

Appendices

for PhD thesis

Dwelling adaptation for sustainability: Improving
interventions for energy efficiency, comfort and equity in
Tasmania

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Appendix A – Overview of the research approach and timeline

Table A-1: Research timeline

Research stage (when begins)	Description	Date
Early research (literature reviews and consultations)	Introduction to the problem through people's experiences and academic and public literature reviews.	July 2006
	Consultations with sponsor and principal supervisors.(Further consultations with sponsor and reports to sponsor throughout thesis)	September 2006
	Move to Tasmania.	December 2006
	Exploration of Tasmanian context through observation and printed documents.	Began December 2006
	Exploration of approaches that accommodate contextual and sustainable research lens and that recognize complexity.	January –June 2007
	Exploration of key issues housing, sustainability, home improvement, equality.	March – Dec 2007
Research design	Realization that needed to study incrementally. Identification of possible stakeholders. Prepared initial ethics application for focus group.	March 2007
	Crystallization of the research questions.	Mid 2007
	Ethics round one application and clearance of the project with relevant parties.	August-September 2007
Fieldwork begins	Focus groups (first round) with housing experts (stakeholders), grouped according to employment status in local, State or Australian government and non-government and private sectors. Research problem presented and advice sought on research questions and interview questions for household interviews.	October 2007
Analysis begins	Recognition of the importance of lived experience.	Late 2007

	Receipt of nominations of possible housing occupant participants from housing experts. Householders recruited with the assistance of the original panel of experts who participated in the focus group. Contact with households via letter through SLT. Organization of first round of interviews.	October- November 2007
	Generation of the letters of introduction, information sheets, question and observation guidelines and ethics documentation.	December 2007
	Second ethics application based on guidance from focus groups and designed around opportunity to study the GGAER program.	November- December 2007
	Letters to participants. Responses gathered and appointments booked. The interview questions developed with reference to literature reviews, focus group discussions and supervisor guidance.	November 2007- January 2008
	Interviews (first round) with housing occupants and observations of their homes. Talked about summer comfort, well-being, energy efficiency, home improvements, dwelling features and indoor thermal performance.	February/March 2008
	Journaling about own dwelling energy efficiency and comfort behaviours and in parallel to interviews.	2008 -2009
	One-off interviews with professionals representing organizations involved with the GAER Project. Only a few interview conducted as few organizations replied.	March –August 2008
Fieldwork (participant checks on initial data)	Focus groups (second round) with the same groups of Tasmanian housing professionals as were involved in the first round of focus groups. During these focus groups, findings from the first round of interview and observation sessions with housing occupants were reported to the focus groups and responses were sought on initial findings from the household interview data.	May 2008
	Interviews (second round) with housing occupants and observations of their homes. The purpose was to: ask about energy management and comfort in autumn; further	May 2008

	observe the dwelling features in different seasonal conditions; gain more detailed insights into occupants' experiences of their housing, in particular in relation to the perception of health and well-being outcomes, energy management and costs, and related matters; and to report back on findings to date and engage in 'member checking' with participants. The interview questions and observation protocols were developed considering data generated previously in both focus groups and housing occupant interviews.	
	Interviews (third round of) with housing occupants and observation of their homes. The interview questions and observation protocols were developed considering data generated previously in both focus groups and housing occupant interviews. Discussed home improvements, comfort and energy management through winter and related topics including wellbeing and capacity.	July - August 2008
Analysis	Transcriptions / initial analysis /writing.	March 2008-2009
	Methodological clarification.	2007-2008
	Changed to part time to study.	Mid 2008
	Key realizations forming: Process, time, application of theory.	2008-2010
	Household interview summaries written up and sent to participants.	2009/10
	Key analytic themes emerge.	2009
	Thesis synopsis development / chapter development.	Late 2009-2011
	Chapter writing.	2010-early 2013
All stages	Writing of papers and chapters and contact with stakeholders occurred throughout the course of the research.	2007-Early 2013

Appendix B – Focus group invitations and schedules

Note: The Glenorchy Greenhouse Action Energy Rebate (GGAER) Program was also known as the Glenorchy Energy Rebate Program (GERP).

Phone introduction

Outline of script to be used for phone introductions for focus groups (to identify position, name and address)

Hello my name is Phillipa Watson. I am a researcher at the School of Geography and Environmental Studies at the University of Tasmania.

How are you?

I am working on funded research about the drivers and impediments to making improvements to existing housing for health and wellbeing and environmental gains.

We have identified your organisation's input as valuable to the study and seek your participation in 2 focus groups.

(if secretary/personal assistant) Could I speak to...(name of person or position)..... regarding this please

OR

I am ringing to enquire to whom I should address this invitation ...

if passed on repeat intro

We will be running focus groups in October at the School of Geography and Environmental Studies.

The focus groups are gathering together housing experts in Tasmania.

Their aim is to discuss the barriers and drivers to the sustainable renovation of Tasmanian housing.

We are interested in input from your organisation. The focus group findings will inform housing case studies to be undertaken in this project.

(Get the full name, phone number and email if possible)

(Be polite but firm – if put off – say ‘I appreciate that’ or ‘I see the difficulty but it is important to have a participant from your organisation’)

If contacting Head of Divisions – say –

If you are not able to attend we would appreciate it if you could nominate a delegate from as we feel that your organisation’s input is important.

I will be sending / emailing out a letter of introduction and an information sheet containing all the details of the focus groups.

Thank you for your help.

Invitation to participate in focus groups

Sent on UTas GES letter head and included attached information sheet as presented on the following pages

(Insert date) September 2007

Address of invitee

RE: Invitation to focus group supporting research into housing modification for health, well being and environmental outcomes.

Dear (name of housing stakeholder)

As a person who has expertise and interest in housing and its processes and as a representative of [organisation] we would like to invite you to participate in a University of Tasmania research project. The project is exploring existing Tasmanian housing and the drivers and impediments to housing improvements for health, well-being and environmental outcomes.

We would be delighted if you (or someone you nominate from your organisation) would agree to participate in two focus groups. The first focus group will be held on (insert the date) and the second (date to be decided) early in 2008. Your focus group will comprise of other professionals from (choose one depending on invitee and what focus group invited to) local government / state government / commercial organisations that relate to housing use and modification / not for profit, non government or social support agencies. Each focus group session will be two hours long and afternoon tea will be provided.

Advice from this (choose one depending on invitee and what focus group invited to) local government / state government / commercial organisations that relate to housing use and modification / not for profit, non government or social support agencies and other housing stakeholder focus groups being held will inform planned in-depth case studies of Greater Hobart households. The case studies will involve interviews with household occupants and observations of their homes.

Details of the research project are provided in an information sheet, which is attached. The information sheet describes the background to the project, the time and venue of the focus group, the objectives of each focus group session and contact details regarding the project. A consent form is also attached.

We feel that your contribution is valuable and we hope that you are able to attend. Please indicate your intention to accept (or decline) the invitation by phoning 03 6226 8233 or emailing pwatson0@postoffice.utas.edu.au (please note the zero in the email address).

The project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC). If you have any concerns or complaints about the conduct of this project their contact details are listed in the information sheet under contacts.

Yours sincerely

Elaine Stratford

Chief Supervisor to the project

Head of School of Geography and Environmental Studies

University of Tasmania

Information sheet for housing stakeholder focus groups

Attached to invitation letter on previous page

Research project: 'Sustainable housing for equity and energy efficiency'

The Research

The renovation of existing housing, under sustainable guidelines, offers the opportunity for improvement in housing occupants' quality of life and a reduction of ecological and economic impacts. Tasmania has an ageing population and over 40% of households are classified as low income. Over a fifth of Tasmania's housing stock is over 50 years old and over two thirds 20 years or older (ABS 2000). The stock is some of the oldest in Australia. Insulation statistics show that although 30% of houses have timber external walls and 41% have single brick veneer (ABS 2005b p17), only 75% have any insulation at all (this includes sarking). Complete insulation is assumed to be rare as only 3% of the sample surveyed have floor insulation (ABS 2005b p22). This above data, personal accounts of cold, uncomfortable houses in Tasmania (supported by Weaver 2004) and a high level of energy use in the domestic sector (ABS 2005b), suggests that there is a problem with the quality of the housing stock.

Federal and Tasmanian government sustainability goals, regulation and the pressure of climate change require improvements in housing performance in terms of resource use and social support. Given the relatively slow rate of housing replacement (ABS 2005a), modification of existing under-performing houses would seem to be the only practical solution to these issues.

The project is investigating how to support improvement of Tasmanian houses in order to increase well-being of occupants and reduce environmental impacts. The research question being explored is; *What are the drivers and impediments to the sustainable renewal of houses in Tasmania?*

Benefits of participation

Your input into the focus group will ensure the research:

- is informed by your professional local knowledge and experiences,
- maps and understands policy, legislation and civil housing processes in Tasmania,
- is relevant to the context.

The findings from the focus groups will also provide guidance for housing case studies to be undertaken as part of this project in 2008. A summary of preliminary research findings, based on focus group data and the completed housing (member-checked) case studies will be available to all focus group participants around the end of 2008. It is hoped these findings will provide relevant insights into challenges and opportunities of sustainable modification of existing houses in Tasmania.

Focus Groups

The focus group will meet twice for two hours each time. There will be one focus group held on October the (insert date) and one held early in 2008. If you are not able to make it to the focus group we would welcome another representative from your organisation who is involved with housing to attend.

Focus group objectives

The objectives of the focus groups are to:

- seek the advice of stakeholders to inform questions for in-depth housing occupant field work,
- identify stakeholder priorities in terms of housing and its modifications for health, well-being and environmental impacts,
- understand further what are the most important processes that may bring about change in existing housing for health, well-being and environmental reasons, and
- ask assistance in recruiting households for the housing case studies.

During the first focus group participants will be presented with an introduction to the housing problem that is being investigated and then asked to assist in the development of questions for housing occupant surveys. Stakeholder priorities in terms of housing health, well-being and environmental concerns can be discussed at this point. After the first focus group, advice from participants will be integrated into planned housing occupant investigations. The main purpose of the second meeting of the focus group will be to report the findings from the first round of housing interviews and to record stakeholder responses to these findings.

Four different groups of housing experts are being organised. There is a focus group for local government professionals, for state government, for commercial organisations, and one that includes non-government, not for profit and social assistance organisations.

Venue

The first focus group will be held on the (insert date) of October at 3:00pm-5:00pm, in room 324, level three at the School of Geography and Environmental Studies, the University of Tasmania, Sandy Bay Campus. Afternoon tea will be provided. A map of Sandy Bay Campus is attached to this letter. The Geography and Environmental Studies Building is building no. 12 on the map. Free parking may be available along Earl Street (and other surrounding streets) or in the car park marked on the map that is entered off Grace Street. Affordable voucher parking is available between building 29 and Churchill Avenue.

Focus group moderator

The focus groups will be conducted by Phillipa Watson with the assistance of one other person.

The Research Team

The research will primarily be used as the data for the PhD thesis of Phillipa Watson. Her research is funded by the Department of Infrastructure and Energy's Office of Energy, Planning and Conservation (50%) and the Dean of Graduate Research, University of Tasmania (50%). She studies under a team of supervisors: Dr. Elaine Stratford (Primary Supervisor), Dr. Roger Fay, Dr. Aidan Davison and Dr Rowland Atkinson (co-supervisors) who will be supervising and involved in the focus groups and field work.

Concerns about the focus group

Please be assured that:

- The project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC).
- The focus groups are voluntary and attendance is not compulsory.
- Whilst the groups will be identified and your name listed as an expert advisor in the write-up of findings, comments will be dis-associated from any specific person. Comments will be identified at a focus group level only.
- We will be allowing you an opportunity to review the notes made during the focus group so that you may advise us of any sensitive material that must not be quoted or referred to.

Due to the group structure of focus groups we cannot assure that comments will remain anonymous. Please feel free to contact Phillipa Watson if this concerns you. If you have any concerns or complaints about the conduct of this project of an ethical nature, please contact the Ethics Executive Officer of the Human Rights Ethics Committee as listed in the contacts section below.

Data and its use

The focus group sessions will be recorded in order that accurate information may be taken from the sessions for use in the research. Focus group information will be used to inform housing case studies where occupant interviews will be conducted and observations made of their homes. The data from both the focus groups and the housing case studies will be used to inform the PhD thesis of Phillipa Watson. Data will be stored at the University of Tasmania, School of Geography and Environmental Studies. All hard and soft copy data will be stored in secure files. Data will be kept for at least five years. When the data is no longer required it will be shredded and erased.

Contacts

To RSVP for the focus group or for any further explanation about the research or focus groups please contact Phillipa Watson at pwatson0@postoffice.utas.edu.au or 03 6226 2833.

If you have any concerns or complaints about any aspect of the project or its conduct, please contact the Ethics Executive Officer of the Human Rights Ethics Committee (on 03 6226 7479 or human.ethics@utas.edu.au). The Executive Officer can direct you to the relevant Chair of the committee who reviewed the research.

First round of focus groups (October 2007): focus group schedule and discussion prompts

First focus group – 2 hour

(Below are notes to guide a semi-structured focus group session. I am interested though to see what the groups find important and what they prioritise as issues.)

Introducing the research team

Good afternoon – my name is Phillipa Watson. I am a PhD candidate here at the University of Tasmania in this school - Geography and Environmental Studies. I will be facilitating the focus group today.

This is Prue Slatyer. Prue is another research higher degree student and a professional in the built environment industry. She will be assisting with the focus group today.

Thank you for coming – we appreciate the time you have taken out of your busy schedule to help us out.

Mention:

Afternoon Tea

Toilets

Fire Alarm/drill

Parking permits

The Focus group is informing

The focus group will be informing research for the project titled ‘Sustainable Housing for Equity and Energy Efficiency’. This project is my PhD research project. The project is investigating ways to support the improve or modify existing Tasmanian housing stock for social and environmental gain.

Specifically for this research investigation and for Tasmania: *What drives and impedes sustainable housing renewal in Tasmania and how can we facilitate relevant sustainable action?*

The research team

The research team for the project comprises myself and my four supervisors at the university. Dr. Elaine Stratford is the primary supervisor, and Dr. Roger Fay, Dr. Rowland Atkinson and Dr. Aidan Davison are co-supervisors.

Funding

The research is a funded project – with half funded by the Graduate Dean of Research Utas and the other half by The Tasmanian Office of Energy Planning and Conservation which is part of the Department of Energy Infrastructure and Conservation.

Although it is funded it is also an independent study.

Focus Group Objectives

The objectives of the focus groups are to:

- seek the advice of stakeholders to inform questions for in-depth housing occupant field work,
- identify stakeholder priorities in terms of housing and its modifications for health, well-being and environmental impacts,
- understand further what are the most important processes that may bring about change in existing housing for health, well-being and environmental reasons, and
- ask assistance in recruiting households for the housing case studies.

This basically means that:

- 1) You are here as informants for the research and to support further research into housing
- 2) We are really keen to know as a professional but with you unique experiences - what your experiences have been, what your points of views are and the position that you take in regards to the subject matter today
- 3)

Why were the participants invited?

Your input into the focus group will ensure the research:

- is informed by your professional local knowledge and experiences,
- maps and understands policy, legislation and civil housing processes in Tasmania,
- is relevant to the context.

The information generated in this focus group will provide assistance in generating questions for the housing case studies for this project. The case studies will be studies of houses and their occupants around greater Hobart. Interviews will be conducted and observations made of their houses.

After the focus groups and case studies have been completed and analysed a preliminary report will be available. It is hoped these findings will provide relevant

insights into challenges and opportunities of sustainable modification of existing houses in Tasmania.

What are we talking about today?

We are taking today about housing in Tasmania, its current state and the potential for improving housing stock in Tasmania for health, wellbeing and environmental gains.

The focus group will run like a conversation.....

The focus group today is intended to be a discussion between all of you . I am here to prompt and guide the discussion today. So by all means talk directly to each other. Focus groups generate a lot of data and we have a list of questions that we would like to explore. So please do not be offended if I jump in with another question or a prompt or ask someone else for their opinion about what is being discussed. We may at times also just have to move on due to time limits.

Introduction of participants

Ask participants to introduce themselves, mentioning their professional position, organisation and what they have to do with housing and its processes

Where do we start?

For this research question we are starting with you – the experienced professionals.

Questions?

Ask question at intervals and encourage responses from the group.

(take notes and ensure recorder is working)

Section 1: Opinions/values/experiences

What do you think about the state of Tasmanian housing stock and how it affects its householders, and the environment?

Do you think that there is a need for change in existing housing stock?

Note the insulation information -

What about improving energy efficiency in housing for wellbeing, economic and environmental (eg climate change) purposes?

What has held back sustainable change in housing?

How can sustainable change in housing be supported through the housing processes such as policy/commerce and community support, especially in the existing housing stock?

Renovation would be difficult for many householders - How can help be provided to those not in the position to renovate for themselves and what form would the assistance take?

Do you think that we should start with something like energy efficiency – or is it too late and do we need to go the whole way and renovate for energy, water, indoor air and environmental impacts all at once?

What drives and impedes sustainable housing renewal in Tasmania and how can we facilitate relevant sustainable action?

Is State government /...../...../ the place for drivers to be put in place?

Section 2: Ask about questions for Case studies

Ask participants for advice on types of questions that should be asked of housing occupants and the observations that should be made of their homes.

Describe what doing

Range of homes

Interviews – x3 with whole family,

Observation of homes over same period – summer to winter

What, information, in your professional opinions, would be useful to see come out of the housing case studies?

What would it be useful to understand about householders and their occupants (in terms of housing quality health wellbeing and the environment)?

What would be useful to observe in their homes?

How would you prioritise the questions and observations to be made with the householders?

What are the key priorities from your professional perspective? What need for information do you see?

Ask for assistance in finding case study houses

Ask if these organisations can help to recruit households for the study.

(see list of backgrounds looking to include in study)

Let participants know what happening next

Three more focus groups this week

Then info from these will inform case studies of households

Then I will contact you and reconvene the focus groups to let you know what happened in the first round of interviews and to get your responses to it all.

Run through objectives of second focus group.

Letter of Invitation to second round of focus groups

Sent on UTas GES letter head and included attached information sheet as presented on the following pages

23rd May 2008

RE: Invitation to participate in the second xxxxxx focus groups on xx May XX 2008 supporting research into energy efficient housing improvement.

Dear xxxxxxxx

In October 2007 you participated in a focus group for the research project 'Sustainable Housing for Equity and Energy Efficiency', at the University of Tasmania. At the time a follow up focus group was planned after further fieldwork had been commenced. Fieldwork with householders and organisations who were involved with a program called the Glenorchy Energy Rebate Project has since been initiated and a round of summer interviews has been completed.

Therefore, I would like to invite you to participate in a second xxxx focus group looking at energy efficient improvement of Tasmanian housing. This second focus group will give me the opportunity to; report back to you on the outcomes from the first round of focus groups; present preliminary findings from the study of householders involved with the Glenorchy Energy Rebate Project; gather your thoughts on the fieldwork to date; and, record your ideas for the next stages of the research. Your input in the first round of focus groups was valuable and your thoughts and advice were instrumental in defining the direction of the research. I would like to again seek your participation in the second round of focus groups in order to build on this constructive beginning.

The focus group will be held on the xx of May 2007 at xxxx - pm, in room 324, level three at the School of Geography and Environmental Studies, the University of Tasmania, Sandy Bay Campus. Morning / Afternoon tea will be provided

The fieldwork conducted with householders involved with the Glenorchy Energy Rebate Project has been very informative, highlighting the complex issues that need to be considered in home improvements for energy efficient outcomes. Householder participants have been extremely helpful, providing me with detailed insights into their situations and decision-making processes. Preliminary analysis of the householder interviews and findings from the previous focus groups will be presented for discussion during the focus group.

Please indicate your intention to accept (or decline) the invitation by phoning 03 6226 8233, or 0433 212 619 or emailing pwatson0@postoffice.utas.edu.au (please note the zero in the email address). If you are not able to make it to the focus group I would welcome another representative from your organisation who is involved with housing to attend.

I hope that you are able to attend. I look forward to seeing you there.

Kind Regards

Phillipa Watson

PhD Candidate

University of Tasmania

Information sheet for the second round of housing stakeholder focus groups

Attached to invitation letter on previous page

Research project: ‘Sustainable housing for equity and energy efficiency’.

Researcher / focus group facilitator: Phillipa Watson, PhD Candidate, UTas.

The Research

This research project is looking at the possibility of large scale energy efficient housing improvement in Tasmania for health, wellbeing and environmental gains. The intent of the research is to gain insight into the conditions, at both institutional and individual scales, that will support low income householders to make basic energy efficient improvements to their homes.

Two lines of investigation are being pursued in this research. The first is to engage with you, as professional stakeholders with a relationship with housing processes, in focus groups. This is in order to create a picture of what happens in housing processes in Tasmania as well as to consult with you on the subject matter of the research. The second is to study energy efficient housing improvement from the perspective of the householder. To do this, householders and organisations involved with a rebate scheme called the Glenorchy Energy Rebate Project have been engaged as research participants.

The Glenorchy Energy Rebate Project (GERP) householder fieldwork

Households who had applied for the Glenorchy Energy Rebate Project were invited to participate in this research through a letter of introduction. The letter was sent through the third party of Sustainable Living Tasmania. Householders prepared to participate contacted Phillipa Watson. Participants were asked to meet with Phillipa three times, in their homes, between February and July 2008 so that in-depth conversations could be held through warm to cold seasons. Organisations who were involved with GERP are currently being invited to participate in the research.

Household recruitment has been completed and proved successful. 21 household representatives replied to the invitation and of these 18 were willing to participate and 17 have actually become participants. As this study is a qualitative study and will look in depth at the participants’ experiences and their homes, 18 households are more than enough to provide quality, detailed and dynamic data. Other members of the participating households are also taking part in the interviews and research, bringing the number of participants up to 23. The first round of household interviews was conducted between mid February 2008 and early March 2008.

The Glenorchy Energy Rebate Project is part of Glenorchy’s Greenhouse Action Plan and, from July 2007 to May 2008, offered Glenorchy residents rebates on particular energy and water efficient appliances and fixtures for their homes. The Project has supported householders to energy efficiently improve their houses

through an unusual collaboration of organisations providing significant rebates and discounts for appliances and fixtures.

The main organisations involved in the GERP Project are: Glenorchy City Council, the Australian Greenhouse Office (now part of the Department of Climate Change) and Sustainable Living Tasmania (a non-government, sustainable living advocate organisation based in Hobart). Local businesses were also involved and offered major discounts on appliances and fixtures for householders to purchase. The Australian Greenhouse Office funded the project, the Glenorchy City Council has supported it and Sustainable Living Tasmania is managing and rolling it out.

Why investigate Glenorchy Energy Rebate Project householders?

GERP is a contemporary attempt at home improvement on a large scale. GERP brings together organisations from different levels of government, a non government organisation and commercial enterprises to work with householders towards better home energy efficiency. This is a unique collaborative arrangement and, from the initial interviews, it appears to be a reasonably successful one. There is a lot to be learnt by investigating a program such as this for future attempts at improving household energy efficiency. The combined accounts of actors involved in GERP will provide rich data on particular housing processes and drivers that encourage domestic energy efficiency.

Research Intentions for Glenorchy Energy Rebate Project fieldwork

The intent is to gather data through interviews with the various actors involved in GERP and, most significantly, householders who participated. The aim is to identify who took part in GERP, why, how and to what effect. GERP's processes and effects are to be explored with participants, along with concepts of domestic energy efficiency, comfort and home improvement. Dwellings of the household interviewees are also being observed for any energy efficient improvements and comfort characteristics.

Focus group aims:

Convening a second focus group provides the opportunity to report on the findings from the original focus groups held in October of 2007 and discuss the GERP investigation so far. A preliminary analysis of the first round of householder interviews from the GERP fieldwork will be presented and discussed. In this discussion Phillipa will be seeking; to understand what reactions you have to the preliminary household findings; your advice for the remaining fieldwork and an indication as to what areas of the research are of most interest to you. The outcomes of the focus group will be used to inform the final rounds of householder and GERP organisation interviews and data analysis.

There are four different focus groups being organised. There is a focus group for local government professionals, for state government, for commercial organisations, and one that includes non-government, not for profit and social assistance organisations. The discussions from all four focus groups will be taken and analysed and used to guide the research.

Participation

Your input into the focus group will ensure the research; is informed by your professional local knowledge and experiences; maps and understands policy, legislation and civil housing processes in Tasmania; and, is relevant to the Tasmanian context.

A summary of preliminary research findings, based on focus group data and the completed housing (member-checked) case studies will be available to all focus group participants around the end of 2008. It is hoped these findings will provide relevant insights into challenges and opportunities of sustainable improvement of existing houses in Tasmania.

Please be assured that:

- The project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC).
- The focus groups are voluntary and attendance is not compulsory.
- Whilst the groups will be identified and your name listed as an expert advisor in the write-up of findings, comments will be dis-associated from any specific person. Comments will be identified at a focus group level only.
- You can review the notes made during the focus group so that you may advise us of any sensitive material that must not be quoted or referred to.

Due to the group structure of focus groups we cannot assure that comments will remain anonymous. Please feel free to contact me if this concerns you. If you have any concerns or complaints about the conduct of this project of an ethical nature, please contact the Ethics Executive Officer of the Human Rights Ethics Committee as listed in the contacts section below.

As with the previous focus group I will moderate the discussion.

Venue and Date

The focus group will be held on the **xx** of May 2008 at **xxx**pm, in room 324, level three at the School of Geography and Environmental Studies, the University of Tasmania, Sandy Bay Campus. **Morning** / Afternoon tea will be provided. A map of Sandy Bay Campus is attached to this letter. The Geography and Environmental Studies Building is building no. 12 on the map. Free parking may be available along Earl Street (and other surrounding streets) or in the car park that is entered off Grace Street. Affordable voucher parking is available between building 29 and Churchill Avenue.

Data and its use

The focus group sessions will be recorded in order that accurate information may be taken from the sessions for use in the research. The data from both the focus groups and the GERP household fieldwork will be used to inform the PhD thesis of Phillipa Watson. Data will be stored at the University of Tasmania, School of Geography and Environmental Studies. All hard and soft copy data will be stored in secure files. Data will be kept for at least five years. When the data is no longer required it will be shredded and erased.

Contacts

To RSVP for the focus group or for any further explanation about the research or focus groups please contact Phillipa Watson at pwatson0@postoffice.utas.edu.au or 03 6226 2833 or 0433 212 619.

If you have any concerns or complaints about any aspect of the project or its conduct, please contact the Ethics Executive Officer of the Human Rights Ethics Committee (on 03 6226 7479 or human.ethics@utas.edu.au). The Executive Officer can direct you to the relevant Chair of the committee who reviewed the research.

Second round of focus groups (May 2008): focus group schedule and discussion prompts

3pm	5 min	Introduction
3:05 pm	10 min	Time to read focus group notes
3:15 pm discussion)	10 min	Present 'State of play' (based on focus group
3:25 pm	20 min	Responses
3:45 pm	10 min	Present responses that were given to fieldwork ideas Introduce housing fieldwork / why (esp. qualitative) Snapshot of household fieldwork findings
3:55 pm	15 min	Seek responses to snapshot
4:10pm	10 min	Break
4:20pm	20 min focus group	Discuss changes in Aust. & Tas. society since last
4:40pm	20 min	Ideas for next round of interviews
5:00pm	Close	

Introduction

Welcome

Toilets and fire escapes

Morning / afternoon tea

Aim:

- report on the findings from the original focus groups - state of play including roles and responsibilities, barriers/drivers
- discuss the GERP investigation so far (preliminary analysis to be presented)
- seek reactions you have to the preliminary household findings
- discuss current changed state of play
- gather advice for the remaining fieldwork and indicate areas of research of most interest to you

Outcomes from FG:

- used to inform the final rounds of householder and GERP organisation interviews and data analysis.

