42,550
- Workcover	12,633		12,633	29,040		29,040
TOTAL EXPENDITURE	**2,202,337**	**625,732**	**2,828,069**	**2,192,000**	**530,900**	**2,722,900**

7. Conclusion

The project achieved its aim of finding a way to address the landlord tenant split incentive with over 200 households (tenant and landlord) willingly participating, and it improved comfort within the participating homes whilst not significantly increasing their energy bills.

Our findings indicated co-benefits from improving thermal comfort within households. For example, increased health and wellbeing, improved sleep, a happier household and increased mobility. Although not speciality extrapolated by the consortium, it is probable that increased thermal comfort in one's household could correlate to increased physical activity, improved mental wellbeing and reduced doctor visits, ultimately contributing advantageously to community wellbeing.

In-depth post intervention interviews with 50 tenants indicated that air conditioners and/or insulation were found to have made significant improvements to comfort in a majority (81%) of homes. Specifically, they were pervasively found to have made homes more 'liveable' (25%), meaning that residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons. Additional responses to the ways in which participant's increased comfort has impacted on them include improved sleep (19%), a greater incentive to get up (10%) and children being happier (10%).

The same post intervention interviews indicated that sixty-four (64%) changed their behaviours as a result of the suggestions they received. Participants indicated a range of further energy-saving improvements they would like to make to their dwellings, suggesting that cost and attaining 'landlord buy-in' remained key barriers to doing so.

The trial found that 66% of households where an existing Air-conditioning unit was replaced experienced either a reduction in overall reduction in energy use or maintained their pre intervention levels over the summer months. Where a new unit was installed where there was not one previously only 11% experienced an overall reduction in energy use.

Given the projects focus on South Australia's long hot summer the energy efficiency findings from the analysis of excluding air conditioner usage isolated from other mains use within the home are of particular interest. In the summer months following an intervention, 86% of households showed a significant reduction in estimated AC energy.

When looking at the households where an old air-conditioner was replaced as part of the project intervention on average an estimated 46% reduction in AC cooling energy for the summer months resulted from the AC intervention. That correlated to an average saving of approximately $88 of avoided electrical energy costs, based on an average tariff of 32¢/kWh for the cooling months. When the winter months are included there is an estimated saving of 606kWh/annum that correlates to an average saving of approximately $194 of avoided electrical energy costs, based on an average tariff of 32¢/kWh per annum[19].

[19] Commonwealth of Australia (Department of Industry, Innovation and Science) 2016, Consultation Regulation Impact Statement – Air Conditioners and Chillers, Equipment Energy Efficiency Program, Canberra.

Given the variation in rental values throughout the trial period the 12 month rent freeze may not have been as significant co-contribution to the project as initially envisaged. However, when asked about the ability to be motivated to invest in further energy saving actions landlords stated that cost benefit ratio presented as a main decider. Despite that, 72% agreed or strongly agreed that they were more likely to implement actions to help tenants save energy OR improve their comfort since participating in *Beat the Heat!.*

The project found that working through a Real Estate Agent and Community Housing providers proved an effective way to gain participation in the project, and equally importantly manage the various aspects of the trial.

8. Recommendations

Beat the Heat! has three main recommendations for future work.

Extension of Project
Given the improvements to comfort and the increased health and wellbeing related impacts there is value in a broader rollout of the project. The project aimed to improve comfort while not increasing energy consumption but surpassed expectations by creating an average reduction in bills. This is a clear benefit for this low income cohort who have little or no disposable income.

Continuing the recruitment method through the real estate agents will maintain a high uptake of the project as it provides both the tenant and landlord with some trust and security. The interest expressed by landlords and real estate agents not connected to the project suggests there is an appetite for broadening the project.

The rent freeze adequately met the split incentive to encourage participation, but there would be value in further testing what increased contribution by the same method of foregoing income would be acceptable to landlords.

Targeting households with older inefficient air-conditioners for replacement would provide the greatest energy efficiency benefit, but likely greater comfort improvements would come from those without any existing air-conditioning as indicated by the temperature change findings.

As South Australia moves to cost reflective tariffs where prices increase with summer peak load the importance of ensuring that low income renters can efficiently cool their main living area also increases.

Research into Health Impacts
Our participants spoke of improved sleep, mobility and reduction in stiffness and pain, improved mental health as a result of the intervention. We expect there would be greater health benefits maybe even reduced morbidity should this be explored further.

Especially as days of severe or extreme heat continue to rise there would be merit in further exploring the correlation between improving comfort by installing efficient RCAC and ensuring adequate insulation levels and any increased health and wellbeing benefits.

Equally, Beat the Heat! participants reported greater comfort levels in winter as well as summer suggesting that the value of the project extends to winter as well as summer. Further research could investigate the health and wellbeing benefits in winter.

Greater Planning Time for Future Trials
A key learning from the trial was the need to take more time at the start of the project to plan, trial and refine all aspects of the project. Should a similar trial be conducted again we would highly recommend sufficient time be set aside for these activities.

9. References

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10. Appendices

Appendix A -Telephone interviews with tenants

November 2015

1. Overview

During the period spanning September to November 2015, residents engaged in the *Beat the Heat!* partnership project participated in telephone interviews designed to gauge their satisfaction with the project and its outcomes.

Fifty residents were interviewed, providing feedback on how the air conditioner and/or insulation installed on their premises had impacted upon their comfort, lifestyle and finances, as well as the broader impact of participation in the project on their energy-related behaviours.

The vast majority of participants (92%) were satisfied with the air-conditioner and/or insulation they received. Indeed, 76% reported high satisfaction levels. Only two (2) participants registered dissatisfaction, while one felt 'neutral'.

For respondents who registered high levels of satisfaction (76%), key drivers included affordability, increases in effectiveness and efficiency, greater sense of "liveability" and comfort, and a perception that activities need not be dictated by the weather. A small number of participants felt dissatisfied and cited issues including a lack in 'noticeable changes in comfort' and a waste of time as deterrents for project involvement.

High satisfaction was linked to participants' experience of their air conditioner/insulation as being affordable, effective, and more efficient than their previous means of heating and cooling.

Participants registering lower levels of satisfaction (a minority) linked their concerns to the location of the unit, (marginally) increased costs and issues around care and maintenance of the unit.

With regard to post installation levels of comfort, generally participants reported a greater increase in comfort in winter. However, many participants did not have their air-conditioner/insulation installed in time for use last summer.

Air conditioners and/or insulation were found to have made significant improvements to comfort in a majority of homes. Specifically, they were pervasively found to have made homes more 'liveable', meaning that residents did not have to vacate their homes, or have their activities restricted, in the extremes of the seasons.

Only half of respondents had noted an increase in their energy use in the period since the installation of their air-conditioner/insulation. The same number noted a decrease in use, while the other half had noted no difference or had not yet received a bill. Nearly half of all participants had been actively trying to save energy over the relevant period.

Overall changes in energy use (either positive or negative) were regarded as "very small". Importantly, only two participants reported a marked increase in their energy use since the installation of their air conditioner.

A majority of participants recalled the recommendations made at their energy visit. Seventy percent (70%) found the visit useful, and 60% reported having changed their behaviours as a result of the

suggestions they received. Participants indicated a range of further energy-saving improvements they would like to make to their dwellings, suggesting that cost and attaining 'landlord buy-in' remained key barriers to doing so.

Fifty percent (50%) of participants interviewed had never used their energy monitor. Those who did frequently remarked upon its usefulness in educating them around energy consumption, and indicated that it had informed a change in their behaviours.

Suggestions around improvement to *Beat the Heat!* provided by participants focused on the provision of more information and support with regard to air conditioner maintenance and use of the energy monitor. Ninety four percent (94%) of all interviewed indicated that their involvement in *Beat the Heat!* had been a positive experience overall.

Thematic analysis of the interview corpus informed recommendations for future iterations of *Beat the Heat!* including having explicit discussions about participant expectations prior to commencement, actively facilitating the landlord/tenant relationship, and differentiating the information and materials provided for participants of different levels of technological and physical ability.

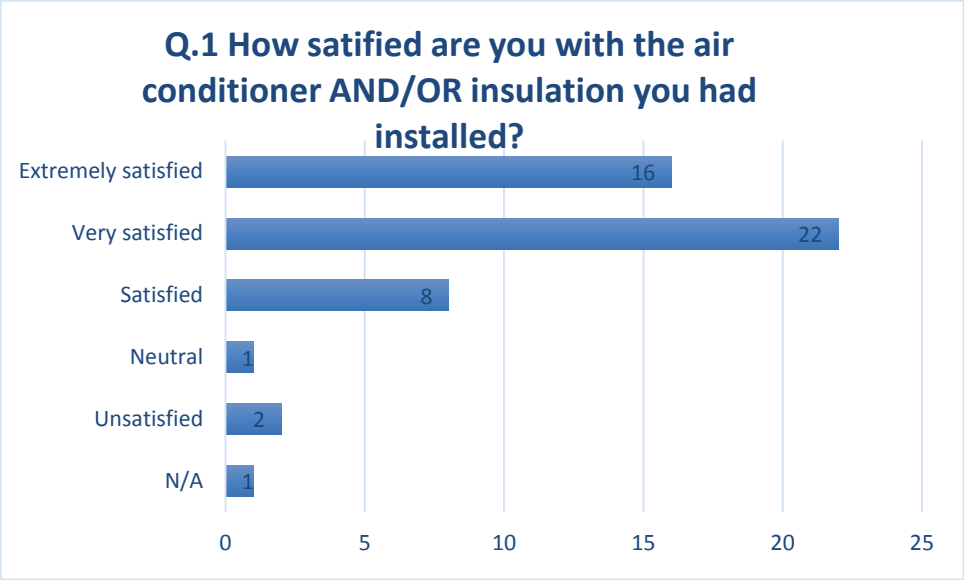
Participant demographics

- A total of 50 participants were interviewed; 20 male and 30 female.
- 17 households within the project that were identified as 'golden households' (households from whom data from all sources was available). 11 households were able to be interviewed as part of the total interview process.
- In order to complete 50 interviews, 109 households were called (response rate just under 50%), but it must be noted that, when they did answer the phone, all participants agreed to participate in the interview.
- Of the participants interviewed, 34 had received only an air-conditioner, 12 had received an air-conditioner and insulation, and four (4) had received insulation only.
- *A full list of questions is located in Appendix A*

2. Results

Question 1 – How satisfied are you with the air-conditioner AND/OR insulation (as relevant) you had installed?

The vast majority of participants (92%) were satisfied with the air-conditioner and/or insulation they received. Indeed, 76% reported high satisfaction levels. Only 2 participants registered dissatisfaction, while one felt 'neutral'. One respondent had not yet used the air-conditioner, so the satisfaction question was not applicable in that case.



Question 2 – Why are you/aren't you satisfied?

In Question 2, participants were asked to provide reasons as to their satisfaction levels as reported in Question 1.

For the participants who reported being unsatisfied, specific justifications were offered:

> *Participant 191 reported that the air-conditioner he received "didn't help" because his landlord "refused to seal the cracks, which he needed to do to get the insulation". This participant explained that he therefore got no benefit from the air-conditioner, as the heat/cool "immediately vanished through the cracks". Frustrated, he described the project as being "all about the landlord, and a waste of time for the tenant".*

Participant 219 registered dissatisfaction on the grounds that receiving insulation only had not made a noticeable change in her comfort. 591 reported feeling 'neutral' about the project for exactly the same reason.

For participants who reported feeling 'satisfied', the primary limitation reported was around the place in which their air-conditioner was installed. Five (5) participants reported that the decision as to unit location was made by the landlord or the installers, and had resulted in poor distribution of heating/cooling.

Other 'satisfied' participants reported small concerns around increased costs (2 participants), problems cleaning the unit (2 participants) and issues of noisiness or inconsistent temperature (2 participants). Two unit breakdowns (subsequently repaired) were reported.

For respondents who registered high levels of satisfaction (76%), some key themes emerged:

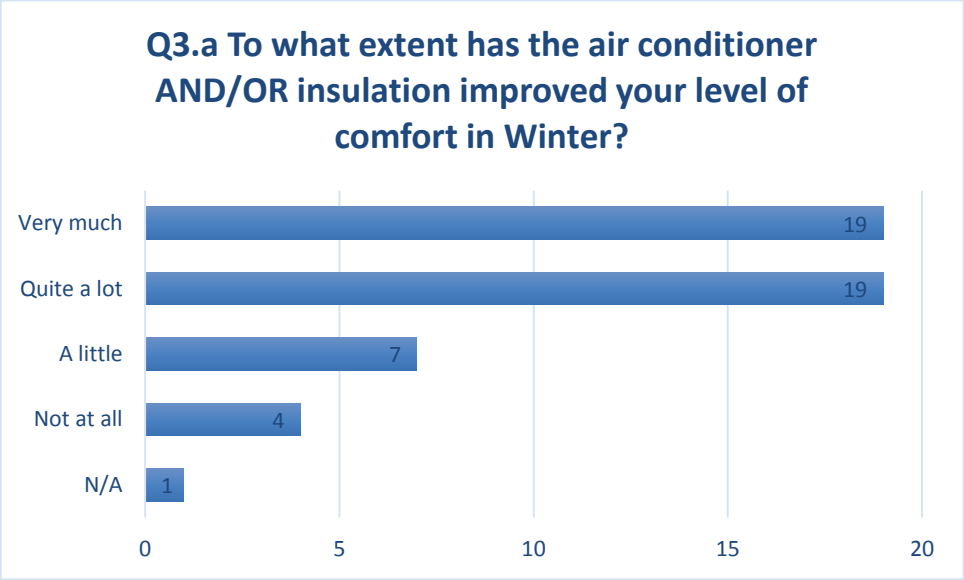
- Significantly, many participants reported that they were pleased that the new air conditioner had proven to be affordable, effective and more efficient than their previous means of heating/cooling their home.
- It was also commonly reported that the new air-conditioner/insulation made the home "more liveable", in that respondents felt they didn't have their activities dictated by the weather, and could stay at home comfortably even in the extremes of the seasons.
- Respondents also described the air-conditioner as providing a 'pleasant heat' that provided a comfortable environment for children.

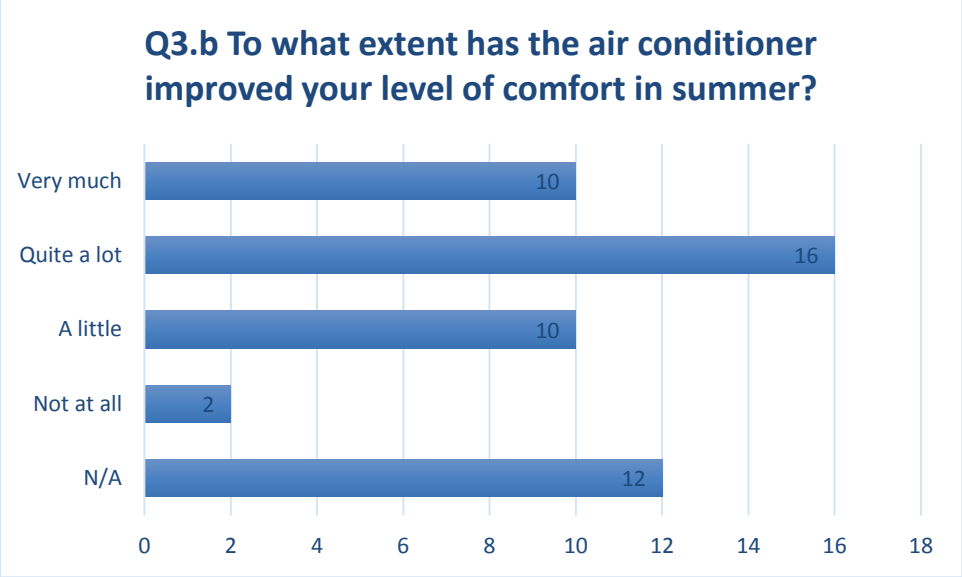
A full list of responses in order of frequency is provided below.

Theme	No. of responses
Affordable	13
More effective than previous means of heating/cooling	10
It is very effective	9
It makes the home more 'liveable'	8
Residual heat is great	7
It is quiet	5
It is a 'lovely kind of heat'	4
There have been no faults	4
It helps me sleep	3
It helps my mobility	2
It is easy/uncomplicated to use	2
It helps my pet	1
It doesn't dry my skin	1
It stops weather extremes from reducing quality of life	1

59 "It has made the main living areas liveable and comfortable. I used to have a less effective air conditioner in the lounge, but cooking and cleaning was still unbearable in the extremes of hot and cold. Now I am more comfortable to cook and just get on with it in summer. [It means] that I can take better care of myself".
821 "It works so much better than my previous air conditioner, which wasn't installed properly. It cools the place down within five minutes. It is quiet and it's not too expensive to run".
877 "It's made it more comfortable when children were here. [It's] basically affordable, and it's more efficient than the old heater".

Question 3 – To what extent has the air conditioner AND/OR insulation improved your level of comfort in winter? And in summer?
Question 3 sought to ascertain the change in participants' comfort levels post-installation.
As the graph below indicates, participants reported a greater increase in comfort in winter, but it must be noted that many participants did not have their air-conditioner/insulation installed in time for use last summer.



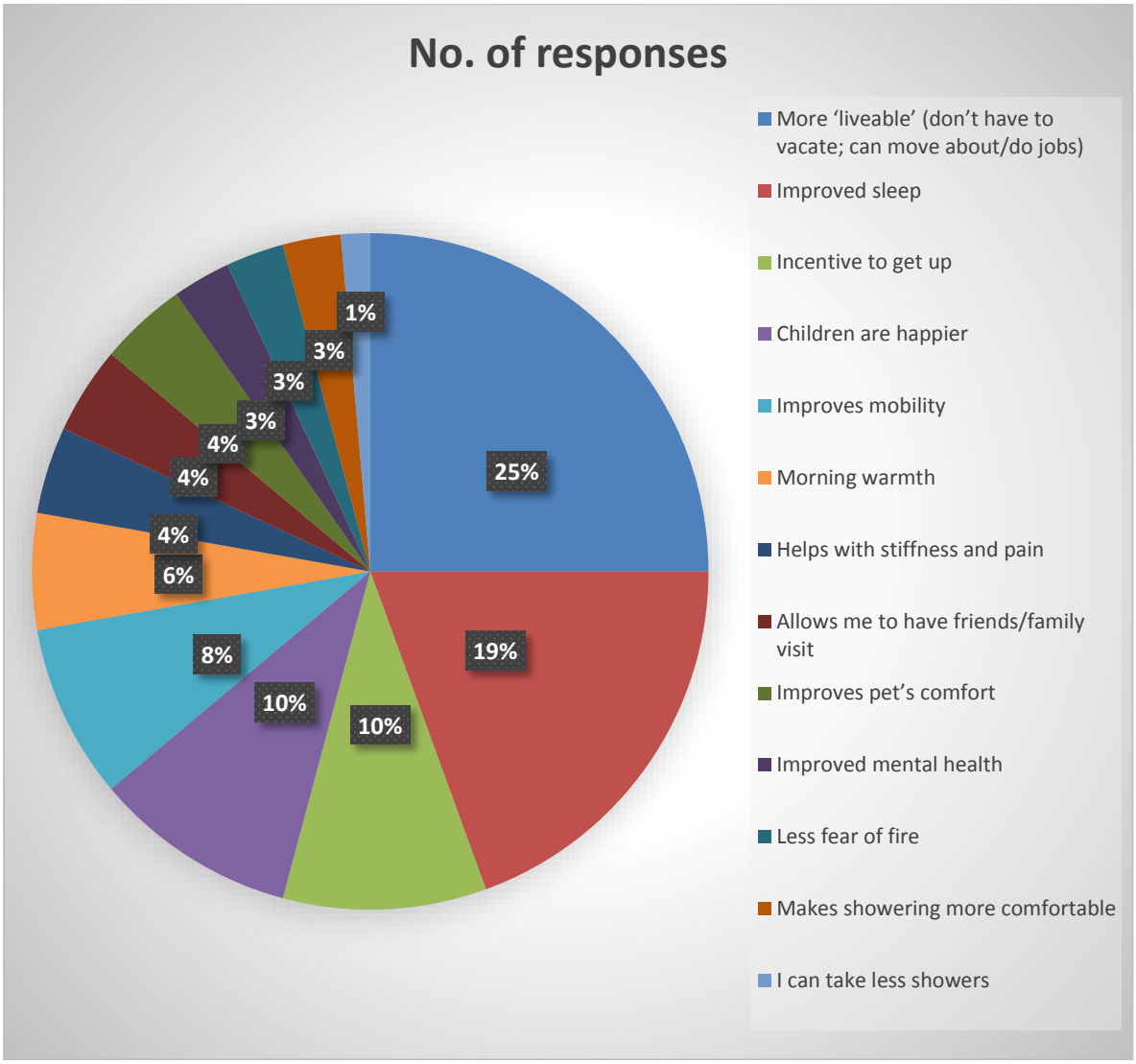


Question 3.c – How did the air-conditioner and/or insulation improve your level of comfort?
Some key themes emerged as participants described the ways in which their comfort has increased since the installation of their air conditioner/insulation.

Most importantly, many respondents reported that their home was simply "more liveable", meaning that they felt able to continue doing daily chores and activities in the extremes of the seasons, as well as moving around freely, and being able to stay up in the evenings.

> *895 "On extremely hot days I put it on all day and it means I can walk around comfortably and do all the usual jobs rather than having to strip to my knickers and lie down!"*
> *941 "I don't have to rug up, I can stay up a bit longer on cold evenings and get things done".*
> *911 "It helped with sleeping in summer, and more so with mobility, mental health and general liveability in winter".*

Improvements in the ability to sleep comfortably were frequently reported. Many participants suggested that the comfortable temperature gave them an "incentive to get up in the mornings", and others reported increased personal mobility on cold mornings. A number of respondents mentioned improvements in their children's comfort as a result of the installation.



Theme	No. of responses & %
More 'liveable' (don't have to vacate; can move about/do jobs)	18 (25%)
Improved sleep	14 (19%)
Incentive to get up	7 (10%)
Children are happier	7 (10%)
Improves mobility	6 (8%)
Morning warmth	4 (6%)
Helps with stiffness and pain	3 (4%)
Allows me to have friends/family visit	3 (4%)
Improves pet's comfort	3 (4%)
Improved mental health	2 (3%)
Less fear of fire	2 (3%)
Makes showering more comfortable	2 (3%)
I can take less showers	1 (1%)

Q4a) Are you aware if your energy use has gone up or down since your air-conditioner/insulation was installed?

Question 4 sought self-reported information around participants' energy use.

As the graph below indicates, ¼ of respondents did not know whether their use had gone up or down (many had not yet received a bill) and ¼ reported that their use had stayed much the same.

Interestingly, ¼ reported a decrease in use, and ¼ reported an increase – yet in almost every case respondents qualified their answer by saying that the change, in either direction, had been "very small".

877 "I think it has gone down slightly".

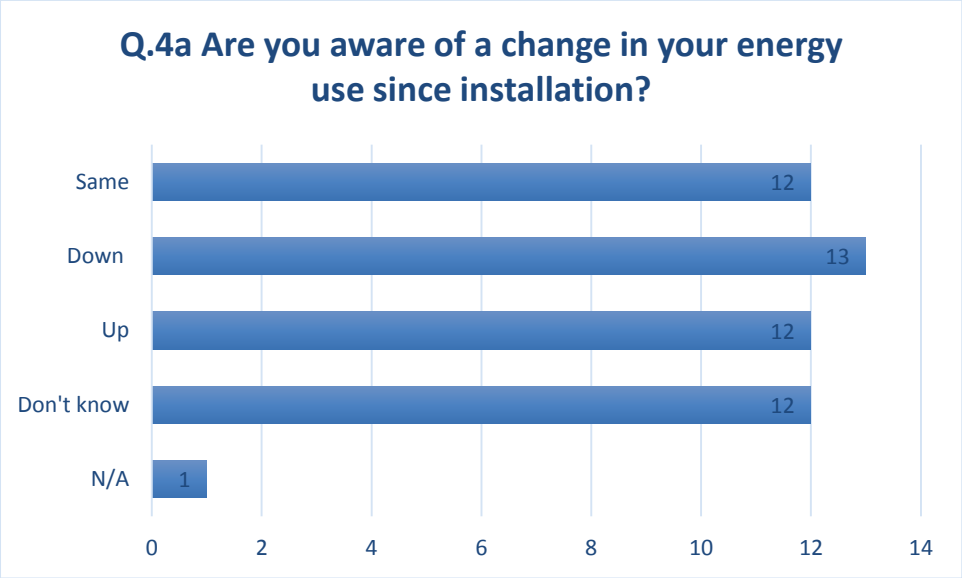
917 "I've noticed a small increase in energy use".

895 "I don't know. It is all taken out of my centrelink".

Importantly, only two participants reported a marked increase in their energy use since the installation of their air conditioner.

1105 "[It] has definitely gone up. Last bill was for nearly $300 which was a shock".

541 "The bill has gone up. We're usually in credit about $60, but now we owe $100"



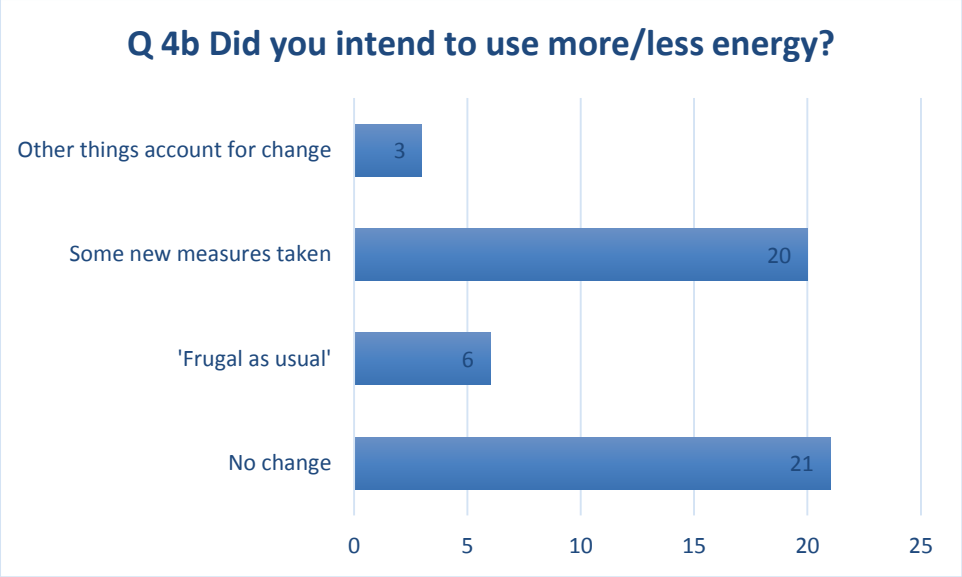
Q. 4b) Did you intend to use more/less energy?

Forty percent (40%) of participants indicated that they had been actively trying to save energy over the relevant time period, while another 42% had made no change to their patterns of consumption. Twelve percent (12%) reported that they have continued to make the energy-saving efforts they have always made, while a final 3% indicated that changes to their pattern of use could be attributed to other factors (including the arrival of a new baby and needing new health equipment.).

877 [We] simply switched from the old to the new heating, and made a bit more effort to turn off appliances at switch.

917 "[We knew] that the air conditioner would increase our power use, so we aimed to limit our reliance on it, and to implement other passive heating and cooling strategies including sealing drafts, letting the sun in when it is cold and shading early in summer".