Preliminary report sent around after fieldwork completed hopefully late 08/early 09.

Report –read

Present state of play / Invite responses

State of play/barriers/drivers discussion

Housing fieldwork – research design and initial findings / responses

Responses that I gained to household research ideas:

- interested in what going on in the house
- all had different golden numbers of participants that would see as relative (which is a quantitative representative belief)
- I decided still qualitative – in order to take mass samples – I would have to make assumptions about who was having the most difficulty, and would have had to much less detail. The issues is I think that we need to understand the subtle dynamics before we understand mass trends. Qualitative multimethod and deals with the complexity of situations.
- One suggestion had been that other projects were already being conducted and I could link up with them. I did this.
- Thanks to Sustainable Living Tasmania

Changes affecting housing since Oct Focus groups last year:

New Federal government

Fed government commitment to Kyoto at Bali

State budget commitment to housing @\$60million

State Government commitment to green state government buildings

State government commitment to phase out standard hot water systems

Price rises to electricity 20% over year

Interest rates climbing 5 times in last year

Tasmanian Office of Climate Change created

SHW rebate from the new government – when?

HBC \$500 for SHW system? When?

Disclosure of energy efficiency at point of sale legislation (in this year?)

Appendix C – Household invitations, information sheets and question prompts

Letters of introduction, invitation and information sheets for household interviews

Letter from Sustainable Living Tasmania

Accompanying the letter from the researcher

Glenorchy's Greenhouse Action

An integrated community greenhouse gas abatement program



Date

Dear

The University of Tasmania School of Geography and Environmental Studies is conducting research into energy efficient housing improvement and Glenorchy's Greenhouse Action Energy Rebate project as an example of such improvement. The research will develop a better understanding of what can be done to encourage more of the same.

As members of a household involved with the Glenorchy rebate project, you are invited to be part of this research. The University researchers are keen to hear what you have to say and believe that your opinions will greatly benefit their understanding of what 'drives' energy efficient housing and inform policy in government on these issues.

All your personal details will be strictly confidential and any information you share with the researchers will remain anonymous. Your names and addresses will not be mentioned in the research that is published. The official invitation letter and a project information sheet attached to this letter are University requirements to ensure you are fully informed of your rights to privacy.

We'd like to encourage you to take part in this research, and hope you can find the time.

Phillipa Watson is the University contact for the project. Please feel free to call her on ph: (03) 6226 2833 mobile: 0433 212 619 or email her on pwatson0@utas.edu.au (please note the zero in the email address). She can then discuss the project further with you, and let you know what your valuable participation would involve.

Yours sincerely,

Sustainable Living Tasmania

A partnership project between Sustainable Living Tasmania, Glenorchy City Council and the Australian Greenhouse Office



Coordinating Organisation: Sustainable Living Tasmania

102 Bathurst St, Hobart 7000. Ph 6234 5566 / Fax 6234 5543
www.sustainablelivingtasmania.org.au

Letter from the researcher

Accompanying the letter from SLT, printed on University of Tasmania letterhead

xxth February 2008

Dear xxxxx

RE: Research into energy efficient housing improvements.

I understand you have been involved with the Glenorchy Greenhouse Action Energy Rebate Project. Because of that we are inviting you to take part in an independent University of Tasmania research project.

We are looking into energy efficient housing improvement in Tasmania and asking how different parts of the community can work together to achieve improvements for householder well-being and environment benefits.

The way that the Glenorchy Greenhouse Action Energy Rebate Project has supported energy efficient improvements to homes is unique to Tasmania. We would like to talk with you and learn about your experiences of the Rebate Project, and ask you about your general energy management and about comfort levels in your home.

We would like to conduct up to three conversations with you and other members of your household over the next six months. These conversations can be organised at times and dates that suit you and other household members. If you feel comfortable, we would also like to have a tour of all or parts of your house and talk about energy use and about energy efficient home improvements you have made (or would like to make) to it.

An information sheet attached to this letter describes the project and how we would like you to be involved in it, and provides our contact details. Your assistance with this research would be *very much* appreciated. We hope that you will agree to meet with us.

Yours sincerely,

Associate Professor Elaine Stratford
Chief Supervisor

Phillipa Watson
Doctoral Candidate

Information sheet for householders on the research project 'Sustainable housing for equity and energy efficiency'

Attached to letters of introduction on previous pages

What is this research about?

This research project is an independent study looking into energy efficient home improvement in Tasmania. Other studies have shown that energy efficient housing improvement can lead to healthier and more affordable living conditions for householders and limit environmental damage.

The Glenorchy Greenhouse Action Energy Efficiency Rebate Project offers a unique opportunity to study energy efficient housing improvement in Tasmania. Running from May 2007 until May 2008, the Scheme has provided rebates to householders in the Glenorchy area for a variety of different energy and water efficient household products. It has been:

- supported financially by the Australian Greenhouse Office (now part of the Australian Government's Department of Climate Change),
- rolled out through the Glenorchy City Council and Sustainable Living Tasmania (a community sector organisation that focuses on sustainable living) and
- aided by local businesses offering appliance and fixture discounts .

What does the research aim to do?

The project aims to understand what sort of support is needed for wide-scale housing improvement. To achieve these aims, the project will:

- investigate how you manage comfort and energy use in your home, and ask what sorts of difficulties you face with comfort and energy;
- assess the house and its features and see how those features affect householder comfort, health and well-being;
- explore how environmental impact can be reduced by housing improvement; and
- examine whether partnerships between householders, government and other organisations can best generate housing improvement.

Why take part in the research?

This research depends on input from householders! Your input will ensure that the research is realistic, and considers real life housing situations, local energy efficient housing improvements and focuses at the local scale. It will also inform government policy on energy efficiency and housing.

What is involved for you?

You would be involved in three conversations with Phillipa Watson, a doctoral student, at your home. These conversations would occur over six months, between February and July 2008. They can be held at a time and a date that suits you. Each conversation would take around 45 minutes of your time. It would be great to have as many of your household members involved as possible. We are interested in the comments of everyone in the household.

We would like to ask about:

- the Energy Rebate Scheme and how you were involved;
- energy management, comfort and well-being in your home; and
- energy efficiency home improvement in general.

If you feel comfortable, we would also like to have a tour of all or parts of your house, its structure, materials, layout and appliances. By looking at your house we can gain a better understanding of:

- the changes that you made through the Glenorchy Energy Rebate Scheme;
- whether or not your house is comfortable to live in and energy efficient;
- any other changes you have made for comfort or energy efficiency; and
- any other changes you would like to make to improve your comfort or the energy efficiency within the house.

In order to record your comments accurately, we would like to tape our conversations with you using a digital recorder. Phillipa can then listen to the recordings back at the office and ensure that she truly understands and accurately represents what you have told her. You will also get a summary report of all the conversations and what they revealed to us by the end of 2008.

Concerns about the interviews

Please be assured that:

- the project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC);
- your name and address will be kept confidential and any comments you make will be anonymous;
- if you ask, you can check the notes we take from the recordings of our conversation with you.

Use of information from the interviews

The information that you share with us will be analysed and used in Phillipa's doctoral project, 'Sustainable Housing for Equity and Energy Efficiency'. Records of the conversations must be kept in secure conditions at the University of Tasmania for a minimum of five years.

Contacts

For any further explanation and to volunteer as a participant please contact Phillipa Watson on 0433 212 619, (03) 6226 2833 or email pwatson0@postoffice.utas.edu.au.

If you have any concerns or complaints about the conduct of this project, please contact the Ethics Executive Officer of the Human Research Ethics Committee (on 03 6226 7479 or human.ethics@utas.edu.au). The Executive Officer can direct you to the relevant Chair of the committee who reviewed the research.

Interview schedule and observation prompts for household fieldwork

Interview and observation prompts were collated for summer, autumn and winter interviews. The interviews through were semi structured, so the interview questions were not always followed exactly. Effort was made to cover all topics areas where ever possible. Whilst observation prompts were extensive, observations themselves had to be conducted quickly and consequently only key observation were recorded for each house. For example, if it was noted that a house was cold, questions and observations would be made as to whether there were any moist or mouldy areas in the house.

Warm Weather (summer) Interview prompts

For householders involved with the Glenorchy Energy Rebate project

[NB: questions taken from file *Guidelines for Householder interviews and obs* dated 5/2/08 that was submitted for ethics approval]

*try to ensure that assumptions are made explicit

Topics to be explored at this session:

- Introductions
- Consent forms (run through and ensure participants are clear about intentions and the fieldwork)
- Summer in the home
- Energy Efficiency
- Glenorchy Energy Rebate Project
- Home improvements
- Summer housing observation

Introductions

Meet household participants and find out their names.

Introduce myself and provide a little background to participants, especially about background long term interest and study of housing and energy efficient characteristics.

Let the participants know what to expect and what the information is being used for.

Consent forms

Go through the consent forms with participants.

Run through information sheet.

Run through the reasons why the interviews are being conducted with householders.

Ask for age groups who live n thew house as well and how many.

Summer in the home

(I will) begin with some quick questions about your home.

- a. In a nutshell, how would you describe your house?
- b. Where do you most like to be (in the house) during summer?
 - i. Why is this?
- c. What are the three best features of your house?
 - i. Why is this?
- d. Do you feel comfortable in your home during summer?

Energy Efficiency

In the project information sheet I mention energy efficiency in the home. I would like to explore this with you....

- e. What does 'energy efficiency in the home' mean to you?
- f. What features of the house help to limit your energy use in summer?
- g. What do you do yourselves in the home to limit your energy use?
- h. Do you use energy to cool you down in summer?

Glenorchy Energy Rebate Project

I would like to ask you about the Glenorchy Greenhouse Action Energy Rebate Project

- i. Introduction and motivation
 - i. How did you find out about the scheme?
 - ii. Who in the household applied to the project?
 - iii. Why did you apply?
 - iv. Did you get a rebate?
- j. Process, actors and agents, organisation
 - v. Could you describe the process that you went through to receive the 'ok' for the rebate?
 - vi. Who did you have to speak with?
- k. Home Improvements through scheme
 - i. What did you have done to your house due to the Energy Rebate Project?
 - ii. Could you describe the process that you went through to have..... installed/put in?
- l. Impressions and thoughts on the Energy Rebate Project
 - i. How did you find the process?
 - ii. Have the changes made through the rebate project affected you in any way?
 - iii. Have the changes to your house changed your habits in any way?
 - iv. Have the changes to your house changed how you live in your house?
 - v. Would you apply for a rebate again?

Energy use and comfort

- vi. When the house heats up, what do you do to stay cool?
- vii. Do you use energy and appliances to cool the house during summer?
- viii. Do you have 'passive' ways of keeping the house cool? (may need to explain passive)
- ix. Have you heard about the energy price rises over the next few years?
- x. Do you think the price rises will affect you greatly?
- xi. When the house heats up do you have any ways to keep cool that?
- xii. Have you heard of the Sustainable Living Tasmania Home Energy Guide?
- xiii. Have you heard of the Department of Climate Change's Home energy guide?
- xiv. Do you know of any other information that helps with energy efficiency around the home?

Improvements

- xv. Had you made any changes for better energy efficiency in the home before Glenorchy Rebate project?
- xvi. Would you like to do anything else to the house for energy efficiency?
- xvii. Have the improvements that you have made to the home changed or helped in any way?

Housing Observation

Ask if can look around the house at the dwelling (or just discuss it further with them).

Restate how will maintain their privacy

Restate that the house structure and layout can indicate a lot about how the house supports energy efficiency and comfort.

Ask to take photos.

Ask them if they would like to come around with me and show the things discussed in the interviews. Take Energy Efficiency audit guide in case they are interested in going through it. Take average energy usage charts.

Record through: annotated drawings – plan, section, elevations, maps

Checklist with notes and photographs

Draw house (plan, sections, elevations etc) to describe:

- room layout
- position in yard
- yard characteristics
- its construction/ structural aspects

- its characteristics in terms of EE, comfort and wellbeing
- windows, door, materials and other bits
- characteristics that indicate EE around the dwelling

Measure any particular areas of interest:

- spot temperature internally
- surface temperatures (eg aluminium window frames versus wall surface)
- overshadowing
- window areas and orientation

Describe any significant features or traces eg mould, major gaps, moisture etc.

Look for barriers to passive and active energy management in the home.

Look for positive characteristics.

What traces do I see? What are missing? What caused it? What was the intention?
 What led to it? What does it mean? What would have changed this particular trace?
 How are they managing this environment to meet their needs?

Consider / Look at:

The house itself

orientation

eaves

structure

style

materials (roof, walls, floor)

colours

cool rooms? When?

Hot rooms? When?

Mould? Position room and ht

moisture

underfloor – enclosed / open, insulation

Floorcoverings – type, underlay?

Floors – type, gaps

ceiling space

noise pathways

Curtains , curtain movement

Pelmets

Draughts/draught-stopping

Gaps – around windows, doors, floors, gaps

Chimneys – flue stop?

Cracks

Heat source: how effective and where

Cooling source – how effective and where

Insulation / insulation

Ceiling

Vents / wall vents

Extractor fans

Type of house, age, etc solar gain thermal mass

Plumbing/downpipes/leaks

Glazing – window types, sliding, double glazing etc

Glare

Wet areas – vent, moisture, mould and light

Clothes drying

External cladding

Sources of airflow?

Sources of heat loss?

Ventilation?

The house and yard relationship

Microclimatic features

North/south

street orientation

noise

landscape

overshadowed

The yard

slope

vegetation (native, deciduous, placement)

landscape

Active energy systems

Appliances

Heating

Cooling

lighting

Hot water services (type/position)

Refrigeration

Food prep and cooking

Exhaust from oven,

Venting the fridge

General venting

The climate and environment

Meso-climatic features

prevailing winds

solar access

major bush around

major landscape elements

The neighbourhood

Describe

Dense

Housing types

Area planning

Industrial? Residential?

Distance to services/hubs

Neighbouring house positions and vegetation and fencing

the greater topography

Autumn Interview prompts

For householders involved with the Glenorchy Energy Rebate project

[NB: questions taken from file *Guidelines for Householder interviews and obs* dated 5/2/08 that was submitted for ethics approval and from focus groups suggestions from May focus groups]

*try to ensure that assumptions are made explicit

Topics to be explored at this session:

- Autumn in the home
- Energy Efficiency
- Glenorchy Energy Rebate Project improvements – any change in household?
- Home improvements – thinking of
- Discussion of concepts: sustainability, climate change.
- The federal budget re: EE and home improvement.
- Would you like to chat about anything in particular?
- Member checking of last interview/observation
-

Autumn in the home

- m. Where do you most like to be (in the house) during autumn?
 - i. Why is this?
- n. Do you feel comfortable in your home during autumn?

Home energy audit guide

Pass over the home energy audit guide from Sustainable Living Tasmania to discuss.

- o. Run through the guide

Glenorchy Energy Rebate Project

Home Improvements through scheme:

- p. Has the process finished?
- q. How is the installation going?
- r. If installed, have you noticed any changes in lifestyle?
- s. Any changes in bills?
- t. Any other changes?
- u. How did you find the process

Energy use and comfort

Keeping warm:

- v. Is the house starting to cool down?
- w. How comfortable is it at the moment?
- x. What are you doing to stay warm?
- y. Do you use energy and appliances to warm the house during autumn?
- z. Do you have 'passive' ways of warming the house?

Now the electricity prices rises have been in for one or two bills:

- aa. Have you any further comments to make about the electricity prices since last interview?

Improvements

- bb. Have you made any changes (home improvements) since I was here last?
- cc. How the house is functioning since improvements – is it any better than it was before the improvements were made?
- dd. Would you like to do anything else to the house for energy efficiency?
- ee. Do you have or are you thinking of any improvements to help keep warm in the cooler weather?

Difficulty of improvements:

- ff. With your GERP or other improvements – did you have any difficulties?
- gg. Any building applications to council needed?
- hh. Any issues with the building code of Australia?
- ii. Are there any issues with accessing rebates that are available?

Concepts and current affairs:

What does the concept sustainability mean to you?

What does the concept of climate change mean to you?

The federal budget came out last week – did you take any note of it? Was there anything you noted in it in regards to home improvement opportunities?

Energy management and financial pressure

Energy boosters for SHW units

Planning DA or not?

If asked to motivate another person – what would you do?

What may have changed from your perspective since we last met?

What perceive your role to be in the whole process of housing improvement?

Electricity – how much using?

Earth hour?

Why is it important to have an EE and improved home for you?

Any behaviour changes?

People's perception of electricity generation

Has there been enough information for you to get on with EE improvements?

Who is responsible for EE home improvements?

Housing Observation

Look at house in autumn to note any changes in dwelling and evidence of habits of occupants in relation to comfort.

Describe any significant features or traces eg mould, major gaps, moisture etc.

Look for barriers to passive and active energy management in the home.

Look for positive characteristics.

What traces do I see? What are missing? What caused it? What was the intention?

What led to it? What does it mean? What would have changed this particular trace?

How are they managing this environment to meet their needs?

Consider / Look at:

The housing observation list considered was the same as that used in summer interviews.

Winter Interview prompts

For householders involved with the Glenorchy Energy Rebate project

[NB: questions taken from file *Guidelines for Householder interviews and obs* dated 5/2/08 that was submitted for ethics approval and from focus groups suggestions from May focus groups]

*When in the interview - try to ensure that assumptions are made explicit

Topics to be explored at this session:

- Winter in the home
- Energy Efficiency in winter
- Glenorchy Energy Rebate Project improvements – any change in household?
- Home improvements – thinking of

- Discussion of concepts: wellbeing, climate change (again), .
- Would you like to chat about anything in particular?
- Final house checks
- Final details needed
- Discuss report and member checks to be sent out

Winter in the home

Where do you most like to be (in the house) during winter?

i. Why is this?

How comfortable is it at the moment?

What are you doing to stay warm?

Do you use energy and appliances to warm the house during winter?

Do you feel comfortable in your home during winter?

How use the house in winter - heating? Routine? ventilation

Any issues in winter?

Energy management and financial pressure?

Have you any further comments to make about the electricity prices since last interview?

Electricity – how much using?

Home energy audit guide – if didn't do last time

Get a chance to look at the home energy audit?

Pass over the home energy audit guide from Sustainable Living Tasmania to discuss.

a. Run through the guide

Glenorchy Energy Rebate Project improvements – any change in household?

How the house is functioning – is it any better than it was before the improvements were made?

Has the improvement assisted to manage the household any better?

Final house checks

Insulation - age and amount – can we check it?

Run through SLT Energy Audit and general energy audit

Winter housing observation – physical comfort traces

Insulation in roof – can I check? – get a ladder to take

Check ceiling insulation if can.

Final details needed

Age bracket of housing occupants in decades

Age groups – thermal comfort any difference in comfort

Energy Bills – last bill?

Discuss report and member checks to be sent out

Glenorchy Energy Rebate Project

Home Improvements through scheme:

- b. Has the process finished?
- c. How is the installation going?
- d. If installed, have you noticed any changes in lifestyle?
- e. Any changes in bills?
- f. Any other changes?
- g. How did you find the process

Improvements

Have you made any changes (home improvements) since I was here last?

How the house is functioning since improvements – is it any better than it was before the improvements were made?

Would you like to do anything else to the house for energy efficiency?

Do you have or are you thinking of any improvements to help keep warm in the cooler weather?

Difficulty with any of the housig improvements?

Has there been enough information for you to get on with EE improvements?

Concepts and current affairs:

What does the concept wellbeing mean to you?

What does comfort mean to you?

What does the concept of climate change mean to you?

-tas gov released a strategy and federal green paper

What drives you to be energy efficient or think about it in the home?

Home improvement – what is the householder's role versus the government's role?

What role should the government play in energy efficient housing improvement?

Haven't been able to spend time with people in a really dire situation – do you know of any examples of people really struggling with cold houses with no hope of changing their situation? How are they managing?

What do you think affects your capacity to achieve home improvement?

Housing Observation

Look at house in autumn to note any changes in dwelling and evidence of habits of occupants in relation to comfort.

Describe any significant features or traces eg mould, major gaps, moisture etc.

Look for barriers to passive and active energy management in the home.

Look for positive characteristics.

What traces do I see? What are missing? What caused it? What was the intention?
What led to it? What does it mean? What would have changed this particular trace?
How are they managing this environment to meet their needs?

Consider / Look at:

The housing observation list considered was the same as that used in summer and autumn interviews.

Appendix D – Business invitations, information sheets and question prompts

Phone introduction

Outline of script to be used for phone introductions for business stakeholders

Phone introduction notes - Glenorchy Energy Rebate Scheme Stakeholder invite

This is....., may I speak to

It is regarding some research at the University of Tasmania exploring the energy efficient improvement of Tasmanian houses.

Hello.....

As a professional representative of the Department of Climate Change / Glenorchy City Council / Sustainable Living Tasmania,

We would like to invite you to participate in a University of Tasmania research project exploring the energy efficient improvement of Tasmanian houses.

We would like to ask you about the organisational aspects of the Glenorchy Greenhouse Action Energy Rebate Project and energy efficient home improvement.

The interview will take around 30-45 minutes and can be organised at a venue, time and date that suits your timetable. The project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC).

We will send you a letter of invitation and an information sheet.

Your assistance with this research would be very much appreciated.

Contact numbers? postal address? [record their details]

the invitation by phoning Phillipa Watson on 0433 212 619, (03) 6226 2833 or emailing pwatson0@postoffice.utas.edu.au (please note the zero in the email address).

Invitation to participate

Printed on University of Tasmania letterhead

March 2008

Name
Position
Organisation
Address
xxxxxxx

Dear XXXX

RE: Research into energy efficient housing improvement.

As someone from [*insert organisation*] who has been involved with the Glenorchy Greenhouse Action Energy Rebate Project, we would like to invite you to participate in a University of Tasmania research project exploring the energy efficient improvement of Tasmanian houses for health, well-being and environmental gain.

We would be delighted if you would agree to be involved by participating in an interview in person or over the phone to discuss the Glenorchy Greenhouse Action Energy Rebate Project and related issues. An information sheet is attached to this letter and it describes the project, details how we would like you to participate, and gives our contact details.

The interview will take around 30-45 minutes and can be organised at a venue, time and date to suit you. Your assistance with this research would be very much appreciated. Your experiences are valuable and we would be very interested to understand more about how your organisation was involved with the Glenorchy Greenhouse Energy Rebate Scheme.

We hope that you will agree to meet with us. Please indicate your intention to accept (or decline) the invitation by phoning Phillipa Watson on 0433 212 619, (03) 6226 2833 or emailing pwatson0@postoffice.utas.edu.au (please note the zero in the email address).

The project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network. This approval means that the research must maintain strict ethical standards and protect confidentiality and anonymity unless given permission in writing to do otherwise. If you have any concerns or complaints about the conduct of this project the contact details for the ethics committee are listed in the information sheet that follows.

Yours sincerely

Associate Professor Elaine Stratford
Chief Supervisor

Phillipa Watson
Doctoral Candidate

Information sheet for research participants representing organisations involved with the Glenorchy Energy Rebate Scheme, for the research project: ‘Sustainable housing for equity and energy efficiency’

Attached to letter of introduction on previous page.

Research description:

This project is investigating energy efficient improvements to Tasmanian housing. It is anticipated that Tasmanians could benefit greatly from energy efficient improvements to poor quality housing stock, which could lead to improved occupant well-being, reducing financial burdens and limiting the environmental impacts of residential energy use.

This research project aims to understand the kinds of processes and support that are needed for wide-scale energy efficient housing improvements in Tasmania. To achieve such ends, the project will:

- investigate how householders manage comfort and energy use in their homes, and evaluate the difficulties they face;
- examine the physical dwelling and ask how its characteristics affect householder comfort, health and well-being;
- seek to understand how environmental impact can be reduced and occupant well-being enhanced by improving housing stock for energy efficiency; and
- explore how best various actors/agents for change in Tasmania can work together to support energy efficient housing improvement in Tasmania.

As part of this research project, the Glenorchy Greenhouse Action Energy Rebate Project is being studied. Running from May 2007 until May 2008 the Project has provided rebates for a variety of different energy and water efficiency products for the home. The Project offers an unusual example of a number of organisations working together with householders to improve the energy efficiency of their homes.

An invitation to participate:

As a representative of a key support organisation for the Glenorchy Greenhouse Action Energy Rebate Project you are invited to participate in this research. Your organisational perspective is valuable to the research and will allow us to understand the processes and priorities that created the opportunity for the funding of domestic energy efficient improvement.

What participation involves

Participation would involve a 30 to 45 minute interview at a time, date and venue suitable to you in March or April 2008. Interviews can take place face to face or over the telephone. We would like to ask you about the Glenorchy Energy Rebate Project and the background to it and energy efficient home improvement in general. Your participation will ensure that we have an understanding of the processes and decision-making that underlies rebates schemes such as this.

In order to record your comments accurately, a digital recorder will be used during the interviews. This step allows detailed records to be made of your comments, which ensures accurate and balanced analysis and interpretation of the findings.

Benefits of participation

Your input will ensure that the research:

- records the development of the Glenorchy Rebates Scheme accurately;
- clarifies what participating organisations gained from the Program; and
- identifies the drivers that brought about the Scheme.

The Research Team and Use of the Interviews

Interviews will be conducted by Phillipa Watson and the research will primarily be used as the data for her doctoral thesis. Her research is funded by the Department of Infrastructure and Energy's Office of Energy, Planning and Conservation (50%) and the Dean of Graduate Research, University of Tasmania (50%).

Phillipa studies under a team of supervisors: Associate Professor Elaine Stratford (Primary Supervisor), Professor Roger Fay, Dr. Aidan Davison and Associate Professor Rowland Atkinson (co-supervisors) who will be supervising all fieldwork.

Interview recordings will be transcribed and stored in secure conditions at the University of Tasmania, School of Geography and Environmental Studies for a minimum of five years.

Concerned about the interview?

Please be assured that:

- the project has received ethics approval from the Human Research Ethics Committee (Tasmania) Network (HREC);
- the interviews are voluntary and you do not have to participate;
- while your organisation will be identified, your name will be kept confidential and any comments you make will be anonymous; and
- transcripts and/or summary notes from the interview will be provided to you to check and correct or amend.

Contacts

To participate in an interview, please contact Phillipa Watson at pwatson0@postoffice.utas.edu.au, 0433 212 619 or 03 6226 2833.

If you have any concerns or complaints about any aspect of the project or its conduct, please contact the Ethics Executive Officer of the Human Research Ethics Committee (on 03 6226 7479 or human.ethics@utas.edu.au). The Executive Officer can direct you to the relevant Chair of the committee who reviewed the research.

Interview prompts

Notes to guide semi-structured interviews with representatives from organisations involved with the Glenorchy Greenhouse Action Energy Rebate Project

One semi-structured interview of around 30-45 minute duration is planned with each, organisational representative. The prompts below will be used as a guide for the interviews.

The interviews are being conducted so that understanding can be developed of an organisational perspective of: the processes that created and supported GERP; how actors worked together in Tasmania to support improvement of Tasmanian houses; the decisions and priorities that led to the organisations being involved in GERP; impressions of GERP and, the interviewees' views on their organisations position in terms of household energy efficiency and comfort.

Interview topics:

- Energy management and comfort in the home
- Energy efficient home improvement
- The Glenorchy Energy Rebate Project and involvement in it
- Knowledge/Priorities/Values/Activity of the organisation as regards ee home improvement
- You organisation and supporting energy efficiency improvements in homes (Then/now /the future)

Interview prompts:

Energy management and comfort in the home

What does the term energy efficiency mean to you as regards the home?

What does the term energy efficiency mean to your organisation as regards the home?

Do you / your organisation see EE in the home as important? Why

How important is domestic EE strategically for Australia?

Energy efficient home improvement

What do you think about improving Tasmanian homes for better energy efficiency and comfort?

What does your organisation say about it??

Barriers to EE improvement?

Drivers of EE improvement?

What do you think needs to happen to make EE home improvement more widespread in Tasmania?

The Glenorchy Energy Rebate Scheme

How did your organisation come to be involved in the GERP?

How did your organisation find the GERP process? Would you be involved again?

Were there any benefits for your organisation? Any Feedback?

Do you think that there is a place for incentive schemes like GERP?

Do you have any suggestions to make about any possible further schemes for EE home improvement?

Who did you have to deal with during the GERP process?

Knowledge/Priorities/Values/Activity of your organisation

Does this organisation have a reasonable working knowledge of EE?

Does this organisation have a reasonable working knowledge of what has to happen to create EE home improvements? Knowledge/professional/construction and planning wise?

Is pushing energy efficiency an important priority for this organisation? What are the most effective or most important activities conducted to achieve this EE goal?

Your organisation and supporting energy efficiency in the home (Then/now /the future)

Does your organisation have long term plans to be involved in home energy efficiency and EE improvement to homes?

Abbreviations

GERP – Glenorchy Energy rebate Scheme

EE - Energy Efficiency

WE - Water Efficient

CC – climate change

Appendix E – Participant backgrounds and capacity

Table E-1: Participant backgrounds that may affect their motivation and capacity to conduct dwelling adaptations

Households/ Participants	Participants, age and health	Participant employment status and tenure and main money source	Moved into dwelling	Changed / incorporated practices for dwelling comfort and energy	Improved physical dwelling space for comfort and energy efficiency?	Plans for further practice changes and physical improvements?	Childhood	Adult	Resourcefulness, Skills, and Capacity	Motivations and values
Cara Edward & Veronica	C/E – 30s V - 10 All good health	C – f/t employ E – student V – child Owner with mortgage C’s income	c. late 2005	Yes.	Yes. Shw with GERP	Yes.	Cara grew up in cooperative, self sufficient housing in a warm Australian climate. Edward grew up in England and remembers cold winters. Veronica has learnt about sustainability through her parents and has responded with action and awareness and enjoys helping parents with activities that will support sustainable living.	Edward practices Buddhism and is a university student. Cara works as a manager for a social welfare and human rights NGO. Gardens vegetables so they can reduce consumption outside the home.	Edward put together the garden beds, installed the insulation, demolished concrete. C and E think through and plan out dwelling changes together. Knowledgeable about what to do around the house. Had a loan for the GERP instalment of shw. Have to save up for each stage of dwelling improvement. Veronica, although still young is interested and gets involved with dwelling changes for sustainability.	Family commitment to sustainability and care for animals and the environment. Have plan to gradually effect change in dwelling and are systematically assessing their action plan and acting on it.
Del and	D – 70s,	Retired	c.	Yes.	Yes.	Yes.	Grew up in England	Lived through 2 nd world	Make their own bread. Used to	Being prepared for

Kirk	physical disability K – 80s, reasonable health	Owners super	1998		shw with GERP		and raised their family there so have experienced much colder inside and outdoors than Tasmania.	war, Kirk was a fighter pilot, Del had to prepare home for nuclear war. Whilst bringing up the family, had a larger piece of land out of the city and grew and prepared some of own food and beverages.	grow their own food in previous dwellings. They are older now and have simplified their living situation and now get trades people in to do jobs. Saved \$ from their super for years so they could improve the dwelling.	aging in place at home as long as possible. Aiming to make the house comfortable. Resourcefulness. Concern for families and disadvantaged people under impact of electricity costs.
Frank	60s General good health but some issues	Retired super	c. mid 1970s	Yes	Yes	Yes	Long history in Tas.	Was a teacher, loves fishing and walks long distances (but limited for a period by a healing ankle). Gardens - vegetables. Works on house himself gradually, eg adjusting a stuck door. Challenged by the loss of his wife a few years earlier and stopped gardening/maintenance on the house for a couple of years because of his grief. Also challenged recently by a leg injury.	Shares dinner with a friend, so that they can share effort and resources. Also co cares for the dog. Has manual skills to maintain the house in general and garden. Not up to crawling in roof space. Broke an arm and found it limited his gardening activities. Works with super instalments and uses the little extra can get out of super for home improvements. Had to cancel GERP plans because used the money on his broken ankle.	Concerned about management of forests and carbon storage loss and monocultures.
Frederick & Keira	F – 60s diabetes, physical issues K – 50s good health	F – redundancy and pension K – casual wage Owners Wage/pension	c. early- mid 2000s	no	Yes shw with GERP	Possible	Keira is originally from overseas.	Fred was in computers and took a redundancy and has diabetes. Keira works casually in food production factories and uses English as a second language. Lived in Tas since 1980 and Sydney	Fred’s diabetes limits his physical activities around the home. He has had a number of physical problems due to the diabetes. Fred took a redundancy. Keira works casually and seasonally. Keira’s English is limited. Fred	Energy efficiency to save money. For Keira it is also for ‘the world’.

								prior to that.	feels better to use the money on things like shw than to stash it away, as will save money in the end.	
Helen (and husband and two children)	H - 30s All good health	H - student scholarship Husband - f/t wage Owner with mortgage	c. late 1990s	Yes	Yes hphw with GERP	Yes	Grew up in Tasmania.	Previously lived in town and enjoyed being close to everything. Studying postgraduate at university full time. Two young children.	Careful with resource use. Husband manually skilled and also has friends in trades. Helen knowledgeable and plans the things that need to be done. Time poor so finds it hard to get to home improvements that wants to do.	Interested in ee and not using coal-based power. Values gardens and value of children growing things. Community and social connections important. Hates waste eg replaced fireplace and found a home for it.
Henry	60s Good health	Casual wage renting	c. 2007	yes	No	No	Childhood in Bridgewater area and recalls the climate of his childhood.	Worked in labour style jobs, and casual seasonal work. Has also worked in a hardware store. See possibility in mentoring challenged youth and teaching them practical building skills.	Careful with resource use. On casual, seasonal wage. Has practical skills but in rented house. Has previously conducted renovations on owned house.	Concerned about social injustice (eg east Timor). Workers having a voice and rights. Everything interconnected. Caring and good management of community infrastructure. Youth mentoring .
Lorraine and Robert	40s good health	L - p/t wage? R - f/t wage Owners	c. 2000	Yes	Yes	Yes	unknown	Robert in army for many years. R and L had moved around a lot in Australia. Have lived in many places. R is skilled in a trade.	Robert does a lot of the handy jobs around the house. They take care with heating until winter. Lorraine looks out for second hand auctions and also provides strategic and design	Energy efficiency. Problem with hw encouraged them to replace it. Comfort - cold draughts.

									thinking to the home renovations. Keep up with home maintenance.	Dwelling improvements need to be aesthetically pleasing as well as functionally pleasing. Have a love for animals and enjoy the garden.
Mark	60s good health	f/t wage owner	c.1995	No	Yes Shw with GERP	Possible	unknown	Was involved as a young adult in opposing the Franklin. Professional – owns a business.	Explained that wasn't very handy himself. Was not clear on how the shw worked when installed. Has money to pay people to help around the home.	Comfort and cares for the environment.
Mary and Martin	50s Mary – chronic ill health M – good health	Martin – own business owners	c.mid 2000s	Yes	Yes Insul +curtains with GERP	Yes	unknown	Have lived in various places in Australia. Martin been politically active about the environment since a young adult. Opposed the dam (?) in Tas. Mary was a teacher but became unwell with chronic fatigue. Martin works with computers(?). Their house burnt down in the Canberra bushfires.	Thinks about resource use carefully. Extensive understanding of energy efficiency but when sought information to plan improvements found that information scattered and no one person could help by themselves with information. Mary is unwell and so has days where she cannot do much. Mary had practical skills as well but generally feels it is good to get specialist help where needed. Martin is skilled and can improve the dwelling but is time poor. Lack of capital gain in suburb limits what can do. Trades not available.	Concern for the environment and climate change. Comfort and wellbeing, and energy efficiency.

Mel	40s reasonable health	f/t wage owner with mortgage	c. 2006	No	No	No	unknown	Bought her new house after breaking up with her husband. Works full time.	Has to be careful due to restrained budget. Bad soil so garden more difficult. Understands the benefits of energy efficiency. Has previously not done any of the home maintenance or practical work. Has begun to learn. Budgetary issues with improvements. See possibility in trading skill sets with others eg she could do the books in return for instalment help.	Aims to be resourceful. Cost and budget key drivers to energy efficiency.
Olive	60s Good health	Retired/pensioner Owner super	c. 1995	yes	Yes Insul with GERP	Yes	unknown	Is involved in the Green's party. Is active in the community - in church (?) and helping out older people.	Takes care not to overheat, and if the electricity bill looks high, then is extra careful. Is vigilant about not using too much. Constrained budget partly drives this. Painted house herself and generally manages herself with some friends' help. Money a barrier. Experienced confusion when sought advice over installing a hp.	Environmental impacts. Energy efficiency , resourcefulness. Necessity is often key driver. Care about the environment, animals and people.
Steve and Gwen	50s S – spinal challenges G – ill health but still	S – pensioner (due to health) G – owns and runs small business owners	c. 2006	yes	Yes Shw and energy saver pack with	yes	Steve lived in Tasmania.	Previously owned a farm on the mainland. Steve previously in the army as career. D owns a business but has been told to sell because of her health	Steve does a lot of the jobs around the house, the garden and cares for his father as his 'day job'. Steve has practical maintenance and improvement skills and	Comfort. Rejuvenating the house. Cares for animals.

	working				GERP			challenges. Gardens for vegetable and fruit. Steve also looks after his parents who live nearby.	understanding of household systems and energy efficiency and comfort strategies. Money often a barrier. Plan improvements and wait until have the money.	
Susan	60s poor health	Retired / Pensioner Rents from family	c.1996	yes	yes	no	Lived on a farm. Father taught resourcefulness in home resources.	Was in the people's army.	Is careful with resources as on a restricted budget and due to childhood 'training'. Will change curtains for different times of the year. If inefficiency is noted, will try and find a solution, eg fridge. Has to get help for house maintenance and improvements. Can sew curtains herself. Susan is physically limited by ill health and uses a walker. Money a barrier. Has practical skill but feels needs more installation skills. Family helps with jobs around the house and susan in turn helps to care for the children and do other jobs.	Comfort from heat and cold. Taking care with resources and caring for family and community.
Terry	60s Good health (hip challenge)	Retired owner	c. late 1980s	yes	yes	yes	In South Africa, aware of challenges in society.	History of social care jobs and political social and environmental care. Gardens fruit and vegetables and makes own beverages and pickles etc. Lives on acreage which is greatly enjoyed. Built current	Tries to be as self-sustaining as possible out of care for the world, and the society. Also on a careful budget. Grows own food, has solar power, preserves etc. Is careful with energy use and careful with heating. Uses fireplace to heat up water for drinks and hot	Care for the planet / environment. Effective use of money. Care for family, community and society. Developing community, especially aborigines

								house.	water bottles. Would like better skills for handy job, (although does already do a lot of handy jobs).	is important.
Trent (and wife and child)	30s good health	f/t work owner with mortgage	c. late 1990s	yes	Yes Shw with GERP	yes	Childhood on a farm – needed to be resourceful	Adult full time desk job. Provides for young child and wife. Has created gardens, home improved to make it comfortable for the family. Gardens vegetables, planted native trees	Is careful with heating, but uses what needs to. Grows vegetables. Got the shw installed. Has practical skills and uses them but also works full time. Is knowledgeable about comfort and energy efficiency and sustainability. Busy with job, home improvements and maintenance and family.	Making the home into what the family need and like. Care of child important. Resourcefulness.
Troy and Nat	60s good health	T – retired / pension N – casual work owners	c.1967	yes	yes	yes	unknown	Actively resourceful-picking up fruit harvest ignored by others, looking out for recycling opportunities. Retired and casual work. T is involved in managing a local club and makes timber models for the markets.	Actively resourceful . They are very careful with lighting, they recycle, have fruit trees, jam and bottle harvests.... They are careful at the supermarkets and buy the specials in bulk and store. Troy has practical maintenance and improvement skills. Nat thinks through everything carefully for the house. Find 2 nd hand materials in their circle of friends and community. House ceiling too low for T to fit insulation himself. Tradesman hard to get. On pensions.	Family Resourcefulness Social involvement. Care for animals. Aware of interconnectedness of water, forests and microclimates. Concerned about pollution Working together. Caring and good management of community infrastructure.

Vanessa And Paul	60s good health	Retired Owners super	c. 2006	yes	Yes Shw, insul, hp and energy saver pack with GERP	yes	unknown	Lived in Melbourne where water was scarce and there was a strong culture of environmental care. In this dwelling are doing an extension. Have previously lived in Tasmania inner city so understood the climate when they moved back.	Actively resourceful. Do whatever they can themselves – eg refinishing 2 nd hand materials, fixing sash window pulleys, and insulating the extension themselves. V and P planned and V researched design ideas thoroughly. High capacity to think through and make changes. Knowledgeable about comfort, energy efficiency and the impact building has on the environment. Retired and using super so very careful not to overspend and are making the house as low cost for long term living. Feel that money and knowledge are barriers. Needing to improve the house motivated. Love older style houses. Environmentally aware and concerned. Timing of rebate was a good fit with their renovating / extension process.	Environmental care Social care Care for community infrastructure Active citizenship Supporting health and wellbeing. Family care.
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General table notes for all tables:

See Appendix V for list of abbreviations and acronyms.

Where a participant's name has been used in the first row, the first letter of the participant's names may be used in place of the full name for the rest of that row.

Appendix F – Housing Stock Statistics

In Tasmania:

- In 2012 there is estimated to be 510 000 householders, 208 000 households (Australian Bureau of Statistics 2010b: table 1.17; Australian Bureau of Statistics 2012) which is the smallest population of an Australian state.
- Population growth 1% p.a. (Australian Bureau of Statistics 2010a: 1) is low for Australia .
- Households numbers - 1% p.a.increase (ibid: table 1.1). Overall in Australia 1994-2004 approx. 19% was added to the entire Australian housing stock (Australian Bureau of Statistics 2007: 3). There is a 1.8 per cent per annum housing increase nationally (Australian Bureau of Statistics 2010a: table 1.1)
- 86% detached housing stock at 2006 census (11 % higher than nationally) (Australian Bureau of Statistics 2006a; Australian Bureau of Statistics 2006b).
- Semi-detached housing was 4% and flats were 9 % of total (5% below national averages) (Australian Bureau of Statistics 2006a; Australian Bureau of Statistics 2006b).

Building materials used in housing in Tasmania:

- Materials used in Tasmania are the same range as used in the rest of Australia, but at different proportions.
- Houses are made from brick, steel and or timber for walls; concrete, steel or timber for floors; and corrugated iron, tiles, fibre cement or poly carbonate for roofs. Fencing materials include timber, brick and corrugated iron. If there is land, a garden is a regular feature, grassed lawn is popular and there is often paving of bricks or concrete. Other building materials for homes include, cement blocks, aerated autoclaved concrete, rammed earth and mud brick (Australian Bureau of Statistics 1999).
- Outside cladding is brick veneer (41%), timber (30 per cent) and double brick (13 per cent) (Australian Bureau of Statistics 2005: 15). Different rates to mainland, but the same materials.
- Timber popular for outside cladding – higher than national average (ibid).
- Brick cladding is less popular than in other States and is also less than the national average (ibid).
- Suspended timber floors were more common than concrete slab-on-ground floors (CEFG October 2007). Slab-on-ground are more common than timber in other Australian states.

Age of housing stock in Tasmania:

- Over a fifth of the stock was older than 50 years and over two thirds older than 20 years in 1999 (Australian Bureau of Statistics 1999) Despite the age of this information it is still a reasonable indicator due to Tasmania's slow rate of changes in housing stock.

Structural issues, repair and maintenance of in housing stock in Tasmania

- Have a higher proportion of major structural problems reported in a 2007-08 survey when compared to the overall Australian proportion (19 per cent for Tasmania, 14 per cent for Australia) (Australian Bureau of Statistics 2009: 7-8).
- A higher proportion of renters (above 25 per cent) reported major structural issues than any other ownership category (ibid).
- Repairs and maintenance had been carried out on 57 per cent of the dwellings in the last 12 months in Tasmania in the 2007-8 survey (ibid).
- Renters reported that repairs and maintenance had occurred in 51 per cent of the cases where it was needed (Australian Bureau of Statistics 2009: 7-8).

Occupant requirements versus available housing stock in Tasmania:

- There are not enough single bed houses in planned housing (ibid).
- Approx. 27% of Tasmanian households are modelled to be single person households, 3% per cent are group households and the balance is family households (Australian Bureau of Statistics 2010b: table 1.17).
- The percentage of lone person households is projected to increase over the next two decades (ibid).
- Households were quite small with on average 2.4 people per household in 2003-04 (Australian Bureau of Statistics 2006c).
- Family size has reduced, there are more single parent-families and the population is ageing and moving to one and two person households (ibid).
- Existing housing / most planned housing not designed for aging in place, disability access, and does not have the appropriate numbers of bedrooms.
- Housing stock does not align with needs now or in future. The average occupants per house is reducing (LGFG, SCSFG, SGFG, CEFG October 2007 and March 2008).

Notes: All percentages have been rounded to the nearest whole.

Appendix G – Focus groups reported barriers

Table G-1: Barriers to home improvement for energy efficiency noted in October 2007 focus groups

Barriers identified in table G-1 were identified in early stages of the enquiry through thematic analysis.(Stratford et al 2008). Not all barriers were necessarily identified by members of the focus groups.

Barriers to energy efficient home improvements	State government	Local government	Commercial enterprise representatives	Social community support sector
Cognitive / affective				
adherence to consumer(ist) values	X		X	X
lack behaviours / habits to effect change	X	X	X	X
lack of motivation/commitment/prioritisation/ values/ awareness	X	X	X	
fear of change		X	X	
apathy (despite agreeing in principle and having awareness)	X	X	X	X
focus on new build	X	X	X	
short term thinking – building for the immediate		X		
culture – Tasmania does it differently	X	X		
not clear on benefits (eg health)	X			
well-being / capacity				
low socio-economic status, income deprivation, poverty	X	X	X	X
unaffordable housing and unmet needs in relation to tenure	X	X	X	X
victim hood, limited advocacy	X		X	X (in gov.)
poor health				
particular demographic characteristics/challenges/change	X	X		X
fiscal, financial, economic and market				
pricing mechanisms, profit imperatives, growthist paradigm	X		X	X
innovation seen as (real or perceived) financial impost	X		X	X
compliance costs			X	
perceived need for significant returns on investments (payback)			X	
ignorance of long term economic benefits of retrofitting			X	
lack of evidence of costs vs benefits		X	X	
cost as the key basis for decision making		X	X	
other costs (material inflation/OH&S) leading to clients choosing cheaper options				

Barriers to energy efficient home improvements	State government	Local government	Commercial enterprise representatives	Social community support sector
pressure on builders to meet a budget				
stress and time constraints change clients' perceptions of cost				
subsidies undermining real market position	X			
lack of market initiatives	X		X	
lack of housing choices on market			X	X
Lack of information available for designers		X		
no detailed information available at point of sale	X			
housing systems, processes, technologies, stock and supply				
standard settlement practices and historical systems and regulations	X	X		
investment in particular forms of subdivision and construction	X			
inappropriate planning and design and construction of housing structures	X	X	X	X
perception of retrofitting as technically difficult/ limited benefit/ unaffordable	X		X	X
poor standards	X			X
clash in environmental aims/priorities	X	X	X	X
lack of appropriately skilled tradespeople			X	X
poor quality housing		X	X	X
builders do what specified or perceived as wanted by consumer			X	
planning limited relationship with existing stock			X	
contextual / environmental constraints				
landform	X		X	
perception of climate	X		X	
actual climate			X	
scale of population and place	X	X		
supply distances/availability/oversupply	X			X
training, skills, knowledge acquisition and transmission				
lack of appropriate education and training [retro, context-eg island supply] / lack of understanding	X	X	X	X
lack of specific skills training [eg insulation, heat pump design ...]	X		X	
lack of good practice/demonstration projects	X		X	

Barriers to energy efficient home improvements	State government	Local government	Commercial enterprise representatives	Social community support sector
lack of good quality information and tools (in accessible documents) about retro	X	X	X	X
insufficient opportunities for up-skilling				X
limited capacity for quality assurance of skills in practice		X		
lack of access to facilities and products / supportive educational environments	X			
lack of collaboration/integration between specialists/professionals / or targeted information dissemination	X			
environmental / sustainable subject matter non-existent or confusing	X	X	X	X
lack of financial support	X			
lack of accessible specialists	X	X		X
limited detail		X		
governance, government and leadership				
risk management				
lack of coherent and connected leadership and political will and example	X	X	X	X
lack of integration in government, governance and/or policy	X	X	X	X
inability to manage or understand demand (including need)	X	X	X	X
lack of rewards and incentives for retrofitting	X	X	X	X
focus on managerialism				
ambiguity of regulations / ability to understand regulations / age of regulations	X	X	X	X
lack of performance targets, benchmarks, standards and accreditation	X			X
lack of appropriate human resources	X			
non-aligned, complex or gaping legislation and regulation [blanket/minimal/non-specific regulation]		X	X	X
tensions over mandatory and voluntary arrangements	X	X		
confusion over roles and responsibilities	X	X	X	
multilateralism	X			
capture of the State by private or union interests		X		
enforcement				

Barriers to energy efficient home improvements	State government	Local government	Commercial enterprise representatives	Social community support sector
government taxes				
short-termism in government or other stakeholder commitments to initiatives		X	X	
using a regulative blanket approach	X		X	
housing funding systems / agreements	X			X
governmental financial difficulty and lowest bid focus	X	X	X	

Appendix H – Priorities informing choice of dwelling

Table H-1: Participant priorities informing the choice of dwelling

Householders	Reasons for choice of dwelling
Cara Edward & Veronica	Chose house with retrofit potential in suburbia rather than building on acreage and building sustainable home as near services and suppliers so limited day to day environmental impacts and reduced land clearing and travel, for example. Chose house that had all the facilities needed, was renovate-able, had some yard area for chickens and vegetable gardens, and was affordable for them. Had moved from interstate and enjoyed the distinct seasons in Tasmania.
Del and Kirk	Bought their home hoping to age-in-place and were prepared to make changes to achieve this. Chose because smaller and recently built so less maintenance required. They bought near shops and in a flat landscape for convenience and ease of movement. A builder-friend inspected the house before purchase. Kirk is older than Del and wanted the house well prepared in case Del was left alone in the years to come.
Frank	Frank's late wife had originally purchased his home from Housing Tasmania in the 70s. Frank lived in the home with his wife and they made a decision to extend their home, rather than leave for another house. This was partly due to good solar access to their block and house.
Frederick & Keira	Frederick and Keira wanted to be somewhere near public transport and a local shop.
Helen	Helen's home was not her own choice. Helen moved into the house that her husband owned. Helen previously lived closer to city and walked everywhere, content here though due to nice neighbours. Husband chose partly because close to his family. However, Helen had come to enjoy the neighbours, the facilities and the community. Helen like the community services available.
Henry	Henry chose his house primarily because it was a small and affordable rental. Henry had recently broken up with his partner, and still having equity in the family home and having a casual and seasonal job, was being cautious with his living expenses.
Lorraine and Robert	Partly because house and yard sunny. This is the longest they have lived anywhere since Robert began with the air force. Lots of animals to hosed.
Mark	Had the house built on a clear block of suburban land, but was aware that the builder had cut many corners.
Mary and Martin	Looked for a house with solar access. Moved to Tasmania from elsewhere in Australia, but had lived in Tasmania previously and understood the climate. Their house, they knew, would be well lived in as Martin would work from home and Mary, who was ill would spend a lot of her time at home.
Mel	Mel had a clear understanding of what she would need in a house and chose her house accordingly. Mel's house was near-new when she bought it and had only been a display home previously which he later sold on. Being new, Mel thought the maintenance would be lower than an older house. Wanted a house with a heat pump. The house has a good view which was attractive to Mel. Mel had only purchased the house 18 months before I spoke with her. She had recently split up with a partner and had to be careful to find something affordable.
Olive	Loves the house and being by the water and bought it with a bare yard planted the yard out.
Steve and Gwen	Chose as close to shops and services and public transport as could. Steve had a health scare and so thought it would be sensible to live near to an urban centre. Steve had the possibility of being in a wheelchair so they chose a dwelling that was accessible, including choosing a flat piece of land, with a house with wide doorways. Also chose according to their aesthetic taste for older houses (this house is around 70years old). Chose a suburban house also as they garden vegetables and ornamentals and own dogs.
Susan	Chose the place for the features of the house (such as appropriate kitchen). Susan is on a pension and manages health issues. Her family assisted her to buy the house.

Householders	Reasons for choice of dwelling
Terry	Terry owner-built his house with his partner and family to enjoying the semi-rural position whilst still being able to travel into work in the city. Terry grows vegetables, collects water and generates powers through photovoltaics, and intended to use the property for these purposes when he and his partner purchased it.
Trent	Trent is a partner and a father of a young child. His house improvements have been guided by his life stage.
Troy and Nat	Troy and Nat have lived in their house for a long time. They bought the house from the housing department, as did Frank and his wife. The house was one of many in the same area being sold by the housing department. Troy and Nat did not require a deposit to purchase the house, but rather were required to make weekly payment to purchase the house. The house cost \$4800, with rates included in the regular payments.
Vanessa And Paul	Chose and purchased the house over the internet. They made the decision with some key criteria in mind. V said: ' We always likes old houses, we are not really into new houses. So, I saw this on the internet and I said, 'what do you think?'. And we had four criteria: we wanted a level block, off street parking, one level and a view, oh, brick too, so that is five. And it was everything, so we bought it.' When V and P bought the house, the house had had renovation work done to it and what would have been a front veranda, at the entry, had been enclosed and the kitchen was in a similar small enclosed area out the back of the house. Vanessa and Paul knew they would renovate, and in the end extended the house as well, reinstating the front veranda and planted a large vegetable and ornamental garden.