905 "I haven't thought about it".



Q. 4c) Why have you used more/less energy?
Participants were asked to provide a reason for any change they had noticed in their pattern of energy consumption.

For those who had noted an increase in energy use, seven (7) respondents attributed the change directly to the use of the new air conditioner. Others linked the rise to "a particularly cold winter", to a change in energy company, and to the purchase of other new appliances.

Respondents who noted a decrease in energy use largely attributed the drop to the fact that the new air conditioner was simply "more efficient" than their previous model (10 respondents). Four (4) respondents attributed the decrease to the fact that watching the energy monitor has made them "more aware, and more frugal" about energy use. Others linked the drop to the new insulation, and to other energy-saving behaviours (including the purchase of new appliances).

Q.5a) Do you recall having an energy visit where someone came and talked about ways you can save energy throughout your house?

I. **Do you remember some of the things they suggested (these were also sent in a written report)?**
II. **If no, would you like to receive the report again?**

Only four (4) participants could not recall the energy visit. Of those who could recall it, 17 (34% of all interviewed) could not recall any specific suggestions they received at the time, or in the subsequent report.

The other respondents recalled a wide array of recommendations, frequently including turning appliances off at the switch, closing off unused rooms, sealing drafts, closing curtains, and washing clothes in cold water.

Recommendations recalled	No. of mentions
Turn off appliances at the switch	12
Close off unused rooms	9
Sealing drafts	8
Close curtains	6
Wash clothes in cold water	5

Shade windows with awnings, sails	6
Use energy-saver bulbs	5
Don't rely on/overuse the A/C	4

Other recommendations received:

- have a 4-minute shower
- check the star rating of appliances,
- turn off the air conditioner when desired temperature is reached
- ask landlord for a screen door, buy rubber door seals
- use the sun's warmth in winter
- don't use the 'automatic' setting on the air conditioner.

Q.5b Have you implemented any of the recommendations you were given? Why?
Twenty (40%) of respondents explained that they had not implemented any of the recommendations coming out of the energy visit.

A pervasive reason provided was that issues around age and health meant participants felt the: "need to prioritise comfort" over energy-saving measures.

A further 16% of participants indicated that they were "already doing the things suggested" and therefore took no further action in this regard.

Sixty Four (64%) of respondents reported making changes to their energy-related behaviours after the energy visit. The most frequently-reported changes included turning appliances off at the switch, not over-using the air conditioner, sealing drafts, closing doors and not running the air conditioner too cold in summer and warm in winter.

Recommendations implemented	No. of mentions
Turn appliances off at the switch	14
Close doors	7
Don't over-use the air conditioner	5
Close the curtains	5
Seal drafts	5
Don't run the a/c too high/low	5
Wash clothes in cold water	3
Short showers	3
Check the energy monitor	3
Use the sun's warmth	2
Turn a/c off when desired temp. reached	2
Use energy-saver globes	2
Close old a/c vents	1
Dress warmly	1
Screen door fitted	1
Awnings installed	1

Q. 5c) Was the energy visit useful?
Only 22% of respondents *did not* find the energy visit useful. Many of these explained that 'it was not anything they didn't already know'. Four (4) respondents could not recall the visit.

Seventy percent (70%) of respondents found the visit to be helpful, and many made concerned themselves with reporting how much they had appreciated the kindness of David and Igor.

Feedback commonly included a request for more information about cleaning the air conditioner units, which was cause for concern for many. Others requested more information about how to use and maintain the energy monitor. One participant requested a 'fridge-magnet list' of energy-saving tips that could be referred to on an ongoing basis. Interestingly, one respondent reported that David's recommendation that a screen door be fitted at his home gave him "leverage to ask the landlord for it", and ultimately to have one fitted.

> *901 "The visit was useful. It would be better to receive a brief list of suggestions that could be stuck to the fridge for reference".*
> *917 "It was useful. After talking to a neighbour also in the project, it would probably be useful to give more information about using both the A/C and the monitor. My neighbour forgot how to use the monitor so I had to help him use it".*
> *911 "[The visit] changed how I did things".*
> *839 "The man was nice but it wasn't overly useful"*

Q.6 If you could make changes to save energy, what would they be?
Participants listed a range of improvements they would like to see made to their homes if money, time, and their landlord's approval were no object. Most frequently these included purchasing solar panels, upgrading appliances, getting awnings and repairing wall and ceiling cracks.

Other responses included new door frames, roller shutters, double glazing, more doors, insulation, getting a fan, changing windows, getting blinds, changing to gas, getting a better shower rose, solar water heating and erecting a veranda.

895 "I would like to get some blinds for the kitchen against the afternoon sun, but they have to be approved so I can't just go and get the ones that are on special"
911 "I would love to have solar panels, proper door seals, better windows and solar water heating".
919 "The place is full of cracks and is really in disrepair. It makes it impossible to keep in heat or cool. Needs major repairs".

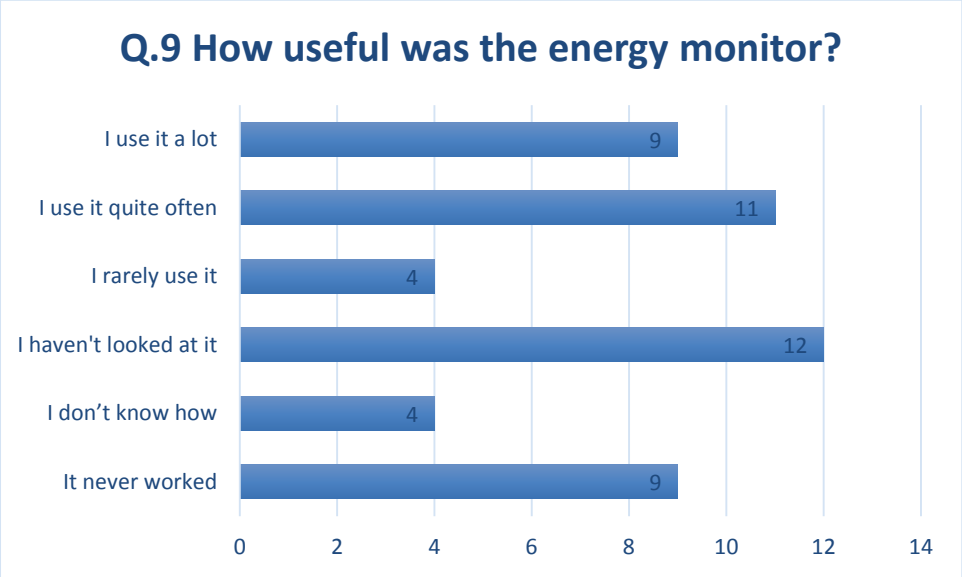
Q. 7 What's stopping you?
In reporting barriers to saving energy, participants routinely mentioned "getting the landlord to fund the improvements" as the key sticking point, as well as the cost of any improvement they decide to make themselves. Health, age and comfort were also presented as key barriers. One respondent who had made energy-saving improvements to a previous home asked "why would I spend the time and money doing something that's really just going to benefit the landlord? I would if there could be some arrangement like a rent reduction".

> *59 "I'm not going to do all those things when it's someone else's place".*
> *279 "[The problem is] getting landlord buy-in"*
> *821 "It's an old place – it's hard to know where to start with improvements, and would be a waste of money"*

Q.8 Do you have any ideas for how you would like to receive energy efficiency information?
Sixty percent (60%) of participants said that mail is their preferred mode, while 10% indicated a preference for email. Four respondents said they would appreciate an additional home visit, and the remaining respondents said they did not need or want further information.

Q.9 How useful is the energy monitor? How does it help you monitor your energy use?
Fifty percent (50%) of respondents did not use their energy monitor at all (18% because it never worked and 8% because they do not know how to use it).

Forty percent (40%) of respondents reported using the device quite often, or a lot. One respondent reported having read an alarming article about problematic radiation emitted by smart meters that convinced her to turn hers off.



For respondents who found the monitor 'useful' (referred to it quite often) and 'very useful' (referred to it a lot) key benefits included its educational value:

- Thirteen (13) respondents indicated that the monitor had 'taught them which appliances use the most power', and how to manage their use to maintain appropriate usage levels.
- Seven (7) respondents indicated that the mere presence of the monitor (e.g., walking past it in the kitchen) serves as a reminder to turn off unused appliances.
- Other reported benefits of the monitor included the fact that it shows 'a little effort makes a difference', and that it can inform appliance upgrades.
- One respondent indicated that watching the monitor made her more comfortable about the 'unknown' of the new air conditioner in that she could see its effect on power usage rather than 'waiting to be surprised by the bill'.

Q.10 Do you have any suggestions for how a project such as *Beat the Heat!* could be improved to make it easier/more valuable for tenants? If not, why not?
A majority of participants reported feeling pleased with their involvement, and grateful for the help and kindness of the team.

- The most frequently raised suggestions focused on a need for more information on cleaning and maintenance of the air-conditioning unit (4 participants), and on the operation of the energy monitor (4 participants).

- Two respondents indicated that they would have liked more explicit warning that the air-conditioner could cause their power bill to 'blow out'.
- Other feedback included a call for more communication between the administering body to avoid duplication, the recommendation that the team involve tenants themselves in decisions about unit placement and the provision of more information about the risks of smart meters.

Q.11 Overall, has participating in *Beat the Heat!* been a positive experience for you? If not, why not?

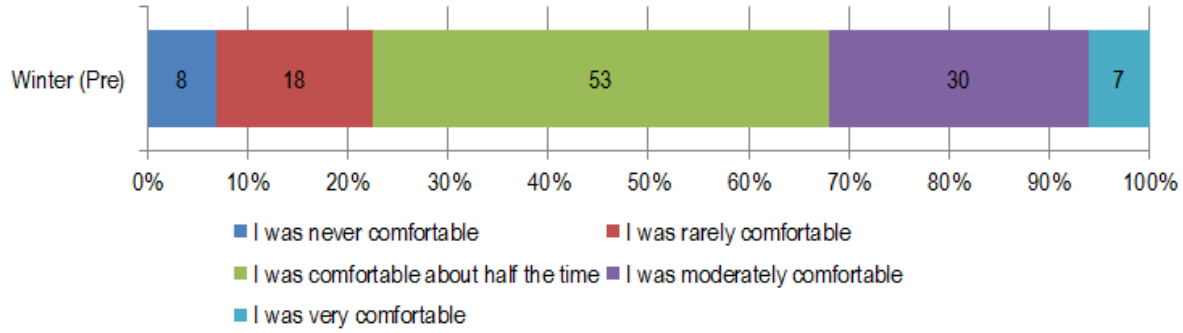
Only one respondent suggested that participation had not been positive, one described themselves as 'neutral' and one reported that they 'didn't know'.

All other respondents (94%) indicated that their involvement in the project had been positive. Numerous participants expressed thanks and gratitude for the provision of their air-conditioner and insulation, as well as for the kindness and professionalism of the administering team.

Appendix B - Survey 1: pre intervention tenant comfort & behaviour

13 Questions, 178 total Responses

Q1: **Thinking about the TEMPERATURE in your home, how comfortable were you in your home last WINTER?**



Approach:

Survey responses (before and after) were assigned a "Comfort_score" on a scale of 0 to 4. Comfort change determined by numerical comparison of "Comfort_score"

	Comfort_score
I was never comfortable	0
I was rarely comfortable	1
I was comfortable about half the time	2
I was moderately comfortable	3
I was very comfortable	4

Comfort scores

Average WINTER Comfort_score for the sample was **2.1**

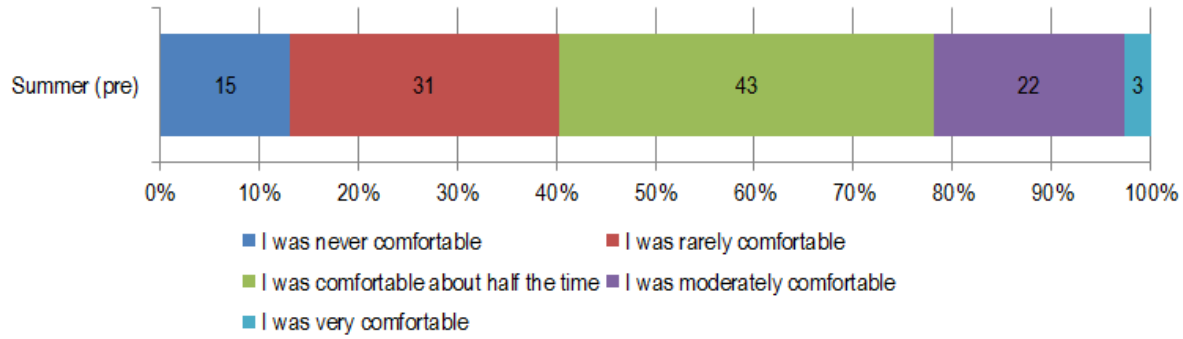
Median was 2 (i.e. "I was comfortable about half the time").

Comments summary

32 comments were recorded.

A number of those who achieved a level of comfort noted the cost of doing so. Others noted the use of an oven as a heater and the use of a kerosene heater. Others talked about being comfortable in only part of the house.

Q2: **Thinking about the TEMPERATURE in your home, how comfortable were you in your home last SUMMER?**



Comfort scores

The Average Comfort_score for the sample was 1.7, median was 2 (I was comfortable about half the time). The mean SUMMER Comfort_score was 20% below that of WINTER.

Average SUMMER Comfort_score for the sample was **1.7**

Median was 2 (i.e. "I was comfortable about half the time").

The mean SUMMER Comfort_score was 20% below that of WINTER.

Comments summary

33 comments were recorded.

Again, a number of those who achieved a level of comfort noted the cost of doing so. Others talked about being comfortable in only part of the house. Several respondents (5) mentioned faulty or broken air-conditioners. Another common theme was difficulty sleeping on hot nights.

Q3: **Do you or anyone else who lives in your home have any health issues or other circumstances (including children or elderly people) that affect your need for heating or cooling?**

38% or respondents answered YES (n=65)

Comfort scores

This cohort had an average WINTER Comfort_score of **1.9** (10% below that for the full sample)

This cohort had an average SUMMER Comfort_score of **1.6** (5% below that for the full sample)

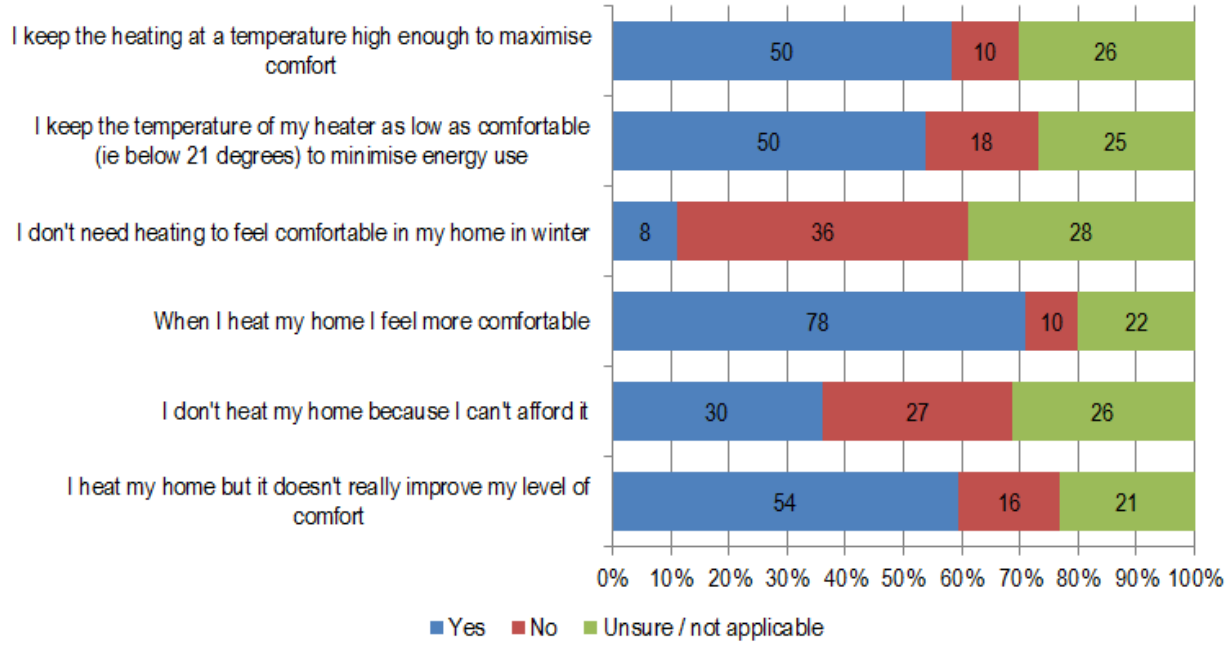
Comments summary

33 comments were recorded.

The descriptions recorded included Arthritis (n=11), Asthma and other respiratory (15), Heart conditions (5), various skin conditions, depression, high blood pressure. A number of the descriptions referred to children.

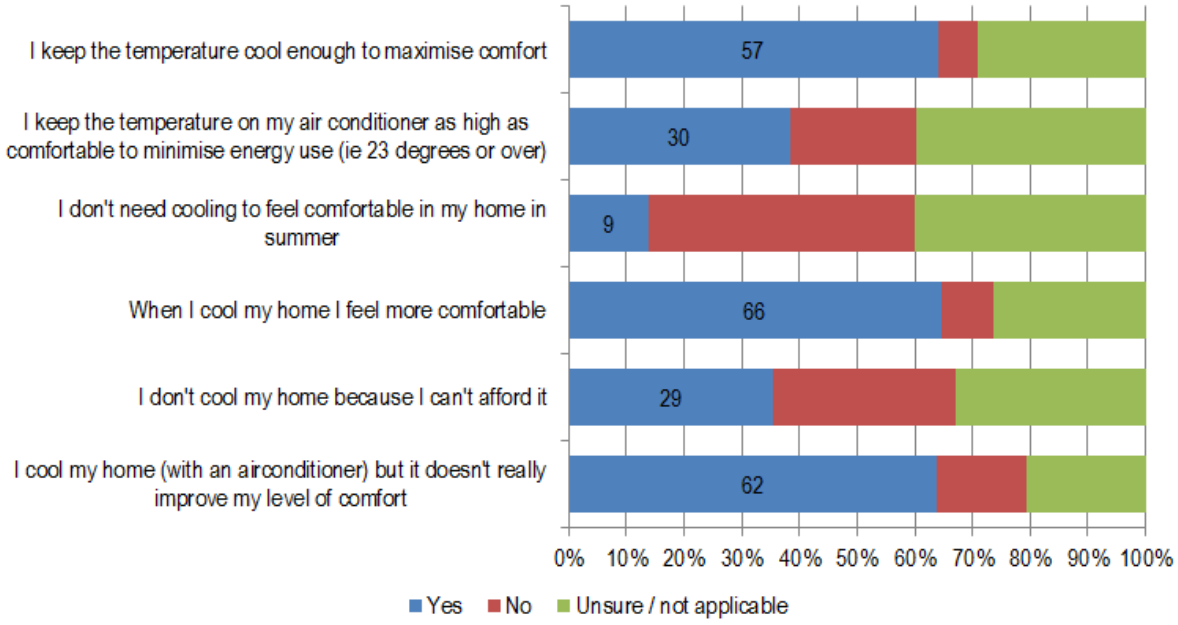
Q4: **Which of the following apply to you in WINTER?**

Related to Q1



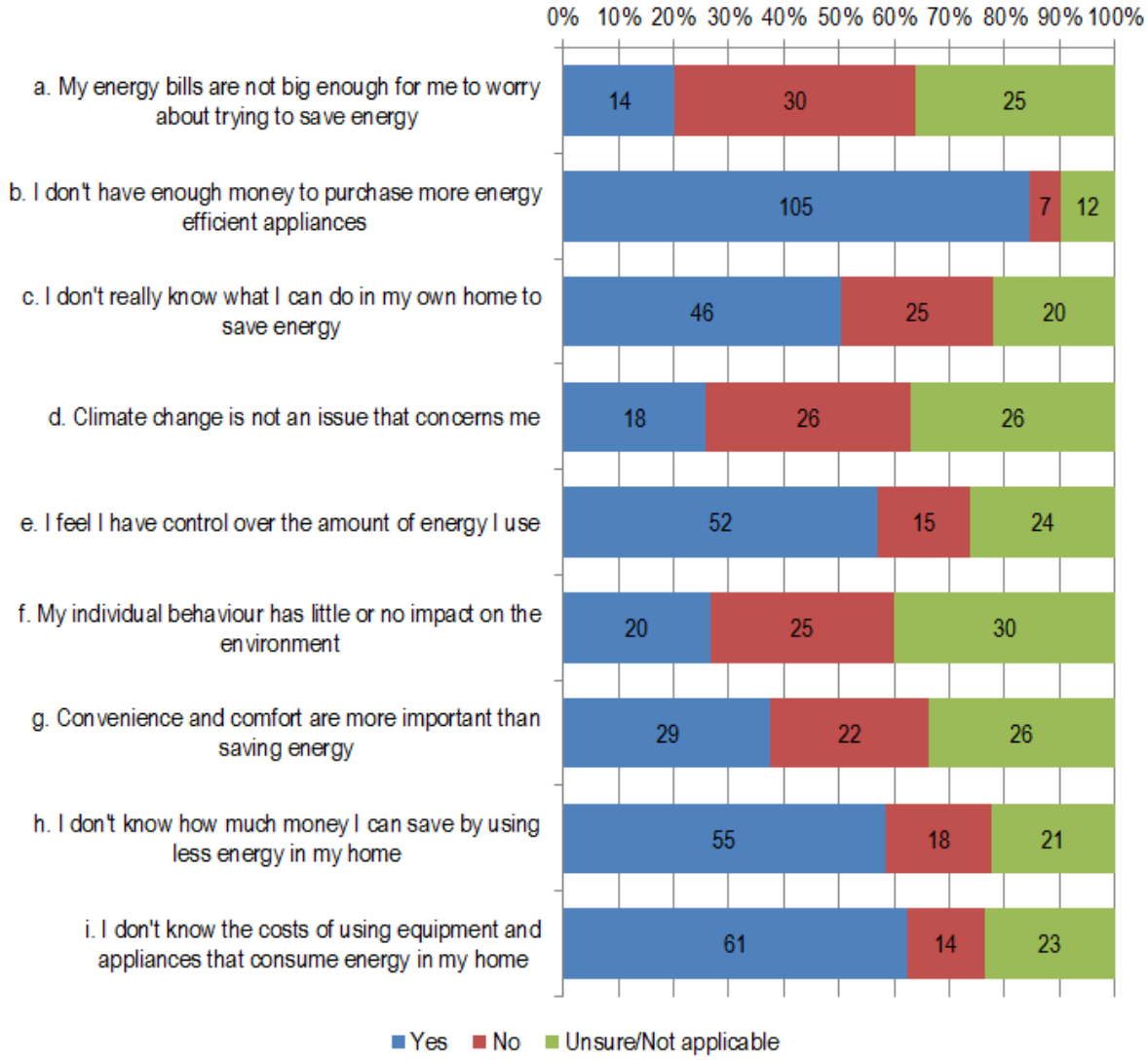
Answer Options	Yes	Mean Winter Comfort_score
I heat my home but it doesn't really improve my level of comfort	59%	1.6
I don't heat my home because I can't afford it	36%	1.5
When I heat my home I feel more comfortable	71%	2.2
I don't need heating to feel comfortable in my home in winter	11%	3.3
I keep the temperature of my heater as low as comfortable (ie below 21 degrees) to minimise energy use	54%	2.2
I keep the heating at a temperature high enough to maximise comfort	58%	2.1
Full Sample		2.1

Q5: **Which of the following apply to you in SUMMER?**
Related to Q2

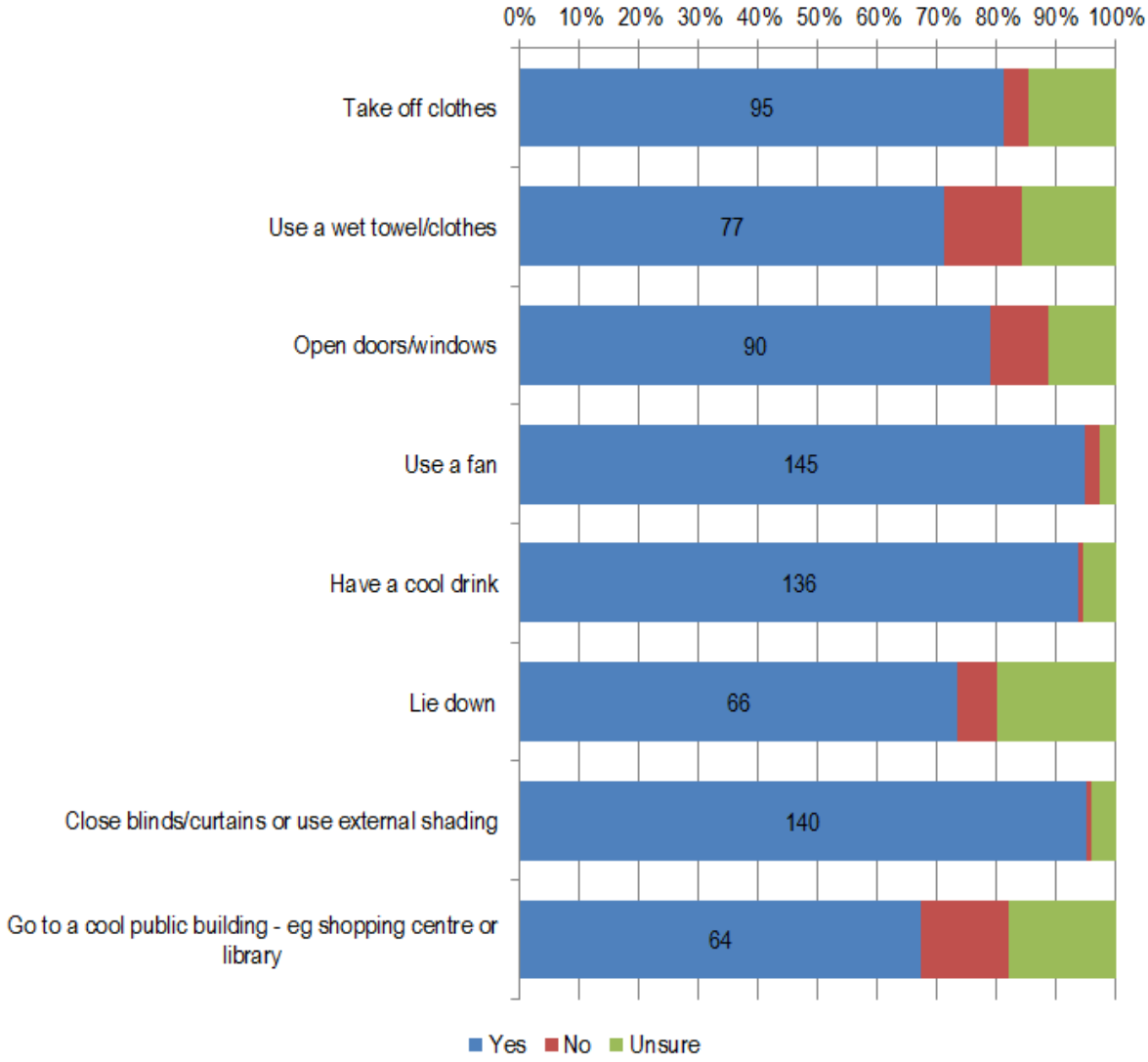


Answer Options	Yes	Mean Summer Comfort_score
I cool my home (with an airconditioner) but it doesn't really improve my level of comfort	64%	1.1
I don't cool my home because I can't afford it	35%	1.3
When I cool my home I feel more comfortable	65%	1.9
I don't need cooling to feel comfortable in my home in summer	14%	1.9
I keep the temperature on my air conditioner as high as comfortable to minimise energy use (ie 23 degrees or over)	38%	2.0
I keep the temperature cool enough to maximise comfort	64%	1.8
Full sample		1.7

Q6: W**hich of the following apply**



Q7: **During a heatwave, which of the following actions have you taken to improve your level of comfort (instead of using an airconditioner OR as well as using an airconditioner?)**



Comments summary

16 comments were recorded.