Appendix I – Functions and purposes of dwelling

Table I-1: Types of housing needs and services that underlie dwelling development and adaptation

Need/expectation of domestic scale dwelling spaces	Function / Service	Examples of common physical manifestations or design solutions
Shelter/enclosure from environment extremes (climate eg rain, wind, temperatures, vegetation eg pollen, falling branches)	Shelter, enclosure,	Roof, walls, floor, windbreaks, weather stripping, outdoor shading
Ability to moderate climate of dwelling and dwelling enclosure (warm/cool/maintain) for comfort to maintain health	Passive control ability, resistive enclosure, ventilation and control (fresh air intake), insulation, solar control, heating, cooling, water supply. Windows and openings for daylight entry (enough daylight for psychological health and physical safety) and Fresh air systems	Insulated roof, walls, floors, doors, windows, other openings and vents, outdoor shading, swimming pool, sprinklers
Protects, provides safety and security (as well as feeling of).	Securable enclosure	Roof, walls, floors, doors, locks, fences, planting, hot water thermostat limiters
Provides privacy/calm	Shelter, enclosure, ownership & vegetation.	Planting , yard
Is a base for gathering connection / interconnection with other people and the community.	Areas for gathering, openings for seeing and speaking through, sight lines, soft boundaries to the property	Living room, formal lounge room, verandas, front doors Front door, back door, backyard, entertainment areas, phone, computers, low fencing
Gathering of householders	Space for family to live together in the house,	Living room, dining table, kitchen bench, yard and garden spaces eg pergola
Personal/health care provisions	Water supply and areas for use, heating and cooling, fresh air intake, place for rest.	Bedroom, bathroom, darken-able windows (eg curtains blinds)
Cleanliness	Place and systems to keep the body, clothes, fixtures and fittings , and the house clean.	(eg bathroom, laundry, cupboards, washing machine)

Need/expectation of domestic scale dwelling spaces	Function / Service	Examples of common physical manifestations or design solutions
Food storage, preparation and consumption	Place and facilities to prepare and keep food	Bench, cupboard, fridge and pantry, sink
Mediator of the relationship with the outside world, eg connects with nature	Space and facilities for care and interaction with other living species	Garden, dog doors, cat beds, kitty litter area, pot plants.
Care for nature	Management of toxic outputs, limiting of resource use, ability to cycle resources,	Native gardens Garden ponds
Ability to adjust and change the dwelling space	Flexible living	Multiple use rooms Zonable areas within the house
Freedom to move around dwelling space	Openings, systems that allow access	Doors, smooth opening handles, lightweight doors to open, hobless showers, hand rails.
Personal space and identification as individual	Personal areas in which to express yourself, organisation of household systems	Painted walls, gardens, artworks, furniture
Resting	Calm, darkenable spaces, resting furniture	Bedroom, bed, curtain
Activities	Space and facilities	Shed, timber, nails
Play/leisure opportunities	General purpose indoor or outdoor space	Living room, outdoor open space, table and chairs in or outdoor, trees, sunny spots, shaded spots, chess board, pack of cards.
Place of work	Area and storage systems to work with (eg office and shelves), phone, computer with internet hook up, signs, table	Not everyone uses the home for this purpose. However there is a large enough population who do it to attend to it and it has been identified as a useful strategy in terms of sustainability.
Support for 'doing' capacity	Facilities for supporting knowledge and skills	Workshop, books, internet access and computer
Availability of water	Water collection and supply	Rainwater tank, water pipes, taps
Availability of energy sources	Energy resources collection and supply	Solar collectors, timber pile in a shed, wind generator, electricity supply, switches,
To secure social status	Social status	Aesthetically pleasing hosue

Need/expectation of domestic scale dwelling spaces	Function / Service	Examples of common physical manifestations or design solutions
Economic security	Affordable systems, potential for money generation	An efficient heater in a resistive enclosure, a productive food or flower garden.

Appendix J – Drivers of energy efficiency

Table J-1: Self-reported drivers of energy efficiency of participant households

Household / participants	Drivers of energy efficiency
Cara Edward & Veronica	Justice issue for people, animals and the environment. Not handing a planet to children that is 'impoverished' We can do our bit as we have contributed to the problem
Del & Kirk	We can't avoid doing – its everywhere People saying not be ee will affect children's lives Affordability
Frank	Concerned about carbon emissions Money management /saving and price of oil up
Fred & Keira	To save money (worried about future expenses) Worried about the world
Helen	To save money To limit waste To not use coal fired electricity and limit impact on climate change
Henry	To save money To improve the environment To minimise health effects on community
Lorraine & Robert	To be efficient To minimise costs
Mark	Environment
Mary and Martin	Cost Environment
Mel	Money management/affordability
Olive	To try and reduce electricity bill To be economical (meaning more than just with money)
Steve and Gwen	Did not provide a response
Susan	Did not provide a response
Terry	Comfort Environment
Trent	Cost management (resourceful attitude)
Troy & Nat	Resourcefulness (no waste) Being careful, because of links to what is going on out in the world Money management
Vanessa and Paul	Managing money For future generations

Appendix K – Comfort perception and dwelling performance related to climate

Table notes are at the end of the comfort perception section.

Issues with overheating coloured orange

Issues with cold areas coloured blue

Summer interviews

Table K-1: Summer comfort, climate and temperature indicators on day of interview

	Date (day / mth) 2008	Time of interview	Temp. (ambient) in living or dining/kitchen area at interview (°C)	Other key temps at interview (°C)	Householder reported comfort at time of interview.	House performance indicators at interview and climate notes.	BOM daily min-max (°C)	BOM sunshine (hrs)	BOM rain (mm)	BOM temp 9am (°C)	BOM wind (direction, speed km/hr) 9am	BOM temp 3pm (°C)	BOM wind (direction, speed km/hr) 3pm	Mean min-max temps for month
Mark	22/02	12pm	@19.8	@20 outside on SW side (?)	Moderate – not too hot.	Cloudy. Not much wind. West rooms get hot so has to close curtains.	12.1-23.0	1.9	0	12.7	NNW, 15	22.4	NNW, 17	12.6-22.1
Frank	23/02	10am	@19.4 (living/dining area)	@24 outside	House gets too hot.	Gets hot so draws curtains. Quite hot at night. Strong NW winds (shake the windows). Windy cloudy day, some light rain. Sunny and open locality.	11.9-19.0	8.1	9.6	13.8	NW, 19	14.0	SSW, 28	12.6-22.1
Olive	25/02	3:30pm	@21	unknown	Felt ok	Doesn't overheat much in summer. Well shaded to the N. Lots of mass and near the water's edge. Was 24°C on car thermometer just before interview. Mild summer day.	9.9-22.9	11.2	0.2	16.8	ESE, 13	21.5	NW, 22	12.6-22.1
Del & Kirk	26/02	5pm	@24	@21 in study/spare room (no W sun).	All right. Del doesn't cope as well as Kirk.	House does get hot but manage it with curtains and venting. Had been snow on Mt Wellington a couple of days before.	11.8-17.8	4.1	0.6	13.8	ENE, 6	16.0	ESE, 24	12.6-22.1
Steve & Gwen	27/02	5:30	@20.8 6:30pm	-	Felt it was warm. G finds heat a challenge.	House cooling down as sun setting. A cool day. Hot living room in afternoons – use the fan to cool.	10.9-18.8	5.9	0.2	13.3	NNW, 9	17	SW, 26	12.6-22.1

Fred & Keira	28/02	10am	Ceiling heat thermostat set to 19 (temp would be a couple degrees less at living height).	-	Relatively comfortable but a bit cool in the mornings	Cold in morning. Has thermostatically controlled ceiling heat on at 15 during day and 20 at night otherwise gets too cold. Rained at the end of the interview.	8.2-14.2	8.5	1.2	11.3	SSW,20	12	SSW,31	12.6-22.1
	Date (day / mth) 2008	Time of interview	Temp. (ambient) in living or dining/kitchen area at interview (°C)	Other key temps at interview (°C)	Householder reported comfort at time of interview.	House performance indicators at interview and climate notes.	BOM daily min-max (°C)	BOM sunshine (hrs)	BOM rain (mm)	BOM temp 9am (°C)	BOM wind (direction, speed km/hr) 9am	BOM temp 3pm (°C)	BOM wind (direction, speed km/hr) 3pm	Mean min-max temps for month
Troy & Nat	28/02	1:30pm	-	19.5 in kitchen/dining (interview here)	Comfortable at this temperature.	Cloudy day, not warm. Comfortable enough that generally didn't need to use active cooling devices. Rarely would turn the hp on to 20 to cool the house but approx once a week uses the ceiling fan.	8.2-14.2	8.5	1.2	11.3	SSW, 20	12.0	SSW, 31	12.6-22.1
Vanessa & Paul	29/02	10am	@15 (currently not in use)	@15- 18 in the different rooms of the house (not living in much of the house as it was being renovated and extended	Ok in summer - do not require extra cooling.	Cloudy day and around 19 degrees at the beginning, but rained near the end. Have found little cold and uncomfortable while in granny flat/garage while building.	7.7-15.0	5.7	4.0	10.9	SSW, 26	13.6, SSW, 24		12.6-22.2

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Cara, Edward & Veronica	02/03	3pm	@ 20.3	-	Generally comfortable	Doesn't get too hot although W bedrooms do get hot but use curtains.	11.9-19.7	6.5	0	14.5	SSE, 4	18.9	SE, 20	11.4-20.3
Terry	05/03	10am	@21.8	19 in southern areas of house	Bit hot, likes it about 17.	Comfortable to warm day. Sun was out and the view was clear (no fog).	8.4-23.6	9.8	0	11.4	NNW,20	20.7	ESE, 19	11.4-20.3
Mel	06/03	5:30pm	@25	@24.4 in laundry, NE bedroom 26.4.	This temp a bit hot. Had just arrived home and house had been closed all day.	Warm hot sunny day. Not much breeze at time. House has large bank western windows. Uses blind to control insolation.	11.4-23.8	8.3	0	16.3	NNW,17	23.3	NE,11	11.4-20.3
	Date (day / mth) 2008	Time of interview	Temp. (ambient) in living or dining/kitchen area at interview (°C)	Other key temps at interview (°C)	Householder reported comfort at time of interview.	House performance indicators at interview and climate notes.	BOM daily min-max (°C)	BOM sunshine (hrs)	BOM rain (mm)	BOM temp 9am (°C)	BOM wind (direction, speed km/hr) 9am	BOM temp 3pm (°C)	BOM wind (direction, speed km/hr) 3pm	Mean min-max temps for month
Lorraine & Robert	08/03	4pm	@20 in dining / kitchen	-	Cool in house. Fairly hot outside (but like the hot weather).	'Fairly cool' inside. Sun was out. Strong breeze in afternoon..	9.8-19.3	7.3	0	13.4	N, 7	18.4	ESE, 15	11.4-20.3
Susan	12/03	1pm	@25.4	-	Comfortable, no appliances or activities to cool down further. Was comfortable	Keeps the house open to keep it cool.	13.2-22.0	8.2	0	16.1	NNW, 15	21.0	ESE,17	11.4-20.3

					during interview.										
Trent	15/03	10am	-	23 in kitchen / dining (interview here)	Comfortable. Yesterday first time had used air conditioner for a month or two (yesterday was 37°C)	Sunny day. Good temperature in summer. Uses cooling for hotter days over 30 degrees. Does heat the kitchen/dining for 5 minutes in the morning to warm it a little as it is the coldest, most reactive room in the house.	11.5-21.5	10.7	0	16.5	NE,6	21.3	SE,19	11.4-20.3	
Mary and Martin	17/03	10am	-	-	comfortable	Different areas of the house most comfortable depending on the day. Rumpus cool on a hot day. Use the coolest room on hot days.	15.5-26.0	5.4	0	17.0	ESE, 4	25.2	ESE,13	11.4-20.3	
Helen	1 st interview in autumn	-	-	-	Comfortable in summer	Uses doors and curtains to manage as heats up. In evenings is hot and vent at night to help with this.	-	-	-	-	-	-	-	-	
Henry	1 st interview in autumn	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table K-2: Indicators for householder summer comfort compared to average BOM climate data

	Householder comments about summer comfort (too hot, too cool, usually comfortable)	Householder comments about house performance	BOM mean min-max summer months	BOM mean sunshine hrs/day summer months	BOM rainfall mm/day summer months	BOM Climate pattern statistics 1981-2010
Cara, Edward & Veronica	Generally comfortable.	Doesn't get too hot although W bedrooms do get hot but use curtains. Manage the house according to heat. House doesn't warm up well on cloudy days. Generally a comfortable summer house. Had lots of sunny days in summer.	Dec 12.2-22.7 Jan 13.7-24.1 Feb 11.4-21.2	Dec 8.3 Jan 9.3 Feb 7.4	Range: Dec 0-22.6 /day Jan 0-1.4/day Feb 0-17.2/day Rain days: Dec 13 Jan 6 Feb 15 Days over 2 mm/day: Dec 7 days Jan 0 days Feb 7 days Days over 10mm day: Dec 3days Jan 0 days Feb 2 days Total rain mm/month: Dec 83.4 Jan 3.0 Feb 65.0	Temp min-max °C Dec 11.3-20.4 Jan 12.6-22.2 Feb 12.6-22.1 Total mean rainfall mm /month: Dec 57.1 Jan 44.4 Feb 36.3 Mean daily sunshine: Dec 7.4 Jan 7.9 Feb 7.8
Del & Kirk	Kirk is ok, but Del finds it too hot.	Thought had only one hot day this summer when had needed to use the fan. Had been snow on the mountain a couple of days before the interview.				
Frank	House gets too hot.	Gets hot so draws curtains (then house is dark). Quite hot at night. Strong NW winds - shake the windows. Sunny and open locality.				
Frederick & Keira	Relatively comfortable but a bit cool in the mornings.	Sun warms up house during the day and it can get too warm in the afternoons. Only overheats occasionally when hot days. Can be windy. Uses a fan on hot days – about 6 days this summer.				
Helen	Comfortable in house generally – night time hotter (heat builds up).	Uses doors and curtains to manage as heats up. In evenings is hot and vent at night to help with this. Occasionally uses a fan.				
Henry	-	-				
Lorraine & Robert	Feel comfortable, like the warmer weather.	When hot outside stays 'fairly cool' inside. Can get cool if house is closed. Wind hits strongly in afternoon and can be cooling.				
Mark		House gets hot but manages by closing out sun with curtains.				

	Householder comments about summer comfort (too hot, too cool, usually comfortable)	Householder comments about house performance	BOM mean min-max summer months	BOM mean sunshine hrs/day summer months	BOM rainfall mm/day summer months	BOM Climate pattern statistics 1981-2010
Martin & Mary	Moved to Tas partly due to heat on mainland.	Different areas of the house most comfortable depending on the day. Rumpus cool on a hot day. Dominant NW wind which shakes the house and rain can come with it.				
Mel	Doesn't like the heat. There weren't too many hot nights (ie over 15°C).	Not much breeze at time of interview. House has large bank western windows. Uses fan on hot nights.				
Olive	Doesn't feel too hot in summer in the house.	Doesn't overheat much in summer. Well shaded to the N. Lots of mass and near the water's edge. Only a few hot days in summer that felt had wanted a fan.				
Steve & Gwen	G feels it is warm (finds heat a challenge).	Hot living room in afternoons – use the fan to cool. Cool house with breeze when around.				
	Householder comments about summer comfort (too hot, too cool, usually comfortable)	Householder comments about house performance	BOM mean min-max summer months	BOM mean sunshine hrs/day summer months	BOM rainfall mm/day summer months	BOM Climate pattern statistics 1981-2010
Susan	Doesn't like temp going over 25°C as then gets uncomfortable.	House is closed up when out, when returns heat 'smacks you in the face'. Craft room ok this time of year.			Range: Dec 0-22.6 /day Jan 0-1.4/day Feb 0-17.2/day	Temp min-max °C Dec 11.3-20.4 Jan 12.6-22.2 Feb 12.6-22.1
Terry	Bit hot, likes it about 17.	The house is a bit hot for T in summer, regrets using cellulose insulation in the ceiling as believes that batts may have been more effective.	Dec 12.2-22.7 Jan 13.7-24.1 Feb 11.4-21.2	Dec 8.3 Jan 9.3 Feb 7.4	Rain days: Dec 13 Jan 6 Feb 15	Total mean rainfall mm /month: Dec 57.1 Jan 44.4
Trent	Is used to worse heat than in Tasmania. Likes around 18 degrees.	House good in summer				

	Householder comments about summer comfort (too hot, too cool, usually comfortable)	Householder comments about house performance	BOM mean min-max summer months	BOM mean sunshine hrs/day summer months	BOM rainfall mm/day summer months	BOM Climate pattern statistics 1981-2010
Troy & Nat	The heat in Tasmania is a problem for Troy (where as he can cope better with Qld heat).	House rarely needs a/con cooling. Once a week-ish find they need the ceiling fan. Would like a little more air movement at night in the bedrooms (would like fans in there). Generally the house is ok to be in in summer.			Days over 2 mm/day: Dec 7 days Jan 0 days Feb 7 days	Feb 36.3 Mean daily sunshine: Dec 7.4 Jan 7.9 Feb 7.8
Vanessa & Paul	V doesn't like the heat in Melbourne but finds Tas heat in summer ok. Found that when had to stay in the granny flat/garage while renovating it was a little uncomfortable temperature wise (cold and hot).	House keeps fairly cool due to brick walls and takes a few days to heat up. Tas hot spells don't generally last long enough to make the house uncomfortable. Use cooling breezes in the house.			Days over 10mm day: Dec 3days Jan 0 days Feb 2 days Total rain mm/month: Dec 83.4 Jan 3.0 Feb 65.0	

Table notes are at the end of the comfort perception section.

Autumn interviews

Table K-3: Autumn comfort, climate and temperature indicators on day of interview

	Date (day/mth) 2008	Time of interview	Temp. in living area at interview (°C)	Other temps at interview (°C)	Householder self reported comfort indicators.	House performance indicators and climate notes.	BOM daily min-max (°C)	BOM sunshine (hrs)	BOM rain (mm)	BOM temp 9am (°C)	BOM wind (direction, speed km/hr) 9am	BOM temp 3pm (°C)	BOM wind (direction, speed km/hr) 3pm	Mean min-max temps for month
Henry	18/04	1pm	@19 ish	-	Using heater when needed.	16 degrees outside just before interview.	7.7-15.9	6.2	0	10.2	NNW, 9	13.9	SSE, 17	8.3-18.0
Helen	20/05	1:30pm	@16.4	@16 in kitchen,	Not too bad with doors shut.	Not so bad if shut doors. Sun in afternoon (can be a problem). Close up and closes curtains when put heater on. Use the heater.	6.2-16.8	6.9	0	11.3	N, 7	14.8	NW, 24	7.9-16.2
Troy & Nat	20/05	5pm	-	Dining /kitchen@15.5 Noticeably dropped over interview. Temps taken at end of int.	T felt warm enough in dining area. Had door to outside open for dog. Generally felt comfortable in evening with heating.	@11.4 degrees outside at end of interview. Surfaces of vinyl cladding @9.5. Heating used in evenings	6.2-16.8	6.9	0	11.3	N, 7	14.8	NW, 24	7.9-16.2
Vanessa and Paul	21/05	2pm	-	@13.25 in garage kitchen area.	Mornings bitter. Would be using heating if had some (in garage while house being built). Having to layer up clothes and use gloves.	-	5.4-11.1	7.4	0.4	8.5	NNW, 13	10.2	SSW, 17	7.9-16.2
Del &	21/05	4pm	Maintained	-	Afternoons getting	Using heaters. Sun	5.4-	7.4	0.4	8.5	NNW, 13	10.2	SSW, 17	7.9-

Kirk			by heater with thermostat @ 20.		cold. Using heaters to keep warm in living and workroom and sometimes the bedroom.	comes in during day. Pull outside blinds down as sun is too direct.	11.1							16.2
Fred & Keira	22/05	1:30pm	Maintained by heater with thermostat @19.5 (which translated to slightly lower).	-	Sometimes in aut doesn't warm up inside at all - but F thought had been a mild autumn.	Using less heating as had perspex layer installed on windows. Ceiling heat thermostat set at 19.5. Bedroom ceiling heat at 15 and higher at bed time. Close doors.	0.7-12.2	8.5	0	2.9	NNW, 19	11.7	NW, 20	7.9-16.2
Lorraine & Robert	22/05	6:30pm	-	unknown	Had been mild. (No heater use yet). Had felt cold some days and in the mornings	Sun coming in so house is still warm enough. Use lounge room in afternoon - sun shines in. Was 3°C outside that morning. Not much wind around. Let sun in during the day. Close up house, rug up. Felt cold at interview.	0.7-12.2	8.5	0	2.9	NNW, 19	11.7	NW, 20	7.9-16.2
Steve and Gwen	23/05	5:30	unknown	-	The house feels cold (sometimes cooler than outside). Use the heater in the evenings 5-7pm. Son used separate plug in heater (often).	Use heater in the evening for 2 hrs. Steve exercises in the garden to warm up. Close up curtains and doors when using heater. Opens up curtains for afternoon sun. Rug up.	2.8-14.8	4.9	0	8.2	NNW, 17	12.4	ESE, 13	7.9-16.2
Martin and Mary	26/05	10am	-	Aims to have @15-17 with heat pump	Colder but using the heaters to keep warm and zoning	Using heaters and zone. Heat pumps on timers so come on just before	7.1-12.3	0.0	0.0	9.6	NW, 13	11.5	NW, 9	7.9-16.2

				and @ 19 if Mary needs it.	off the house. When come into unheated kitchen/dining at night for a drink it is cold but ok. Don't need heaters is it is a sunny day.	get up. Use the hps morning to lunch and evening to bed. About 13°C in morning inside last few days. The living room gets quite cold without heating but is better since ee home improvements. Close curtains for night heating.								
Olive	29/05	3pm	Below 15 degrees	-	Comfortable during the day. Feeling colder and has used heaters at night for a couple of weeks.	When began to get cold used a hot water bottle and blanket but now using plug in heater at night. Closes curtains at night till 9pm. Uses electric blanket. (PW notes – a reasonable day)	9.4-16.5	0.0	0.4	15.1	N, 35	16.2	NW, 28	7.9-16.2
Cara Edward & Veronica	30/05	7pm	unknown	-	Generally comfortable but up and down depending on the day. Anything below 16°C inside feeling cold.	Nice day – 15°C outside. Some use of heat pump to get ready in the morning. Close up house to keep warm, close curtains, covered air vents.	11.6-16.1	0.3	1.0	12.3	NNW, 20	14.8	ESE, 7	7.9-16.2
Frank	31/05	10am	@17.4	-	Pretty warm but takes chill off in morning. Appreciates the sun when it comes in.	Pretty warm. Uses heater in morning. Sunny day. Sunny suburb. Windy as well.	9.7-13.8	6.4	0	12.0	WSW, 9	12.0	SE, 17	7.9-16.2
Susan	02/06	10:30am	@14.6	@16.9 in kitchen in sunlight.	Comfortable after 1 hour interview sitting.	4°C at 7:30am. Closes up and heat house in later afternoon and evening. Mainly using living in	4.0-14.4	7.0	0.2	5.3	N, 13	14.2	NNW, 17	6.1-13.9

						aut as sun comes in the room.								
Trent	02/06	1pm	Interview held elsewhere	-	Most comfortable year yet due to heat pump and extension (installed last yr). At around 16 starts to think about extra clothes and heating.	Use heating to manage the colder temperatures. Don't use heaters so much when the sun is out.	4.0-14.4	7.0	0.2	5.3	N, 13	14.2	NNW, 17	6.1-13.9
Mel	04/06	5pm	-	@18 dining (heater had been on 20 mins)	Cold enough that using heaters in the morning and evening.	Heat pump on when getting ready and when comes home. Small fan heater for spurts of extra warmth when getting dressed. Adjusts blinds to chase sun when home.	8.4-14.3	4.6	0.2	10.8	NNW, 13	14.2	NW, 7	6.1-13.9
Mark	05/06	5:15pm	unknown	unknown	Floor feels cold. Has the air conditioning at 22°C at the office which Mark finds comfortable.	Uses curtains to keep warmth in. Heater on in evenings. Bedroom heater on overnight. Rugs up.	8.4-16.8	4.1	0	10.0	NNW, 17	15.2	ESE, 11	6.1-13.9
Terry	Interviews in summer and winter	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes are at the end of the comfort perception section.

Table K-4: Indicators for householder autumn comfort compared to average BOM climate data

	Householder comments about autumn comfort (too hot, too cool, unusually comfortable)	Householder comments about house performance	BOM mean min-max autumn months	BOM mean sunshine hrs/day autumn months	BOM highest rainfall mm/day autumn months	BOM Climate pattern statistics 1981-2010
Cara Edward and Veronica	Generally comfortable but up and down depending on the day. Anything below 16°C feeling cold.	Nice day – 15°C outside. Some use of heat pump to get ready in the morning. Close up house to keep warm, close curtains, covered air vents.	Mar 11.3-21.9 Apr 8.3-18.0 May 7.9-16.2	Mar 7.0 Apr 7.0 May 4.8	Range: Mar 0-16.4 Apr 0-8.8 May 0-2.0	Temp min-max °C Mar 11.4-20.3
Del and Kirk	Afternoons getting cold. Using heaters to keep warm in living and workroom and sometimes the bedroom.	Using heaters. Sun comes in during day. Pull outside blinds down as sun is too direct.			Rain days: Mar 8 Apr 8 May 7	Apr 9.4-17.8 May 7.6-15.1
Frank	Pretty warm but takes chill off in morning with heater.	Pretty warm. Uses heater in morning. Sunny day. Sunny suburb. Windy as well.			Days over 2 mm/day: Mar 5 Apr 2 May 0	Total mean rainfall mm /month: Mar 39.3 Apr 43.4 May 36.0
Fred & Keira	Doesn't warm up inside at all but thought had been a mild autumn.	Using less heating as had perspex layer installed on windows. Ceiling heat thermostat set at 19.5. Bedroom ceiling heat at 15 and higher at bed time. Close doors.			Days over 10mm day: Mar 1 Apr 0 May 0	Mean daily sunshine: Mar 6.5 Apr 5.6 May 4.5
Helen	Not too bad with doors shut.	Not so bad if shut doors. Sun in afternoon (can be a problem). Close up and closes curtains when put heater on. Use the heater.			Total rain mm/month: Mar 30.8 Apr 19.6 May 6.0	
Henry	Using heater to help stay comfortable.	Using heater when needed.				
Lorraine & Robert	Had been mild (no heater use yet). Had felt cold some days and in the mornings.	Sun coming in so house is still warm enough. Use lounge room in afternoon - sun shines in. Was 3°C outside that morning.				
Mark	Floor feels cold	Uses curtains to keep warmth in. Heater on in evenings. Bedroom heater on overnight. Rugs up.				
Martin & Mary	Colder but using the heaters to keep warm.	Using heaters and zone. Heat pumps on timers so come on just before get up. Use the hps morning to lunch and evening to bed. About 13°C in morning inside last few days. The living room gets quite cold without				

		heating but is better since ee home improvements. Close curtains for night heating.				
Mel	Cold enough that using heaters in the morning and evening.	Heat pump on when getting ready and when comes home. Small fan heater for spurts of extra warmth when getting dressed. Adjusts blinds to chase sun when home.				
Olive	Comfortable during the day. Feeling colder and has used heaters at night for a couple of weeks.	When began to get cold used a hot water bottle and blanket but now using plug in heater at night. Closes curtains at night till 9pm. Uses electric blanket.				
Steve and Gwen	The house feels cold (sometimes cooler than outside).	Use heater in the evening for 2 hrs. Steve exercises in the garden to warm up. Opens up curtains for afternoon sun. Close up curtains and doors when using heater.				
Susan	Comfortable at around 14.6 ambient internal.	Closes up and heats house in later afternoon and evening. Mainly using living in aut as sun comes in the room. Craft room is cold.				
Terry	Interviews summer and winter only.	-				
Trent	Most comfortable year sue to renovation. Cold enough to use heaters when no sun.	Most comfortable year yet due to heat pump and extension (installed last yr). At around 16 starts to think about extra clothes and heating. Don't use heaters so much when sun is out.				
Troy & Nat	T generally feeling warm enough during the day without heating. Uses heating at night to stay comfortable.	Troy said the interview day @6pm felt about 8 degrees to him. Comfortable using heating in the evening. T felt warm enough in dining area. Had door to outside open for dog. Generally felt comfortable in evening with heating.				
Vanessa & Paul	Mornings bitter.	Would be using heating if had some (in garage while house being built). Having to layer up clothes and use gloves.				

Table notes are at the end of the comfort perception section.

Winter interviews

Table K-5: Winter comfort, climate and temperature indicators on day of interview

Household Participants	Date (day/mth) 2008	Time of interview	Temp. in living area at interview (°C)	Other key temps at interview (°C)	Householder self reported comfort indicators.	House performance indicators	BOM daily min-max (°C)	BOM sunshine (hrs)	BOM rain (mm)	BOM temp 9am (°C)	BOM wind (direction, speed km/hr) 9am	BOM temp 3pm (°C)	BOM wind (direction, speed km/hr) 3pm	Mean min-max temps for month
Lorraine & Robert	11/08	7pm	17.4	Dining: 18 on heat pump thermometer, 15 on another thermometer on far side of room. PW thermometer @16. 8 outside on car thermometer before the interview.	Felt comfortable in dining room during interview. Warm (due to heat pumps). Chilly in the morning.	All three heat pumps on in dining/kitchen, living and downstairs rumpus during interview. Use them in the morning and night. Open up blinds for sunlight. Close up when heat Rug up. House stays pretty warm using the heat pumps. Surfaces in dining room were warm at 19-18°C. The heat holds in the house overnight well once the heat pumps go off. Moisture on the windows in the mornings (but no mould). More comfortable once the windows are dry. Floor in dining warm from heat pump below as well. Been frost overnight lately	1.7-12.7	9.1	0	4.7	NNW, 19	10.5	E, 9	4.6-13.7
Vanessa	13/0	10:30a	-	Kitchen 17	V warm enough	Using heating. Int day cold.	2.0-11.1	3.6	3.0	7.0	NW, 22	10.5	W, 31	4.6-

and Paul	8	m		(heated). South room 12 (no sun, no heater)	in kitchen at this temp. If active would turn the heater down. Wonderful compared to during renovation when in garage. V had chill blains on her hands in the garage in June. Also much warmer than prior to the renovation last winter. Sunny weeks made a big difference to comfort levels and heater us in the house.	Sunny week prior made a huge comfort difference. Renovated, insulated areas and solar gain areas all significantly warmer than other areas of the house. Snow settled down to 600 m in Greater Hobart areas. Not much sun today, but some during int. Raining on an off. Sunny the week before. On warmer winter days don't need to use heating.									13.7
Martin and Mary	18/0 8	11am	8-10 in mornin gs prior to heating.	Aims to have @15-17 with heat pump and @ 19 if Mary needs it. Sunny days not so high.	Keep house heated for comfort and wellbeing.	Uses heaters morning and evening on sunny days and all day on cold and cloudy days. Snowfall on mountain the week before which meant rain for M & M. Wet winter. Rug up. The house gets cold without heating (but better since the insulation and curtains installed).	1.2-13.5	8.3	1.0	6.4	N, 11	12.0	NNW, 22	4.6- 13.7	
Frank	18/0 8	1:30pm	-	15 in the dining room during the interview.	Comfortable during interview. Using heater more. Felt winter	Used heater more during the week as quite cold. Had been snow in higher hills during the week.	1.2-13.5	8.3	1.0	6.4	N, 11	12.0	NNW, 22	4.6- 13.7	

					'a bit' this year. Wk of interview had been an extreme week as compared to winter so far. Liked the sun coming in as was day of int.	Intermittent sun the day of the interview and an 'ok temp. Felt the winter this year. A cold week as compared to the rest of winter so far. Sun coming into the dining area during the interview. Uses heater for 3 hours in the morning and in the evening if home (when this cold).									
Terry	20/08	1pm	@16	@13 car thermometer (car in sunny spot)	Comfortable. Using fire. Keeps active every day.	Lives higher up in the hills and it is often a few degrees cooler, but with good solar access. Had been sunny during the int day. Using wood fire every night.	4.3-13.1	8.6	0.8	8.1	NNW, 11	12.7	WNW, 13	4.6-13.7	
Henry	20/08	4pm	16 (had heater on for 15 mins since got home)	-	Was not comfortable during the interview. Felt cold. Finding the winter cold like in the 50s and 60s.	Unit cold in winter, 'leaky', not heat retentive. Can warm up the room somewhat with the oil heater. Found the winter had been cold like he remembered from the 50s/60s. Closes blinds and puts door snake across.	4.3-13.1	8.6	0.8	8.1	NNW, 11	12.7	WNW, 13	4.6-13.7	
Del & Kirk	22/08	4pm	20.75	-	Cold. Feel comfortable inside in winter generally (heaters). Kirk said that climate was ok at 2pm when going shopping but this	Was a cold house in winter before installed better heaters. Using heaters to keep the house warm. Also use electric blankets. Use heavy doona. Have difficulty with glare so pull blinds down in the middle of the day. Bedroom	4.3-13.1	8.6	0.8	8.1	NNW, 11	12.7	WNW, 13	4.6-13.7	

					afternoon was cold.	<p>window is uncomfortable as only has one layer of curtain and is large. Needed full heat on heater 5 or 6 times this winter. Around 3 on car thermometer at 8:30am, 5 at 9am and 8 at 10am in Sandy Bay and Ridgeway. Had been cold the 2 weeks before the interview.</p>									
Cara, Edward & Veronica	23/08	2:30pm	15 (had kitchen door to outside opened at the time because it was a warm / sunny day)	-	Winter 'ok'. With insulation in hadn't felt the 'bite' of cold like other years	<p>The house hadn't got below 11 in the last couple of weeks. Thought the house held its warmth well as when rose early on a cold morning, the house was not too cold. On warmer summer days the house is opened up. Not many full sunny days now (indicated by needing to boost SHW every 2 days). Sun coming in makes a difference to comfort. Using the hp and ceiling fan to heat the house in the mornings and evenings and during the day if home and need the warmth. If going out for a short time leave the heater running at lowest. Zoning according to needs for warmth. Sealed wall vents off. A warm day so had opened up kitchen door</p>	3.3-14.0	8.7	0	8.8	NNW, 13	13	NNE, 4	4.6-13.7	

						for fresh air.								
Mark	23/08	4pm	16	-	Not cold as house is heated.	Using heating when home. Had a big power bill. When sun helps comfort levels. Tas has had a much colder winter Mark said: 2-3°C less than average for winter. Day of interview was sunny in the morning and cloudy at time of interview.	3.3-14.0	8.7	0	8.8	NNW, 13	13	NNE, 4	4.6-13.7
Susan	25/08	11:30am	Went from 17-13 during int.	-	Susan felt ok at 13°C. Couldn't really warm up in this house that was house sitting.	In another house that was larger and open plan and doors had to be left open a little for a cat. Felt the house was cold and hard to heat with the heat pump. Closed up and closed curtains at night, and rugged up. Heated the house from sunset on.	3.6-15.5	8.8	0	8.6	NNW, 15	15.3	WSW, 15	4.6-13.7
Olive	25/08	2pm	-	Surface temps in dining during the interview 13.2 floor, 14.2 ceiling, 11.4 wall	Warm enough with the sun.	Finds the house is constant temperatures throughout but does warm up when the sun hits the house. Warm sun on the day if the interview. Does get cold in the house but feels ok during the day as active and morning sun comes in. Using oil heater at night in small dining/living area. Opens up curtains for the sun.	3.6-15.5	8.8	0	8.6	NNW, 15	15.3	WSW, 15	4.6-13.7
Mel	25/08	5:15pm	-	21 at dining table at interview (in	A 'lovely' day. Had been colder on previous days.	The sun had been out most of the day of the interview. Had been quite cold prior	3.6-15.5	8.8	0	8.6	NNW, 15	15.3	WSW, 15	4.6-13.7

				throw of hp) (open with living and kitchen areas)		to today. Everyday seems to have a little more light which makes her feel better. Had found winter quite cold and was looking forward to spring.								
Helen	26/08	10am	13 and went to 14 during interview	12 on surfaces outside.	Felt ok during the interview 'its not icy' but would probably have put the heater on though at this temperature. Had cold feet.	Uses heater in living room in mornings and evenings and Helen may use the heater during the day if needed. Closes up when turns on heater. Ventilates during day. Rug up. Had snow in greater Hobart to quite a low level around this date so had been a cold period around the time of the discussion.	6.4-13.8	0.1	0	8.7	NNW, 15	13.4	NW, 11	4.6-13.7
Fred & Keira	26/08	11:30am	17	-	Find that temperature comfortable.	Ceiling heat on at 18.5 during the interview. Uses heating in bedroom and spare also if needed. Closes up house generally but can't completely internally zone due to cats. 12 degrees outside (car thermometer). House in winter sometimes doesn't warm up at all. Only a couple of hours of sunlight during a winter day. Reasonably warm winter day today as some sun. Also cloudy and a strong breeze.	6.4-13.8	0.1	0	8.7	NNW, 15	13.4	NW, 11	4.6-13.7
Troy & Nat	29/08	1pm	-	@16.75 in dining	Using heating at night. Using	Using heating during the evenings and days under	5.1-16.6	8.0	0	8.7	NNW, 20	14.8	E, 11	4.6-13.7

				@16 outside on car thermometer before interview	heater on cold days under 13. On cold days noticed it was 13 in the hallway. Winter cold but likes walking outside on icy mornings.	13. Outside 16 on way to int. Sunny Day. A warm feeling day.								
Steve & Gwen	30/09	4pm	unknown	-	Weather is cold. S generally active during the day. Heat the areas of the house used in the evenings.	Use heater 5-8pm when Gwen arrives home. G uses heater in the morning occasionally. Zones according to where need the heat. Rug up. Closes up house for heating.	7.4-16.6	10.4	0.8	13.2	NNW, 26	15.9	NW, 31	7.1-16.5
Trent	08/10	10:30am	(interview elsewhere) have heaters on thermostat during day but 16-18 and if really cold up to 21	-	Was comfortable with heaters.	Use heaters to stay warm and T has a child and wife at home most days, so the heaters are on during the day. Keep the house open so the heat pumps can heat the whole house.	?	?	?	?	?	?	?	?

Table notes are at the end of the comfort perception section.

Table K-6: Indicators for householder winter comfort compared to average BOM climate data

Household Participants	Householder comments about winter comfort (too hot, too cool, unusually comfortable)	Householder comments about house performance	BOM mean min-max winter months	BOM mean sunshine hrs/day winter months	BOM rainfall mm/day winter months	BOM Climate pattern statistics 1981-2010
Cara Edward & Veronica	Winter 'ok'. With insulation in hadn't felt the 'bite' of cold like other years	The house hadn't got below 11 in the last couple of weeks. Thought the house held its warmth well as when rose early on a cold morning, the house was not too cold. On warmer sunny days the house is opened up. Not so many full sunny days now (indicated by needing to boost SHW every 2 days). Sun coming in makes a difference to comfort. Using the hp and ceiling fan to heat the house in the mornings and evenings and during the day of home and need the warmth. If going out for a short time leave the heater running at lowest. Zoning according to needs for warmth. Sealed wall vents off. A warm day so had opened up kitchen door for fresh air.	Jun 6.1-13.9 Jul 3.9-11.7 Aug 4.6-13.7	Jun 4.9 Jul 5.0 Aug 6.6	Range: Jun 0-24.6 Jul 0-16.2 Aug 0-15.0 Rain days: Jun 18 Jul 17 Aug 13 Days over 2 mm/day: Jun 2 Jul 7 Aug 5 Days over 10mm day: Jun 1 Jul 1 Aug 1 Total rain /month mm: Jun 37 Jul 48.4 Aug 38.6	Temp min-max °C Jun 5.3-12.4 Jul 4.9-12.2 Aug 5.7-13.7 Total mean rainfall mm /month: Jun 42.9 Jul 48.7 Aug 58.6 Mean daily sunshine: Jun 4.2 Jul 4.5 Aug 5.3
Del and Kirk	Feel comfortable inside (with heaters). Kirk said that climate was ok at 2pm when going shopping but this afternoon was cold.	Was a cold house in winter before installed better heaters. Using heaters to keep the house warm. Bedroom window is uncomfortable as only has one layer of curtain and is large. Needed full heat on heater 5 or 6 times this winter. Around 3 on car thermometer at 8:30am, 5 at 9am and 8 at 10am in Sandy Bay and Ridgeway. Had been cold the 2 weeks before the interview. Said in summer that house was a cold house in winter.				
Frank	Comfortable during interview. Using heater more. Felt winter 'a bit' this year. Wk of int had been an extreme week as compared to winter so far (snow to @600m). Liked the sun coming in as it was day of int.	Used heater more during the week as quite cold. Had been snow in higher hills during the week. Intermittent sun the day of the interview. Felt the winter this year. A cold week as compared to the rest of winter so far. Sun coming into the dining area during the interview. Uses heater for 3 hours in the morning and in the evening if home (when this cold).				
Fred & Keira	Finds 17 in living comfortable (ceiling heat at 18.5). House in winter sometimes doesn't warm up	Comfortable with heating. Ceiling heat on at 18.5 during the interview. Uses heating in bedroom and spare also if needed. Closes up house generally but can't completely internally zone				

	at all without heating. Only a couple of hours of sunlight during a winter day.	due to cats. 12 degrees outside (car thermometer). Reasonably warm winter day today as some sun. Also cloudy and a strong breeze.				
Helen	Would probably put the heater on when temp at 13/14°C..	Felt ok during the interview 'its not icy' but would probably have put the heater on though at this temperature. Had cold feet. Uses heater in living room in mornings and evenings and Helen may use the heater during the day if needed. Had snow in greater Hobart to quite a low level around this date so had been a cold period around the time of the discussion.				
Henry	Was not comfortable this winter. Felt cold. Finding the winter cold like in the 50s and 60s.	Unit cold in winter, 'leaky', not heat retentive. Can warm up the room somewhat with the oil heater. Found the winter had been cold like he remembered from the 50s/60s. Closes blinds and puts door snake across.				
Lorraine & Robert	Chilly in the mornings. Fairly comfortable with heat pumps on morning and night. Frosts overnight.	Felt comfortable in dining room during interview. Warm (due to heat pumps). Chilly in the morning. All three heat pumps on in dining/kitchen, living and downstairs rumpus during interview. Use them in the morning and night. Open up blinds for sunlight. Close up when heat Rug up. House stays pretty warm using the heat pumps and tends to hold after they are turned off. Surfaces in dining room were warm at 19-18°C. The heat holds in the house overnight well once the heat pumps go off. Moisture on the windows in the mornings (but no mould). More comfortable once the windows are dry. Floor in dining warm from heat pump below as well. Been frost overnight lately.				
Mark	Not cold as house is heated. Generally in heated environments during winter.	Using heating when home . Had a big power bill. When sun helps comfort levels. Tas has had a much colder winter Mark said:2-3°C less than average for winter. Day of interview was sunny in the morning and cloudy at time of interview.				
Martin & Mary	Keep house heated for comfort and wellbeing. See winter as the biggest issue in Tasmania as regards ee.	Uses heaters morning and evening on sunny days and all day on cold and cloudy days. Snowfall on mountain the week before which meant rain for M & M. Wet winter. Rug up. The house gets cold without heating (but better since the insulation and curtains installed).				
Mel	A 'lovely' day on day of interview. Had been colder on previous days.	The sun had been out most of the day of the interview. Had been quite cold prior to today. Using heaters in mornings and evenings				

	Had found winter quite cold and was looking forward to spring. Everyday seems to have a little more light which makes her feel better.	(and more than last year).				
Olive	Warm enough with the sun but does get cold in the house in winter. Feels ok during the day as active and morning sun comes in.	Finds the house is constant temperatures throughout but does warm up when the sun hits the house. Warm sun on the day if the interview. Using oil heater at night in small dining/living area. Opens up curtains for the sun.				
Steve and Gwen	Weather is cold.	Use heater 5-8pm when Gwen arrives home. G uses heater in the morning occasionally. Zones according to where need the heat. Rug up.				
Susan	Susan felt ok at 13°C. Couldn't really warm up in this house that was house sitting.	In another house was larger and open plan and doors had to be left open a little for a cat. Felt the house was cold and hard to heat with the heat pump. Closed up and closed curtains at night, and rugged up. Heated the house from sunset on.				
Terry	Last few winters had only had to light about 10-20 fires a winter, but this winter had had a fire every night. Nevertheless reported that the winter wasn't 'too bad'.	Comfortable. Using fire. Keeps active every day. Closes up at night to keep in heat.				
Trent	unknown	Warm with heaters. Use heaters to stay warm and T has a child and wife at home most days, so the heaters are on during the day. Keep the house open so the heat pumps can heat the whole house.				
Troy & Nat	Winter cold but likes walking outside on icy mornings.	Using heating at night. Using heater on cold days under 13. On cold days noticed it was 13 in the hallway. Finds that with the heating is comfortable.				
Vanessa and Paul	Finding winter much better than last winter now the renovation finished. Were in garage for part of the winter and V had chill blains and felt it was impacting their health.	A cold day the day of interview. V warm enough in kitchen at this temp. If active would turn the heater down. Wonderful compared to during renovation when in garage. V had chill blains on her hands in the garage in June. Also much warmer than prior to the renovation last winter. Sunny weeks made a big difference to comfort levels and heater us in the house.				

Table notes:

The data presented here is for the generation of indicative characteristics and trends.

See Appendix V for abbreviations and acronyms.

All indicator temperatures were taken from Hobart, Tasmania Daily weather observations of the Australian government Bureau of Meteorology (Hobart was the closest weather station to Glenorchy). <http://www.bom.gov.au/climate/dwo/index.shtml>

Interviews were approximately 1 -1.5 hours long which means that temperatures were taken at any time in the interview period.

The interviews were staged near the middle to end of each season so the participants were able to review a good amount of the season. Summer in general refers to December 07-February 08, Autumn refers to March 08-May08, Winter refers to June 08-August 08

Appendix L – Dwelling layout, neighbouring features, landscape and solar access

Dwelling plans

Notes for dwelling diagrams

The diagrams in this section describe the dwellings in plan view to show the dwelling space layout, the house orientation, positions of neighbouring houses, major vegetation and objects around the home and slope direction. The area shaded in green describes the dwelling area of the household. The areas shaded grey describe the neighbouring buildings. Rooms that were under or over the plan level shown are noted. Houses are often built on one level, but when there is a slope there may be a second story (generally under the main story) that has one or two rooms.

Abbreviations in diagrams of plans

Abbreviation	Description
B	Bedroom
Ba.	Bath
Ch.	Chicken enclosure
D	Dining area or room
E	Entry area
G	Garage (roofed and enclosed)
L	Living
K	Kitchen
La.	Laundry
N	North (associated solid line arrow denotes direction of North)
Sh.	Shed (roofed and enclosed)
St.	Study
CP or C	Car Port (has a roof, but is not enclosed)
Sl.	Slope (associated dashed line describes the downhill direction of the slope)
VG	Vegetable Garden

Diagram of the plan of
Cara, Edward and
Veronica's dwelling space
at 1:400



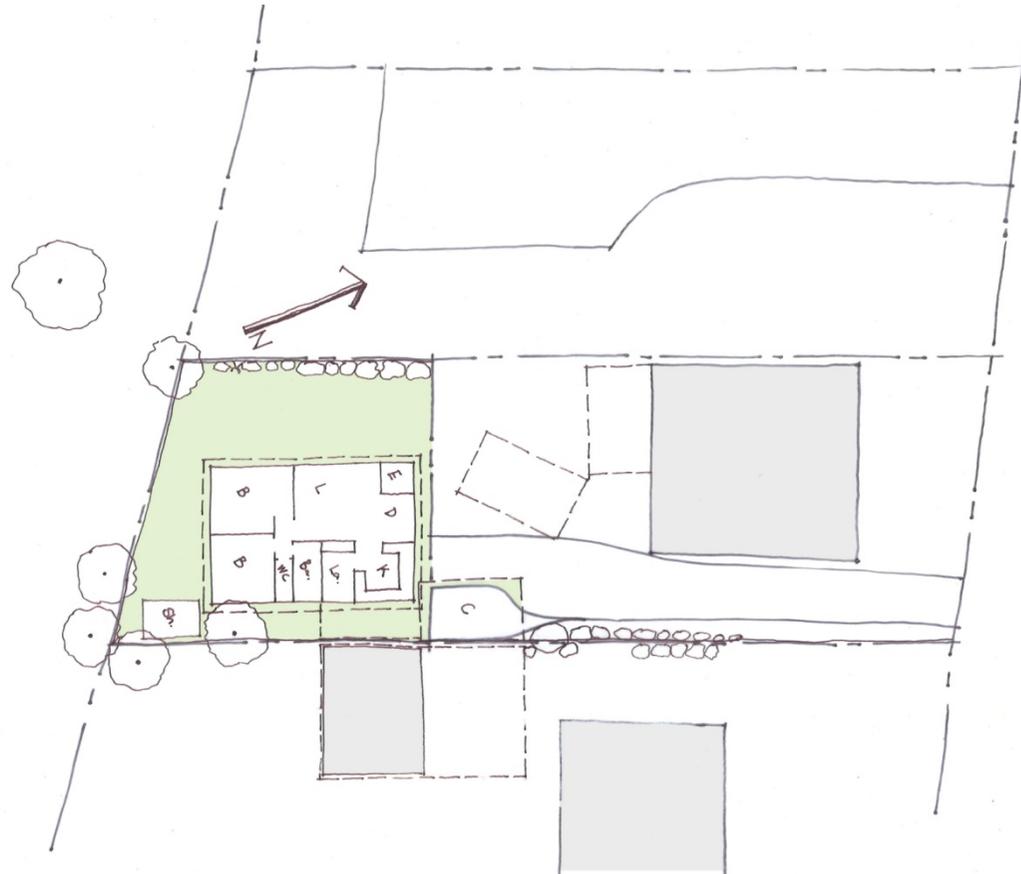


Diagram of the plan of Del and Kirk's dwelling space at 1:400

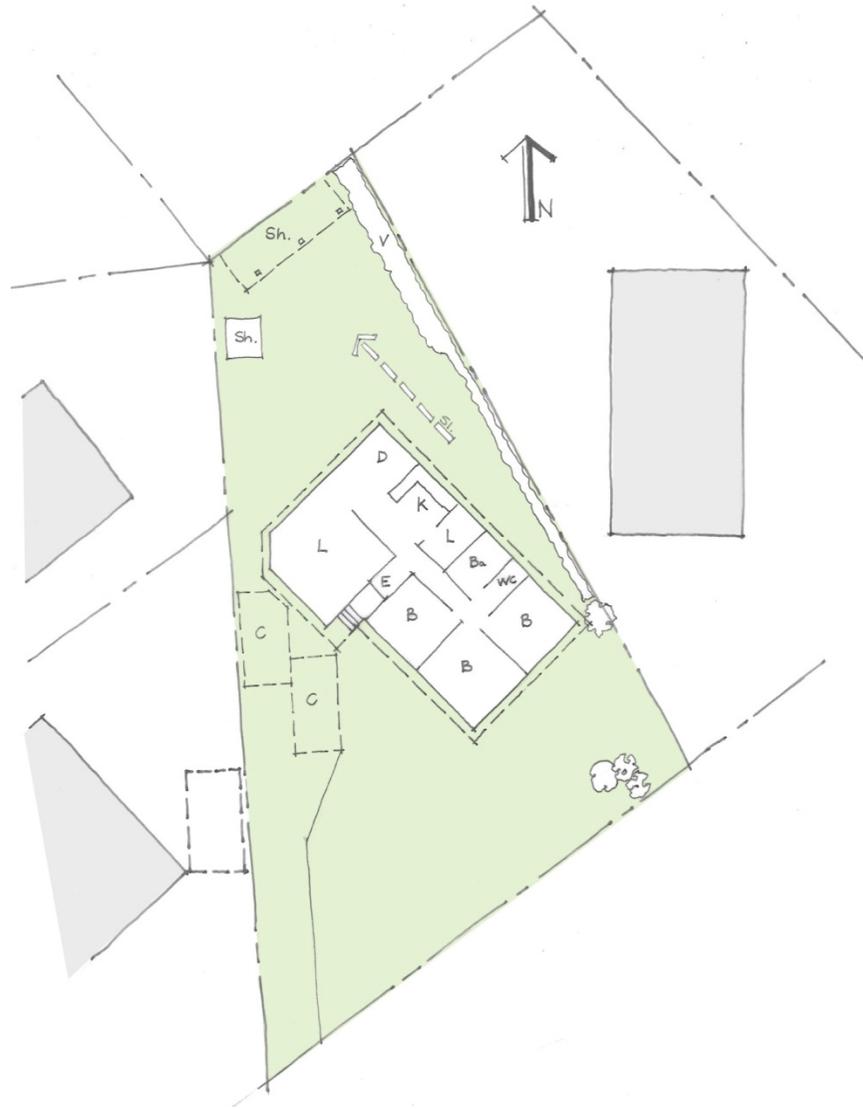


Diagram of the plan of Frank's dwelling space at 1:400

note: study/entertaining/storage area sits under D/K/L



Diagram of the plan of Frederick and Keira's dwelling space at 1:400



Diagram of the plan of
Helen's dwelling space at
1:400

Note: garage under living,
storage under western
bedrooms.