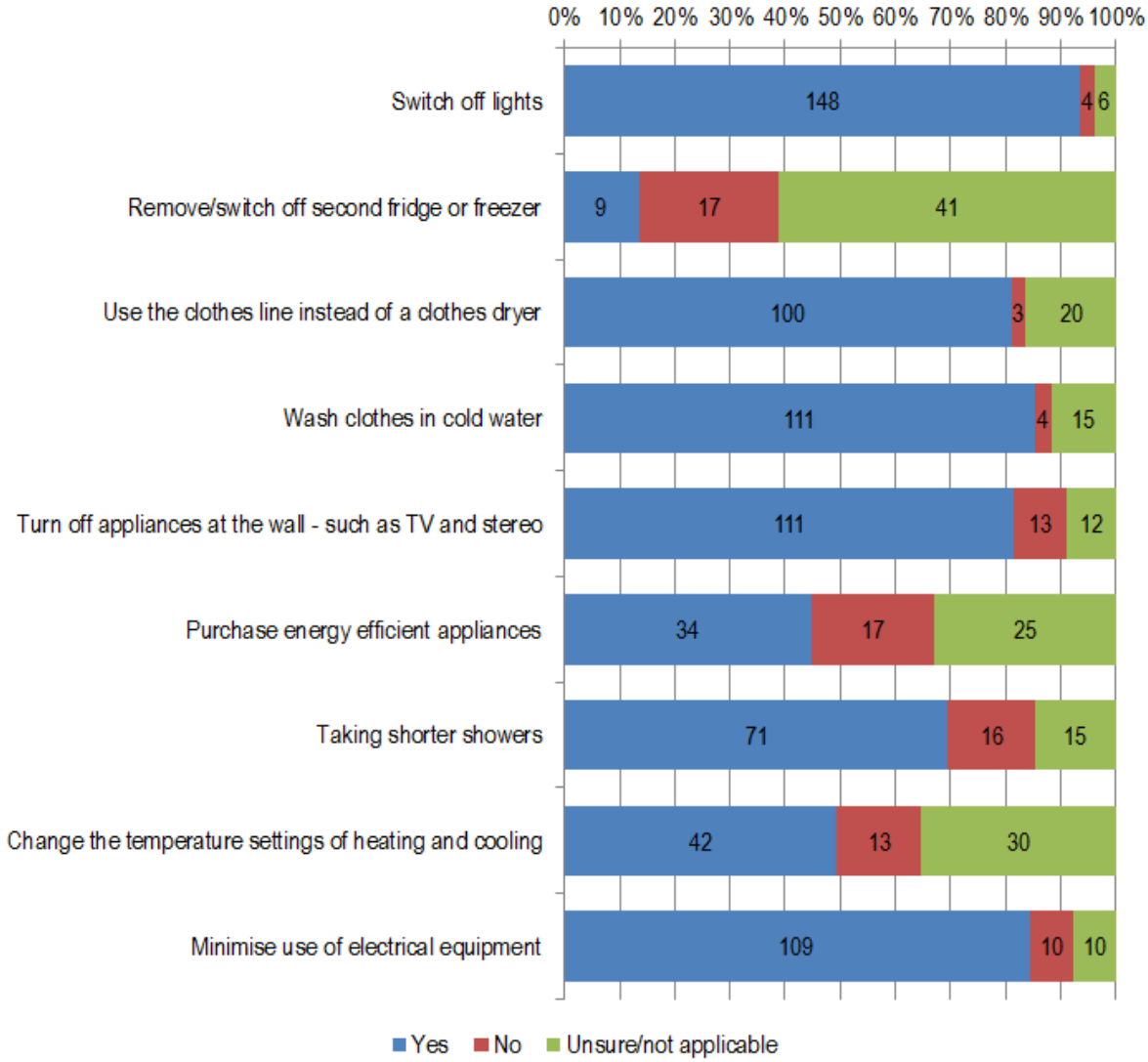
The strongest theme was “water”;

- Wet towels on head and neck
- Swimming pools and aquatic centres
- Cold showers and baths
- Spray bottles

Other theme was related to ventilating houses at night – including wet towels or sheets over screen doors to provide some evaporative cooling.

One respondent stated “Daughter needs to sleep at other family members house with RCAC”

Q8: What other actions have you taken in the past 3 months to save energy in your home more generally?

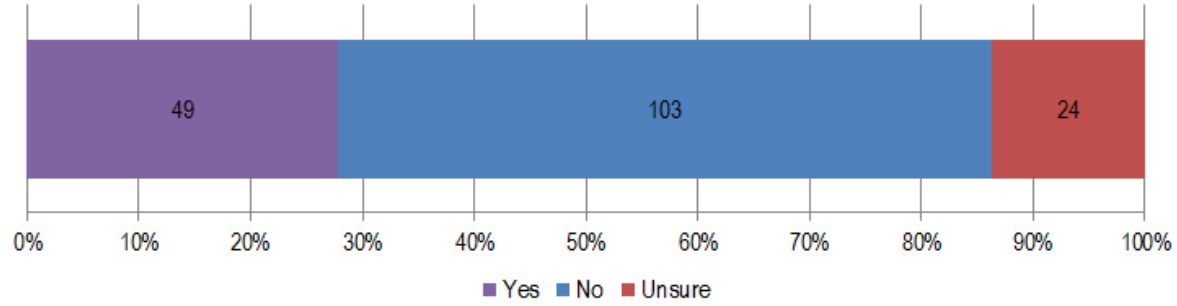


Comments summary

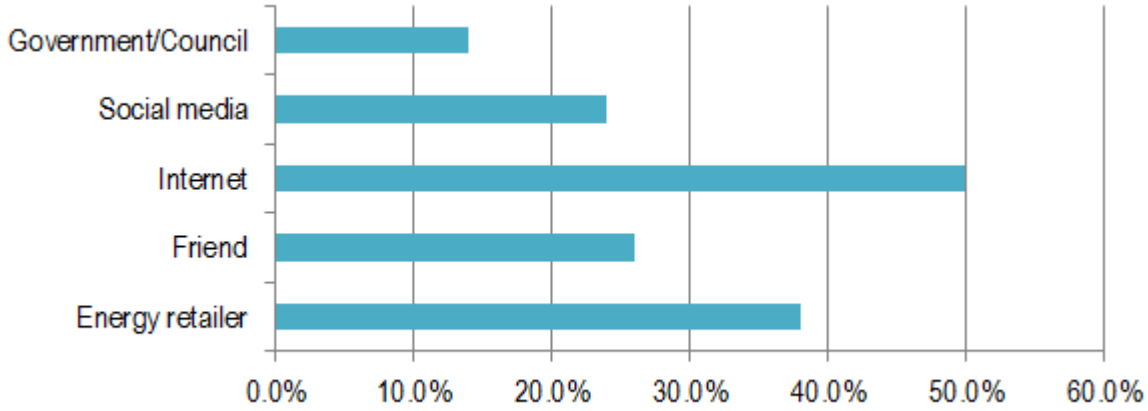
10 comments were recorded.

Respondents referred to blocking draughts, using electric blanket instead of a heater, standby power cut-out devices, timers and “trying to get kids to switch things off (big and small kids)”.

Q9: We are interested in understanding where people go to get information about energy in their home. Have you previously sought information about how to save energy in your home?



Q10: If yes, do you recall where you sought this information from?



Comments summary
19 comments were recorded.
Three respondents referred to specific knowledge from past work and/or study as being a source of information. Others referred to family (in addition to friends) and more traditional media: radio, newspapers and books.

Q11: Is there anything you have tried to do to reduce energy use in your rented property but couldn't get approved?
17 respondents (11% of those who responded to this question) said YES to this question.

Comments summary
21 comments were recorded.
The stated requests included:

- Solar power and solar hot water
- Pergola
- Aircon and heating – new and servicing of existing
- Curtains
- External blinds
- Screen doors
- Ceiling fans

Three respondents stated that their landlord was supportive of energy efficiency changes. Another reported that their "land lord has provided 1 x 1000 W and 1 x 2400 W oil filled electric heaters for portable heating"

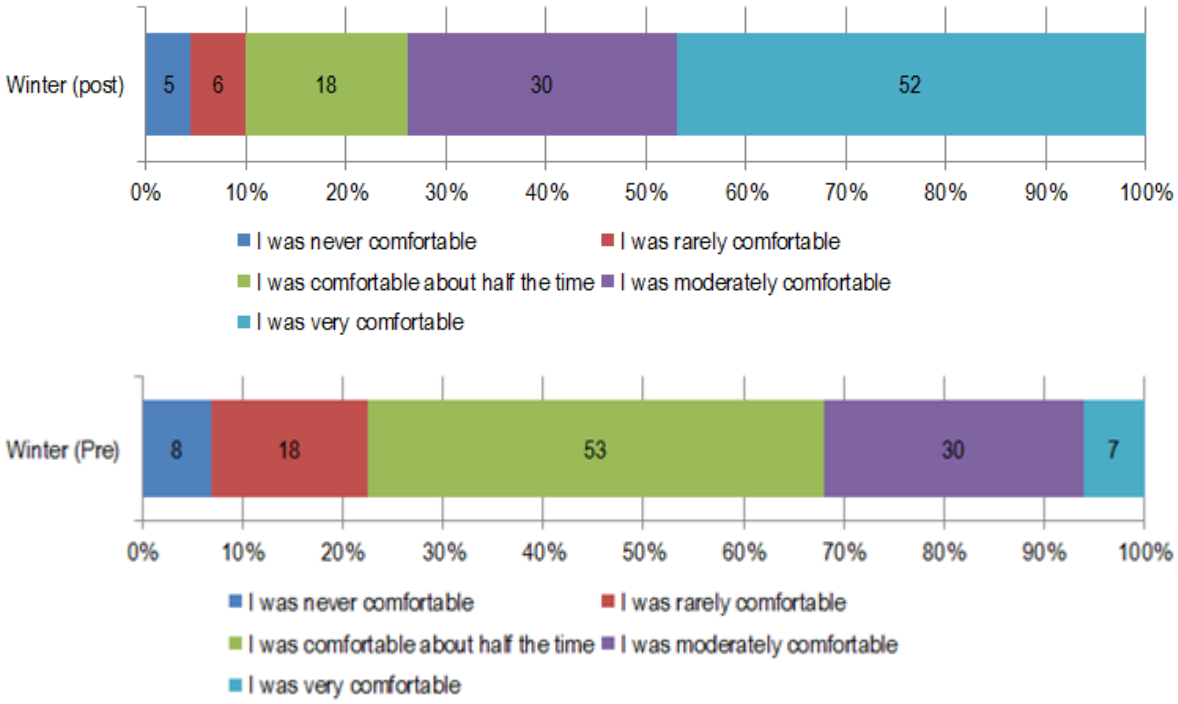
Q12: Do you have any other comments about energy or how to improve the *Beat the Heat!* project?
Open ended question. 51 responses recorded. Not analysed for this report. For review by Project Team.

Q13: Names and Addresses
Not reviewed or analysed for this report

Appendix C - Survey 2: post intervention tenant comfort & behaviour

14 questions 117 responses

Q1: **Thinking about the TEMPERATURE in your home, how comfortable were you in your home last winter? (since your new air conditioner and/or insulation was installed), PLEASE TICK ONE RESPONSE.**



Comfort scores

Average WINTER Comfort_score for the full sample BEFORE interventions was **2.1.**

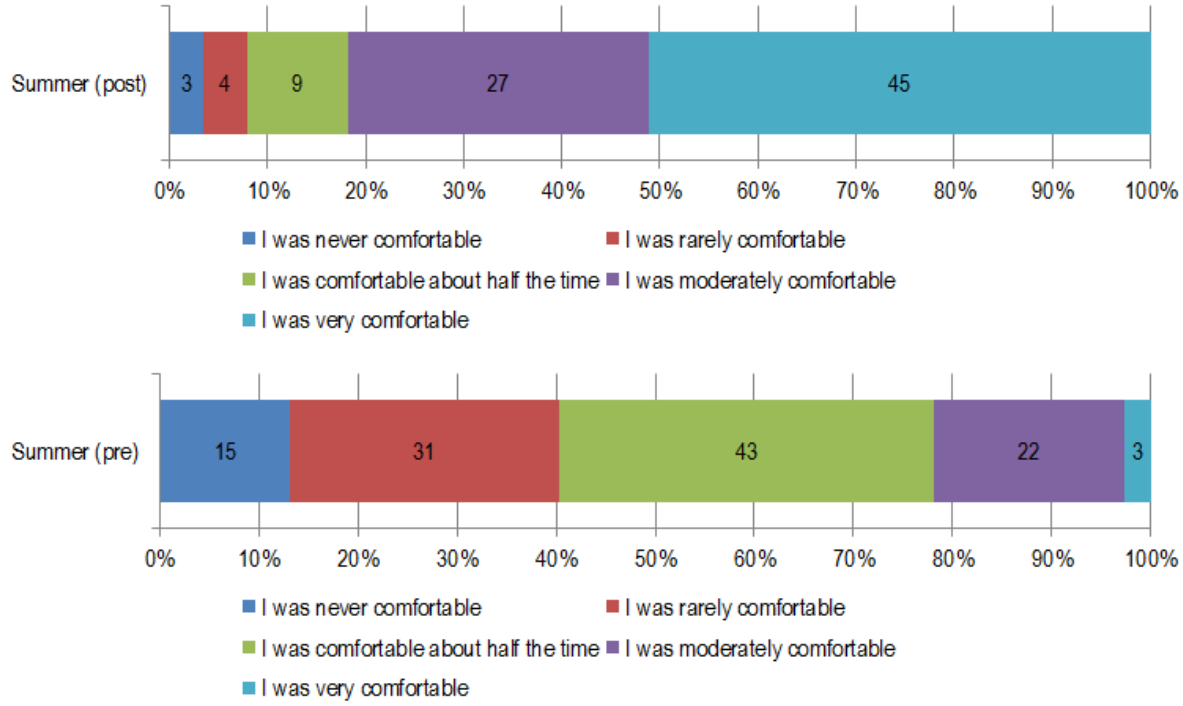
Average WINTER Comfort_score BEFORE interventions for the sample completing BOTH surveys was also **2.1.**

Median was 2 (i.e. “I was comfortable about half the time”).

Average WINTER Comfort_score AFTER interventions for the sample completing BOTH surveys was **3.1.**

Median was 3 (i.e. “I was moderately comfortable”).

Q2: **Thinking about the TEMPERATURE in your home, how comfortable were you in your home last summer? (since your new air conditioner and/or insulation was installed). PLEASE TICK ONE RESPONSE.**



Comfort scores

Average SUMMER Comfort_score for the full sample BEFORE interventions was **1.7.**

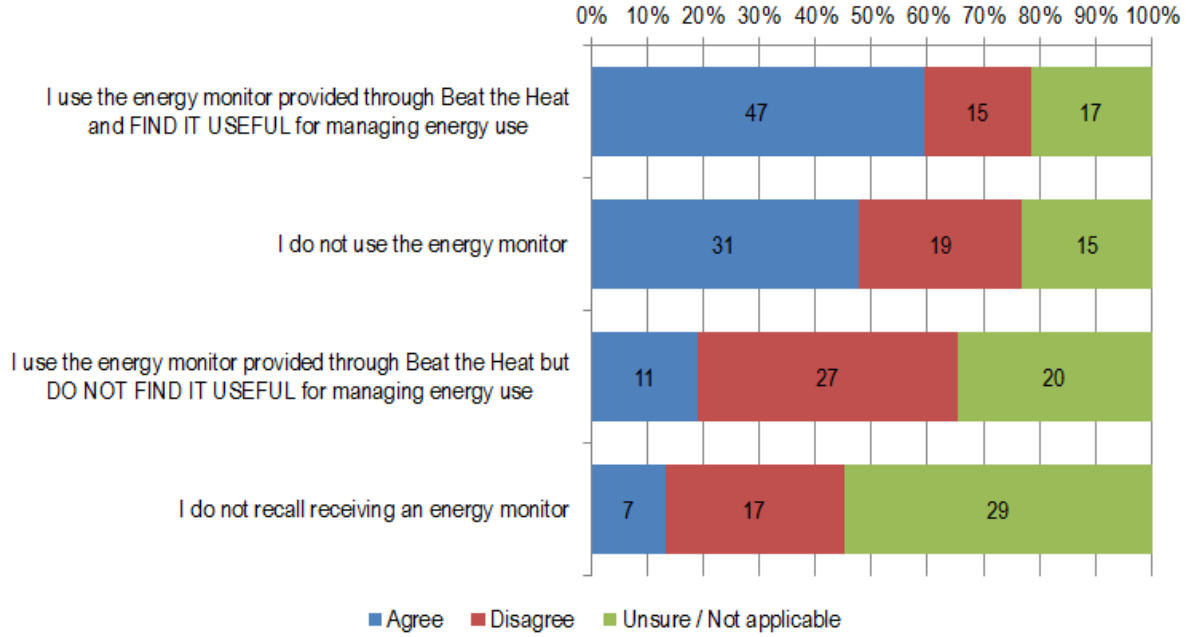
Average SUMMER Comfort_score BEFORE interventions for the sample completing BOTH surveys was also **1.7.**

Median was 2 (i.e. “I was comfortable about half the time”).

Average SUMMER Comfort_score AFTER interventions for the sample completing BOTH surveys was **3.2.**

Median was 3 (i.e. “I was moderately comfortable”).

Q3: **Please respond to the following statements relating to the ENERGY MONITOR you received when your air conditioner was installed. Please tick one response for each statement.**



Comments Summary

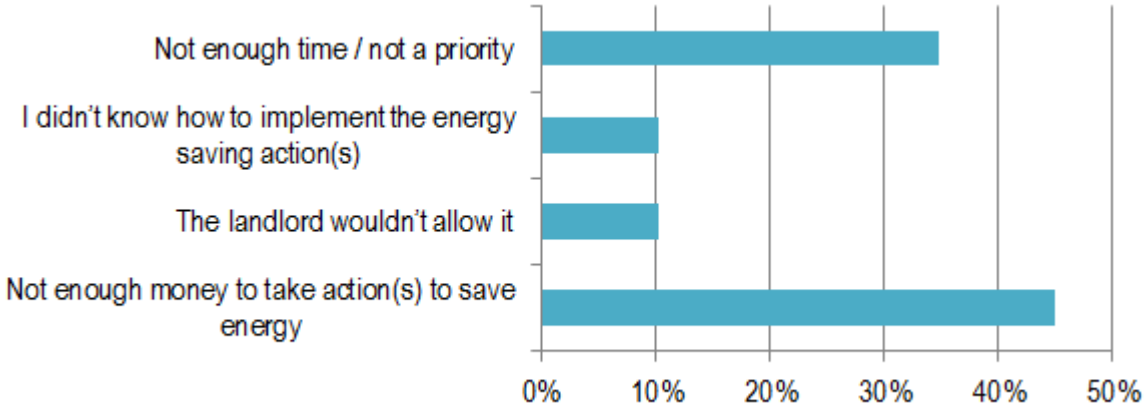
35 comments were recorded

The majority of comments related to problems with the monitor. These included broken and failed items as well as not knowing how to use the monitor.

Several reported using the monitor for an initial a period of time or “now and again”.

One respondent express concern about the potential health impacts of smart meters (presumably the electromagnetic radiation from wireless communication technologies in these meters). This was a significant issue in Victoria during the state wide roll-out of Advanced Metering Infrastructure (AMI).

Q4: **Please identify what has STOPPED you taking action to reduce energy in your home (as recommended by the energy worker from *Beat the Heat*!). Please select the most relevant answer from the list below or write in the box provided.**



Comments summary

57 Comments were recorded although most of these stated that 'nothing' had stopped them or that their consumption "is very low already". Of those that did add to the survey responses above, the main mention was of the need to control kids use of lights, computers etc.

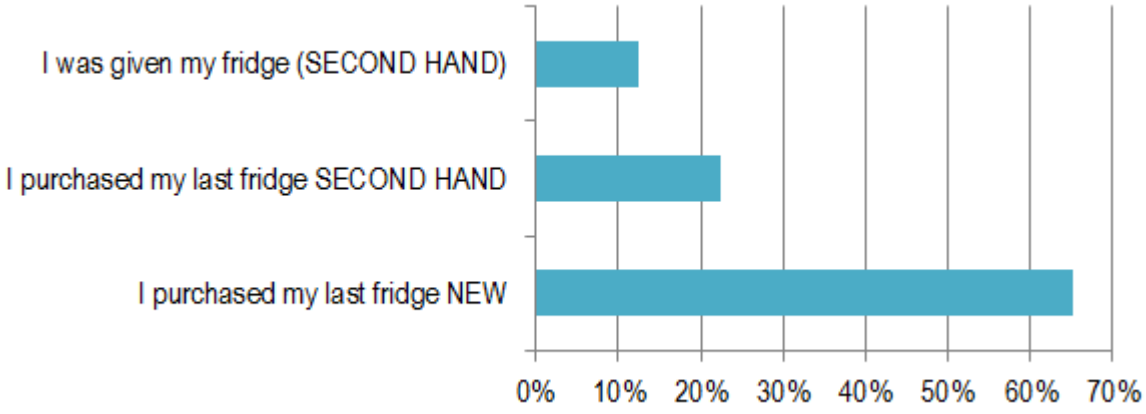
Q5: **Please tell us about any NEW actions you have taken to save energy since receiving a home visit from an energy worker during the *Beat the Heat*! project.**

This was an open ended questions and there were 57 responses. 40 of these indicated a new action since receiving a home visit.

4 of the 40 (10%) referred to purchasing a new appliance. The remainder either made reference to being generally more conscious and aware of energy use and/or had changed behaviours such as:

- Air conditioner thermostat settings
- Switching off lights and appliances not in use
- Zoning (one had added an internal door)
- Using blinds

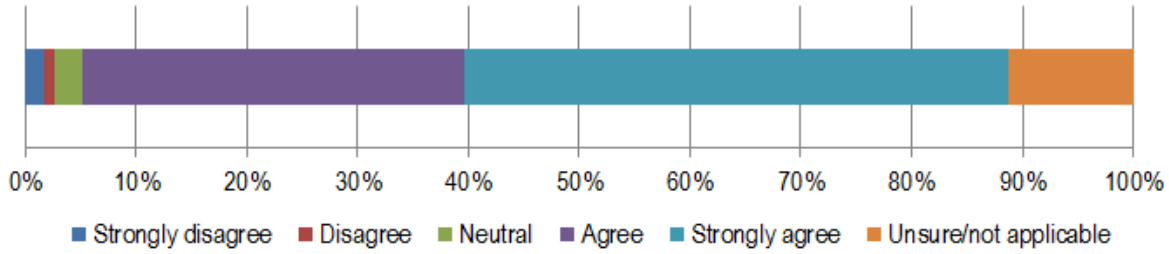
Q6: **Where did you get your last fridge from? (please select most relevant choice)**



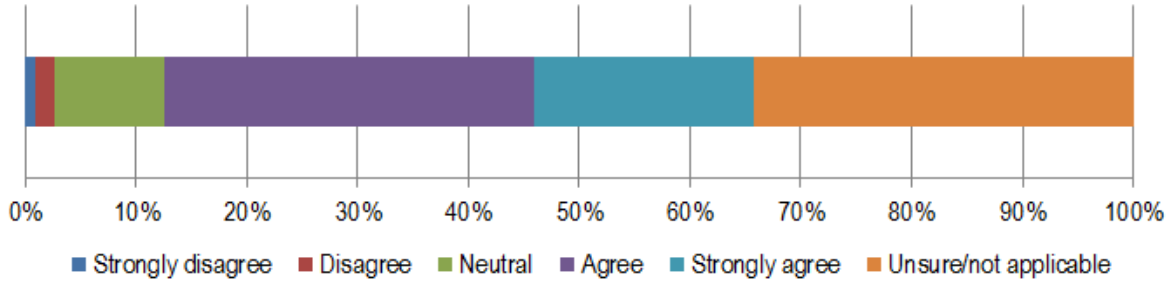
One respondent indicated they were renting their fridge from Rentlo.