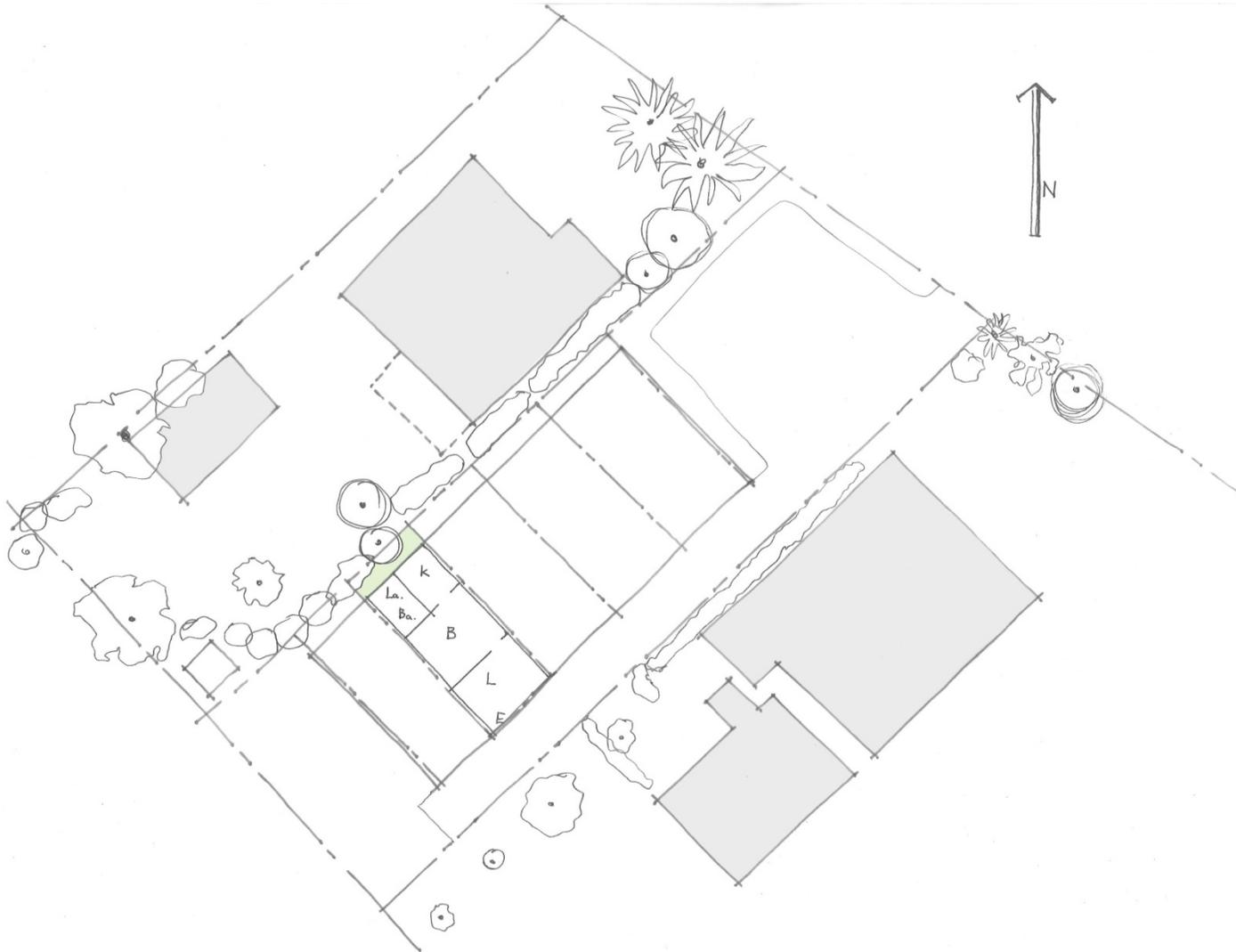


Diagram of the plan of Henry's dwelling space at 1:400

Note: the dwelling is a unit, so private outside areas is extremely small.



Diagram of the plan of Lorraine and Robert's dwelling space at 1:400

Note: Rumpus room, laundry and animal enclosure under kitchen, dining and stairs.

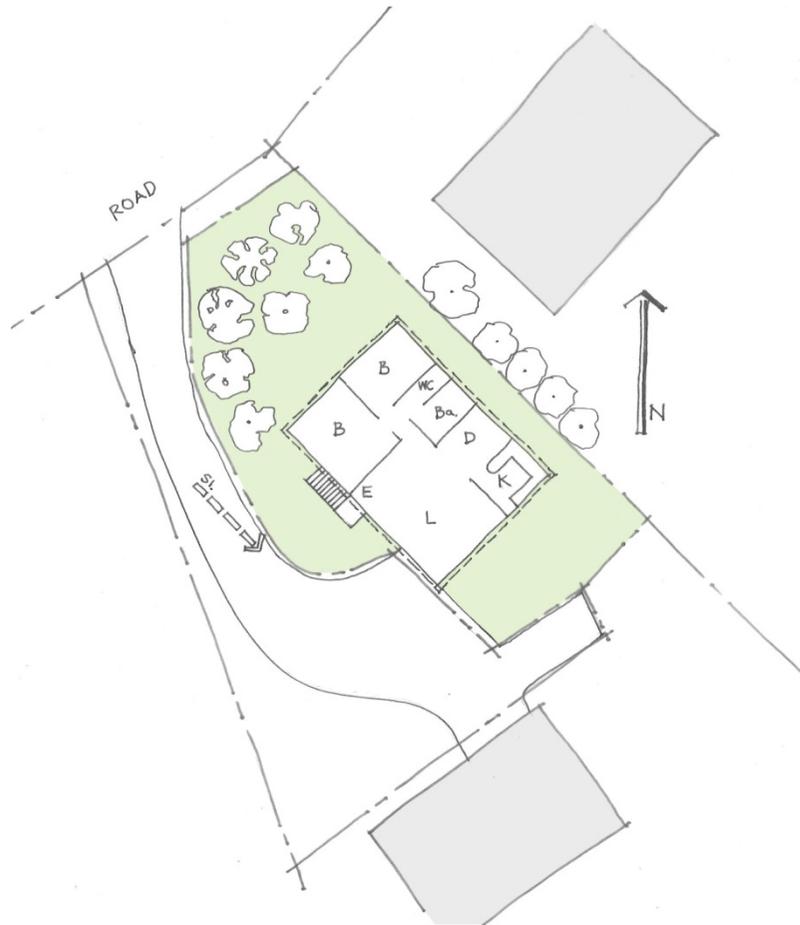


Diagram of the plan of
Mark's dwelling space at
1:400

Note: Garage under living and
kitchen, storage is under entry
space and bathroom.

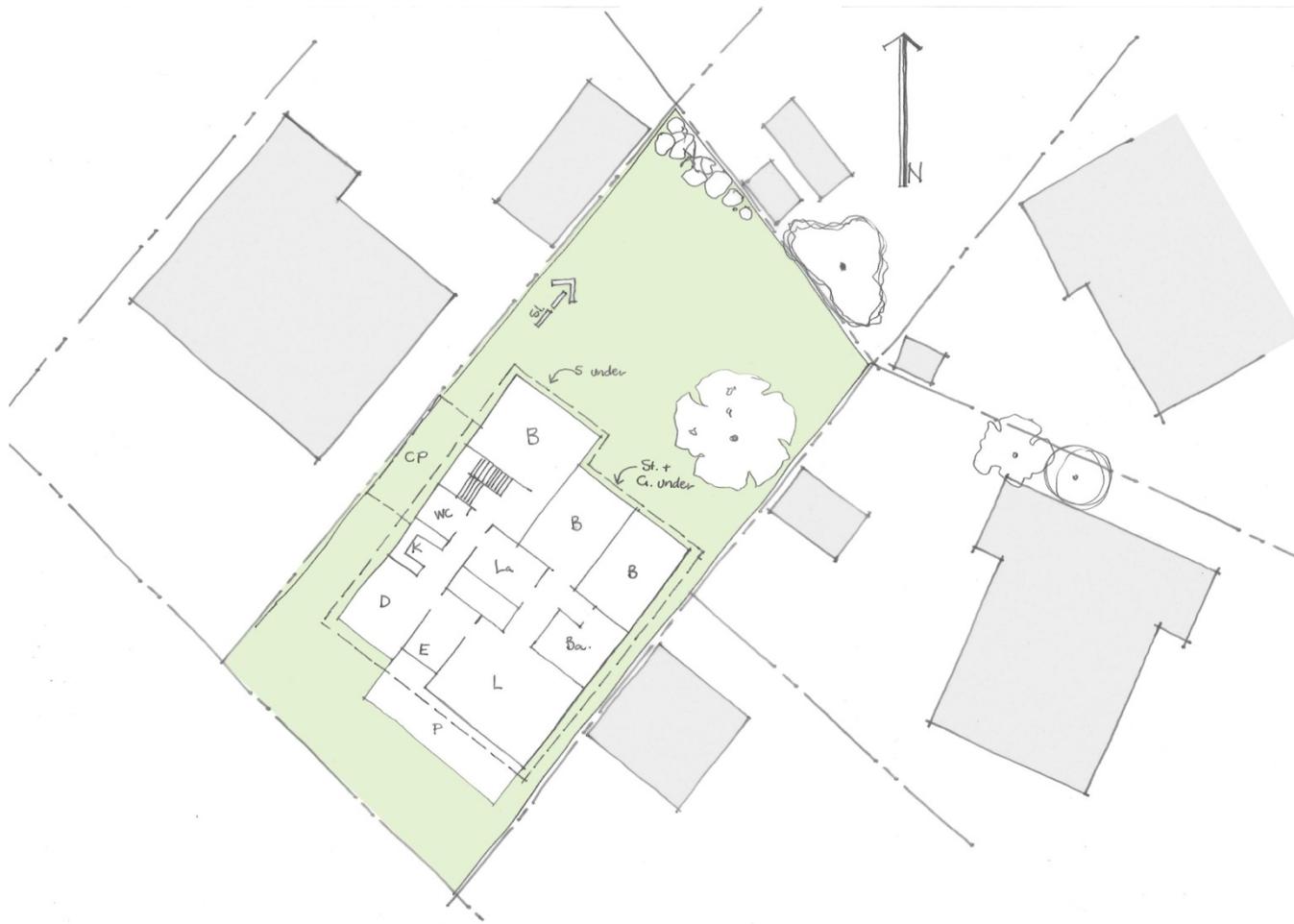


Diagram of the plan of
Mary and Martin's
dwelling space at 1:400

Note: Study under northern
bedroom, storage and garage
under middle bedroom.

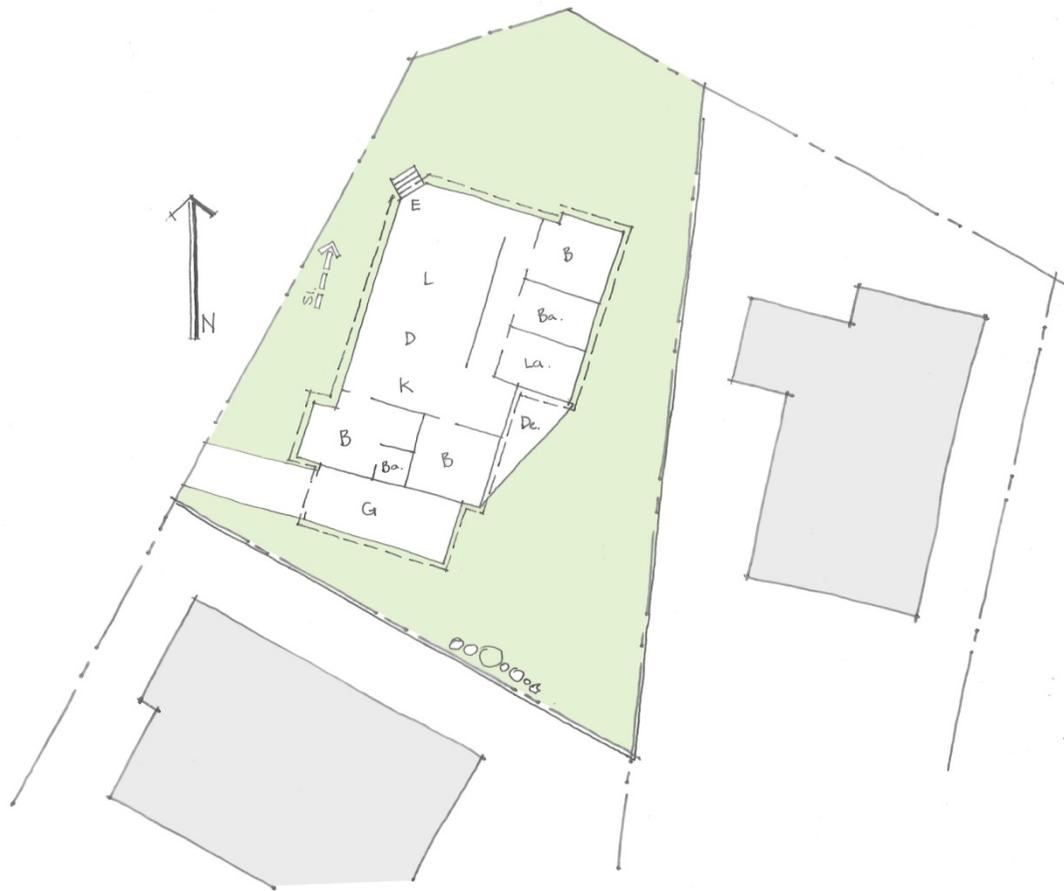


Diagram of the plan of
Mel's dwelling space at
1:400



Diagram of the plan of
Olive's dwelling space at
1:400

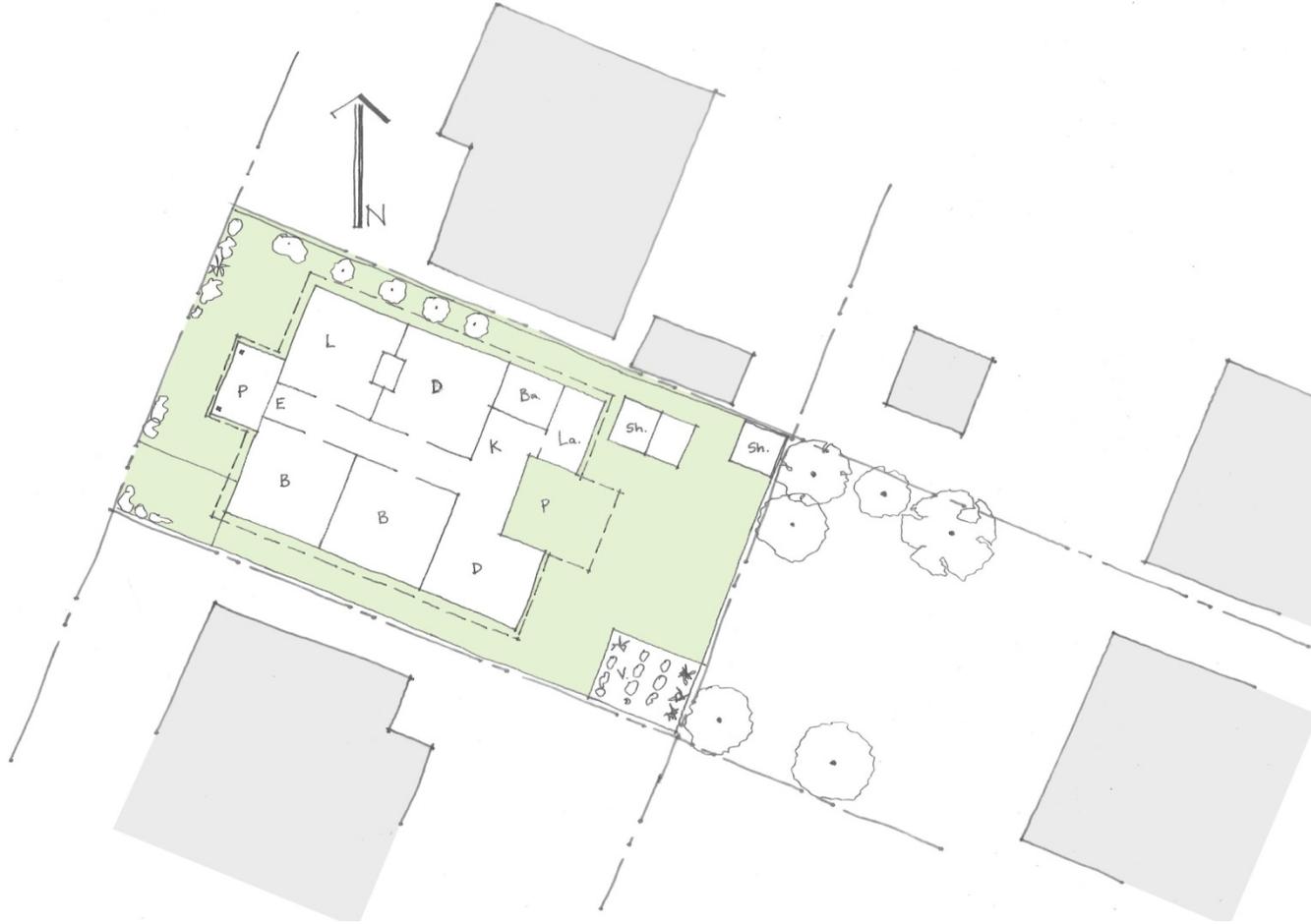


Diagram of the plan of
Steve and Gwen's dwelling
space at 1:400

Diagram of the plan of
Susan's dwelling space at
1:400

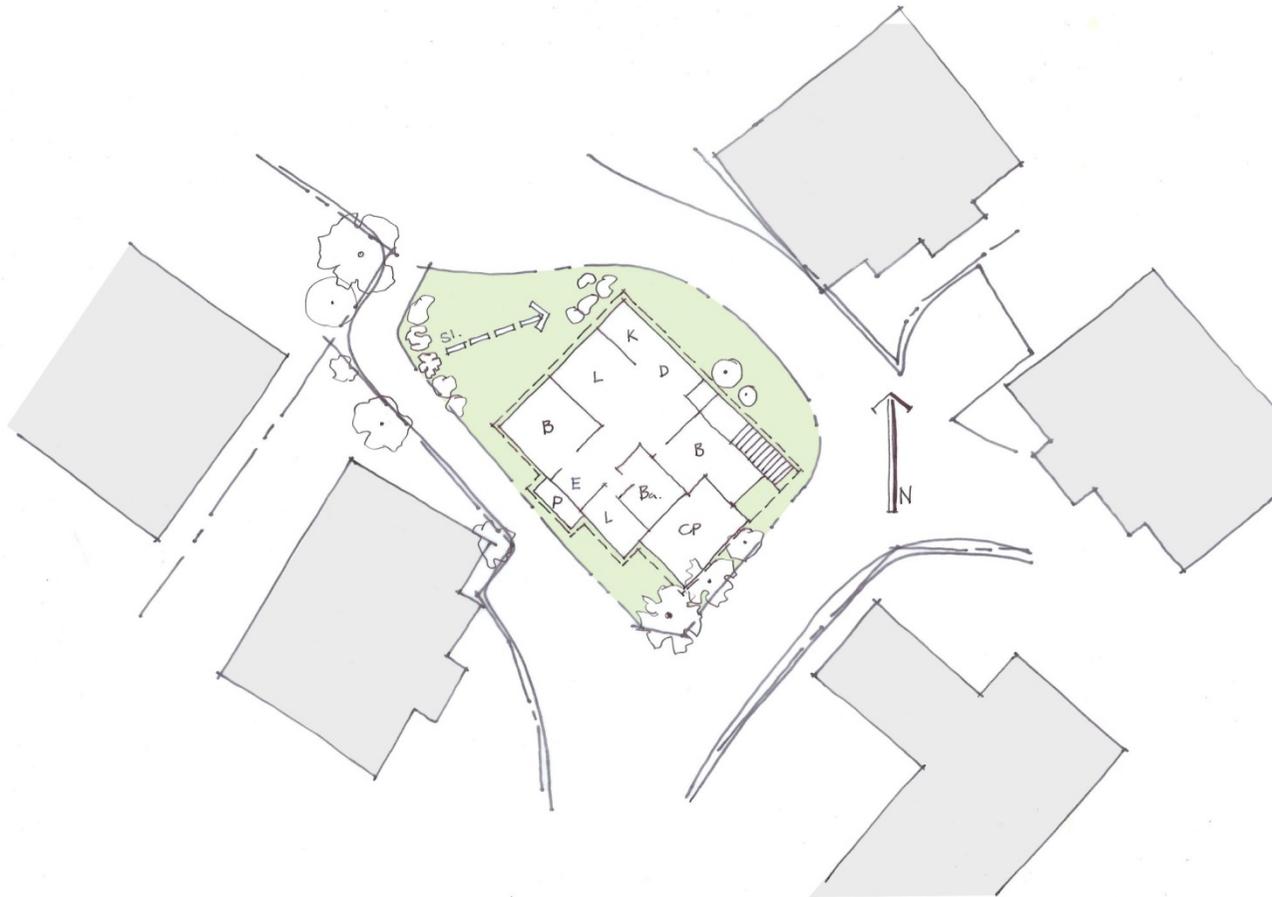




Diagram of the plan of Terry's dwelling space at 1:400

Note: There is a bedroom/rumpus space under the south eastern corner of the living area.

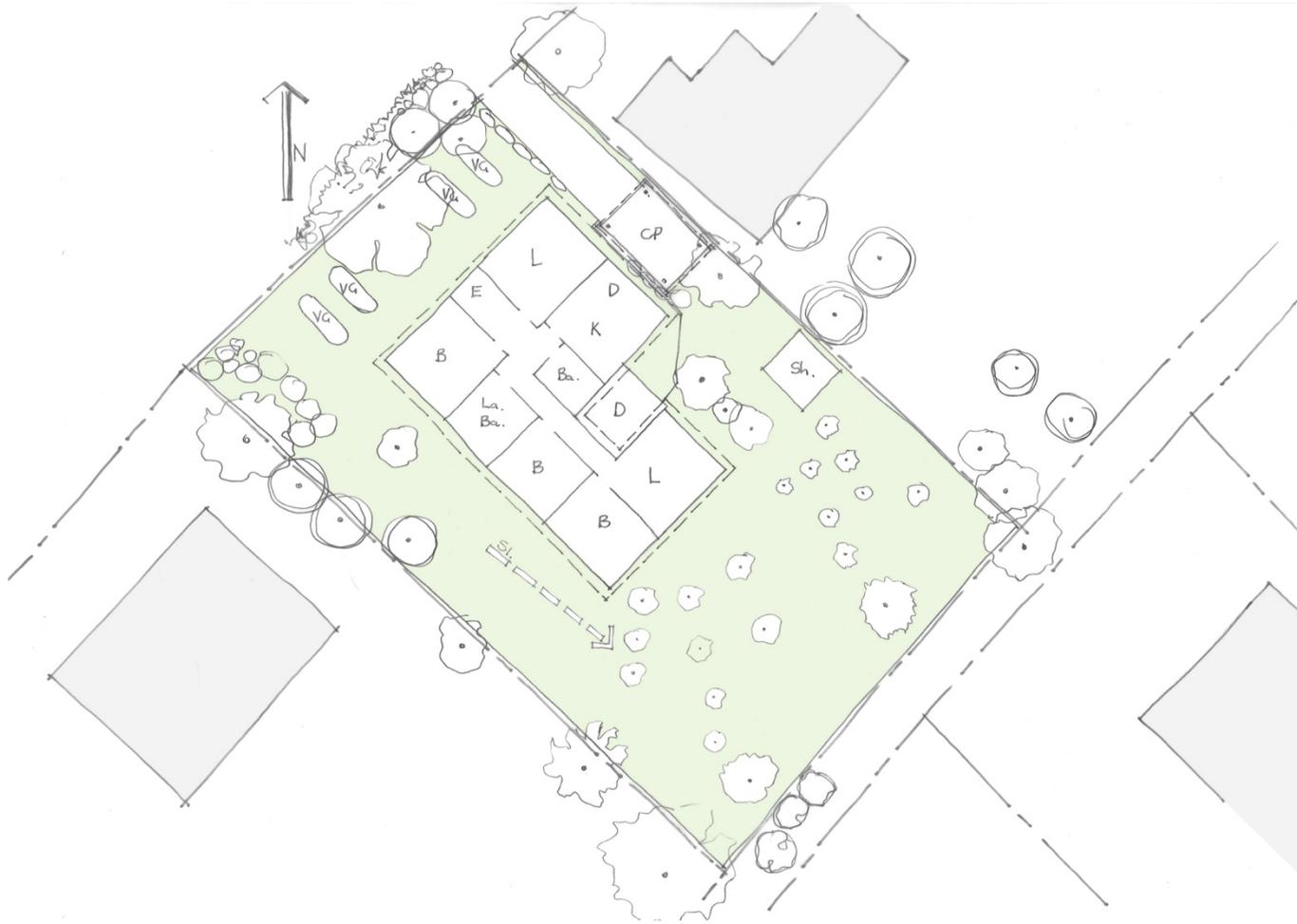


Diagram of the plan of
Trent's dwelling space at
1:400



Diagram of the plan of Troy and Nat's dwelling space at 1:400

Note: water tanks for garden watering were installed by the winter interview between the dining area, the living area and the carport.



Diagram of the plan of
Vanessa and Paul's
dwelling space at 1:400

Solar access

Table L-1: Solar access notes for each dwelling space

Information gained from householder interviews and observations made by the researcher of the dwellings.

Cara Edward & Veronica	Backyard N side, front yard and street on S side. Sun into living room, entry and one bedroom in morning, kitchen and vege garden in the backyard during day (n) and laundry and 2 bedrooms in the afternoon. Not much solar gain through windows in the morning. C, E, V think the sun makes significant difference to their comfort during the day. Overcast days don't feel like they warm up. The house has access for successful shw service and installed one.
Del and Kirk	The dwelling sits in the low central area of Glenorchy, surrounded by suburban dwellings and institutional facilities. The block of land is fairly flat, as per the surrounding area. The square block and house have good solar access. Sun comes into the kitchen in the morning, the dining room in the morning and the middle of the day, lounge room in the afternoon Solar hot water has been installed and has good solar access, although has not been very successful in reducing energy bills (the shw inefficiency is suspected as being due to other installation issues).
Frank	The dwelling sits in a suburban landscape, up near the top of a hill in a fairly exposed position. Site has good solar access due to its position high on a hill and the house sits on the flatter top of the hill. Sun travels through spare bedroom/ study in the morning, kitchen/ dining in morning and living during the day. All gardens have good solar access. Sun affects levels of use of heaters and daily living patterns.
Frederick & Keira	The dwelling is a unit, which is attached by a party wall to a neighbouring dwelling, and sits mid way up a significant sized hill. Due to the position of the neighbour, there is no solar access to living spaces in the morning. Main bedroom and living/dining get the afternoon sun. F likes to read near the window (vision impaired) due to the incoming sunlight on the western side.
Helen	The dwelling sits up a hill in and exposed position. The neighbouring suburban houses (ex housing commission as well) are well separated (partly due to the slope) and there is good solar access to the block all day. The block's longest axis sits approximately WSW to ENE (street side). The living room view and focus out to NE/E and captures morning sun, the kitchen catches western afternoon sun and the backyard also catches the afternoon sun. No windows on the northern wall.
Henry	The dwelling sits low in the flatter area of Glenorchy. The length of the unit block runs NE to SW and Henry's unit is attached to other unit by party walls. This means that H's and everybody else's units have their external walls to the SE and NW with most windows to the SE and small utility window to NW. Direct sunlight is limited and would be minimal in living area and kitchen, with no direct sun into the bedroom at all.
Lorraine and Robert	The dwelling sits on a slope above the river valleys flats of the Glenorchy area and receives good amounts of sunlight. The house sits on the slope, not tucked into it and so receives sun all day. Sun hits the kitchen/dining in morning, living room and one bedroom during the afternoon. One bedroom also receives morning sun. Kitchen /dining are ne, and the living and bedroom nw.
Mark	The property is on a NE-SW long axis and sits on a moderate to steep slope. The dwelling also sits along this axis. The kitchen is E, living S, bedrooms N and W on corners of the house. Morning sun hits the kitchen, afternoon sun hits the bedrooms. Mountain blocks late afternoon sun coming through the living room near the entry area. Through summer 10am -4pm there is no direct sunlight through windows due to trees on a neighbouring block to the north. The sun comes in directly 6-10 am and 4-7pm direct. Sun still hits the house on other surfaces though. The sloping yard sits below the street slopes to the SE and has a steep driveway. Fruit trees sit in the yard on the w side but higher than the house, at top of block and they also block sunlight into the house.
Mary and Martin	Looked for a house with solar access. The block is rectangular with a low to moderate slope and the street is on the sw. The axis of the block runs from the sw to the ne and sits near the Derwent river. The sun is not obstructed and hits the bedrooms and lower level office during the day and the dining/kitchen and then lounge in the afternoon. The backyard receives full sun for a significant amount of the day.