Q7: **Please respond to the following (9) questions relating to the *Beat the Heat*! project.**

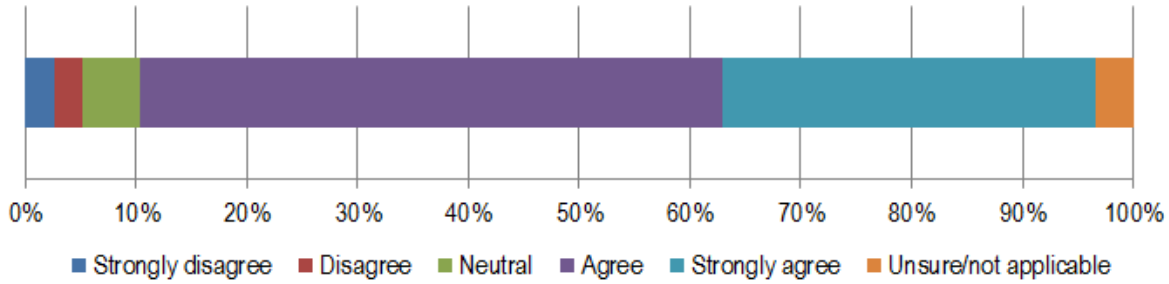
The air conditioner I had installed through Beat the Heat has improved my level of comfort



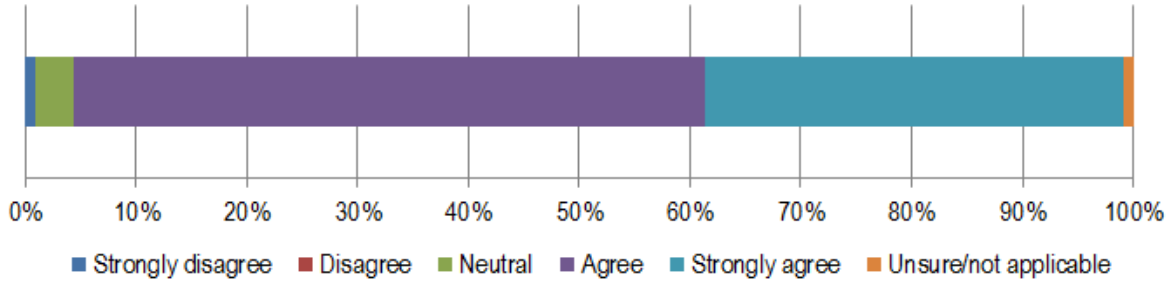
The insulation I had installed through Beat the Heat has improved my level of comfort



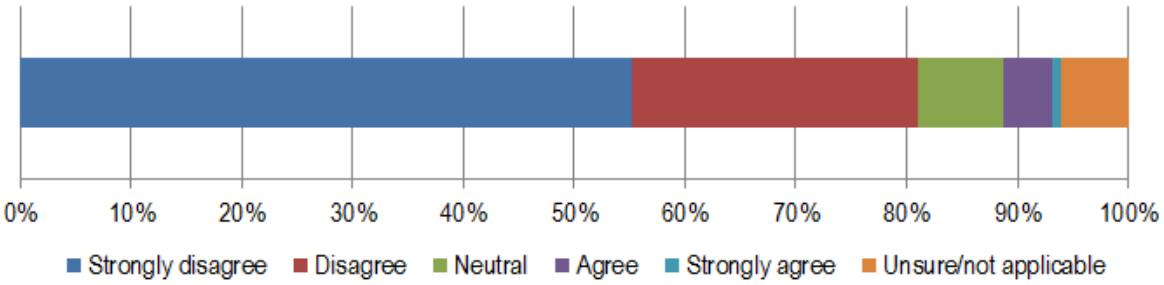
The visit from the energy worker with ideas on how to save energy was useful



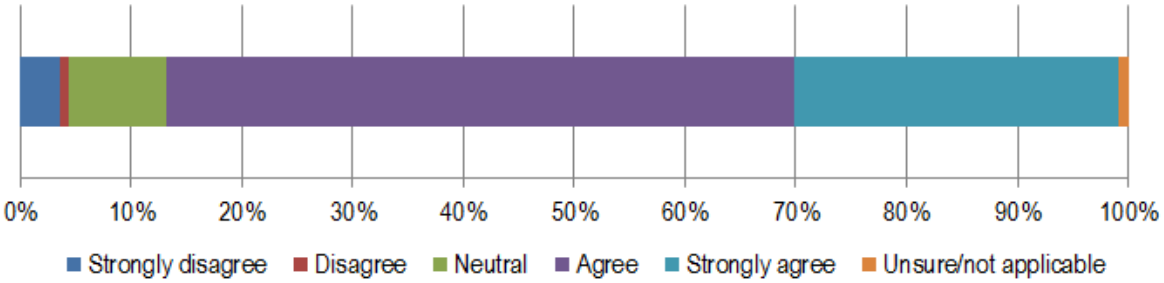
Participating in the Beat the Heat project was easy



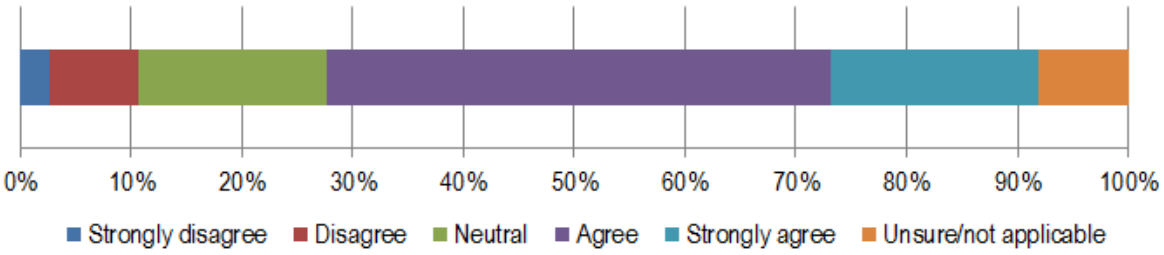
I didn't want to participate, but I felt pressure by my landlord to sign up



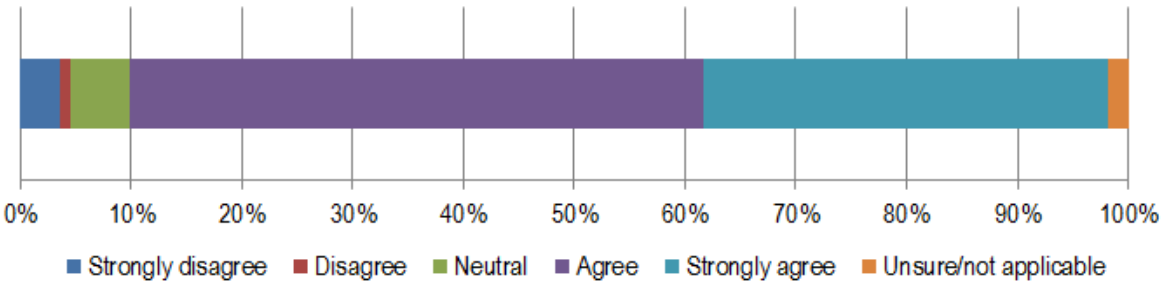
Communication about the Beat the Heat project was clear and easy to understand

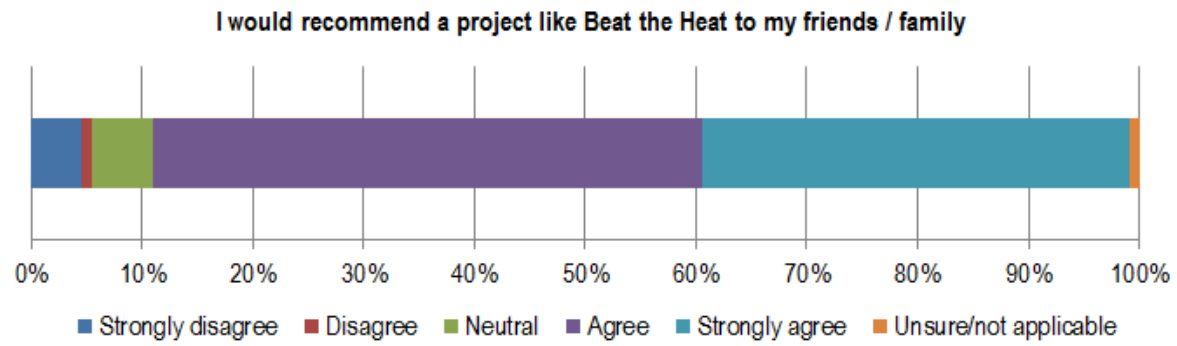


I am more likely to stay in this property as a tenant (if I am able to) because of the upgrade(s) and assistance received through Beat the Heat



Overall, the Beat the Heat project has been valuable for me / our household





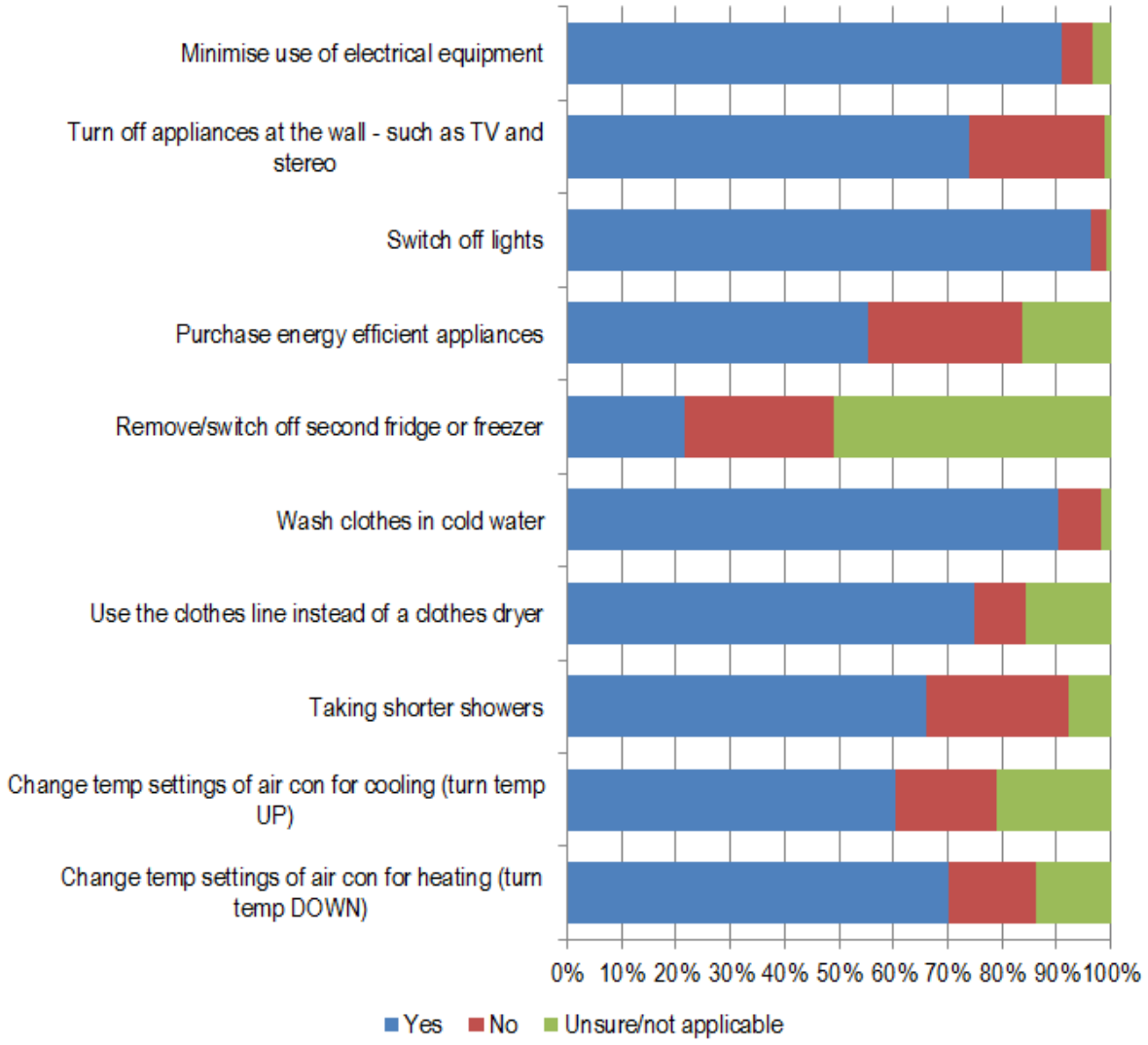
Comments Summary

21 Comments were recorded of which 14 were broadly positive and 7 were broadly negative.

Negative comments include reference to poor experiences with installers and general comments such as *"It hasn't made a big difference to us"*.

One respondent noted that, "*All my friend's A/C are better than mine*"

Q8: **What actions (10 options) have you taken in the past 3 months to save energy in your home?**



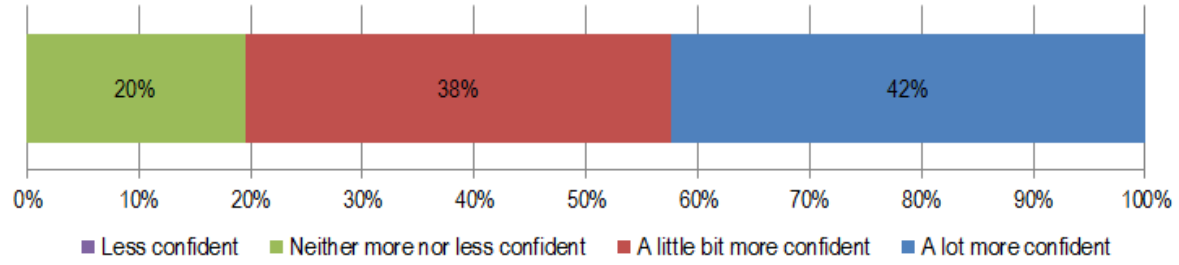
Comments Summary

8 Comments were recorded. One referred to external shading. Others mentioned barriers to these individual actions.

Positive comments included:

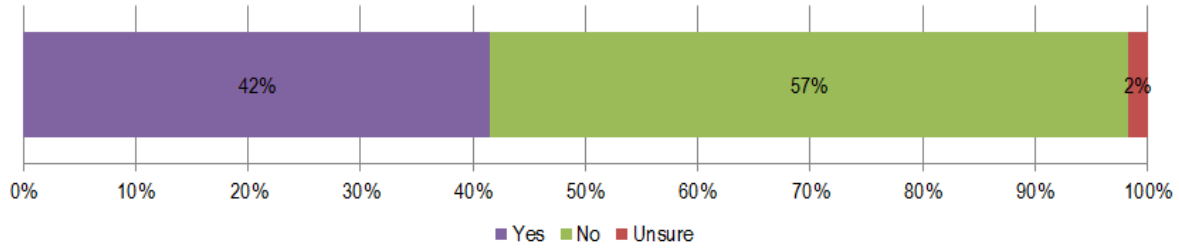
"Have managed to reduce my electricity bills. Now on a payment plan and am catching up. Will soon be in front for the first time ever."

Q9: **Do you feel more confident you can successfully take action to reduce energy use in your home as a result of being involved in *Beat the Heat!*?**

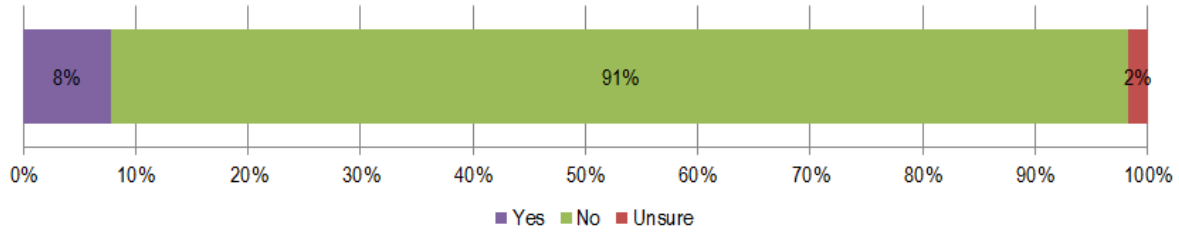


No one reported feeling "less confident" and only around 20% of respondents reported being "neither more or less confident".

Q10: **Prior to participating in *Beat the Heat*! had you ever been in financial difficulties because of an energy bill?**

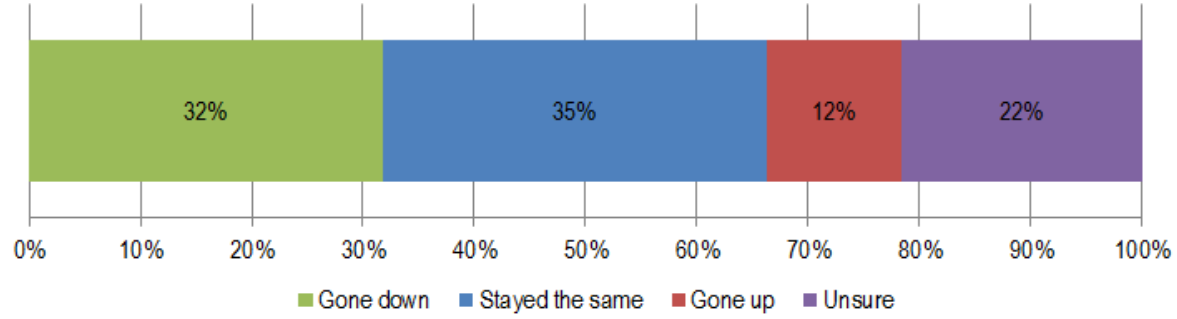


Q11: **Prior to participating in *Beat the Heat!* have you ever been disconnected from electricity or gas?**



9 out of 16 respondents reported having been disconnected from electricity or gas. Historic state-wide figures are in the order of between 1 and 2 customers per 100 each year (Source: ESCOSA, AER).

Q12: **Since participating in *Beat the Heat!* would you say your energy bills have**



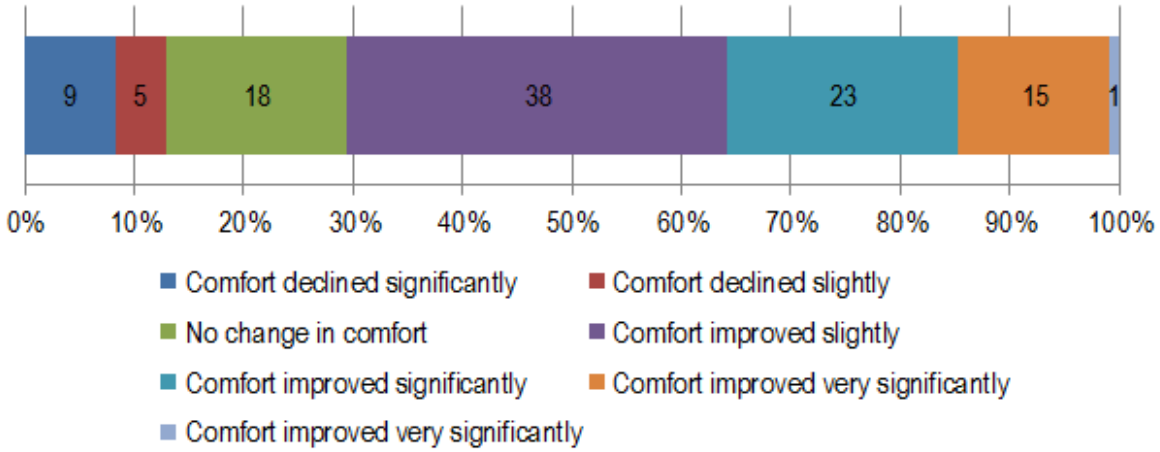
12 respondents reported that their energy bills had gone up. None of these reported a reduction in Summer Comfort, 8 reported no change and 4 reported an increase in summer comfort. Two reported a decline in winter comfort (along with an increase in bills), 2 reported no change in winter comfort and 8 reported an increase in winter comfort.

Comparing individual responses across surveys

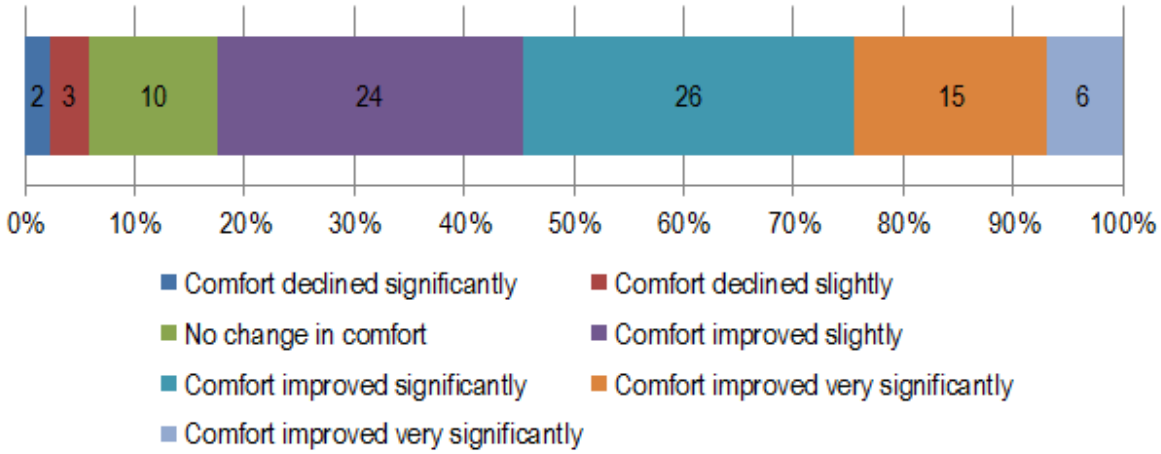
Approach: Survey responses (before and after) were assigned a "Comfort score" on a scale of 0 to 4. Comfort change determined by numerical comparison of "Comfort score" (SUMMER, WINTER) before and after interventions:

	Comfort change
Comfort declined significantly	-2
Comfort declined slightly	-1
No change in comfort	0
Comfort improved slightly	1
Comfort improved significantly	2
Comfort improved very significantly	3
Comfort improved very significantly	4

WINTER



SUMMER


2
3
10
24
26
15
6
0%
10%
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30%
40%
50%
60%
70%
80%
90%
100%
Comfort declined significantly
Comfort declined slightly
No change in comfort
Comfort improved slightly
Comfort improved significantly
Comfort improved very significantly
Comfort improved very significantly

Appendix D – Landlords Survey 1 – Pre Intervention

Participating Landlord survey – Survey highlights

86 landlords completed the survey.

Question 1: Motivation for participating

Respondents were asked an open-ended question about their main motivation for participating in the *Beat the Heat!* project. Eighty people responded to this question. The main themes mentioned are below

- Benefits to tenants (improved comfort and/or lower energy costs) – 36 mentions
- Win-win outcomes (benefits to both tenant and landlord) – 18 mentions
- Free/reduced cost air conditioner; capital upgrades to property – 12 mentions
- Energy saving (or simile, such as helping the environment) – 14 mentions
- Encouragement by land agent – 8 mentions
- Request by tenant – 5 mentions
- Make property more attractive in future for tenants (easier to rent out) – 3 mentioned

Thought the insulation in the house could be replaced so thought the project would be beneficial to me and the tenants

I want to make our unit as much like home for our tenants as possible

To do the right thing and help out my tenants

This is a great Incentive for landlords

We liked that it offers us a way to improve the energy efficiency of our property while making it more comfortable for our current and future tenants without upfront cost to us

Seemed like an opportunity too good to overlook financial incentive and green angle to project.

Suggested/advised by agent of the potential energy savings

We looked at it and it was win win for everyone.

It will improve the my home both in value and quality the better quality of the home the better tenants you attract and or retain

To provide better heating and cooling for my tenants

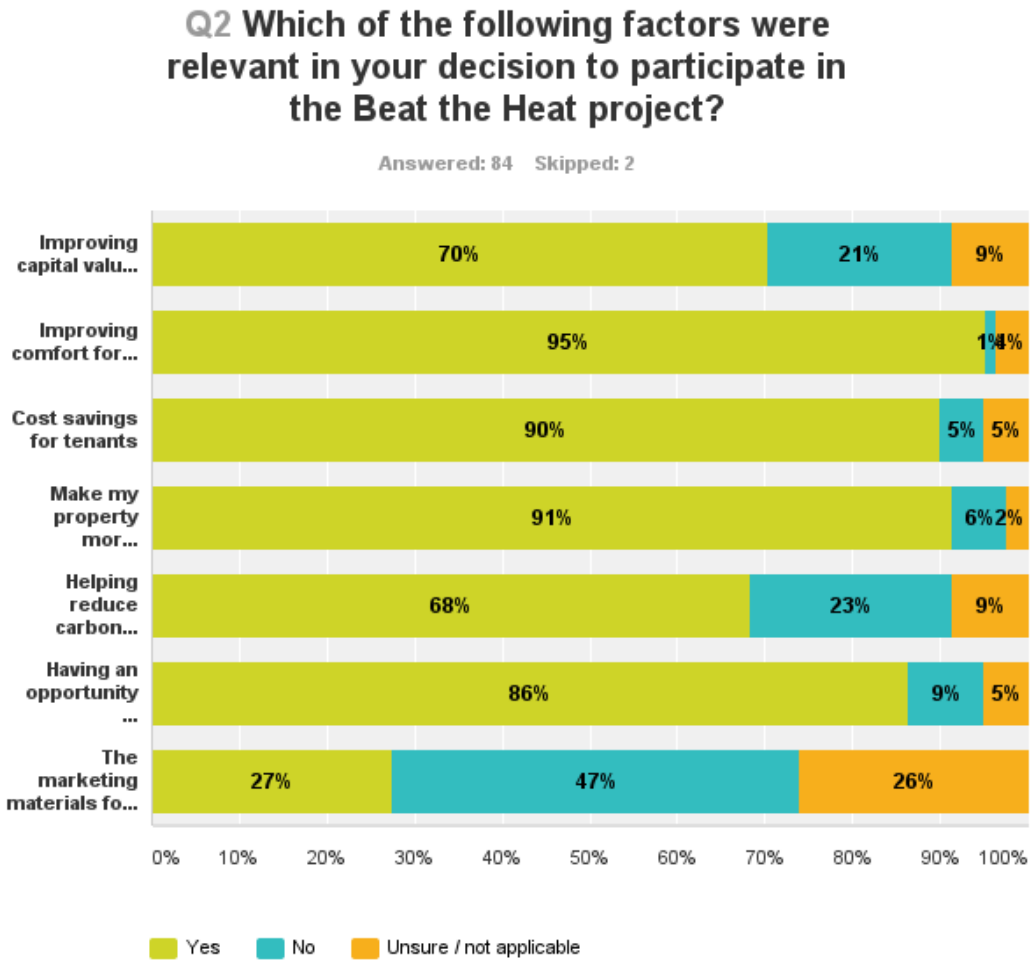
Seemed like an opportunity too good to overlook financial incentive and green angle to project.

The property manager sent her the info and she okay.

To improve the comfort of community Housing, low income tenants.

Qu. 2 - Relevant factors in participating[20]

Consistent with responses to question 1, 'improving comfort for tenants' was cited most frequently as a relevant factor in the landlords decision to participate in *Beat the Heat!*, followed by 'making my property more appealing for long term tenancies' and 'cost savings for tenants'.



Further to this, other factors for landlords deciding to participate in the project were:

- Having an opportunity to access low or no cost capital upgrades in my property and
- Helping reduce carbon emissions / taking positive action on climate change

The marketing material for the project ranked low as a deciding factor for landlord buy-in.

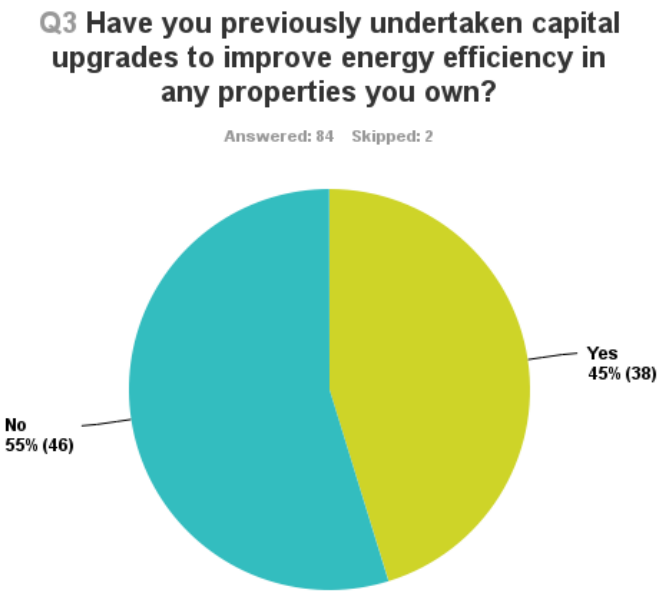
---

[20] Full text:

Improving capital value of my home
Improving comfort for tenants
Cost savings for tenants
Make my property more appealing for long term tenancies
Helping reduce carbon emissions / taking positive action on climate change
Having an opportunity to access low or no cost capital upgrades in my property
The marketing materials for this project

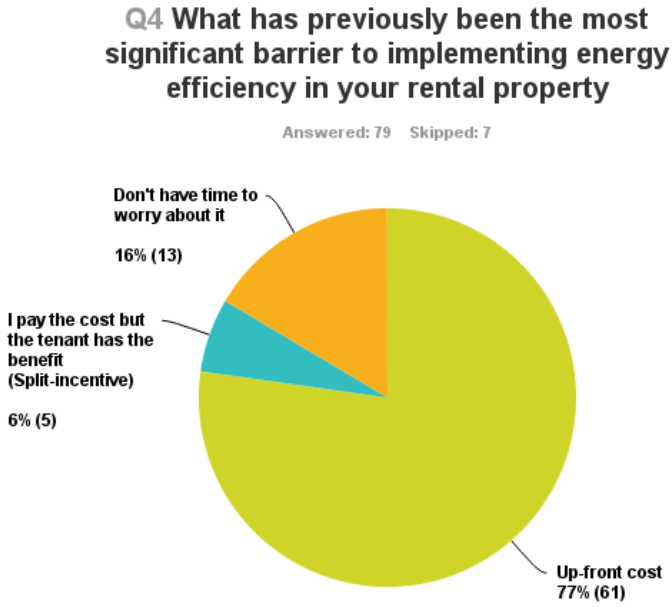
Qu 3 – Previous energy efficiency capital upgrades?