Mel	Single detached dwelling on an average suburban dwelling, sitting on a corner block with a low grade slope and good solar access. The e neighbour may block some early sun. House sits with living area facing the street, down a long side of the block. The orientation is ne to sw along the road. Sun hits bedroom in the morning, living during the day and in afternoon, and the main bedroom in the afternoon.
Olive	The dwelling sits next to the Derwent river and is a suburban block with minimal slope and good solar access. Sun hits the kitchen and dining and living in the e side in the morning and the dining, entry and living on the w side in the afternoon. Bedrooms sit in the W wing of the house and receive afternoon sun. Gardens include some large trees, and one is to the n of the house and blocks the northern sun significantly.
Steve and Gwen	The dwelling is on a suburban block, in the flats of Glenorchy and has good solar access. The house is square shaped house with dining facing nne and living sitting to the n with external walls facing nne and wnw. nnw to sse axis down hallway. Front Yard sits on the wnw, and the back yard ese. The backyard has good solar access in the first half of the day, and the front yard solar access in afternoon. Kitchen/laundry/backyard receive morning sun with dining receiving sun slightly later in the day and living and main bedroom receiving sun in the afternoon. Shw was installed sue to good solar access and was successful.
Susan	Susan's dwelling is a stand-alone unit on a small piece of sloping land. The house receives reasonable levels of sun throughout the day, due to being sited in a slope. The dining and kitchen are on the ne wall, the living is on nw wall with a bay window, the entry is on sw wall, and the bathroom and carport are on se wall. Sun hits the dining and kitchen during morning and living during the afternoon. The bathroom and carport have no direct sun.
Terry	Terry's dwelling is a semi-rural block that sits high in foothills of the range behind Glenorchy. The property is acres in size and the house sits in a clearing with good solar access. The house sits at the top the eastern side of a steep hill, but sits on a fairly flat spot, and sits about 480 m above sea level. The long axis of the house is north facing. Living/dining area is to the N and gets sun in the morning and during the day. The bedrooms are on the southern side of the long axis of the house and the bathroom and the laundry are at the SW end. Terry has installed solar power and has good electricity generation due to the all day sun.
Trent	Trent's house is a detached house on suburban block with neighbours on the ne, se, sw and street on the nw. The solar access is generally good, although western sun can be blocked. The kitchen has a ne aspect with morning sun, the lounge room is ne and nw with morning and afternoon sun, the entry hall has a nw aspect with afternoon sun, and the bedrooms are on the w corner with afternoon sun. There is an extension with a new living area which has a ne/e aspect, and so mainly receives morning sun. Has installed shw.
Troy and Nat	Troy and Nat's dwelling is a suburban block that sits up on the slope of a hill, near the Derwent. The block receives all day sun, partly because of the position on the slope. The sun hits the dining and kitchen during the day and the living in the afternoon.
Vanessa And Paul	Vanessa and Paul's dwelling sits on a larger-size suburban block in a flat area, near the river Derwent. The block has all day access to the sun. Bedrooms receive morning sun, the kitchen/dining receives midday and afternoon sun and other bedrooms receive afternoon sun. Some sun is blocked by the neighbouring houses in the morning and afternoon. The solar access to their roof allowed them to install a shw.

Note: Only Frederick/Keira and Henry's dwelling spaces appear to have significantly limited sunlight access. In 1999, 77 per cent of Tasmanian householders respondents to an ABS survey reported that their living areas received winter sunlight. The survey did not specify, however, how many hours of sunlight the living area received and no information was given on what other areas of dwellings had access to sunlight (Australian Bureau of Statistics 2002: 204). Participants of this study appear to be receiving reasonable levels of sunlight to their dwellings.

Appendix M – Thermal resistance tables

Insulation status and dwelling age in participant dwellings

Table M-1: Insulation status of the Glenorchy dwellings

Household / participants	Type of insulation	Where installed	Year insulation installed	Thickness	Age/era of house	Moved into dwelling	Comments	Insulation effect assumed (low-mid-high)
Cara, Edward & Veronica	polyester (recycled) batts	ceiling	2008	new R3.5 on top of old R1.5, on a 10 mm foam board ceiling	c. 1950s	c. late 2005	From Victorian supplier. Felt difference when installed and it allowed hp heat to flow further through the house. Installed by occupants gradually over a month. Had an accident and came through ceiling whilst installing the insulation. Knew more than most participants about the status of their insulation. Thick lathe and plaster in the walls which the participants report has some insulating effects. Bought house 2006. Noticed that could heat house more effectively with same amount of energy after installed. Installed after bought the SHW with the GERP rebate. If no GERP rebate would have installed insulation first as see that it is a basic to energy efficiency. The old R1.5 in the ceiling is assumed to be less resistant with age.	ceiling - high walls - low floors - low
Del & Kirk	fibreglass 'pink' batts	ceiling	2003	assume R2.5	c.1994/5	c. 1998	Not able to climb into roof and small ceiling space so were not able to check the insulation when installed. Work has been done in the ceiling cavity since so they suspect the insulation has been disturbed. Bought house a couple of years after it was built.	ceiling - low- mid walls - low floors - low?

Household / participants	Type of insulation	Where installed	Year insulation installed	Thickness	Age/era of house	Moved into dwelling	Comments	Insulation effect assumed (low-mid-high)
Frank	cellulose insulation in original house pink batts laid in extension	ceiling (original and extension) & walls (extension only)	1973 cellulose 1989 pink batts extension	ceiling – assume 100mm cellulose walls- assume R1.5	c.1963 Extended c. 1980s	c. mid 1970s	F's partner bought house 1971 from housing department. Cellulose insulation was laid through the older section of the house and pink batts were laid through the extension done in 1989. Frank knows that there are birds living in the cellulose!	Original ceiling - low walls - low floors - low extension - mod
Frederick & Keira	batts	ceiling (over ceiling heating system)	Pre 2007 (unsure)	newer batts r 3.5 over thinner existing batts – assumed r 1.0.	c. early 1980s?	c. early-mid 2000s	Installed new batts when installed ceiling heat. Insulation must be laid when ceiling heat is laid.	ceiling - high walls - low floors - low
Helen	batts (glass?)	ceiling	2002	assume r 2.5	originally housing department c. 1960/early 70s?	c. late 1990s	Batts in roof space now but have been blown around by wind and have also been disturbed when took the fireplace out (so there are gaps). Planning to install more when can (but may not be soon). Insulation may cause the heat to catch in the house in summer (which makes the house overheat).	ceiling – mod? walls - low floors - low
Henry	Presumed none-	-	-	-	unknown but possibly c.1970s ?	c. 2007	Presumed there is no insulation as there is no evidence of any changes being made to the building since it was built. Has lived in the unit since @ 2007.	ceiling - low walls - low floors - low
Lorraine & Robert	pipied in – cellulose insulation ?	ceiling	installed on or before 2002	assumed 100mm deep	c. 1950s or 60s underfloor extension c. ?	c. 2000	Couldn't remember when insulation was installed. Thinking about insulating under floor of dining/living. Has access as rumpus area and also underfloor space to access. Been in this house since @2000.	ceiling - mod walls - low floors - low
Mark	Fibreglass batts and	ceiling – insulation	installed when house built	assume r1.5	c.1995/6	c.1995	Presumed insulation installed, as more modern construction methods would have been used. Mark	ceiling – low-mod

Household / participants	Type of insulation	Where installed	Year insulation installed	Thickness	Age/era of house	Moved into dwelling	Comments	Insulation effect assumed (low-mid-high)
	sisalation	walls - sisalation	@1995/6				has been in this house since it was built @ 1995/6.	walls - low-mod floors - low
Martin & Mary	'pink' batts and batts (general)	ceiling and walls (old insulation only)	New laid in ceiling in 2008, original laid @ 1960s when house built in ceiling and walls	original insulation around r1.5, new insulation much higher r?. assume r 4.0	c. late 1960s	c.mid 2000s	Used GERP rebate for insulation in ceiling. Had to remove the roof for the insulation to be laid. The roof has since leaked on numerous occasions. Tried to engage the company who laid to help fix the problem, but eventually had to go to their insurance company. The moisture leaking has been a significant problem. Original insulation thin and had moved.	ceiling - high walls - low-mod floors - low
Mel	batts?	ceiling? walls?	Installed when house built @ 2005 ?	? assume r 2.5	c.2005	c. 2006	Bought house when just built (was a spec house). Assumes there is insulation in the ceiling but not sure as cannot check herself but thinks that there is as there is a temperature difference between inside and outside. Assumes there is no wall insulation. This house would have been under 3 star ee legislation?.	ceiling - mod-high walls - mod? floors - low
Olive	cellulose insulation fibre	ceiling	early 2008	assume 100mm thick (r 2.56)	c.1950s?	c. 1995	Installed by trades and with GERP rebate. Been in the house since approx. 1995. Olive was not sure of the effect the insulation had. Small roof space so she hasn't looked in the roof space.	ceiling - high walls - low floors - low
Steve & Gwen	no insulation	-	-	-	c.1930s or 40s	c. 2006	Planning to install in ceiling. Thinks that lathe and plaster walls assist to insulate somewhat.	ceiling - low walls - low floors - low
Susan	thin batts, type ?	ceiling	installed @1987	thin - assume r 1.0	c.1987	c.1996	Handyman let her know that the insulation was moved around and therefore having less effect when he was in the roof for another purpose. Susan	ceiling - low walls - low floors - low

Household / participants	Type of insulation	Where installed	Year insulation installed	Thickness	Age/era of house	Moved into dwelling	Comments	Insulation effect assumed (low-mid-high)
							cannot get in the roof herself. Planning to install more insulation soon. Been in this townhouse since @ 1996/7.	
Terry	cellulose insulation (ceiling) thin foam insulation - floors	ceiling floor walls	ceiling - when constructed walls - insulating batts floors - recent thin foam(c.2008)	assume 100mm cellulose. walls assumed 70mm, r1.5. foam insulation meant to be thin, assume r 1.0.	c.mid 80s ? underfloor extension c. 2000s	c. late 1980s	Noticed the difference when installed the underfloor insulation. Terry does not think that the ceiling insulation was very effective.	ceiling - mod? walls - low- mod floors - mod
Trent	ceiling - batts wall - batts (1/3 of house) floor - sisalation stapled under kitchen	all ceiling 1/3 house in walls (extension) under floor in kitchen	ceiling and extension walls 2007 kitchen floor 2008	batts in ceiling assumed r 3.0. walls assume 70mm r1.5. kitchen - sarking	c. 1950s extension c. 2007	c. late 1990s	Ceiling insulation laid in entire ceiling. Wall insulation installed in about 1/3 of house when the extension built. Floor is insulated under kitchen so far (sisalation-like material that is stapled on). Under the kitchen is one of the most reactive sections of the house and therefore gets cold. Has done the easy section, the rest of the underfloor section is moderately difficult to access, partly as it is used for storage. Double glazed windows in extension. Roof all insulated. Roof itself has gaps - can see daylight through (so stays reasonably cool). In extension has fully insulated walls. Floor insulation has taken away some of the noise and blocked up some of the floor gaps in what is the coldest and most reactive room in the house.	ceiling - mod- high walls - low/ mod floors - low
Troy & Nat	ceiling - batts	ceiling	1998	70mm, so assume r1.5	c.1960s	c.1967	Installed the ceiling insulation at the time bought a heat pump because heard that the insulation would help with energy efficiency. The roof space was quite small so Troy had put some insulation in	ceiling - mod walls - low floors - low

Household / participants	Type of insulation	Where installed	Year insulation installed	Thickness	Age/era of house	Moved into dwelling	Comments	Insulation effect assumed (low-mid-high)
							himself and then stopped and had someone install the rest in the ceiling.	
Vanessa and Paul	ceiling – batts extension walls - batts	ceiling extension walls	2008	ceiling r3.8 walls - @70mm, so assume r 1.5	c. 1940s extension c. 2008	c. 2003 ?	The new extension and the new garage were insulated, and insulation was being installed in ceilings in other areas of the house. No floor insulation was laid. Laid with renovation in ceiling and in garage. At win int V and P had laid most of the insulation, but the living room ceiling hadn't been done yet. R3.8. In walls of extension, original walls double brick.	ceiling - high walls - mod floors - low

Table notes:

Table M-1 (above) describes insulation material in participant's dwellings that is installed to add insulating affect to the building shell (of structure and claddings). Table M-2 describes the overall heat resistance of the building shell and added insulation.

In most circumstance participants provided incomplete information about the insulation in their dwellings which has meant that assumptions have had to be made in the tables. Where an assumption has been made it has been noted in the tables. Assumptions are based on the information that was provided as well as knowledge and understanding of insulation requirements and installations typical of various eras of construction.

Resistance figures in this table are given as if the insulating materials were installed new. In table M-2 a reduction in resistance has been assumed for older or ineffectively laid insulation materials.

Resistance of building elements in participant dwellings

Table M-2: Approximate resistance values in building skin (for indicative purposes).

Building elements with insulation levels that match or exceed the requirement of new build housing in the BCA is coloured orange.

Building elements with less than the amount of insulation required for new build housing in the BCA is coloured blue.

Elements of the building that were not covered by the BCA at the time of this analysis are coloured with green hatch.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
Cara, Edward & Veronica	Roof/ceiling	Tiles + corrugated iron + timber frame [0.4]+10 mm foam board (0.3) + insulation (R3.5+R1.0 (was R 1.5))	0.40 + 0.20 + 4.5	5.2	4.3	Adaptations – re-roofed, insulation added	High resistance to heat flow. The old R 1.5 would now be less resistant with age and gaps, so the R figure is assumed to be higher than actual performance levels.
	walls	Weatherboard + lathe and plaster	0.47	0.47	2.4	No	Difficult to access to insulate.
	floor	Suspended timber + timber frame (open sub-floor with skirt) + carpet	0.7	0.7	1.5	No	Difficult to access underfloor. Replacing flooring not seen as a priority.
	underfloor	Brick plinth enclosing entire underfloor	See floor	-	-	No	Considered in floor resistance .Works in conjunction with floor elements. Difficult to access.
	windows	Single glaze (timber frame) + curtains (drapes) + pelmets	0.21 + 0.33	0.54	0.56-0.7	Adaptations in train at 2008 – pelmets being moved closer to the window frame.	

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
Del & Kirk	Roof/ceiling	Corrugated iron + sarking with foil + plaster board + insulation batts (R 2.0)	0.38 + 2.0	2.38	4.3	Insulated c.2003	Assumed R value as information lacking. D and K think the insulation has been moved by trades, therefore has a reduced R value (from 2.5 to 2.0). Assumed unventilated.
	walls	Brick veneer + timber frame + plasterboard + sisalation?	0.47	0.47	2.4	no	Assume brick hard up to timber frame.
	floor	Concrete slab (uninsulated) + carpet	0.65	0.65		no	On ground, no insulating skirt or insulation laid in slab. Currently no resistance aim for this situation – see notes on floors below.
	windows	Single glazed (aluminium frame) + curtains (drapes) + blinds no pelmets	0.16 + 0.06 + 0.03	0.25	0.56-0.7	Blinds/curtains/exterior blinds c. 2003	Replaced vertical blinds with blinds and curtains and installed exterior blinds.
Frank	roof / ceiling main level original	Tile + timber frame+ plasterboard + cellulose insulation	0.40 + 1.5	1.9	4.3	Cellulose added 1973	Cellulose was installed 1973, so it is assumed its performance has significantly reduced (from 100mm to 60mm).
	walls main level original	Brick + weatherboard + timber frame + plasterboard	0.47 + 0.3	0.77	2.4	Brick added when extension constructed 1989	
	floor main level original	Timber planks + timber frame + carpet	0.7	0.7	1.5	no	Date of carpet installation unknown. Enclosure of brick when walls reclad 1989.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	roof / ceiling main level extension	Tile + timber frame+ plasterboard + pink batts	0.40 + 1.0	1.45	4.3	Extension, including insulation 1989	Extension done 1989. Assumed pink batts fibreglass and that their effectiveness has reduced somewhat (from R 1.5 to 1.0).
	walls main level extension	Brick + timber frame + pink insulation batts + plasterboard	0.55 + 1.0	1.55	2.4	Extension, including insulation 1989	Assume R1.5 batt insulation due to time put in. Assume that the resistance has reduced somewhat. (R1.5 to 1.0)
	floor main level extension	Timber planks + carpet (or lino)	0.7	0.7	1.5	Extension 1989	With ceiling element below
	ceiling lower level (extension)	Timber frame + timber planks + plasterboard	0.47	0.47	1.5	Extension 1989	With floor element above
	walls lower level (extension)	Brick + timber frame + pink batts + plaster board	0.55 + 1.0	1.55	2.4	Extension 1989	Assume R1.5 batt insulation due to time put in. Assume that the resistance has reduced somewhat. (R1.5 to 1.0)
Frank	floor lower level (extension)	Concrete + carpet	0.65	0.65	1.0 edging insulation	Extension 1989	Underfloor heating piping – not sure if insulated. See notes on floors below. BCA requires resistance in slabs with heating.
	Underfloor (under main level, original)	Timber planks + timber frame, brick enclosing underfloor space	See floor		-	Enclosure of brick when walls reclad 1989	Considered in floor resistance. Suspended but within approx. ½ m of the ground. Higher resistance required in BCA due to underfloor heating.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	windows	Single glaze (aluminium frame) + some curtain coverage (not comprehensive) no pelmets	0.16 + 0.03	0.19	0.56-0.7	Original timber framed windows replaced when house extended 1989.	
Frederick & Keira	Roof / ceiling	Tile + sarking + timber frame + insulation batts + ceiling heat panels + plasterboard	0.40 + 3.5 + 0.8	4.7	4.3	Ceiling heat and batts installed - pre 2007, but not very old at interview. Thin batts put in by a previous owner.	Assumed sarking installed when built. Assumed older 'thin' batts are R1.0 and the effectiveness reduced to 0.8. Insulation in ceiling due to ceiling heat.
	walls	Brick veneer + timber frame + plaster board	0.55	0.55	2.4	no	One party wall shared with neighbouring unit.
	floor	Timber on piers	0.7	0.7	1.5	no	
	Windows general	Single glazed (aluminium frame) + curtains (drapes) no pelmets	0.16 + 0.06	0.22	0.56-0.7	See window retrofit below	
	Windows living and main bed retrofitted	Single glaze (aluminium frames) + acrylic double glaze retrofit+ curtains (drapes) No pelmets	0.33 + 0.06	0.39	0.56-0.7	Window retrofit on selected windows 2008.	The difference pre and post window renovation was reported as significant.
	Underfloor	Brick walls enclose underfloor space	See floor	-	-	no	Considered in floor resistance
Helen	Roof / Ceiling main level	Corrugated iron + timber frame + batts + plasterboard (or fibreboard)	0.38 + 2.0	2.38	4.3	Glass batts installed 2002	Assume batts installed at 2.5. Batt's have been blown around in roof, so assume an insulation loss (R 2.5 to 2.0).

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	Walls main level	Brick veneer + timber frame + plaster or fibro board	0.55	0.55	2.4	no	
	Floor main level	Timber planks, timber and steel frame + carpet (tiles in kitchen)	0.7	0.7	1.5	no	Enclosed underfloor with brick walls. Floor exposed to underfloor spaces, which are quite large (due to slope). Resistance includes ceiling below.
	Ceiling lower section	Timber planks + timber and steel frame + carpet	See floor main level	-	-	no	Resistance includes floor above
	Walls lower section	Brick with brick piers	0.30	0.30	2.4	no	
	Floor lower section	Paving on ground	?	-	-	-	This section of the house is a garage. Currently not specified in the BCA.
	Underfloor (of main level)	Brick walls enclose the underfloor space.	See floor 0.30	0.30	-	no	Enclosed underfloor with brick walls. Underfloor spaces, large volume due to steep slope under the house.
	windows	Single glaze (steel frame) +curtains (weave) + pelmets	0.16 + 0.11	0.27	0.56-0.7	Curtains	
Henry	roof / ceiling	Corrugated iron + timber or steel frame + plasterboard	0.35	0.35	4.3	no	Assume no sarking, or fatigued sarking. Flat roof.
	walls	Concrete block + paint	0.53	0.53	2.4	no	This R value assumes that there is a framed and lining as in the BCA.
	floor	Concrete slab (uninsulated) + covering	0.65	0.65	-	no	On ground, no insulating skirt or insulation laid in slab. Currently no resistance aim for this situation in the BCA – see notes on floors below.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
Henry	windows	Single glaze (timber frame (?)) + loose blinds (venetian and not covering) No pelmets	0.21 + 0.0	0.21	0.56-0.7	Has attempted to reduce the gaps in the vertical blinds.	
Lorraine & Robert	Roof / Ceiling main level	Corrugated iron + timber frame + cellulose insulation + lathe and plaster or fibro board	0.38 + 2.00	2.38	4.3	Cellulose pre 2002 (in before purchased the house)	Assumed some loss of insulating effect of the cellulose as compacts (100mm down to 80mm).
	Walls main level	concrete feature block + timber frame + lathe and plaster or fibro board	0.53	0.53	2.4	no	
	Floor main level	Timber + timber frame + tiles (kitchen) or carpet (living)	0.70	0.70	1.5	Flooring has been changed in various areas. Tiled kitchen after moved in.	
	windows	Single glaze (timber frame) + blinds or curtains No pelmets	0.21 + 0.03	0.24	0.56-0.7	no	Window coverings varied but not heavy drapes.
	Ceiling lower section	Timber planks + tiles + timber or steel frame + plasterboard	See floor main level	-	-	Renovated into living space post original house	Considering adding resistance to floor
	Walls lower section	Concrete block	0.41	0.41	2.4	Renovated into living space post original house	
	Floor lower section	Concrete (uninsulated)	0.55	0.55		Renovated into living space post original house	On ground. Currently no resistance aim for this situation in the BCA – see notes on floors below.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	Underfloor (of main level)	Enclosed by concrete feature block	See floor	-	-	no	Considered in floor resistance
Mark	roof / ceiling living area	Corrugated iron + timber frame+ insulation batts + plasterboard + sarking	0.38 + 1.25	1.63	4.3	No insulation in at 1995/6	Assumed sarked due to era built. Assumed R1.5 batts with reduced effectiveness to 1.25.
	Walls living area	Brick veneer + timber frame + sarking + plaster board	0.68	0.68	2.4	no	Assumed sarked due to era built
	Floor living area	Timber frame + chipboard + carpet (some tiled)	0.7	0.7	1.5	no	
	Ceiling garage under	Carpet + timber or steel frame + chipboard	See floor living area	-	-	no	
	Walls garage under	Brick with brick piers	0.30	0.30	2.4	no	
	Floor garage under	Concrete (uninsulated) (no covering)	0.55	0.55		no	On ground, no insulating skirt or insulation laid in slab. Currently no resistance aim for this situation in the BCA – see notes on floors below.
	Underfloor (of main level)	Enclosed by brick walls	See floor	-	-	no	Considered in floor resistance
	windows	Single glazed (aluminium frame) + curtains (drapes) + pelmets	0.16 + 0.33	0.49	0.56-0.7	no	
Martin & Mary	roof /ceiling main level	Cliplock metal + timber frame + glass batts + plasterboard	0.35 + 3.5	3.85	4.3	Glass fibre pink batts installed 2008	There have been problems with the roof leaking so the glass fibre batts will have been less effective. Assume R4.0 reduced to 3.5.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	walls main level	Brick veneer + timber frame + insulation + plasterboard	0.68 + 1.0	1.68	2.4	no	Insulation installed when house built. Insulation would have been thin to fit in the wall gap and have assumed insulating loss (R1.5-1.0)
	floor main level	Suspended timber planks + timber frame +carpet (or linoleum)	0.70	0.70	1.5	Assumed carpets upgraded at some point	
	ceiling lower level	Suspended timber planks + timber frame +carpet + plaster board	See floor main level	-	-	no	
	walls lower level	Brick with brick piers + plasterboard	0.33	0.33	2.4	no	Curtain added to enclose underfloor space from main level. Curtains and pelmets added to windows 2008.
	floor lower level	Concrete (uninsulated) + covering	0.65	0.65	-	no	On ground, no insulating skirt or insulation laid in slab. Currently no resistance aim for this situation in the BCA- see notes on floors below.
	underfloor (of main level)	Enclosed with brick walls	See floor	-	-	no	Considered in floor resistance. Large volume due to slope. Some area concreted and used for storage.
	windows	Single glazing (aluminium frame) + venetians + curtains (drapes) + pelmets	0.16 + 0.33	0.49	0.56-0.7	Curtains and pelmets added 2008	
Mel	Roof / ceiling	Corrugated iron + timber frame + sarking + insulation (?) + plasterboard	0.38 + 3.0	2.85	4.3	no	2005 construction so assume R3.0 standard for ceiling insulation as required in the BCA.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	walls	Brick veneer + timber frame + sarking + plasterboard	0.55 + 1.0	1.55	2.4	no	2005 construction so assume R1.0 standard for wall insulation as required in the BCA.
	floor	Timber planks + timber frame (tiles in some places)	0.70	0.70	1.5	no	
	windows	Single glazing (aluminium frame) + vertical blinds No pelmets	0.16 + 0.0	0.16	0.56-0.7	no	
	underfloor	Enclosed by brick walls	See floor	-	-	no	
Olive	roof / ceiling	Clip lock metal + timber + cellulose insulation + fibro board	0.35 + 2.56	2.91	4.3	Insulated late 2007	Assume 100mm thick cellulose which is assumed R2.56.
	walls	Concrete feature block + internal layer, presumed fibro on frame	0.53	0.53	2.4	no	
	floor	Timber planks + timber frame + carpet (brick-enclosed underfloor)	0.70	0.70	1.5	no	Underfloor enclosed
	underfloor	Enclosed with brick	See floor	-	-	no	Suspended floor 0-900mm from the ground to the floor.
	windows	Single glazing (metal frame) + blinds and light curtains No pelmets	0.16 + 0.03	0.019	0.56-0.7	Curtains/blinds added / replaced	
Steve & Gwen	roof / ceiling	corrugated iron + timber frame + lathe and plaster	0.38	0.38	4.3	no	

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	walls	Weatherboard + timber frame + lathe and plaster	0.47	0.47	2.4	no	
	floor	Timber planks + timber frame + carpet (enclosed underfloor)	0.70	0.70	1.5	no	
	underfloor	Brick plinth that encloses the underfloor area	See floor	-	-	no	
	windows	Single glaze (timber frame) + curtains (drapes) No pelmets	0.21 + 0.06	0.27	0.56-0.7	curtains	
Susan	Roof / ceiling	corrugated iron + timber frame + sarking + thin fibre glass batts	0.38 + 0.5	0.88	4.3	no - insulation in prior to S moving in @ 1996.	Assumed sarking. Insulation thin, has moved and is having less effect so assume now R0.5 (from R 1.0).
	walls	Brick veneer + timber frame + sarking + plaster board	0.55	0.55	2.4	no	
	floor	Concrete (suspended) + carpet	0.65	0.65	1.5	no	
	underfloor	Enclosed by brick wall	See floor	-	-	no	
	windows	Single glazing (aluminium frame) + curtains (drapes for winter) + pelmets	0.16 + 0.33	0.49	0.56-0.7	Curtains	
Terry	Roof / ceiling main level	Corrugated iron + timber frame + reflective sarking + cellulose insulation + timber cladding	0.38 + 2.0	2.38	4.3	Plan to upgrade insulation	Terry built this and insulated in the beginning. Assume cellulose 100mm thick and somewhat reduced over time to 80mm.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	walls main level	Timber cladding + reflective sarking + timber	0.47	0.47	2.4	no	Terry built as he wanted it.
	floor main level	Timber + insulation (foam) + plaster board	0.70 + 1.0	1.7	1.5	insulated and lined under with under house renovation (a number of years previously) and in 2008.	Insulated after built, lined under for a room after built. Assume foam R1.0 as thin foam products have better resistance rating than other materials in relation to thickness.
	ceiling lower section	Timber + insulation + plaster board	See floor main level;	-	-	Insulated and lined under with renovation	
	walls lower section	Stone (150/200mm thick) + mortar + timber frame + plasterboard Or timber cladding + timber frame + reflective sarking + insulation batts + plasterboard	0.53 Or 0.47+ 1.5	0.53 Or 1.47	2.4	Lined and sarked as renovation.	Assumed similar resistance to concrete block in stone. Assume the insulating value at R1.5 in 70mm wall space..
	floor lower section	Concrete + covering	0.65	0.65		?	Currently no resistance aim for this situation in the BCA – see notes on floors below.
	underfloor	Enclosed space by stone walls or timber walls – see lower section walls	See floor main level	-	-	no	
	windows	Single glazing (timber frame) + curtains (drapes) No pelmets	0.21 + 0.06	0.27	0.56-0.7	Pelmets in train at interviews	

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
Trent	Roof / ceiling	Corrugated iron + timber frame + insulation batts + lathe and plaster or plasterboard	0.38 + 3.0	3.38	4.3	Insulation 2007	Assumed R3.0 due to the recent renovation work.
	Walls original	Weatherboard + timber frame + lathe and plaster	0.47	0.47	2.4	no	
	Floor original	Timber + timber frame (+ sarking under kitchen)(+ carpet in some rooms)	0.70	0.70	2.5	no	unenclosed
	Walls extension	Weatherboard + timber frame + insulation (70mm) + sarking + plaster board	0.47 + 1.5	1.97	2.4	Built 2007	Assumed 70mm batts of glass fibre at R1.5. Assuming a standard 70mm stud used.
	Floor extension	Timber + timber frame + carpet	0.70	0.70	2.4	Built 2007	Unenclosed below
	Windows existing	Single glazing (timber frame) + curtains (close weave?) no pelmets	0.21 + 0.03	0.24	0.56-0.7	no	
	Windows in extension	Double glazing (timber frame) + curtains (close weave?) No pelmets	0.33 + 0.03	0.36	0.56-0.7	Installed 2007	
	underfloor	Open to air	See floor	-	-	no	unenclosed
Troy & Nat	Roof / ceiling	Corrugated iron + timber framing + insulation batts (70mm) + fibro	0.38 + 1.25	1.63	4.3	Insulation 1998	Assumed batts and standard 70mm stud work, so batts at R1.5. Assume some reduction to R1.25.
	walls	Vinyl + weatherboard + timber frame + fibro	0.47 + 0.30	0.77	2.4	Vinyl cladding 1998?	Assumed vinyl R 0.30

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	floor	Timber planks + timber frame (+ vinyl laminate covering in kitchen) (+ carpet in living) (enclosed underfloor)	0.70	0.70	1.5	Perhaps floor coverings changed ?	Enclosed underfloor
	underfloor	Enclosed by concrete block walls /plinth	See floor	-	-	no	Considered in floor resistance
	windows	Single glazing (aluminium frame) + blinds + curtains (close weave) No pelmets	0.16 + 0.03	0.19	0.56-0.7	?	Replaced some originals?
Vanessa & Paul	Roof / ceiling original	Corrugated iron + timber frame + insulation (R3.8) + fibro or plaster board	0.38 + 3.8	4.18	4.3	Insulation 2008	
	Walls original	Double or triple brick + plaster	0.68 Or 0.68 + 0.30	0.68 or 0.98	2.4	Refinished 2008	
	Floor original	Timber planks + timber frame	0.70	0.70	1.5	no	Underfloor enclosed by walls.
	Underfloor original	Enclosed by brick walls	See original floor	-	-	no	low height, approximately 200-350mm off the ground.
	Roof/ceiling extension	Corrugated 'colour bond' + sarking + timber frame + glass fibre insulation (R3.8) + plaster board	0.38 + 3.8	4.18	4.3	Built 2008	
	Walls extension	Timber + sarking + timber frame + glass batt insulation (70mm) + plaster board	0.47 + 1.5	1.97	2.4	Built 2008	Assume the 70mm wall insulation is R1.5.