Thirty eight (45%) of landlords reported that they had previously undertaken energy efficiency upgrades to properties they own.



Qu. 4 Barriers to implementing energy efficiency

Up-front cost was cited as the biggest barrier to implementing energy efficiency upgrades, selected by 77% of respondents.
Sixteen percent of the respondents cited that they didn't have time to think about energy efficiency.



Appendix E - Landlords Survey 2 - post intervention

Landlords Report #2

This report encapsulates feedback, comments and assessment from landlords who participated in the *Beat the Heat!* project. The survey was administered at the end of the project's timeframe.

The survey's aims were to review perceptions of effectiveness, efficiency, impact and ease of the project from a landlord's perspective. The survey also sought information on behaviour change that had occurred during or as a result of the respondent's involvement in the project.

The survey was administered by one of two methods:

- Via a phone call (undertaken on a random basis). 15 telephone interviews were conducted during late November and early December 2015; OR
- Via an online survey that was self-administered by participants

A total of 35 landlords completed the second survey, however a large number did not answer many of the questions.

Overall, the respondents indicated a strong level of satisfaction with the project and perceived it as an additional benefit that their property was able to offer to tenants.

Further to this, in general terms, participants indicated that the recommendations on further actions on how to save energy in my rental property were useful; and that they were more likely to implement actions to help tenants save energy OR improve their comfort since participating in *Beat the Heat!*.

Outside direct actions that were undertaken as part of the project, a modest number of landlord (only 1/3 of those who answered related questions) have indicated additional actions taken to improve the energy efficiency of their rental properties. Many cited financial constraints as being the main impediment for making further changes, together with perceptions of the tenants 'being happy' (ie there was no impetus for making further change(s)).

A number of respondents highlighted that the project had increased their knowledge of energy efficiency and how to save energy. For others, the process was perceived to be positive and worthwhile. Other noted with enthusiasm that they would like to be involved in any similar projects in the future

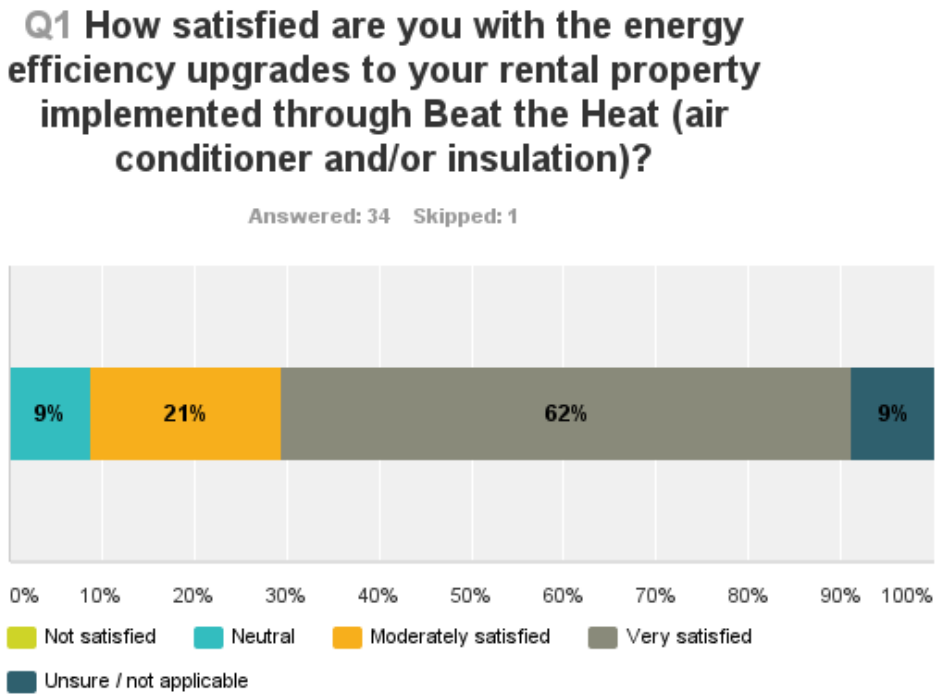
While only a small number of respondents *expressed dissatisfaction at the general communication of the project, their concerns were prospectively of a more serious nature: these included an unresolved electrical issue and maintenance of the AC unit. Despite their acknowledgement of the great intent of the project, their experience has resulted in a reluctance to nominate themselves for future projects.*

The theme of aligning the project with 'reputable tradesperson(s) was raised by two respondents. One who noted the need to ensure reputable tradesperson were involved and the other who noted that electrical work at their property had not be undertaken appropriately.

Despite these opportunities for improvement on future projects, it was evident that of the landlords who answered the post project survey, generally, expressed appreciation both have been involved with the project and of the outcomes.

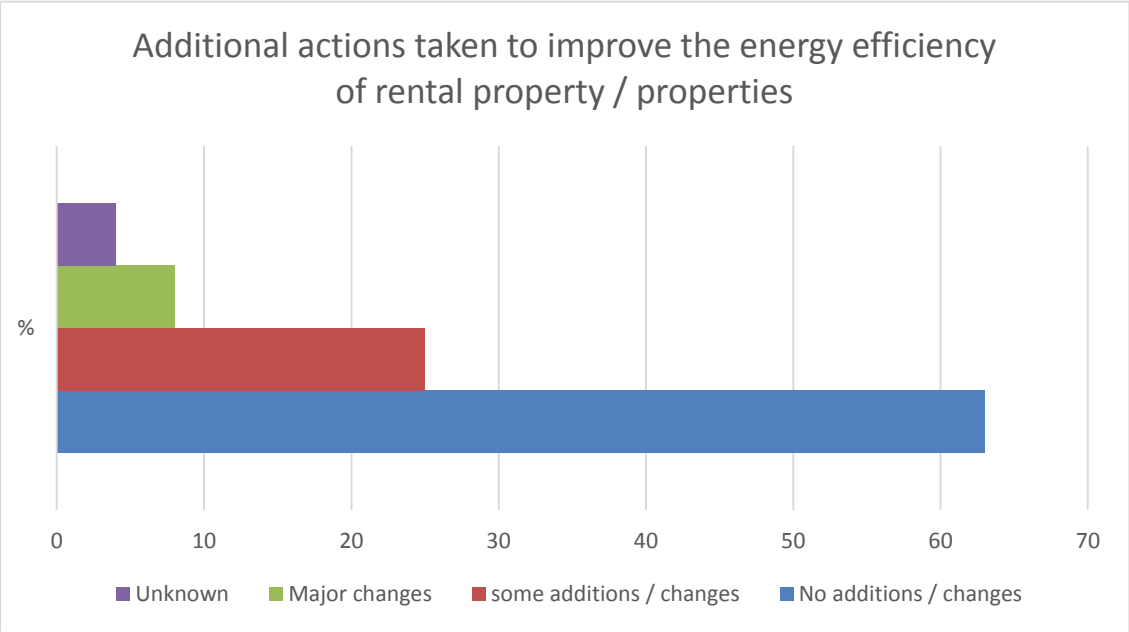
Question 1: level of satisfaction with energy efficiency upgrades to your rental property

The majority of respondents (83%) who answered the survey indicated a strong level of satisfaction with the energy efficiency upgrades received at their rental property through the *Beat the Heat!* project.



How satisfied are you with the energy efficiency upgrades to your rental property implemented through Beat the Heat (air conditioner and/or insulation)?		
Answer Options	**Response Percent**	**Response Count**
Not satisfied	0.0%	0
Neutral	8.8%	3
Moderately satisfied	20.6%	7
Very satisfied	61.8%	21
Unsure / not applicable	8.8%	3
	answered question	34
	skipped question	1

Q2 Please tell us about any additional actions you have taken to improve the energy efficiency of your rental property / properties since receiving recommendations through *Beat the Heat!*.



Just under half of the respondents answered the question relating to additional actions taken to improve the energy efficiency of rental properties. Of these

- One (or 4%) did not know
- Two (or 8%) were undertaking major changes
- Six (or 25%) had undertaken some changes
- 15 (0r 63%) had not undertaken any changes

Unknown (one respondent)

> *I live in rural SA and my property is in Adelaide and I don't inspect my property personally. I have left this Beat the Heat! to my property manager.*

Major Changes (8% of respondents)
Major changes cited by the respondents included Reviewing hot water service: examining the ability to install instantaneous hot water service at all properties and undertaking undertook Utilities Training (offered by Uniting Care Wesley).

Some Changes (25% of respondents)
Just over one quarter of the respondents highlighted some additional / changes that they had undertaken. These included

- Installing an additional internal door where there wasn't one.
- Adding another air conditioner at their own expense
- Replacing window coverings

No *Changes* (63% of respondents)
Interestingly over sixty percent (15 of 24) of the respondents cited that they had undertaken no actions / changes since being involved in the BTH project.
For some this decision was generate from the fact that the tenant was happy / content and that there was no perceived need to make changes. Noted comments included:

> *Haven't done anything as tenant was happy*

None. Didn't perceive a need
There has been none... we just went ahead and did the project... it's been a painless process
As it's not a big property and not that old there hasn't been a need to upgrade anything else

An additional comment worthy of note.
Overall we are only 'moderately happy' with the project for the following reasons:

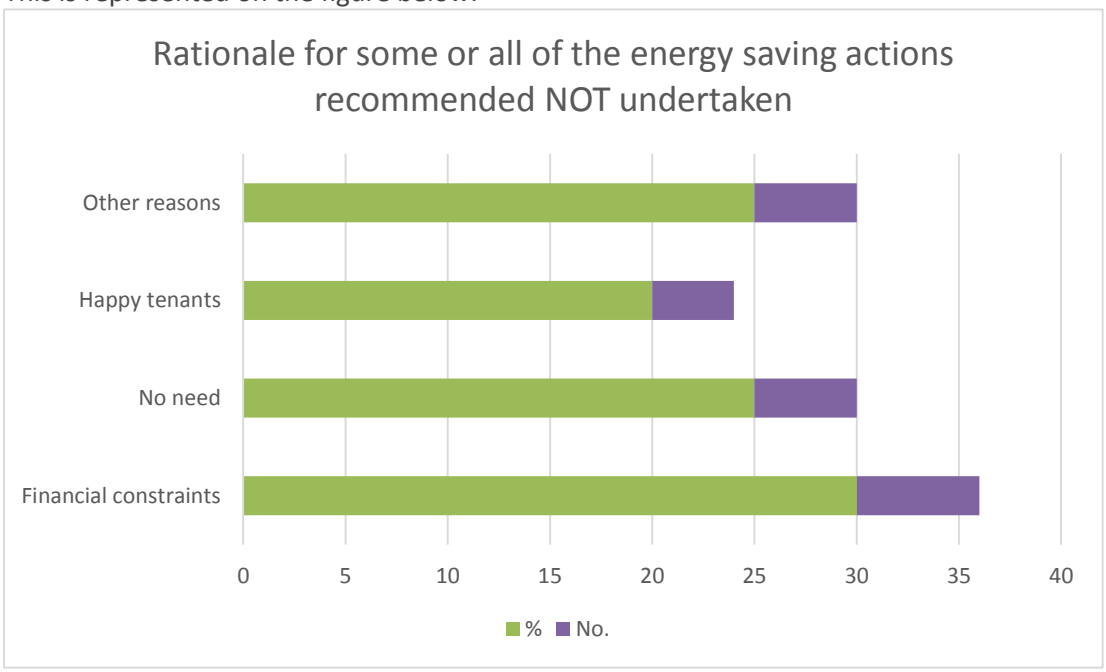
- we were not advised / did not receive communication to alert us to the fact that we were successful with the project
- we didn't know the process eg: when the A/C was installed
- we were not happy with the communication of the project However we are obviously satisfied with the project's intent

Question 3: Where you haven't taken some, or all of the energy saving actions recommended in your *Beat the Heat!* report, please describe to us the main reason why.

Twenty of the 15 (or 75 %) of respondents answered this question.
When asked to respond to why landlords may not have undertaken all or some of the recommended energy savings, answers were generally clustered into four key themes:

- Other reasons (5 respondents, 25%)
- Happy tenants (4 respondents, 20%)
- No need / didn't feel compelled (5 respondents, 25%)
- Financial constraints (6 respondents, 30%)

This is represented on the figure below:



These categories are expanded further below:
Other reasons
Don't believe a report was done

Not enough time to arrange and implement the recommendations Some ideas were really good!

Happy tenants

The installation of the AC unit meant that our tenant was happy / satisfied so we didn't feel the need to do anything else

No Need

Remote inspection of my property is impossible

I had already been doing bits toward this

Financial constraints

Lack of finance

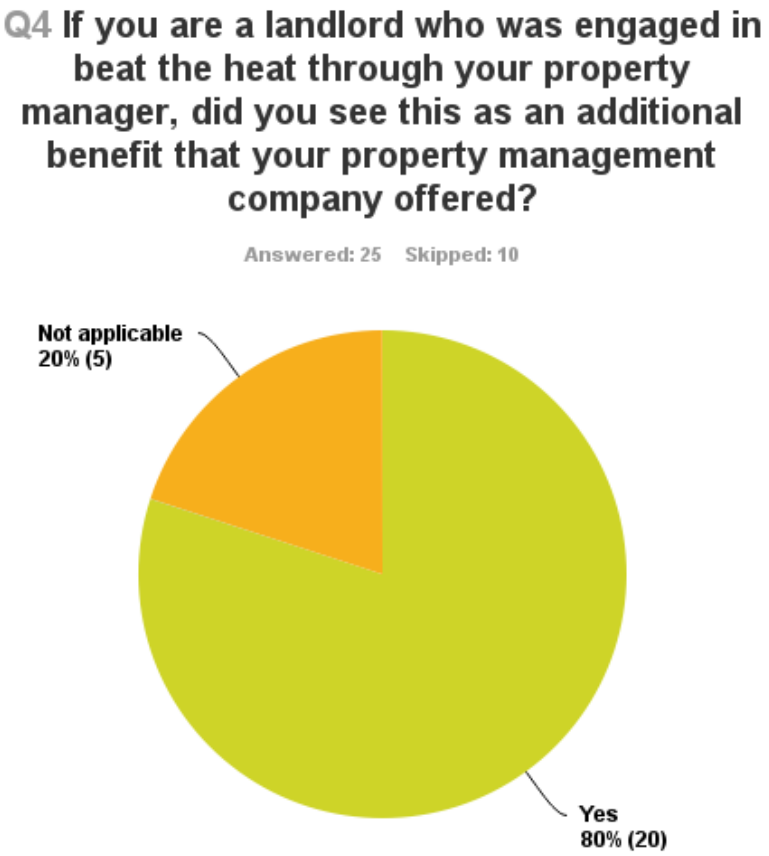
It all comes down to finances we don't have $ for the upgrades also we don't physically own the properties

Importantly, one respondent expressed dissatisfaction at the general communication of the project. Their concerns ranged from an unresolved electrical issue to information on management and maintenance of the AC unit. Despite their acknowledgement of the great intent of the project, their experience has resulted in a reluctance to nominate themselves for future projects.

We were not happy with the communication of the project:
We didn't receive the certificate of compliancy following the installation of the A/C
when the A/C was installed we experienced an electrical issue (we are not saying it was because of the installation but there was a correlation)
We've had an issue with water leaking from the A/C unit on to the carpet... who decides where the A/C should be installed? We received no information on how to manage and or maintain the system (maybe this went to our agent / tenant?) - we have not received a warranty on the A/C

Because of these items we would be reluctant to put ourselves forward again for a future project. While the project has a great intent we could not be confident that future processes will be undertaken with appropriate communication.

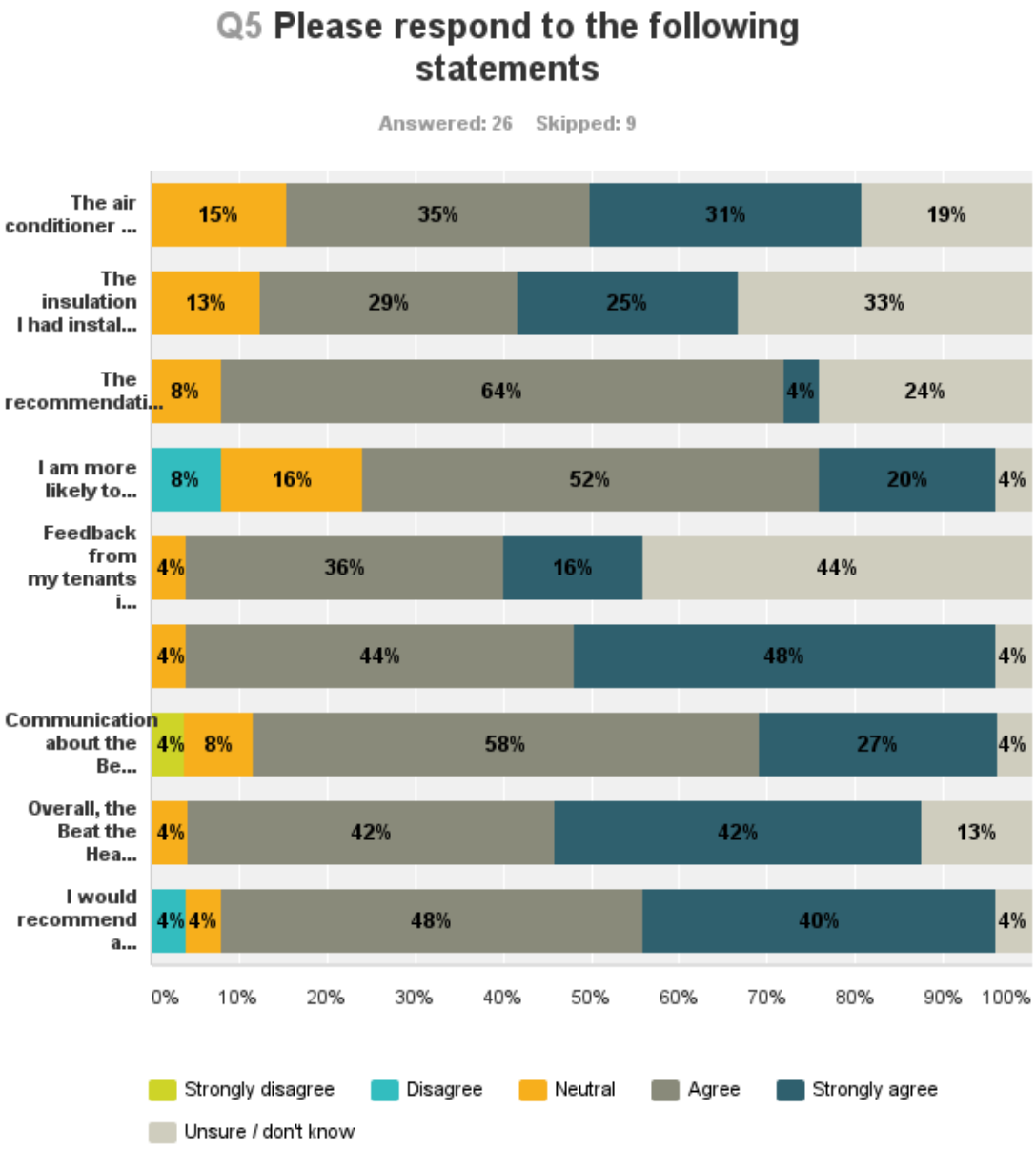
Question 4: Perceptions of BTH as an additional benefit from property management company



The majority of respondents (80%) who answered the survey perceived the project as an additional benefit that the property management could offer.

If you are a landlord who was engaged in beat the heat through your property manager, did you see this as an additional benefit that your property management company offered?		
Answer Options	**Response Percent**	**Response Count**
Yes	80.0%	20
No	0.0%	0
Not applicable	20.0%	5
Please comment		5
	answered question	**25**
	skipped question	**10**

Question 5: Reponses to statements relating to the project



When asked about the perceived benefits and value of the BTH project, landlords cited the following as 'high value' (statement they agreed or strongly agreed with) outcomes:

- The installation of the *air conditioner* and its perceived appeal factor to renters. Seventeen of the 26 respondents (or 65%) stated that they *agreed* or *strongly agreed* that this action had improved the value of their property;
- The installation of the *insulation* and its perceived appeal factor to renters. Thirteen of the 24 respondents (or just over half) stated that they *agreed* or *strongly agreed* that this action had improved the value of their property; and
- The increased levels of happiness of their tenants. Thirteen of the 25 respondents (or just over half) stated that they *agreed* or *strongly agreed* with this.

Further to this, 23 of the 25 respondents (92%) stated that they agreed or strongly agreed with the statement that that the level of comfort of their tenants was important to them.
When asked about whether the communication of the project had been clear and easy to understand, 22 of the 26 respondents (85%) agreed or strongly agreed that it had been.

Finally, 22 of the 25 respondents (88%) agreed or strongly agreed that they would recommend a project like *Beat the Heat!* to my friends / family

Please respond to the following statements

Answer Options	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Unsure / don't know	Response Count
The air conditioner I had installed through *Beat the Heat!* has improved the value of my property AND/OR made it more appealing to renters	0	0	4	9	8	5	26
The insulation I had installed through *Beat the Heat!* has improved the value of my property AND/OR made it more appealing to renters	0	0	3	7	6	8	24
The recommendations on further actions on how to save energy in my rental property were useful	0	0	2	16	1	6	25
I am more likely to implement actions to help tenants save energy OR improve their comfort since participating in *Beat the Heat!*	0	2	4	13	5	1	25
Feedback from my tenants is that they are happier in my property since the *Beat the Heat!* interventions	0	0	1	9	4	11	25
The comfort of my tenants is important to me	0	0	1	11 (	12	1	25
Communication about the *Beat the Heat!* project was clear and easy to understand	1	0	2	15	7	1	26
Overall, the Beat the Heat project has been valuable for me	0	0	1	10	10	3	24
I would recommend a project like *Beat the Heat!* to my friends / family	0	1	1	12	10	1	25
						answered question	26
						skipped question	9

Question 6: Please tell us about any additional benefits from participating in *Beat the Heat!.*

A number of respondents highlighted way in which the project had increased their knowledge of energy efficiency and how to save energy. A number highlighted the beneficial relationship between a happy tenant and the ability to retain them for a longer period of time:

> *There are obvious benefits for the tenant... having a comfortable environment means that they are likely to stay for longer and build a longer term relationship with us / property manager*

… "a happy tenant is a good tenant!"

I know that in one of my properties the tenants are 'really happy' with the process and outcome. For them (the tenants) the project greatly improved heating comfort for them during the winter

We learned through the project: how to maintain the coolness of the house and make the tenants more comfortable

A number of respondents found the process positive and worthwhile. Other noted with enthusiasm that they would like to be involved in any similar projects in the future:

The notion of Beat the Heat! (energy savings) is a noble one

It's been very smooth sailing and very positive. The contractors very polite and helpful which was great for our tenants.

The flow on effects of the project have been great: eg the ability to increase energy efficiency, the internal learnings for our organisation.
If you do this again, we'll definitely put our hand up! :)

Question 7: What would motivate you to invest in further energy saving actions in your rental property / properties?

When asked about the ability to be motivated to invest in further energy saving actions, cost benefit ratio presented as a main decider.

We would consider solar both for electricity and hot water if it was financially beneficial

The opportunity to continue cost savings / cost efficiencies ... The project is good for the environment too! (but $ are the main driver)

While this related to the availability of funds for some, for others investment would be attractive if they could see an increase value of the property as a result of the venture. One respondent highlighted a desire to see more subsidies for improvements / capital investment.
Amongst the other answers was a desire to see the process linked with 'reputable' tradesperson(s), and better communication and or advertising about the project and anticipated benefits.
A small number of respondents also noted they would be motivated to invest further if their tenant(s) indicate a desire to do so. One respondent indicated that their tenants were their main concern as they are not driven by environmental consciences choices:

Satisfaction of tenants I'm not a 'save the planet' person!

Question 8: Do you have any other comments about energy or the *Beat the Heat!* program?

When asked about other comments, only half of the respondents answered. Whether the others declined to answer for convenience / timing reasons or other rationale is unknown.
Of the seventeen (49%) respondents who answered, most respondents indicated their appreciation and enjoyment at having been involved. Others noted that their tenants benefited too

Glad to have been involved

The project worked really well the tenants have been very happy

A very good project. Our tenant found it very positive and supportive

For others this extended to genuine enthusiasm and gratitude:

A brilliant initiative! Great to see the Govt. giving back. Thanks to Uniting Communities!

It was very good. It was good to be involved - thanks

Excellent project

One respondent indicated that they found the program a *'Waste of time as no tenants took up the offer'*. Another indicated that the program ought to have been better advertised as they and only discovered it be accident.

The theme of aligning the project with 'reputable tradesperson(s) was raised by two respondents. One who noted the need to ensure reputable tradesperson were involved and the other who noted that electrical work at their property had not be undertaken appropriately:

We were somewhat disappointed to receive a letter from SA POWER Network saying that the installations were not up to scratch (the power arrestor should have been installed and hadn't been)

Overall, however, persons who answered this question indicated high levels of satisfaction and support for the program. This included the following:

I'd like to be contacted when it is run again as I have a number of other properties which could benefit from assessment.

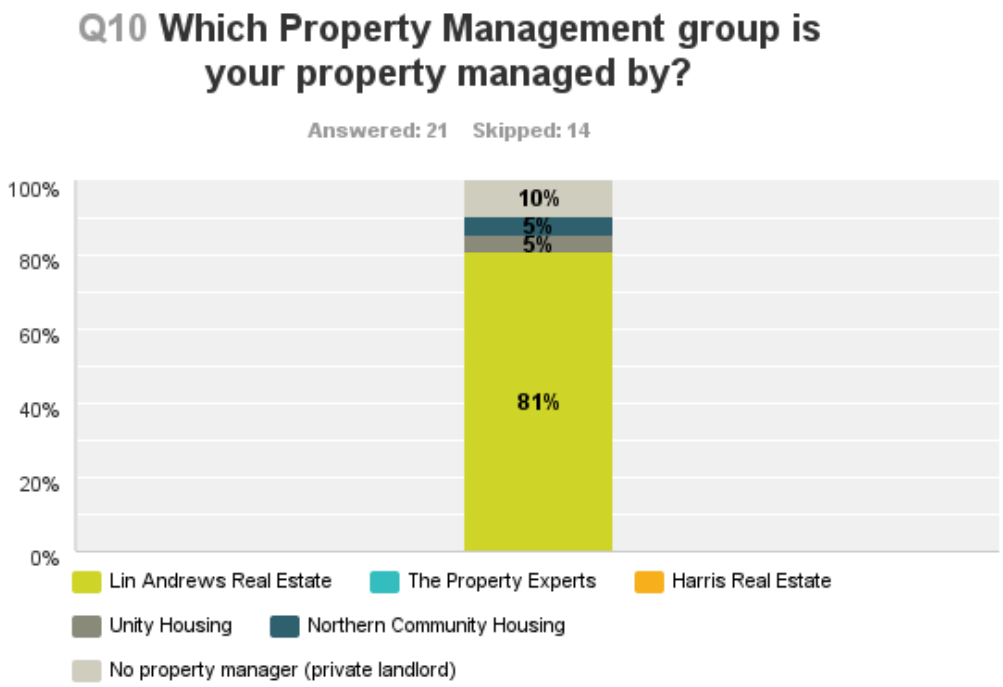
Very good project, would gladly adopt it in our other 3 Elizabeth rentals.

DEMOGRAPHICS

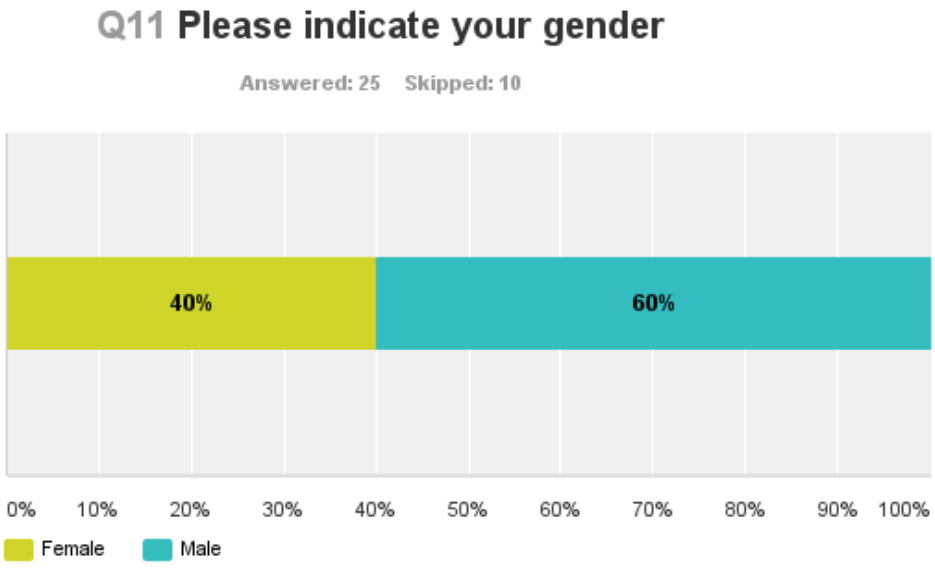
Question 9

Names and addressed were provided by all respondents.

Question 10



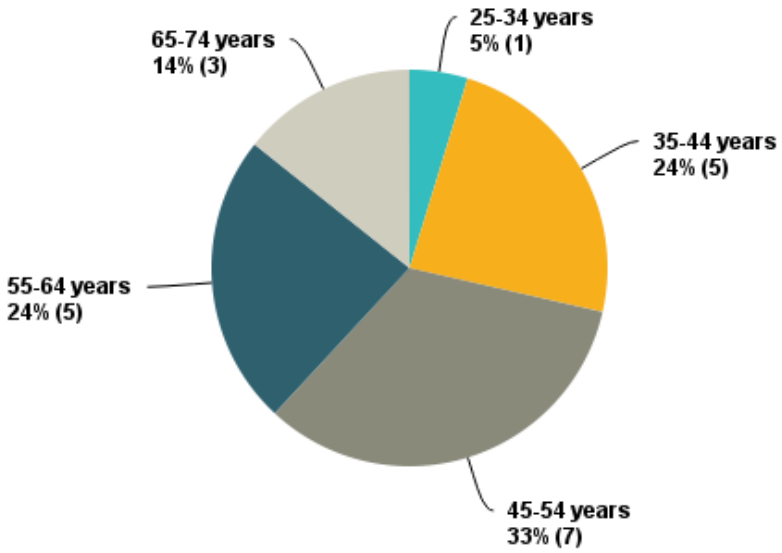
Question 11



Question 12

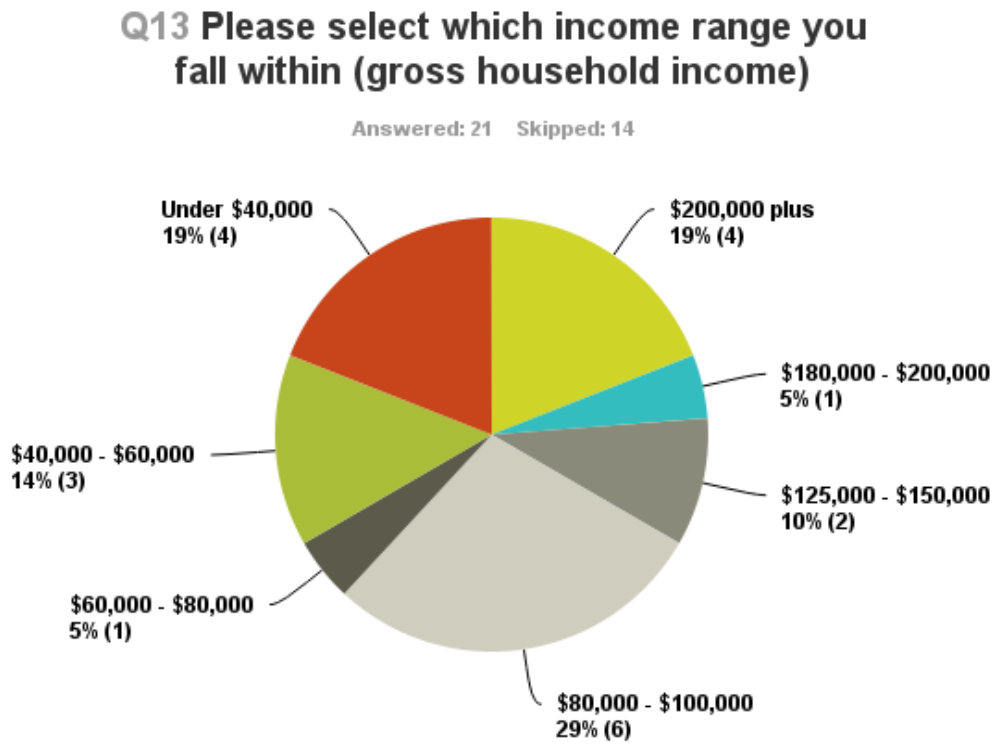
Q12 Please indicate which age group you fall within

Answered: 21 Skipped: 14



Just over eight percent (80%) of respondents fell into the age cohort of 3 – 64 years of age. Within this the largest proportion of respondents were between the age of 45 – 54 years.
Those of 65 – 74 years of age comprised 14% of the respondents, while on five percent (5%) fell into the 25 – 34 age bracket.
There were no respondents in the 75+ years age bracket.

Question 13



The Landlords illustrated a range of household income with just under twenty percent (20%) EACH nominating both

- > $40,000 and
- < $200,000

Of the remaining landlords (62%) almost 30% nominated a gross household income of $80,000 - $100,000 and the remaining (approximate) 35% displayed a relatively even spread over the outstanding household income categories (that is from $40,000 to $200,000).

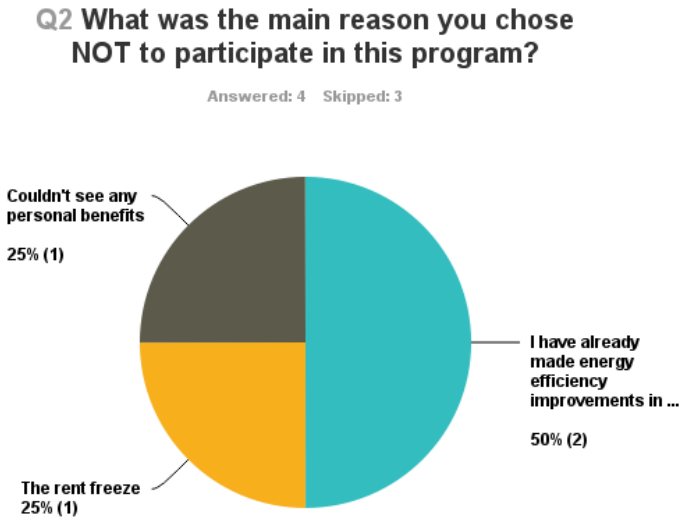
Appendix F – Non Participating Landlords Survey

The project team was able to gather feedback from a small sample of landholders (totalling seven (7) in number) who chose not to partake in the *Beat the Heat!* Project. The results of the survey are noted below:

Hearing about the project
When asked about whether they recalled hearing of the project from Lin Andrews Real Estate 100% of the seven (7) participants noted that they did.

Rationale for not participating
When asked about the main reason why they chose to NOT participate, the most common reason landlords gave was that they had already made energy efficiency improvements in their rental properties (50% of those who answered the question).
two other reasons most commonly cited by landlords for non-involvement were:

- The rent freeze variable embedded in the BTH project
- That they couldn't see any personal benefits



A number of other reasons were also noted:

- That the landlord will be demolishing the house
- That the property was new
- That the landlord was abroad and not likely to be interested in the project

Capital upgrades
When asked specifically about when they had previously undertaken capital upgrades to improve energy efficiency in their rental properties 50% of landlords stated they had and 50% stated that they had not.
(Note: only 6 of the 7 participants answered this question).

Barriers to implementing energy efficiency
Interestingly, the most significant barrier for implementing energy efficiency in their properties was not perceived to be upfront cost, but that landlords don't have time to think about the issue.

Perceptions of the role of property managers to assist with energy efficiency

Of the five (from seven) participants who answered the question relating to perceptions of the property manager in assisting landlords and tenants with energy efficiency, 80% (four participants) stated they did not. The reaming one participant (20% of responses) stated that they did.

Appendix G – Energy Analysis

Summer Consumption - Old AC replaced by RCAC Intervention

Table 16 16 below contains the Mains electrical energy consumption from billing periods of approximately 3-months in the summer (cooling) months from November to March inclusive, which was collected by SAPN for billing purposes prior to project interventions for the dwellings where a new AC replaced an "Old AC". This table also contains corresponding Mains and AC energy used in the same household, over the same period for the following year, after the project intervention. It should be noted that for this table, all households received an air-conditioner intervention and 28% of these also received a ceiling insulation intervention, with the remainder already having sufficient ceiling insulation levels.

Table 16; Energy Consumption Pre and Post-Intervention During Summer (Cooling) Months for Households with Old Air Conditioners - November to March Inclusive (2013-2016)

#	Client ID	SAPN Data (Pre-Int.)	WASP Data (1 Yr After SAPN)		Post v's Pre Int. Mains Energy Ratio	Pre-Int AC Status	Int Group
		SAPN Mains Energy (kWh)	WASP Mains Energy (kWh)	WASP AC Energy (kWh)			
1	251	3248	664	252	0.20	Old AC	ac
2	495	4774	2024	485	0.42	Old AC	ins ac
3	351	2085	1054	550	0.51	Old AC	ac
4	193	1769	978	390	0.55	Old AC	ac
5	491	2469	1550	520	0.63	Old AC	ins ac
6	195	2343	1545	391	0.66	Old AC	Ac
7	363	428	288	4	0.67	Old AC	Ac
8	349	1381	940	351	0.68	Old AC	Ac
9	45	1072	800	214	0.75	Old AC	Ac
10	287	538	417	80	0.78	Old AC	Ac
11	271	1064	827	104	0.78	Old AC	Ac
12	1053	1357	1077	191	0.79	Old AC	ins ac
13	59	845	680	69	0.81	Old AC	ins ac
14	293	2227	1917	190	0.86	Old AC	Ac
15	281	2702	2570	512	0.95	Old AC	Ac
16	917	513	503	89	0.98	Old AC	Ac
17	633	900	887	12	0.99	Old AC	ins ac
18	209	2582	2614	49	1.01	Old AC	ins ac
19	455	1264	1298	138	1.03	Old AC	Ac
20	1095	661	710	219	1.07	Old AC	Ac
21	741	643	702	206	1.09	Old AC	Ac
22	1133	382	463	61	1.21	Old AC	Ac
23	847	1157	1433	297	1.24	Old AC	Ac
24	339	2307	2868	495	1.24	Old AC	Ac
25	605	436	572	284	1.31	Old AC	Ac
26	289	881	1219	253	1.38	Old AC	Ac
27	1101	359	505	148	1.41	Old AC	Ac
28	*173*	*510*	*756*	*66*	*1.48*	*Old AC*	ins ac
29	191	1415	2205	467	1.56	Old AC	Ac

30	715	777	1294	114	1.67	Old AC	ins ac
31	89	661	1260	417	1.91	Old AC	Ac
32	565	233	518	102	2.22	Old AC	ins ac

N.B. House with Solar PV in italics

In Table 16, the column entitled "Post v's Pre Int. Mains Energy Ratio" was calculated by dividing the post-intervention (WASP) Mains energy by the pre-intervention (SAPN) Mains energy, therefore associated values that are less than one represent a post intervention drop in total energy consumption.

Summer Consumption – No AC prior to RCAC Intervention

Table 17 below relates to dwellings which had no functioning air-conditioner (i.e. "No AC") prior to the intervention where a new AC was installed. Furthermore, the column entitled "Post v's Pre Int. 'Non AC' Mains Energy Ratio" represents the ratio of post-intervention mains energy excluding that used for air-conditioning (i.e. the difference between WASP Mains and WASP AC) to pre-intervention Mains energy, to account for the fact that there was no AC prior to the intervention. It should be noted that for this Table, all households received an air-conditioner intervention and 30% of these also received a ceiling insulation intervention, with the remainder already having sufficient ceiling insulation levels.

Table 17 Pre and Post-Install Energy During Summer (Cooling) Months for households without Air Conditioners Prior to Intervention - November to March Inclusive (2013-2016)

#	Client ID	SAPN Data (Pre-Int.)	WASP Data (1 Yr After SAPN)		Post v's Pre Int. Mains Energy Ratio	Pre-Int AC Status	Int Group
		SAPN Mains Energy (kWh)	WASP Mains Energy (kWh)	WASP AC Energy (kWh)			
1	**71**	**776**	**165**	**79**	**0.21**	**No AC**	ins ac
2	**991**	**2879**	**1119**	**104**	**0.39**	**No AC**	ins ac
3	337	2494	1824	634	0.73	No AC	ac
4	275	900	846	69	0.94	No AC	ac
5	411	548	557	49	1.02	No AC	ac
6	39	396	410	34	1.04	No AC	ac
7	333	1072	1125	36	1.05	No AC	Ac
8	169	1914	2026	405	1.06	No AC	ins ac
9	1099	186	225	41	1.21	No AC	Ac
10	407	1284	1581	102	1.23	No AC	Ac
11	967	408	511	76	1.25	No AC	Ac
12	845	1013	1281	151	1.26	No AC	Ac
13	43	560	724	81	1.29	No AC	Ac
14	895	334	432	114	1.29	No AC	ins ac
15	93	295	449	128	1.52	No AC	Ac
16	901	332	559	109	1.68	No AC	ins ac
17	921	254	460	118	1.81	No AC	ins ac
18	345	1116	2341	453	2.10	No AC	Ac
19	69	278	664	40	2.39	No AC	Ac
20	1131	377	1425	464	3.78	No AC	Ac

*N.B. Anomalous Data in **bold***

It can be seen that for households which had no air conditioner prior to installing a new unit, only 11% experienced an overall drop in post intervention energy use, excluding households with anomalous data. For the 18 households listed in Table 17 with no anomalous data, in total 14MWh of pre-intervention Mains energy was consumed, compared with 17MWh of post intervention mains energy over the approximately three-month summer periods each year. This equates to an overall 21% post-intervention increase in Mains energy for all houses listed in Table 17.

Summer Consumption – Evaporative cooler by RCAC Intervention

In Table 18, the column entitled "Post v's Pre Int. Mains Energy Ratio" was again calculated by dividing the post-intervention (WASP) Mains energy by the pre-intervention (SAPN) Mains energy. It can be seen that for households which had some form of evaporative air conditioner prior to installation of a new reverse cycle system, 13% experienced an overall drop in post intervention energy use, excluding households with anomalous data. For the 8 households listed in Table 18 - with no anomalous data, in total 7.3MWh of pre-intervention Mains energy was consumed, compared with 7.1MWh of post intervention mains energy over the approximately three-month summer periods each year. This equates to an overall 3% post-intervention decrease in Mains energy for all houses listed in Table 18.

Table 18; Pre and Post-Install Energy During Summer (Cooling) Months, November to March Inclusive (2013-2016)

#	Client ID	SAPN Data (Pre-Int.)	WASP Data (1 Yr After SAPN)		Post v's Pre Int. Mains Energy Ratio	Pre-Int AC Status	Int Group
		SAPN Mains Energy (kWh)	WASP Mains Energy (kWh)	WASP AC Energy (kWh)			
1	479	759	606	13	0.80	Duct. Evap	ins ac
2	399	1096	1004	52	0.92	Duct. Evap	ac
3	487	1008	1265	84	1.26	Duct. Evap	ins ac
4	95	1531	2065	325	1.35	Duct. Evap	ins ac
5	1071	1434	757	309	0.53	Port. Evap	ins ac
6	1073	576	493	143	0.86	Port. Evap	ins ac
7	929	726	622	150	0.86	Port. Evap	ac
8	1093	240	358	114	1.49	Port. Evap	ins ac
9	**903**	**198**	**488**	**288**	**2.46**	**Port. Evap**	ac

*N.B. Anomalous Data in **bold***

Air Conditioning Energy Analysis

In considering households that had their AC replaced as project intervention in the following summer months, 80% of the 20 households that yielded useable data showed a significant reduction in estimated AC electricity consumption. For these 20 households listed in Table 19, in total 11.4MWh of estimated pre-intervention AC energy was consumed, compared with 5.2MWh of post intervention AC energy in relation to the same summer periods each year. This equates to an overall 54% post-intervention decrease in estimated AC energy for these households.

Table 19 19 below compares the air conditioning energy use before and after the intervention for households that had their air conditioners replaced. It contains a column entitled “Post Int., Non-AC Energy”, which is the difference between the Mains and AC energy, representing the energy consumed by all electrical end-uses other than the air-conditioner. For the purposes of analysis, it was then assumed that the energy for electrical end-uses other than the air-conditioner would be the same for a given period each year.

The results of attempts to estimate air-conditioning energy prior to an intervention, based on post-intervention AC data with ‘degree day’ adjustments (as outlined in section 3.3.2), are contained in Table 19, below. It should be mentioned that the number of degree days for the summer period from November 2013 to March 2014 (214), was 50% higher than the number of degree days for the summer period from November 2014 to March 2015 (143).

It should be noted that a number of outliers, comprising estimates of pre-intervention AC energy that were either less than zero or unrealistically low, were removed in the process of generating data for Table 19. Anomalous data for households that was previously included has also been removed and data has been sorted from earliest to latest start date.

Table 19: Comparison of estimated pre-install AC energy to post-install AC energy during summer (cooling) months (2013-2016)

#	Client ID	Start Date	End Date	SAPN Mains Energy (kWh)	Post Int. Non-AC Energy (kWh)	WASP AC Energy (kWh)	Pre Int. AC Energy (Est.) (kWh)	Pre-Int Degree Days	Post-Int Degree Days	Adjusted Pre-Int. AC Energy (kWh)	Adjusted Pre-Int. v's Post Int. AC Energy Ratio
1	495	30/09/13	3/04/14	4774	1540	485	3234	284	198	2163	0.22
2	455	25/10/13	28/04/14	1264	1160	138	104	274	199	76	1.81
3	363	31/10/13	9/01/15	428	284	4	144	392	196	72	0.06
4	351	8/11/13	27/04/14	2085	504	550	1581	319	278	1373	0.40
5	281	15/11/13	18/02/14	2702	2058	512	644	117	79	434	1.18
6	293	15/11/13	18/02/14	2227	1727	190	500	196	101	259	0.74
7	349	19/11/13	17/02/14	1381	588	351	793	196	101	410	0.86
8	287	19/11/13	18/02/14	538	337	80	201	196	109	111	0.72
9	271	20/11/13	20/02/14	1064	723	104	341	196	125	218	0.48
10	251	21/11/13	21/02/14	3248	413	252	2835	185	132	2031	0.12
11	195	22/11/13	25/02/14	2343	1155	391	1188	188	126	798	0.49
12	491	28/11/13	3/03/14	2469	1030	520	1439	159	100	906	0.57
13	193	29/11/13	3/03/14	1769	587	390	1182	170	119	825	0.47
14	45	29/11/13	27/02/14	1072	586	214	486	185	125	329	0.65
15	59	9/12/13	12/03/14	845	611	69	234	185	125	158	0.44
16	1053	17/01/14	19/01/15	1357	886	191	471	656	915	657	0.29
17	605	8/10/14	8/01/15	436	289	284	147	166	117	104	2.74
18	741	14/10/14	14/01/15	643	496	206	147	50	10	30	6.89
19	1095	23/10/14	23/01/15	661	491	219	170	242	344	242	0.91
20	917	23/10/14	23/01/15	513	414	89	99	176	290	163	0.54

Figure 20 illustrates the differences between pre-intervention AC energy, with and without adjustment to incorporate the impact of climatic difference, and post-intervention AC energy for households where a new AC replaced an old AC. When comparing pre and post-intervention AC energy, whether relating to weather adjusted or unadjusted pre-intervention AC, we are seeing a substantial savings in energy use for AC, which can be directly attributed to the intervention.

Figure 20: Comparison of pre-intervention to post-intervention AC energy, for summer months, where an old AC was replaced by a new AC (2013-2016)

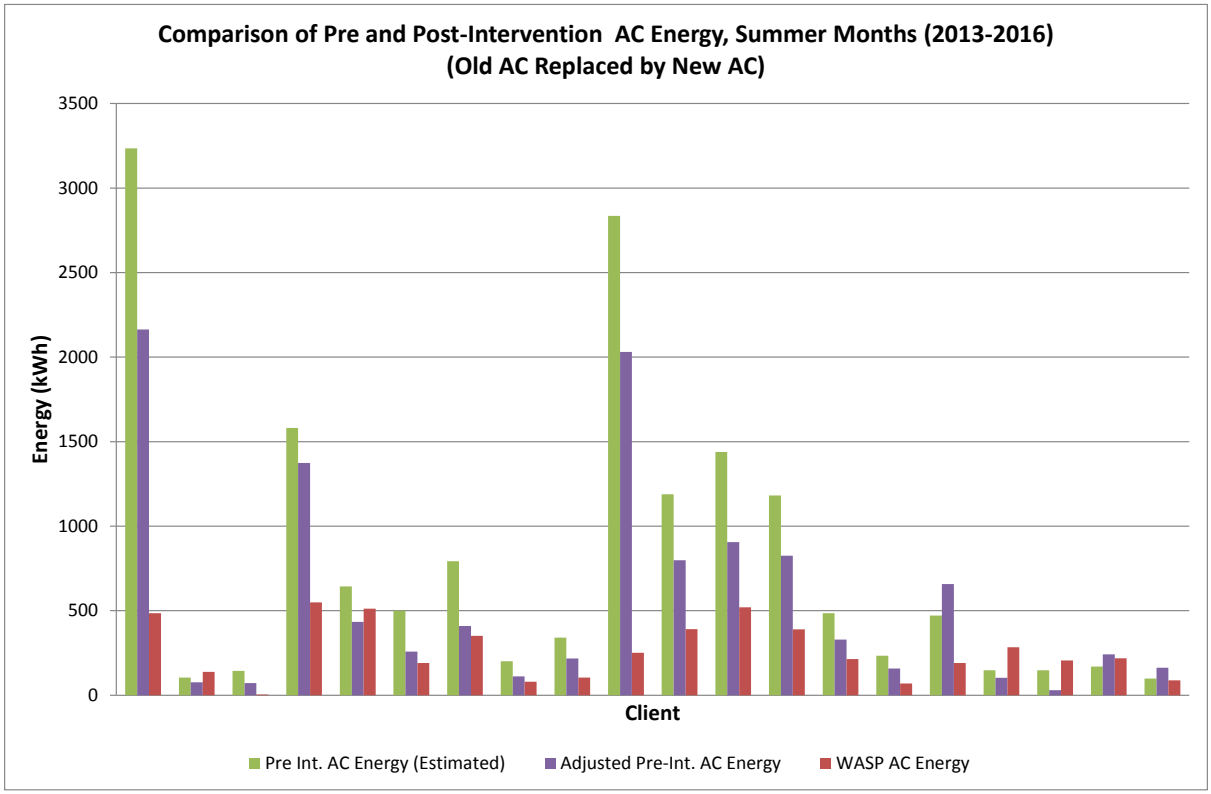


Table 20 20, below, utilises data for the 21 households with an unbroken subset of post-intervention, AC energy data for the summer cooling months of November 2014 to March 2015, inclusive where an old air-conditioner was replaced as part of the project intervention. In Table 20, the cooling load ("Estimated New AC Load") was estimated through multiplying WASP monitored AC energy for a given household by the rated Energy Efficiency Ratio (EER) of the new air conditioner. 'Estimated New AC Load' was converted to an estimate of what the AC energy would have been over the same period, if the intervention was not implemented ("AC Energy Without Int."), by dividing the old air-condition energy use by the EER. Based on the data in
Table 20 20, on average an estimated 46% reduction in AC cooling energy for the summer months (Nov '14 – Mar '15) resulted from the AC intervention. These data also yield that an average of 276kWh of AC cooling energy per household was therefore avoided as a result of the intervention from November to March. This correlates to an average saving of approximately $88 of avoided electrical energy costs per summer, based on an average tariff of 32¢/kWh for the cooling months[21] .

[21] Commonwealth Government, *Protecting human health and safety during severe and extreme heat events:* A national framework, November 2011

All households show that AC energy was avoided, which relates to the fact that all AC interventions involved the installation of an air-conditioner that had a higher EER than the old AC.

Table 20: Modelled AC Energy Without Intervention for Summer (Cooling) Nov 2014 – Mar 2015

Client ID	New AC Cooling Energy	Estimated New AC Load (using EER)	Predicted AC Energy Without Int. (using EER)	AC Cooling Energy Avoided	AC Cooling Energy Difference	AC Energy Avoided	Estimated Cooling Energy Cost Saving
	(kWh)	(kW)	(kWh)	(kWh)	(%)	(kWh/day)	($/day)
45	267	1015	474	207	44%	1.37	$0.44
209	45	170	126	81	64%	0.54	$0.17
455	95	382	196	101	52%	0.67	$0.21
343	65	249	111	46	41%	0.31	$0.10
195	472	1651	821	350	43%	2.32	$0.74
191	745	2667	1159	415	36%	2.75	$0.87
271	147	590	294	146	50%	0.97	$0.31
495	430	1744	868	438	50%	2.90	$0.92
351	338	1212	603	264	44%	1.75	$0.56
287	132	475	241	110	45%	0.73	$0.23
491	597	1928	959	362	38%	2.40	$0.76
293	263	1271	645	382	59%	2.53	$0.81
59	76	289	100	24	24%	0.16	$0.05
211	275	1275	647	372	57%	2.46	$0.78
349	549	2081	1035	486	47%	3.22	$1.02
193	449	1606	698	250	36%	1.65	$0.53
199	333	1265	699	366	52%	2.42	$0.77
363	46	166	84	38	45%	0.25	$0.08
339	383	1238	579	195	34%	1.29	$0.41
147	377	1431	774	397	51%	2.63	$0.84
281	853	3243	1613	760	47%	5.03	$1.60

If the data contained in Table 20 was expanded to include data for the additional 54 households that were originally excluded due to missing an average of 93 days of data over the same 151 day period, a 49% average reduction in AC cooling energy would be predicted for the summer months (Nov '14 – Mar '15) resulting from the AC intervention.

Temperature

Pre and post intervention temperature data was collected during summer months between November and March for comparison of the impact of intervention on thermal comfort in 93 households. It was found that, in total, the number of hours where thermal comfort was achieved following the interventions was 7% higher than that prior to interventions, with 88% of all monitored temperatures being below the 27°C comfort threshold. On average for each household, 93 days of pre-intervention temperature data was compared with 133 days of post intervention temperature

data, to calculate the aforementioned improvement in thermal comfort. It should be noted that out of the 93 households, 76% experienced an increase in their overall percentage of thermal comfort, with a further 4% experiencing a slight (<1%) change.

In order to investigate why a number of households had worse comfort temperature results after the intervention, the degree days method was used to evaluate the impact of the weather conditions during the monitoring period for all the houses with decreased comfort. It was found that for these less comfortable households, the average daily degree days were over 90% higher in the post intervention period. In other words, the weather was considerably hotter during the post intervention temperature monitoring period.

Table 21: Summer comfort data from survey and iButton data and Post v's Pre Intervention Mains Energy Ratio

Client ID	Summer Comfort Change (Survey)	Post Int Elec Bill Change (Survey)	Comfort % (iButton)	Intervention Type	Post v's Pre Int. Mains Energy Ratio
95	-1	Gone down	99	ins ac	1.35
691	No Response	Gone down	96	ins ac	N/A
169	3	Gone down	87	ins ac	1.06
487	0	Gone down	87	ins ac	1.26
93	3	Gone down	83	ac	1.52
271	4	Gone down	69	ac	0.78
1063	No Response	Gone down	53	ac	N/A
275	1	Gone down	53	ac	0.94
485	0	Gone down	39	ins	N/A
835	1	Gone down	34	ac	N/A
451	3	Gone down	32	ins ac	N/A
715	2	Gone down	15	ins ac	1.67
771	3	Gone down	4	ac	N/A
567	-2	Gone up	100	ac	N/A
147	2	Gone up	99	ac	N/A
649	3	Gone up	67	ins ac	N/A
59	3	Gone up	47	ins ac	0.81
251	-1	Gone up	42	ac	0.20
907	3	Stayed the same	99	ac	N/A
883	2	Stayed the same	99	ac	N/A
739	2	Stayed the same	97	ac	N/A
943	2	Stayed the same	97	ac	N/A
933	3	Stayed the same	95	ac	N/A
931	2	Stayed the same	83	ac	N/A
905	3	Stayed the same	77	ac	N/A
515	2	Stayed the same	64	ac	N/A
949	2	Stayed the same	61	ac	N/A
57	No Response	Stayed the same	49	control	N/A
71	2	Stayed the same	41	ins ac	0.21
281	4	Stayed the same	41	ac	0.95
199	No Response	Stayed the same	36	ac	N/A

293	1	Unsure	95	ac	0.86
193	2	Unsure	94	ac	0.55
725	2	Unsure	93	ins ac	N/A
45	0	Unsure	91	ac	0.75
797	4	Unsure	87	ins ac	N/A
697	0	Unsure	83	ac	N/A
215	No Response	Unsure	78	ac	N/A
917	1	Unsure	75	ac	0.98
731	2	Unsure	23	ins	N/A
455	No Response	Unsure	12	ac	1.03
495	No Response	No Response	100	ins ac	0.42
597	No Response	No Response	100	ins ac	N/A
951	No Response	No Response	100	ac	N/A
903	No Response	No Response	99	ac	2.46
735	No Response	No Response	99	ins ac	N/A
191	No Response	No Response	98	ac	1.56
927	No Response	No Response	97	ac	N/A
337	No Response	No Response	96	ac	0.73
919	No Response	No Response	95	ac	N/A
491	No Response	No Response	95	ins ac	0.63
967	No Response	No Response	89	ac	1.25
607	No Response	No Response	88	ins ac	N/A
901	No Response	No Response	87	ins ac	1.68
1047	No Response	No Response	82	ins ac	N/A
627	No Response	No Response	82	ins ac	N/A
769	No Response	No Response	71	ac	N/A
39	No Response	No Response	65	ac	1.04
145	No Response	No Response	58	ins	N/A
845	No Response	No Response	52	ac	1.26
789	No Response	No Response	45	ins ac	N/A
351	No Response	No Response	39	ac	0.51
195	No Response	No Response	37	ac	0.66
343	No Response	No Response	32	ac	N/A
339	No Response	No Response	31	ac	1.24
681	No Response	No Response	16	ac	N/A

Appendix H – Tariff Analysis

OBJECTIVE 1: Assess the impacts on energy consumption and costs of implementing thermal systems that include installing energy efficient reverse cycle air conditioning (RCAC) and/or ceiling insulation in the main living area of the home coupled with associated training for efficient associated use and general household behavior

Measure 2: Extent to which any changes in consumption levels and profiles may be impacted by future tariff options.

This component of the project seeks to understand the implications of network tariff reform on *Beat the Heat!* participants. Under recent changes to the National Electricity Rules, electricity network tariffs for households and small businesses must become more cost-reflective from 2017[22]. This is expected to involve a change to interval metering (from 2018) and network tariffs based on monthly peak demand as well as total consumption.

It was not possible to collect interval data prior to the interventions and hence the changes in consumption patterns are not able to be assessed. However, it is possible to analyse the impacts of changes in tariffs for this sample as a group of households with relatively high-efficiency air conditioners and good levels of insulation. Intuitively, these households should fare reasonably well under tariffs intended to reward good summer demand performance. However, the significant diversity in consumption patterns leads to diversity in tariff outcomes.

SA Power Networks has had a residential demand tariff available since July 2014. The following analysis is based on the published 2015-16 prices. It is noted that the final tariff design for the period 2017-20 is the subject of a formal regulatory process – the Tariff Structure Statement that is being reviewed by the Australian Energy Regulator (AER) [23].

SA Power Networks Network Tariffs - Residential
APPLIES TO USAGE FROM 1 JULY 2015

Customer Category	Units	Min Qty.	DUOS excl GST	TUOS excl GST	PV JSO excl GST	Total excl GST	Total incl GST
Low Voltage Residential - Single Rate							
Supply Rate	$/day		0.2563		0.0441	**0.3004**	**0.330440**
Block 1 Usage Rate	$/kWh	First 333.3 kWh/mth	0.0745	0.0300	0.0130	**0.1175**	**0.129250**
Block 2 Usage Rate	$/kWh	Balance Usage	0.0990	0.0360	0.0173	**0.1523**	**0.167530**
Low Voltage Residential - Actual Demand (monthly)							
Supply Rate	$/day		0.0000			**0.0000**	**0.000000**
Summer Monthly Demand Rate	$/kW/mth	min 1.5 KW	9.0600	2.8600	1.5600	**13.4800**	**14.828000**
Winter Monthly Demand Rate	$/kW/mth	min 1.5 KW	4.5300	1.4300	0.7800	**6.7400**	**7.414000**
Additional Monthly Demand Rate	$/kW/mth		0.0000	0.0000	0.0000	**0.0000**	**0.000000**
Usage Rate	$/kWh		0.0483	0.0153	0.0083	**0.0719**	**0.079090**

The data collection as part of BTH has provided a unique opportunity to examine the impacts of tariff options on the consumption profiles of a range of households where there is also a degree of knowledge about some key attributes of the households in question. Low-income renters are a cohort

[22] http://www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements
[23] https://www.aer.gov.au/node/42356

of interest for policy makers as they are often identified as being vulnerable to energy and housing costs.

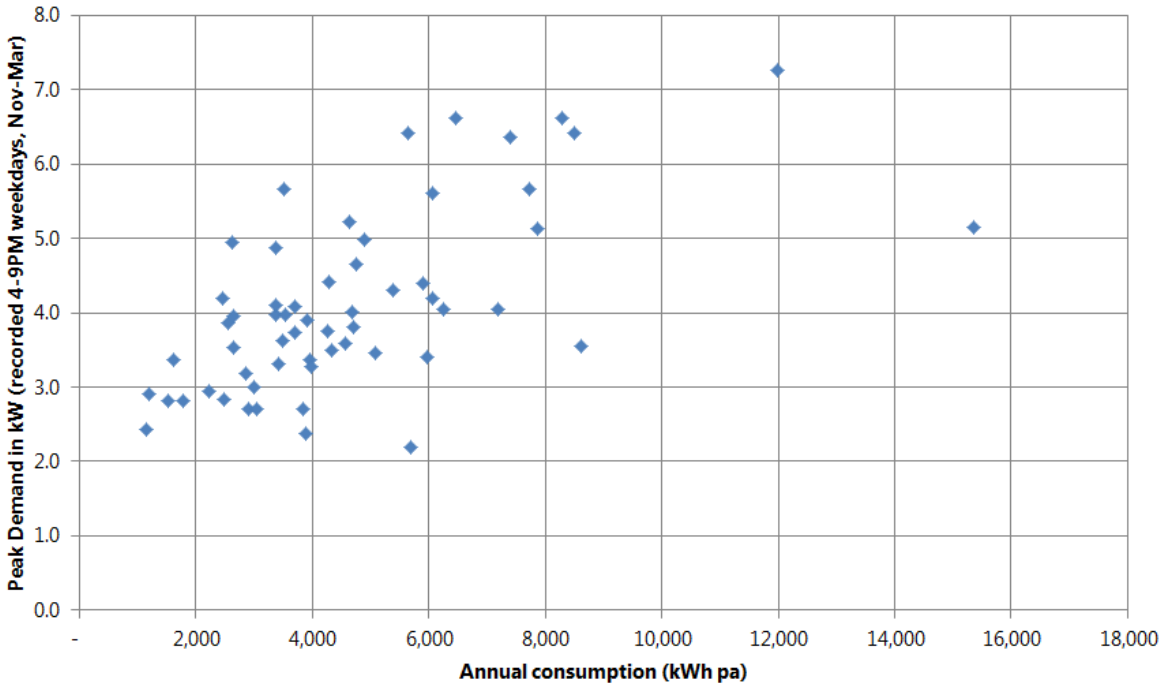
This is an important opportunity to develop detailed customer impact case studies (see Section 5) for consideration in the further development of cost-reflective network tariffs.

Summary

58 profiles have been retained for use in the summary analysis. These have been individually reviewed for data gaps and anomalies and are considered to represent a reasonably sound and diverse set of load profiles.

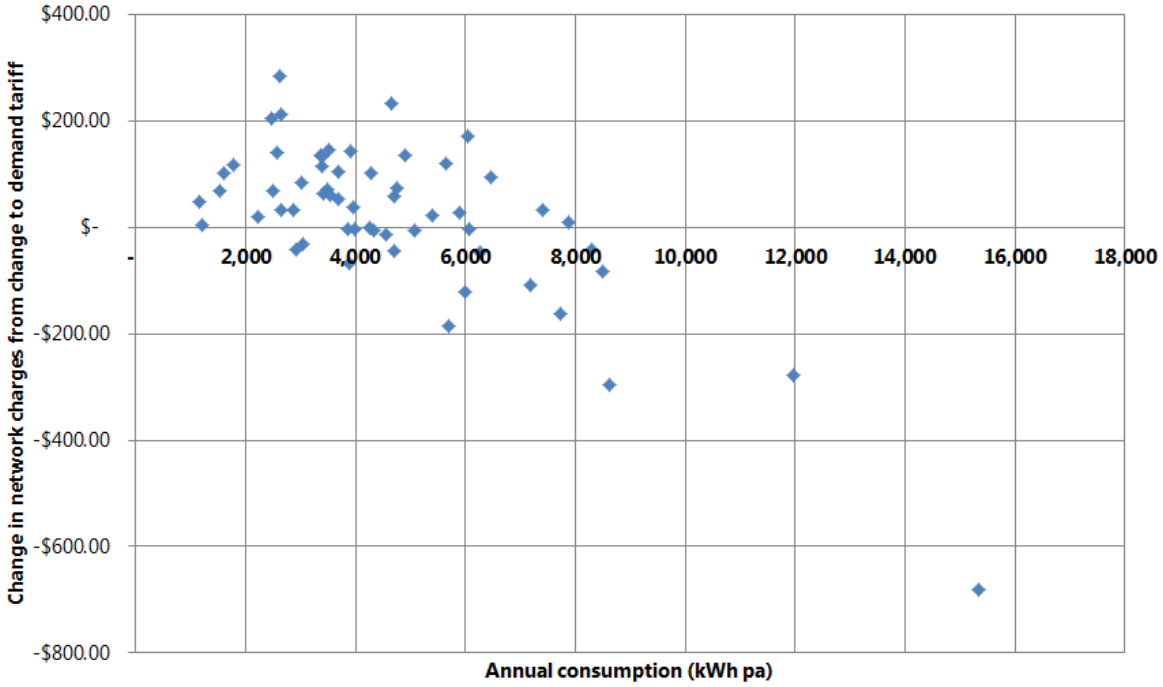
The demand tariff option introduces a charge based on the peak demand recorded between 4PM and 9PM any day of the week. A higher rate applies between November and March than for the rest of the year. Currently, network charges are based on aggregate consumption between meter reads. In order to understand the impacts of such changes, the consumption patterns of these 58 households have been contrasted between the existing tariffs and SA Power Networks new demand based tariff.

Figure 21 below illustrates the diverse combinations of summer peak demand and annual consumption recorded for the sample:



For each household, network charges were calculated for both the SAPN standard residential tariff and the new demand tariff. In summary, the majority of households would experience an increase in network charges as shown in Figure 22. However some households, especially those with higher levels of consumption (6,000 kWh and above), would experience substantial reductions.

Figure 22: Estimated difference in network charges between tariff options (demand; standard) vs Annual Consumption



The impact analysis can be segmented by main source of income to provide an interesting insight into the diversity of impacts:

Table 22: Summary of comparison of tariff options for customer segments

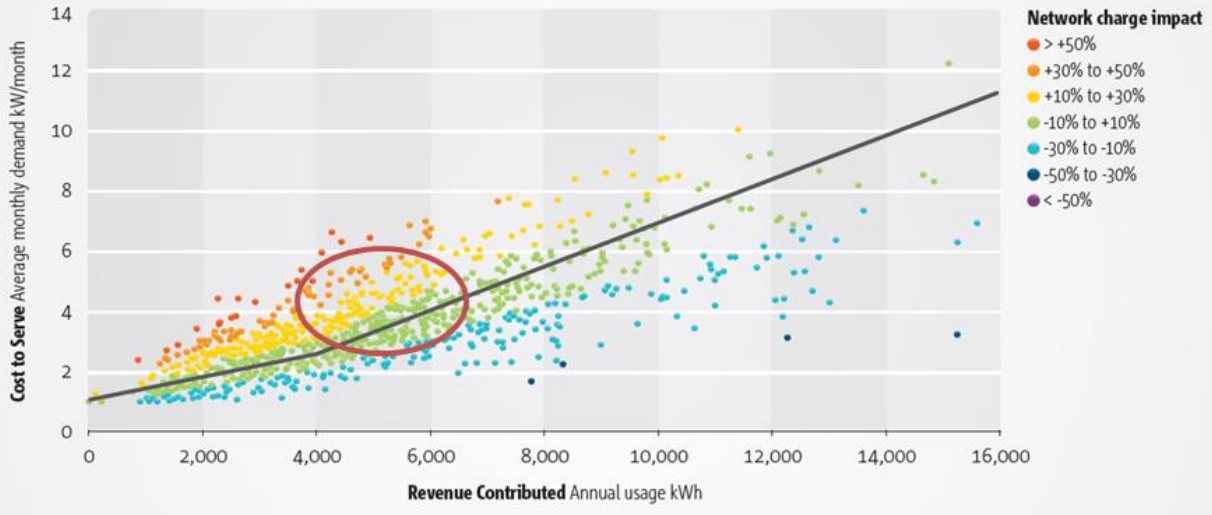
Main Source of income	Impact of Demand Tariff on Network Charges	Average annual consumption (kWh)	Comment
Full sample (n=58)	3%	4,664	Overall impact across all in sample was an increase in network charges
Wages (n=28)	8%	4,327	Well above average impact
non-waged (n=30)	-1%	4,979	Overall, those primarily receiving pensions and benefits would expect a slight reduction in network charges
Aged Pension (n=8)	12%	2,837	Overall, this cohort can expect a significant increase. This may be due to having lower total consumption
DSP (n=6)	0%	4,020	On balance, demand charges are cost-neutral for this group
Newstart or Student Allowance (n=10)	-11%	7,817	This is the group most likely to benefit from a change to demand tariffs. This may be due to having higher total consumption

The diversity of impacts and diversity of total consumption, between the groups are important considerations for education and support initiatives as part of the transition to more cost-reflective demand based tariffs. The above results suggest a need to considered targeted communications.

These results are similar to those indicated by SA Power Networks in their Tariff Reform Consultation Paper (September 2015)[24]. In SA Power Network's Figure 23, the red oval highlights the consumption range of most BTH Participants (around 2,000 to 6,000 kWh pa) and that most of these experience an increase in network charges.

Figure 23: Residential without PV

'Residential without PV' customer sample, showing impact of cost reflective network prices vs current prices. Network costs are about half of the retail bill. Break-even line shown in black.



The median annual usage for residential customers is 4,000 kWh pa (x-axis measure). Such a customer has an annual retail bill of about $1300 pa to $1500 pa depending on which retailer they use. A 40% network price change/20% retail price change would be about $280 pa.

The case studies of Section 5 however provide examples of households that would experience increases and decreases as summarised in the table below. Households #45 and #925 would both expect a reduction in network charges of 10-15%. Both of these have what is referred to as good "load factors": the ratio of average to peak demand. Household #633 provides a case study of a household who can expect a significant increase in network charges (approx. 14%, around $80 pa). In this case, the household has a load factor of around 10% and can be seen to incur 'demand charges' from short-term spikes in demand likely to be related to electric cooking.

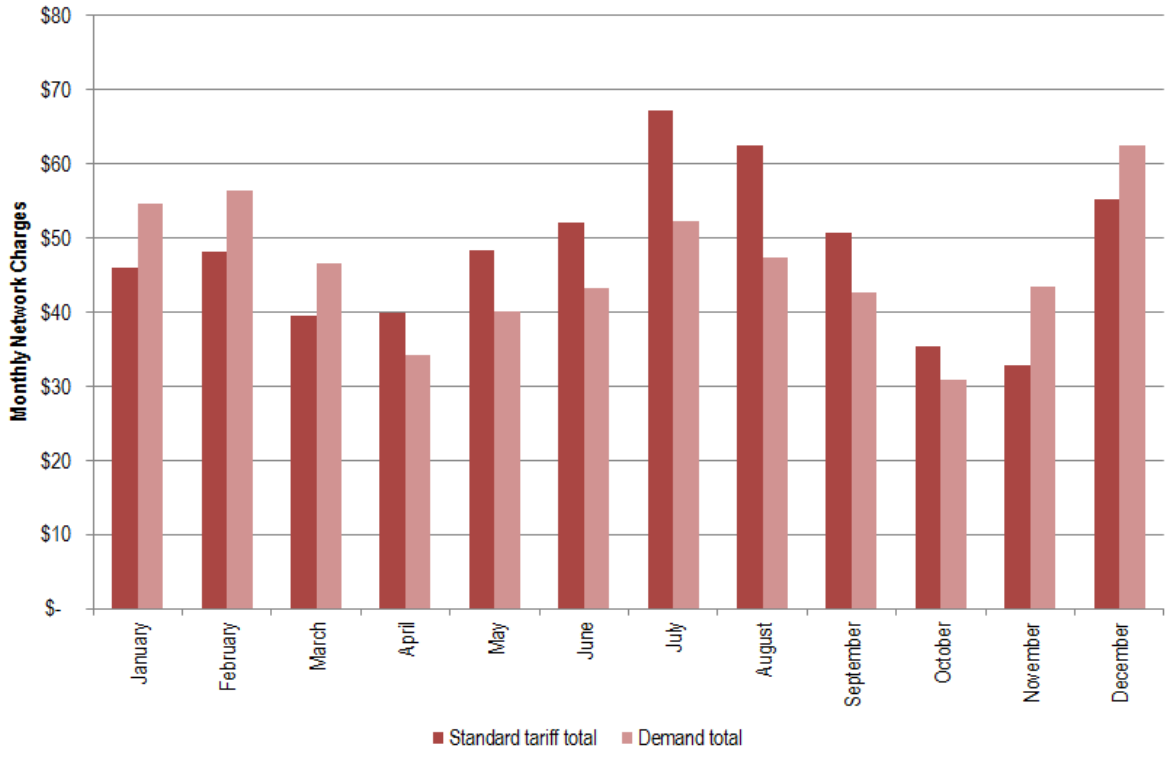
[24] Available from http://talkingpower.com.au/your-views/tariff-structure-statement-consultation/

Client ID:	193	45	59	633	917	925
Consumption (kWh per annum)	3,993	3,855	3,033	3,372	2,023	4,386
Ave kWh per day	10.9	10.6	8.3	9.2	5.5	12.0
Summer Peak Demand (kW)	3.0	2.2	2.6	3.6	2.1	2.1
Winter Peak kW	3.6	2.5	4.0	3.3	2.1	2.5
Load Factor (Summer MD)	14%	16%	12%	10%	10%	21%
Total Standard Tariff	$ 657	$ 631	$ 516	$ 558	$ 361	$ 678
Total Demand Tariff	$ 650	$ 561	$ 536	$ 636	$ 370	$ 575
Difference	-$ 7	-$ 70	+$ 20	+$ 78	+ $ 9	-$ 102
Change %	-1%	-11%	+4%	+14%	+3%	-15%

Load profiles and seasonality of costs

One important observation from the analysis of the 6 case studies is that, as a group, consumption is what would be referred to as 'winter peaking' – average consumption AND peak demand are higher in winter than summer (see Figure 25 25). Under current network tariffs, this group would pay higher prices in winter than summer. However, under SAPN's demand tariff, costs for this group peak in summer as shown below in Figure 24.

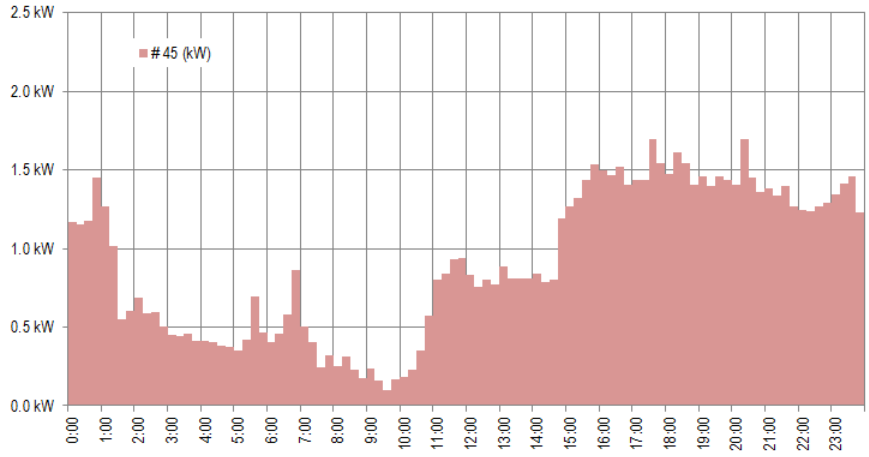
Figure 24: Monthly network charge totals of two tariff options

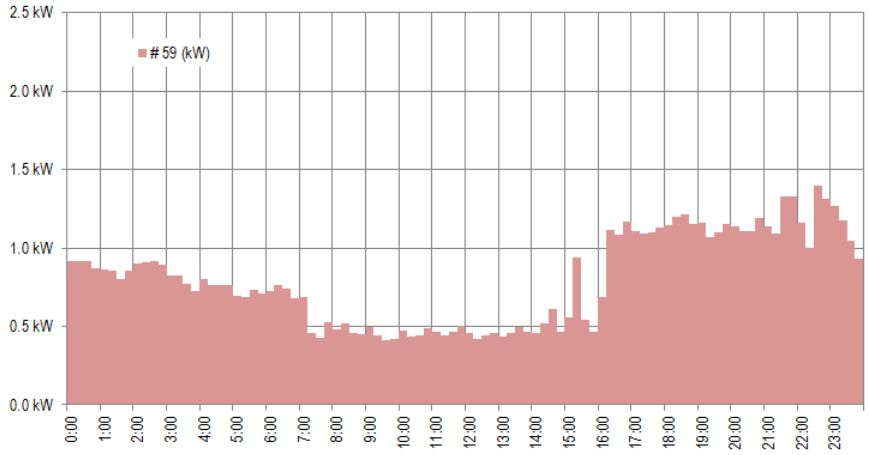


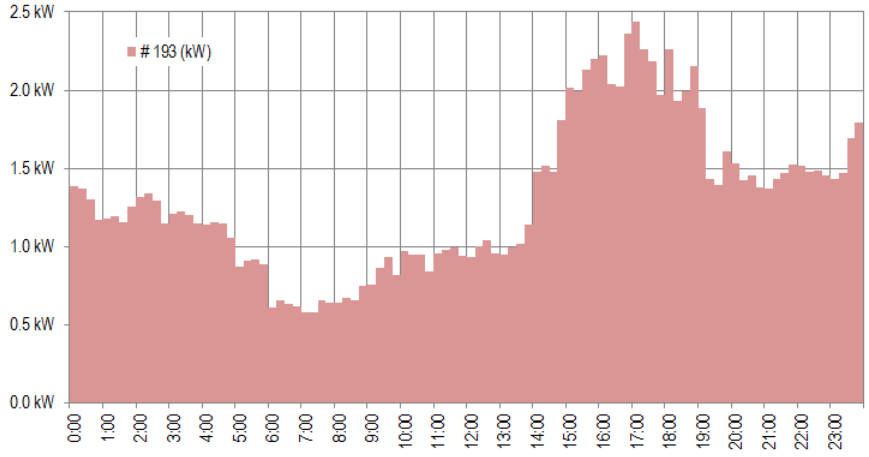
This is an important customer impact of this tariff option in the South Australian context.

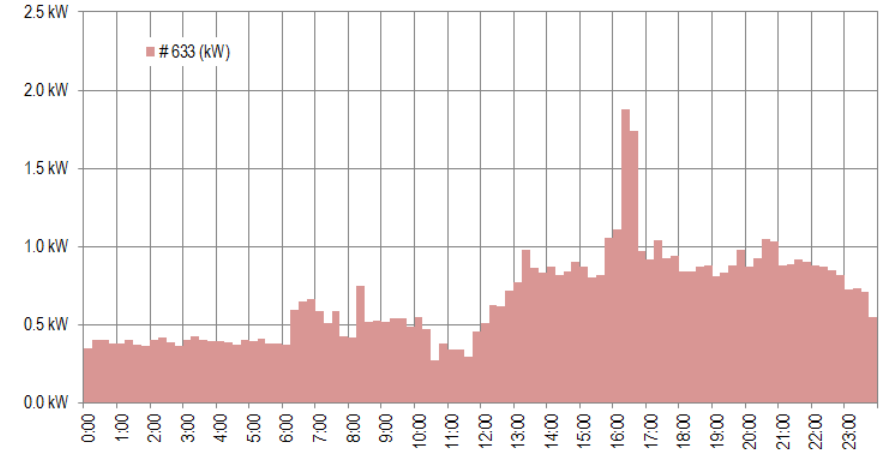
Load profiles and heat waves

Load profile data includes a period of extreme heat Dec 16th to 19th – 4 days above 40°C. The case studies of Section 5 illustrate the diverse consumption profiles of households during these events and are replicated here:





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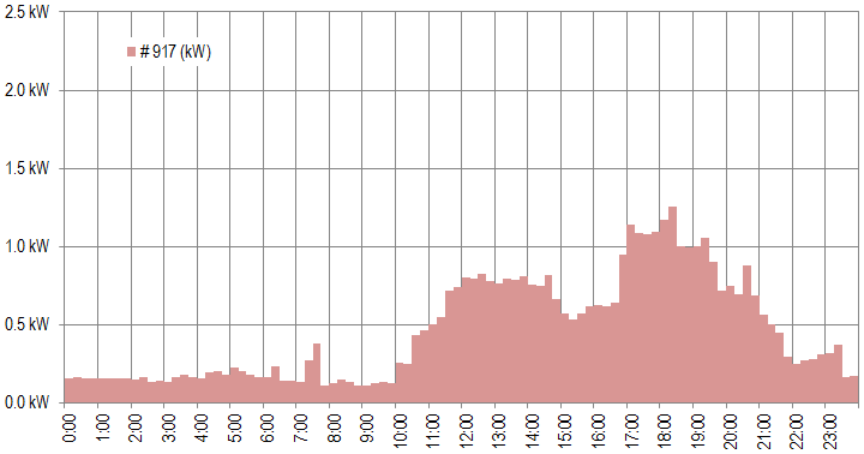
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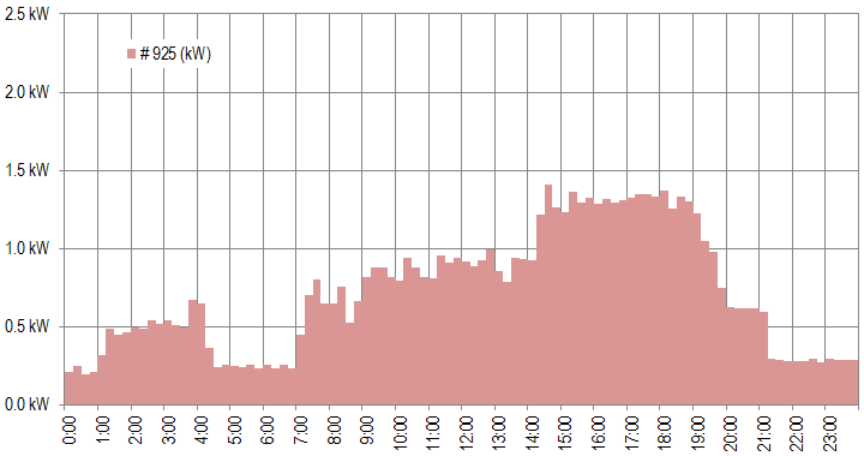
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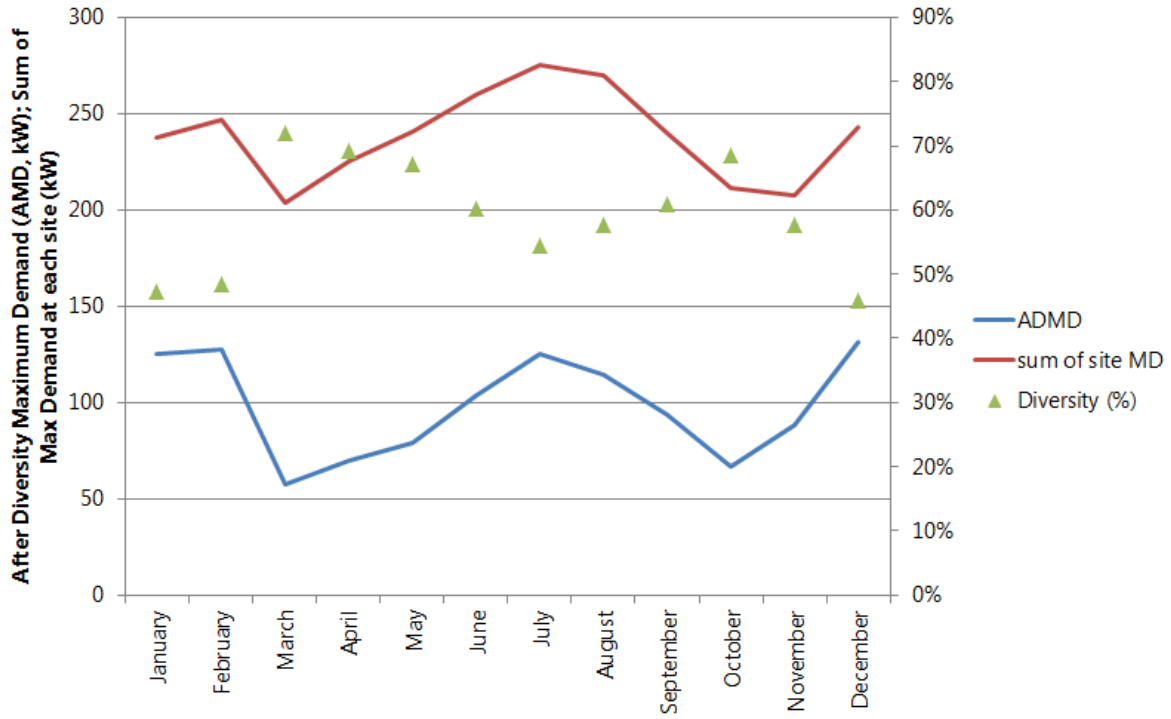
Load Profile Diversity

The aggregation of loads is of interest to retailers and other energy service providers. Figure 25 illustrates the diversity in peak demands by comparing the sum of monthly peak demands recorded at each site (i.e. the peak demand for billing purposes) with the peak demand recorded at any given point in time by the entire portfolio of 58 households (i.e. the after diversity maximum demand or 'ADMD').

As can be seen, in the key summer months (Dec-Feb) and the key winter months (Jun-Aug), there is less diversity in consumption whereas in the milder months there is a much more diversity (less coincident demand) in the consumption patterns. It is coincident demand that drives network costs and tariffs are designed to reflect the diversity in customer demand. For residential customers in SA it is understood that SAPN apply a standard 50% diversity (to convert coincident peak demand into a price signal for individual customers). From this it would appear that this also largely applies to our sample.

Figure 25: Peak demand diversity of participating households



Appendix I - Focus Group, Staff

In attendance: 3 energy workers and one manager from Uniting Communities and 2 Department of State Development Staff

Notes from conversation

Main reactions from tenants

- Most tenants very happy with the project – keen to get EE improvements and be more comfortable in their home. Have come across a number of houses recently who don't have good insulation. Have found one house 3-4 years old that only had insulation in back room.
- Some landlords putting the 'hard word' on tenants – mainly amongst private tenancies.
- Tenancies are pleased with installation process

ISSUE RAISED: Are landlords notified when an installation occurs?

Have people heard of energy efficiency?

- Most people say they have turned lights off – but most people don't know much about energy efficiency.
- Keen to get follow up information

ISSUES RAISED: Possibly alternative / additional interventions would be screen doors, screens on windows, ceiling fans. Quite a few properties don't have screens on windows/doors.
Need faster turn-around time between intervention and energy visit.

Main motivation for involvement in project?

- Reducing energy bills most important
- Comfort also
- Some care about environment and sustainability

Negative reactions

- Concerns about rent increase. Rent freeze very important. Note that rent freeze is 12 months from when landlord SIGNS agreement –not after installation.
- Some didn't want anyone to enter their property
- Some tenants had asked for aircon in past but landlords had said they would have to pay $30/week more

ISSUE/ACTION: Liaise with LARE to check if and by how much rents go up after rent freeze ends (longitudinal study).

Is database useful?

- Very difficult to use on iPad – too wide for screen
- ISSUE: Doesn't flag when events are required

Private rental vs LARE

- Some non-LARE properties are in very poor condition; structurally unsound and not energy efficient at all

Relationships with partner organisations?

- LESS very good and helpful. Generally, it is one-way (from UC to LESS)

Key learnings

- Good project for learning about project management and stakeholder engagement
- Some of consortia don't have energy understanding. Staff engaging householders could have been briefed in energy issues– so they would have better understanding of what questions to ask tenants/landlords... (It was noted BY Natasha Davis that she proposed bringing all the staff who interact with landlords and tenants together early in the project to ensure everyone is on the same page)
- Also need to explain that if data is not collected there are impacts on reporting at the end of project
- Triaging people eligible for project – have spent a lot of time on ineligible households
- Need adequate admin support – admin falling to energy workers
- Goal posts have shifted and there wasn't a clear understanding about project goals and process from the start
- Project wasn't fully formulated before the workers started
- More feedback and input needed from people on the front line to people who control the project
- Query about objectives and how much it will really benefit very low income people
- Better documentation required
- Need input from people at 'front line' into project governance/management.

Any surprises?

- Project has been very fluid – thought it would have been more tied down before being rolled out. Process map helps provide more clarity
- It was supposed to be a very simple project but has kept changing tack to try and meet the targets and deadlines

Suggested actions

- Monthly / quarterly catch up – energy workers to attend operational / governance meetings.
- Also regular catch ups between Sarah and energy workers (could be via phone)
- Communication protocol
- Notify landlords when installations made

See next page for individual feedback

What would be 5 things you would advise someone designing a similar project to *Beat the Heat!?*

A	B	C	D	E
- Need clearly defined roles and responsibilities - Clear data plan • What is needed • How collected & stored • Who is analysing - Required 'outcomes' – e.g. statistics broken down to better enable project mgmt. - Additional staff meetings / staff involvement in process	- Ensure stakeholders who do not come from an 'energy efficiency' background are provided with suitable training in energy efficiency concepts and able to identify which houses have thermal dynamic qualities (or lack of them) relevant to project - Triage households effectively to reduce wasted time in visits - Be sure about what data is collected, how, where, why and by whom to adequately communicate requirements to those collecting and analysing data - It's great to be flexible and creative but can we stop moving the goal posts	- Be clear about outcomes and KPIs - Clearer about process - Consistent training / input/output - Be clear about who is going to benefit from the intervention – why are some people going to benefit and others aren't?	- Base the project on real research – don't fix a perceived problem, make sure you intimately understand the problem before deign interventions - Fully design interventions and develop complete and finalised project documentation prior to roll-out - Continuous communication with and training for frontline staff to ensure consistency of service delivery - Pilot and evaluate then evolve prior to full roll-out - Continuous evaluation to ensure project is meeting original objectives and goal posts haven't changed over time	- Communication with all people involved is paramount and between all levels of the process - Ensure clear goals and procedures - Ask landlords and tenants about options and processes that maybe relevant before starting process - Interaction with and between stakeholders very helpful

What are 3 most valuable outcomes of the project (to date)

D	E	A
- Awareness of procedures that do not work or are inefficient - Interaction with tenants - As a pilot it is aiming to do something about a real issue for tenants	- Understanding of how energy efficient private rental is - Understanding impact of introducing new energy efficiency appliances into low income households - Significant of social welfare organisations being funded to deliver projects where the delivery pressures are so time-controlled that they are forced to roll out before the project is fully planned which causes further delays and issues as the project progresses	- Learning about complexity of projects when all staff involved don't meet requirements – e.g. referral eligibility - Difficulties for staff when projects develop 'piecemeal' - Need to identify / target referral source to target audience to meet requirements of project

Appendix J – Focus Group: Property Managers – Lin Andrews and Kevin Hodges

May 2015

Background

As part of BTH, a representative of Sustainable Focus interviewed the Coordinator from LARE, two property managers from LARE (Salisbury Office and Mile End office) and a property manager from Kevin Hodges.

Results

What is your overall impression of BTH?

- On the whole - Been great for tenants – only had feedback from tenants, not owners.
    - Tenants like to 'show it off'.
- For a lot of properties – PM's received minimal feedback from tenants
- Lack of knowledge amongst some people about how to use RCAC
    - Older couples 'set in their ways' don't know how to project RCAC. (Were they given enough instruction?)
    - Examples of people setting too cold in summer (i.e. 15 degrees) (Don't know if there is before or after behaviour change visit? – PM's don't know anything about these visits)
    - All tenants should have been left instruction books –PM's not aware of tenants having these
- Examples of people still using their Evaporative for cooling
- A few have been placed in strange places
    - PM's not sure why some are located in bedrooms/smaller room
    - One is poorly located in living room
    - PM's believe they or landlord should be consulted on location of RCAC

'I felt better for some of the tenants: 'at least they are going to get what everyone else gets….For them I think it is a huge benefit.'

'An owner expects us to have a running history on their property – so we need to know everything that has happened'.

LESSONS:

- ✓ Ensure installers provide guidance on how to use RCAC and how to minimise energy use
- ✓ Ensure all Property managers fully understand the aims of the project, how it will be delivered etc.
- ✓ Lack of communication with Property Managers / landlords about location RCAC.

Are they all happy?

- Mostly, but not all happy – roof sheets not put back properly; issues with old switchboards (these cases have been notified to LESS)
- One person was worried about the insulation because of the last project

Feedback from landlords?

- No.
- PM's haven't seen the letters of warranty. (ND advised they will be sent shortly)
- One landlord wanted to increase rent dramatically after end of rent freeze. Landlord backed down (Landlord agreement signed very early, so RCAC only installed one month before end of agreement)
- A couple of landlords queried the brand of RCAC – worried it would break down

LESSON:

- ✓ Emphasis quality and use a photo of what is going to be installed

Were tenants pushed into this by landlords?

- Everyone scared initially: if something for nothing what is the catch? When they realised it really was for their benefit most were supportive.
- One tenant complained strongly to PM about the project temperature logging requirements then participated after all and was very happy.

What about all the visits?

- Yes, once they have the air conditioner and they realise there are other visits – they are like 'really, do I have to keep doing this"?

Benefits for LARE?

'Yes. Other landlords have found out about it and wanted to be part of it'

"As a company it gives us another point of difference". We are not just about profit. It's working for the benefit of the community"

Also it is likely to increase the likelihood of tenants staying – benefit for landlord

Has this increased your interest / understanding of energy issues?

- Yes – for example things like 'turning off at the switch.'
- However, PM's commented that they were not supplied with any EE information (or about the project). We were fielding calls and had to say 'don't know, don't know'
- Opportunity to continue raising awareness amongst tenants AFTER BTH.
- Carina reported on one of their tenants with solar system having quarterly bill of $600. 'If I had a little bit more understanding I would be able to help'. (Another PM commented that perhaps having a solar system makes the tenants think they can use as much energy as they want)
- Water costs were also discussed
- SF suggested all PM's have a power meter and be trained in how to use it.

What would an ideal project look like?

- Bring everyone 'onto the same page' at the beginning – we were out in the field but didn't know what was going on
- More 'user friendly' database

    - Provide PM's with limited access to database (ensure they can have access to information to help with chasing landlords etc.)
    - Has been very time consuming for PM to sort through database and work out which properties each PM has in the project
- Using PM's more actively in recruitment would have been valuable
    - Blanket mail-out was not very effective in recruitment
    - Central office LARE did approach PM's to get participants then when they were struggling with numbers Lin Andrews decided to do the mail-out to all
- PM's agreed that other interventions such as *screen doors / ceiling fans* would be good. Even new properties (investment) not built with screen doors. No legislative requirement
    - Ensure they are high quality

LESSON:

- ✓ Send PM's copy of ALL correspondence before it goes out so they are 'in the loop'

Appendix K – Focus Group Governance - Recruitment

January 2015

Overview

- LARE had one person as a key officer – rather than devolving to Property managers to assist with recruiting
- The project was so complex it was determined it was better to have one contact person within LARE rather than many property managers working on promoting BTH in case of misinformation

What worked well?

- ✓ Personal contact works best
    - Contact coming from Property manager – people trust the management. Gives a level of endorsement
    - FOR LANDLORDS: Can provide reassurance and answer questions as well as provide clear outline of cost benefits
    - FOR TENANTS: Simple information

  SCALE ISSUES: Initial time constraints and a sense of urgency to 'get the numbers' led to bulk mailing rather than individual contact
- Single point of contact (quality control) Having one person at LARE made it easier for UC. LARE central coordination point liaised with other PM's if necessary
    - Time constraints for Property managers in regional offices to be involved. Also the project is very complex and there was a risk of misinformation.
- It was great when both landlords and tenants were interested

What did we learn?

PROGRAM REQUIREMENTS / ELIGIBILITY / SCREENING

- ✓ Need for VERY CLEAR and SIMPLE guidelines on eligibility
- Also criteria changed.
- LARE lost 'relationship capital' as people thought they could be involved and then were not eligible.
- Need for adequate <u>screening</u> of potential households before referral. There is a need for a dedicated person to do pre-assessments and be committed to follow up.
- Get all the paperwork / consents in place at one time – a lot of energy is taken up chasing people for switchboard upgrades; landlord agreements, etc.
- There was a different understanding among project participants about eligibility, including low income
- Get contact details for participants! – email, phone etc.
- Northern Housing (community housing) designed a survey to determine eligibility.

THE 'PITCH' / KNOWING THE AUDIENCE

- ✓ Need to ensure communication is properly 'pitched' for tenants and landlords.
- People were not rushing to take up a free offer. 'If it sounds too good to be true maybe it is…' People assume a free offer will get taken up. Need a landlord and tenant mindset.
    - For landlord need simple information on COST BENEFIT

    - Initial brochure was too complex. First brochure should have been a simple catchy message not so much detailed information.
    - ✓ TEST MESSAGES with LANDLORDS AND TENANTS
- The demographic being targeted through LARE is different to the clients of UC who are more used to receiving assistance so possibly more responsive to 'offers' such as BTH.
- Community housing more used to being asked to participate in projects such as this than private rental. There was a lot of interest from association

ORGANISATIONAL 'VALUES'

- The values of the property manager impact on how much assistance can be provided by individual property managers – LARE has a strong commitment to 'adding value' for tenants/landlords. Evaluation needs to demonstrate there is a benefit to property manager in terms of increased satisfaction with them as a property manager.
- Benefits of have a not-for-profit organisation involved – not doing for benefit of organisation

STREAMLINING CONTACT WITH PARTICIPANTS

- Relationships are SO important.
- Who 'owns' the relationship? Process unclear and multiple people were contacting households.
    - All LARE clients at the beginning then become UC clients at a handover point. Some confusion over this. SF also received phone calls with queries.
    - ✓ Need single point of contact: 'Welcome to the project. Your contact person is….'
- There was often a lag between referral and tenants or landlords getting further information. (i.e. influx of referrals with limited UC staff to contact them)
- Difficulty making contact with tenants who were not available in working hours
- Participants preference is to go back to the Property manager (with whom they have an existing relationship), not an agency such as UC.
- ✓ Maybe the project should be embedded entirely within a Property Management company (all personal contact to come from PM)

LANDLORD's relationships with TENANTS

- Risk of landlords pestering tenants to participate. Also there is issue from tenant perspective that private landlord (generally) is getting value ($ from government) and landlord isn't prepared to spend on the house

Project management / project governance

- Need for proper project design at the outset – spend time getting everyone on the same page. Processes were not documented – this would have made it easier. Recommendation to Commonwealth that milestone 1 includes project documentation; testing messages and systems etc.
- Get all the staff working on the project on the same page early in the project – consistent messages; streamline processes, etc.
- There was not enough focus and consideration of technical issues from the beginning with a clear system for resolving (i.e. switchboard upgrades)
- Were staffing allocations appropriate?
- In a project like this – processes change as delivery evolves. This needs to be factored in – especially to database design.

Appendix L - Focus Group, Governance – Stakeholder perspectives on Implementation

May 2015

Perspective of tenants

- Cordial, polite installation workers – got good feedback (include some quotes in report)
- Quite a few tenants were reluctant to participate and many have been 'passive' and difficult to engage
    - Tenants wanted to know why landlords should get benefits when they are not good landlords and won't fix other things
    - Some of the landlords quite pushy. (More common in private landlords, but still some tenants in LARE who had pressure from landlord. "my landlord told me I have to ring you'…)
    - Feel harassed about participating.
    - Power imbalance – people say 'yes' but actually no buy-in. Not my property – why should I engage with this?

Perspectives of installers

- Installers found households difficult to deal with
- Run-down properties; poor quality electrical infrastructure = Unpredicted work
    - Switchboard upgrades were not planned at beginning
    - A couple of issues relating to faulty wiring – BTH 'blamed' because the wiring can't cope with new switchboard
    - A couple of landlords went ahead with switchboard upgrades themselves without involvement of LESS.
- Clear difference between community housing – almost 100% appreciative tenants; private tenants very mixed response. Tend to be longer term tenants in community housing also
- Private tenants - A significant number of tenants very reluctant to participate (10-15%)
- Tools went missing at one installation
- Previous projects LESS have worked on – people have to ASK to participate; we are not chasing them (Push not pull).
- Location of RCAC was problematic in a few cases
    - A couple of issues related to strata disapproval of where RCAC located
    - Difficulty locating some RCACs: especially in community housing where houses had been divided. The push for numbers meant we couldn't be selective with properties
    - Also energy workers don't always know intricacies of what is needed to install RCAC

Program design

- BTH didn't take away existing heating / cooling appliances - might push up energy use as they are use both/all. With water heating that wouldn't happen.
- There was very little need for ceiling insulation – most was top-up only.
- Only a handful of houses that had no RCAC – even if an old one. All split systems were taken away; but not 'hole in the wall' systems. (Evaporative coolers were also left)
- Potential cheaper options: Lack of security screen doors / windows. Ceiling fans. Evaporative cooling
- Take away a fridge and put a new one?
- The issue of 'peak' energy load has reduced since this project started.

Lessons for future?

- More streamlined approach – i.e. LESS making installation calls and first visits
- Need clear, specific timeframe for installation. Lag between approval and installation was a problem.
    - We had a process chart – but didn't have resources to meet
    - Awkward number of households – not large enough to scale up resourcing
- Plan, plan, plan
- Recruit via application – people have to demonstrate need
- In future private rental EE project - would it be better to get tenants to consent first and then ask for landlord approval? A project in Victoria went this way and had poor outcomes. Need Property Manager as mediator?

Appendix M – Focus Group, Governance Data Collection

Data collection - What worked well?

General

- Comprehensive
- Broad skill set in consortia
    - The value of qualified staff
- The value of coupling data collection with energy advice – very important part of project
    - Evaluation confirms importance of face to face
- Use of handheld devices when they worked
- Unexpected outcomes captured
- Testing motivations / assumptions

Qualitative

- Interviews – great depth of data and great responses rate
- Very thorough and implemented well
- It was good to discuss and review survey questions to ensure they matched the things we needed and could be understand by participants
- Great to have appropriate researchers doing interviews and analysis
- Well considered and constructed surveys
- Much easier than quantitative

Quantitative

- Larger sample size than similar projects
- RCAC use - measured accurately (not relying on bills)
- Exact requirements of what data needed to be collected not specified or communicated precisely
    - Caused confusion down the track
- When used hand held devices – good efficiency in collection

What could be improved?

Planning, communication and reporting

- Exact requirements for what we wanted to measure and how to collect it could have been defined more precisely (and communicated clearly) rather than making decisions as the project unfolded (Noting this was a pilot
- Communication across consortium / with staff needs improving to ensure more transparency and everyone 'on the same page' (not doubling up on work load)
    - Difficult to see how much of any particular piece of quantitative data we have at any one point in time
- Visibility of progress – esp re quantitative data (missing data)
- Scheduling contact with householders across evaluation
    - E.g. 50 telephone interviews and 2nd comfort survey

Technology for capturing data

- Use well recognised software to reduce likelihood of collection issues

    - better / more reliable loggers
    - include time for testing
- Better use of hand held devices for recording data to save time

Data collection pre-pilot

- Measuring RCAC energy before project – not relying on bills

Database

- Challenges with the CDS database meeting our requirements because we didn't fully understand them from the start – esp CSIRO changes
- Database scheduling

Have we collected the right data to fulfil our reporting requirements / determine if we met the project objectives?

- Uncertainty around how some data will be used in analysis – staff didn't place as high as importance on this
- Difficulties capturing necessary info from old heating / cooling appliances
- Could have considered other ways to capture comfort / temp data
- Profiling participants in relation to their pro-environmental views
- Testing whether landlords with multiple properties are more likely to participate

Appendix N - Focus Group, Governance Lessons

January 2016

What did we learn / what worked well from the perspective of each of the following

Tenants	Landlords	Administration / governance
Project design and uptake • Being careful to assume that what we think would be good for tenants would be readily accepted / understood as benefits by households • Varied response – some thrilled at opportunity; some with attitude of 'it's not enough' – e.g. RCAC should cool the whole house • Potential impact of other low/no cost options – e.g. fans, screen doors, etc. Would have been good to be able to offer these in conjunction or instead of RCAC • Need to simplify eligibility assessment – many different perceptions around this • Reduce the number of households and focus on data quality – too ambitious? • Frozen rent may not be as much value as general rents have 'stalled' (maximum save around $5/week) **Communication** • Need to simplify the contact with tenants – not too many people <u>Worked well</u>	**Communication** • An understanding of just how much preparation was needed to engage and sustain engagement of landlords – the need to ensure top rate communication and to keep communicating • Personalised contact vital for participation / engagement • Consider the way we promoted the project at the start. More targeted/personal approach worked better • Property Managers with single person within LARE **Project design** • Engagement of Real estate agent vital to success • Maybe increase commitment on landlords to make a change? • Issues with upgrading 'out-dated' facilities – need to keep properties up to date (e.g. switch board issue) <u>Worked well</u> Good to have variety – with community housing and private Has increased awareness	**Planning** • Need to more planning and project set-up; clearer roles from the outset ***** • Time to trial and modify at the start • Adequate time for whole trial **Collaboration / governance** • We need a number of different organisations to achieve meaningful outcomes • *Collaborative projectsalways need more time and money than planned* • Perhaps split our suppliers of services from governance for some impartial oversight • Importance of communication – from promotion of project to administrative correspondence (may have been too complicated) **Project management** • More administration support would have assisted UC • Planning ahead and checking progress against this • Contingency budget and need to plan for unknowns • Spreading the knowledge (and therefore work) to

Tenants	Landlords	Administration / governance
• Has facilitated greater awareness of (energy) issues – e.g. consideration of renting more energy efficient homes when there is a choice in the rental market • Hopefully the project has led to the following understandings: – 'we can be more comfortable without increasing our bills' – 'energy management is not rocket science' – 'it is worthwhile to look at and understand our energy bills'	Landlords benefited from improved properties – i.e. insulation and AC added at 'no' cost Hopefully the project has led to the following understandings: – 'improving our houses level of comfort makes tenants happy' – 'energy efficiency is worth advertising' – 'investing in energy efficiency is worthwhile'	reduce time pressures and upskill others (i.e. more than one LARE person) – however this increases risk of duplication and incorrect information being given. • Increase visibility on data and clearer data interim deliverables • We could have used internet more effectively in communicating our work project (e.g. online project management tool) • Quality check installers work <u>Worked well</u> • Stickability of all partners and preparedness to keep engaged over an extended period and adapt when personnel and partners changed • Splitting the governance and oversight of the project from day-to-day admin / operational issues and specifics of data collection, management and reporting • Value of drawing people from different backgrounds

UNITING COMMUNITIES