Participants	Building element	Materials	Approximate resistance rating (R)	Total resistance of building element	2009 BCA or indicative R value aim for this element	Adaptations made? Or planning to adapt?	Comments
	Floor extension	Timber planks + timber frame	0.70	0.70	2.5	Built 2008	Intending to enclose, but not complete are time of interviews.
	Windows original and extension	Single glazing (timber frame) + blinds or drapes No pelmets	0.21 + 0.03 Or 0.21 + 0.06	0.24 or 0.27	0.56-0.7	Some added 2008	All windows installed were of the same era as original windows. All single glazed.

Table notes:

Table M-2 describes the overall heat-flow resistance of different building elements when all material resistances of a building element are added together. The building elements noted in the table are the walls, floors and roof/ceiling. These building elements constitute the elements that create a dwelling enclosure and the resultant heat flow resistance from any of these elements influences the energy efficiency and the comfort of a dwelling enclosure. A wall element includes the building structure, claddings, and any added insulation; the floor element includes the floor structure, the floor coverings, and consideration of under-floor enclosures; the roof/ceiling element includes roof structure, ceiling structure, roof and ceiling claddings, sarking and added insulation.

Resistance values were taken where possible from the Energy Efficiency section of the Building Code of Australia (BCA)(Australian Building Codes Board 2009).The BCA has various thermal resistance requirements for various conditions. The Glenorchy area is defined as climate zone 7 in the BCA. The most appropriate r-value was chosen for each dwelling element considering construction type. Where r-values were not available in the BCA, other resources were consulted. Szokolay (1987) lists transmittance and resistance values for building elements was consulted as a secondary resource. A building energy rating (BERS Pro 4.1 (by Solar Logic)) tool was consulted for resistance and transmittance values not available in other texts.

As of time of writing in 2012, Tasmania still uses thermal resistance standards from the 2009 edition of the BCA; despite a later edition being available that requires increased thermal resistance of dwelling enclosures. The participant interviews were conducted during 2008, so the 2009 thermal resistance levels represent legislative thermal resistance expectations that were closer to expectations of 2008. As the BCA levels chosen are for indicative purposes only, the increase in requirements does not affect the exploration being undertaken.

In estimating the r-value of installed insulation, if the batts were thin, R 0.5 was assumed. 50 mm batts were assumed as resistance levels of R 1.0, 150mm batts are recorded as R1.5. Hard core foam of 40mm is recorded as R1.0. R values given at the time a material is new do not apply throughout the life of an insulative material. If insulation is installed loosely or is old there can be a significant drop in performance. Old insulation sags over time, reducing the effective depth and therefore the effective insulation value. A reduction in performance of insulation has been considered accordingly and noted in the table. Each building element r-value includes consideration of all main materials used for that element. The r-values of each material are added up to gain a total value. The BCA r-value listed is a total r-value air-to-air. Internal and external surface resistances are added to the materials to give the overall value. These surface resistances have not been added to the estimates of household material resistances, and would make a very minor improvement to those household figures.

Windows generally use conductivity or transmittance values (U-values) to describe performance of windows(see for example the windows energy rating scheme at <http://www.wers.net/>). U values are the inverse of the R-values and have been converted to R values for calculations in the table (Szokolay 1987). Glazing allowances for new build houses are generated through context specific equations in the BCA. Each individual house design will have a different requirement for window performance depending on the size and orientation of windows and the size of the house. The R-value aim for windows used in this table is equated to the r-value that would come from a good practice window set-up, which for these purposes is defined as: clear, double glazed window with a timber frame and heavy drape curtains with pelmets. Double glazing in a timber window frame generally has a transmittance of U 3.8-2.5, (an r-value of 0.26 – 0.4). Curtains and pelmets are generally advised for energy efficiency and comfort and can add an extra resistance of R0.3. So the aim is to achieve R 0.56 – 0.7 for the windows.

Windows values for the households were sourced from indicative values listed in the BCA: single glaze clear timber range U5.6-4.3 (R 0.18-0.23, mid range 0.21); single glaze clear with aluminium range U7.9-5.5 (R 0.13 - 0.18, mid range 0.16); double glaze clear with timber range U3.8-2.5 (R 0.26 – 0.40, mid range 0.33); double glaze clear with aluminium range U6.2-3.1 (R 0.16- 0.32, midrange 0.24). A mid range performance is assumed for all windows.

Windows coverings r-values follow the assumptions used in a Australian government accredited housing energy rating tool called Building Energy Rating System (BERS Pro 4.1). BERS allocates r-values of: 0.0 for venetians; 0.0 for open weave; 0.03 for Holland blinds; 0.03 for close weave; 0.06 for drapes (which are 'heavy' curtains); 0.11 for close weave plus a pelmet; 0.33 for drape plus a pelmet. The table has used the closest associated value to the curtains observed in the dwellings.

U-values for double glazing acrylic-retrofitted windows were taken from manufacturer's information. Magic seal acrylic retrofit glazing - see brochure Magicseal 'Magicseal secondary glazing for thermal and acoustic insulation for existing windows' downloaded 27th May 2011 from

www.magicseal.com The retrofitted acrylic gave a higher value (R0.37) than either of the double glazed windows, which seemed unlikely – so the acrylic double glazed window is equivalent to a timber double glazed window.

Concrete slabs are dealt with poorly in the BCA. Concrete slabs on ground are not required to have any resistance at all, except when there is underfloor heating. In the case where there is underfloor heating, concrete slabs are required to have R1.0 insulation around the slab edges only (BCA 2009: 533). The concrete slab on ground requirement has been increased in subsequent versions of the BCA, but at the time of writing (2011) has still not been taken up as legislation by the Tasmanian government. Suspended concrete floors do have an r value expectation in the BCA.

The 2009 BCA requirements concrete slab on ground do not support good energy efficient performance. The ground temperature in Tasmania is colder than would be comfortable, so on average throughout the year, heat flow resistance is required in floor elements, so that heat does not move towards the ground under the concrete slab. The concrete slab on ground is assumed to have a resistance of R0.65 (as the BCA states).

In some cases, exact materials could not be confirmed with participants, so the most likely material fit has been chosen. The materials chosen as the most likely fit would not greatly vary the resistance ratings, nor the outcome of the table greatly.

The lathe and plaster was reported by all householders who had it as providing a noticeable heat flow resistance. In this table it has been given the same heat flow resistance as standard plaster, as there were no readily available credible figure on its heat flow resistance. Lathe and plaster's ability to resist heat flow may be underreported to some extent in this table, although the difference in resistance would not be.

This table does not consider the colour of materials used in the building. While colour can make a significant difference to heat absorption, the Building code of Australia does not currently mention colour as a factor.

Appendix N – Input or extraction of heat

Heater system types

Radiant - heaters that generate infrared radiation and heat a body directly through infrared radiation e.g. a bar radiator or oil heater

Convection - heaters that heat air and move the heated air around e.g. a reverse cycle air conditioner or electric fan heater. Convection heaters always require conduction to occur between the heat source and the air, and then again, between the air and the body being heated.

Table N-1: Types of heaters and sources of heat being used

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
Cara Edward & Veronica	Heat pump	living (open to dining and hallway and kitchen)	unknown	convection	was in when they bought the property. moved in @ 2006.	@ 1950s	Winter at 16-18°C 22°C when have visitors.	wired in t42	Use the heat pump in conjunction with ceiling fan which distributes the air to the kitchen and down the hall to the bedrooms. Use the heater at a comparably low temperature level.
	Portable small bar heater	bedroom/games room	2kw	radiant	unknown		unknown	plug in	Uses in games room. Experimenting to see whether better to use the bar heater or let the heat pump heat flow through the house.
	Large plasma tv	spare bedroom	unknown	convection	unknown		unknown	plug in	Heats up the room when they have it on so provides extra heating!
Del & Kirk	'Atlantic electronic heater' electric panel heater	living/dining	@2-2.4kw (?)	radiant	since @2001	built @ 1994/5	On thermostat and timer and stays on through all seasons. Winter: 6:30am -10/11am on and 4-11pm on max level in winter and is on a minimum level in between. If a cold day then switch on to	wired in - t42 (?)	Can set two different routines into the heaters which they like. The new heaters allow better efficiency with heating and they respond well. Replaced an electric blow heater which had been uncomfortable. 'We have on full from about 7 to about 10/11 and again at night from about now through to

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
							full heat (has done this 5 or 6 times this winter). Autumn: 6am -9/10am, as more summer evening, extend the time at the lower temperature		11oclock. The rest of time its on economy and even if its on full at the moment and the sun is blasting in, it just wouldn't come on at all.'
	'Atlantic electronic heater' electric panel heater	bedroom	@2-2.4kw (?)	radiant	since @2001		Autumn and winter. Autumn – cold nights on until @9 or 10pm. Winter on until 9/10pm.	wired in – t42 (?)	Use when it is cold (in aut and wint) and comes on @ 9/10pm ish just before bed time. In aut only uses if it a 'really' cold night.
	'Atlantic electronic heater' electric panel heater	study	@2-2.4 kw (?)	radiant	since @2001		Autumn and winter. Use when in room (regular, probably daily)	wired in – t42 (?)	Use when it is cold (in aut and wint) and they are in the room, which is during the daytime.
	Electric blanket (double)	bedroom	@150-200 w on high (?)	radiant	unknown		Autumn and winter use to warm up bed for an hour.	plug in	Used to warm up the bed just before go to bed and then turn it off.
Frank	Pureheat electric	dining (open plan with living and kitchen)	4.6kW	radiant, fan convection or both	? post the oil heater - fairly modern	1963	Autumn and winter. Aut – in morning to warm up Win – in morning for an hour Really cold days – uses for up to 3 hours in morning. Granddaughter uses longer.	wired in, t42	Only heats up the area when occupying it. In Autumn uses in the morning to take the 'chill out of the air'. Regularly out in the evening, so only uses it @ every 2nd night. When granddaughter on in morning longer and in evening.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	Oil heater	living (open plan with living and kitchen)	450lt tank	radiant	1973		Autumn and winter. Aut - when granddaughter over use from 5pm-10pm otherwise shorter periods in evening Win - evening if needed Cold/wet days - F uses during the day	na	Uses this when the granddaughter comes to stay (which is fairly regularly) and it is on 5pm-10pm approximately. When put it in oil was 9 cents a litre and at interview time oil was \$1.29-1.39/l. Pre the extension (of the house) the oil heater would be turned on at the beginning of winter and left to run for the winter.
	Plug in heater	study	2.5kw	convection	fairly modern		Autumn and winter. Uses when occupying study to warm room (then off) @ ½ hr?	plug	Uses when in the study or on the computer. Will warm up the room and then turn it off.
	Ixl tastic	bathroom	unknown	radiant	unknown		Autumn and winter assumed	Wired (not T42)	Assume use when bathing only.
	Electric blanket	on bed	b/tn 60-200 w (depending on whether single or double)	radiant	fairly modern		Winter. @half hour? to warm up bed only.	plug	Uses to warm up bed and then turns off.
	Floor heat	downstairs office	unknown	radiant	unknown		n.a	wired in t42	Doesn't use but still has it connected to the power (hasn't used it for 10 yrs). Leaves it connected in case needs it again (connection fees expensive).

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
Fred & Keira	Ceiling heat	living and bedrooms	@70w/m2 (?) - not sure	radiant	fairly recent		Summer, Autumn and winter. On thermostat and timers Summer: living at 17-19 20 in the evening, 15 bedrooms during the day and up to 18 in evening, (mainly in morning) Autumn: living at 20oC -19.5 Winter: 16 overnight bedroom, 19 living day time and on 17 of go out, @7am have it at 19.	wired in on separate tariff (not t42)	Put ceiling heat temperature down after installed perspex on windows as double glazing. Cold in house in the morning even in summer due to lack of sun, so use the heaters even on summer mornings).
	Bar heater	bathroom	@2kw (?)	radiant	older		during showers	plug	
	'Ixl tastic' (2 bulb)	bathroom	2 X 375w heat lamps	radiant	@ april 2008		during showers	wired	http://www.ixlappliances.com.au/
Helen	Pureheat	living	7.2kW	radiant. fan convection or both	@2003	Originaly housing departm ent @ 1960/ea rly 70s?	Autumn and Winter. In winter uses on low as less chance that family will crowd around the heater.	wired in (not t42)	Pureheat replaced a wood heater. Thought they could get a rebate for the higher kW heater but the rebate wasn't that large. Also had to line the power box and needed it signed off so never got the rebate. Wood fire replaced due to asthma in children.
	Stand alone electric	bedroom/s	@ 2kW	radiant	pre 2000		In autumn and winter.	plug	Used when children babies and little and when needs warmth.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	(oil) column								
Henry	Stand alone electric (oil) column	living	2kw	radiant	unknown	Unknown but possibly @1970s?	Autumn and winter	plug	Uses to warm up the room, and uses as often as needs it when home. Other years has tried to be more restrained and use the heater less.
	Stand alone electric (oil) column	bedroom	2kw	radiant	unknown		Autumn and winter (when cold).	plug	Uses sometimes, not so often.
	Electric blanket	in bed	bn 60-200w (depending on whether single or double)	radiant / conduction	unknown		Autumn and winter (when cold).	plug	Uses it to warm up the bed and then turns it off.
	Hot water bottle	in bed	n.a	conduction	unknown		Autumn and winter (when cold).	n.a	Uses it for sleeping
Lorraine & Robert	Heat pump	living	@6kw?	convection	b/n 2008-2007 (fairly new)		@1950s or 60s	Winter season only. Low fan level (2)	wired in (t42)
	Heat pump	dining	@6kw?	convection	b/n 2008-2007 (fairly new)		Winter season only. Low fan level (2)	wired in (t 42)	Turn all the heat pumps on at the beginning of the evening and the turn them off as finish with the room for the night.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	Heat pump	rumpus (downstairs with concrete floor and walls)	@6kw?	convection	b/n 2008-2007 (fairly new)		Winter season only. Low fan level (2)	wired in (t42)	Turn all the heat pumps on at the beginning of the evening and the turn them off as finish with the room for the night.
	fireplaces	living and dining/kitchen	n.a	radiant	older		Not used much.		Don't use these anymore since installed the heat pumps, but prefer the wood fire heat to the heat pump heat.
Mark	Pureheat Belmont Deluxe FW3/6	living/dining/kitchen	6kw?	radiant or fan convection	1995/6	@1995/6	Autumn and winter	wired in, unsure (think not on t42)	Installed by builder when the house was built.
	Stand alone electric (oil) column	bedroom	@2kw?	radiant	unknown		Autumn and winter	plug	Uses on a timer.
Mary and Martin	Heat pump	dining/kitchen	3.5kW	convection	recent to 2008	@ late 1960s	Autumn and Winter: Set hp in dining 15 in the morning and 17 when get up and during the day. If Mary unwell or cold then puts it up to 19 or 20 for a while. Don't need heater so high on sunny days and turn it off in the afternoon. If cold and grey, run hp all day.	t42	Heat pumps mounted at floor level as attempt to reduce drafty feel of the heaters. Finds heaters can be draughty but can adjust the throw and the flow rate and angle of throw which is a significant help. Moved into the house around 2005?

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	Heat pump	living	5kW	convection	recent but prior to 2008		Autumn (not on sunny days) and winter	t42	Use heat pumps in conjunction to get a reasonable temperature between the rooms.
	Electric wall panel	bedroom	2.4kw	radiant	recent but prior to 2008		Autumn (not on sunny days) and winter irregularly.	t42	Irregularly used but use if having a rest on bed on a cold day.
	Electric wall panel	downstairs office	2.4kw	radiant	recent but prior to 2008		Autumn (not on sunny days) and winter	t42	Uses on cold days.
	Column heater	bathroom	@2.0kw?	radiant	recent but prior to 2008		Autumn and winter shower time.	plug	Uses to warm up bathroom, mainly on cold days and also to dry the moisture in the bathroom.
	Oil central heating	various areas	n.a	radiant	unknown		-		Don't use but still connected – original heater that was installed when the house was built.
	IXL tastic	bathroom	unknown	radiant	recent but prior to 2008		Autumn and winter	wired	When bathing.
Mel	Heat Pump	Living / dining / kitchen	@6kw?	convection	2006	@2006	Autumn and winter. Autumn - 21 at night , 19 during day Winter - 22 nice but makes Mel sleepy so keeps at 21. If coming home later, which is a regular thing, set the heater to come on half an hour before she is expecting	t42?	Installed when house built.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
							to arrive home. Lowers the temperature to lowest setting (16?) if goes out for a while and has had it on.		
	Fan heater	bedroom	2.4kw	convection	b/tn 2006-2008		Autumn and winter	plug	Uses for an hour a day when cold to get dressed, and to take the 'chill off'.
Olive	Pureheat electrical	formal lounge	6 kw Radiant heat 2.4 kw Fan heat 3.5 kw	radiant or fan convection	1990s (?)	@1950s?	Autumn and winter	wired	Olive is not sure what the best way to use it is. Average heating area 65 m2 2 stage internal thermostat Automatic 12 hr timer ...Australian made Mixed flow fan Metal Powder coated Uses occasionally (does not like to use this heater as main heat)
	Oil heater	living / dining	n.a	radiant	unknown		Autumn and winter	plumb	Prefers this heat and prepays for the oil so uses this heater more regularly.
	Electric (oil) heater stand alone	living/dining	2.4kw max	radiant	unknown		Autumn and winter	plug	Uses as an alternative to the oil heater. Vulcan quaser elite. Electrical plug in heater. Wattage 240 volts, 50 hertz, 2400 watts..... 2.4 kw system plug in.
	Electric blanket	bed	b/tn 60-200 w (depending on whether single or	radiant/co nduction	unknown		Autumn and winter	plug	Used to leave on at night but now uses to warm up bed and then turns off. Uses in conjunction with hot water bottle.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
			double)						
	Hot water bottle	when sitting in living room	n.a.	conductive	unknown		On cold nights – mainly autumn/winter	n.a	Uses the hot water bottle first when feels cold (as an energy saving strategy) and uses the heater if cold enough. Found using it instead of heater limited her activity so changed strategies.
Steve and Gwen	Electric	living	6kw?-	radiant/convection	older style	@1930s or 40s	Autumn and winter	wired in, t42	Use to heat other areas of the house via zoning with doors (the heat travels down the hallway). Finds it heat comfortable but thinks it is an expensive heater to run. Uses for a few hours at night.
	Heater in armchair	living	unknown	conduction	unknown		Autumn and winter	plug	Steve uses this at night after the living heater has gone off (around 7or 8pm)
	Fan heater	various rooms	@2kw?	convection	unknown		Autumn and winter	plug	Mainly used by son when he stayed with them for a period of months.
Susan	Pureheat Electric	living	4.5kw	radiant and convection	1996 or 1997	@1987	Autumn and winter. If using radiant - uses 2 bars, not 3	t42	Likes the heat pump. If turns on in the morning just uses the fan warmth as warms the room up faster.
	Electric heater	craft room or where needed	unknown	convective ?	unknown		Autumn and winter	plug	Small and moveable. Uses heater when in the craft room but doesn't use the craft room so much in winter as it is sunnier and warmer in the living area.
	Radiant wall heater	bathroom	unknown	radiant	unknown		Autumn and winter when bathing..	plug	Uses for shower time only.
Terry	Wood	living /	n.a.	radiant	mid 1980s	mid	Autumn? and winter	n.a.	Warms an open plan area kitchen, dining and

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	heater	kitchen / dining				1980s			living. Firewood from own block. Also cooked soup and warmed water on it. When family were home had used fan to transfer heat to other areas. Installed when house built. Saxon woodheater
	Fan	various	unknown	circulate convective heat	mid 1980s		Autumn? and winter	plug	Used when family at home to move heat into bedroom areas.
	Hot water bottle	in bed	n.a.	conductive	unknown		Autumn? and winter	n.a	Warms water up on wood heater.
Trent	Heat pump	new lounge area (extension)	8.5kW	convection	installed 2007	c. 1950s extension c. 2007	Autumn and winter on thermostat Autumn: 16 during the day, 18/19 at night, 17 when go to bed. When not home puts heater on 12. Winter: on all the time between 16-18 degrees.	t 42?	
	Electric, wall mounted with 3 bars and fan.	lounge area	8.5kW	radiant and convection	unknown		Autumn and winter. Only on when needed. In autumn if a sunny day might not use, if a 12 degree day, would have on. Use it on 1 bar often. In winter: generally on, on low fan or bar. Turned off at night.	t42?	Wall mounted with 3 bars and a fan heater
	Unknown	kitchen	unknown	unknown	unknown		Summer: turn on heater for a	unknown	Coldest and most reactive room in the house.

	Heater type	Area of house	Power usage	Type of heat/heat transfer	Age of heater	Age/era of house	Level or temperature (oC) generally used at + season	Plug in, wired in, on tariff 42?	Comments
	type						few minutes to take off the chill. Autumn: ? Winter: ?		
	Electric panels	bedroom 1	unknown	unknown	unknown		Autumn and winter ?	unknown	Used at night autumn/winter/spring when go to bed.
	Electric panels	bedroom 2	unknown	unknown	unknown		Autumn and winter ?	unknown	Used at night autumn/winter/spring and when (child) has a sleep.
Troy & Nat	Heat pump	dining	?6-8.5kw	convective	1999	1967	Autumn and winter 20 cooling 20/21 when warming	t 42?	Use at night when come in on 19/20. Opens up living/dining doors when about to use living so warmth goes in.
Vanessa and Paul	Heat pump	kitchen/dining	?6-8.5kw	convective	2008	1940s	Autumn and winter	t42?	Chosen as lesser impacting heating option. Use less on sunny days. Use at 16 if active, 18 of not active.
	Flat panel radiant wall heater	lounge	unknown	radiant	2008		Autumn and winter	unknown	Generally uses in the evening.
	Flat panel radiant wall heater	study	unknown	radiant	2008		Autumn and winter	unknown	Study heated on cold and overcast days. Don't heat on sunny days.

Table notes:

This table is for indicative purposes only. T 42 is a tariff that is applied to hot water heating and heaters over a certain kW output rating. The tariff is a cheaper tariff than the standard electricity power cost.

Seasonal heater use tables

Summer

Heater use was less common in summer so it has not been tabulated. Comments have been made in chapter four in the relevant section on heating practices.

Autumn

Table colour key:

	Temperature on full, high or approximate equivalent. 21 degrees and above is noted as full/high.
	Temperature on medium / economy or approximate equivalent.
	Temperature on low or equivalent.
	More occasional use / approximate or assumed use patterns. Unsure of temperature. See 'comments' column for explanation.

Table N-2: Heater use patterns for autumn

Household/ participants	Heater type	Area of house	5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11	Time at home/work status	Comments	
Cara Edward & Veronica	Heat pump	living (open to dining and hallway)																				C- f/t work outside home E - f/t uni student V - school	Use on colder days when getting dressed. Using for anything under 16°C	
	Small portable bar heater																						Seeing whether heat pump heat can heat the house up effectively without using this heater	
	Large plasma tv	spare bedroom																					Regular leisure activity, assumed use for some time most days.	
Del & Kirk	'Atlantic electronic heater' electric panel heater	living/dining			full										full								Retired	On thermostat so only heats up when room temperature falls below a set temperature.
	'Atlantic electronic heater' electric panel heater	Bedroom																					On to warm up the bedroom before bed	

Household/ participants	Heater type	Area of house																				Time at home/work status	Comments
			5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11		
	Floor heat	downstairs office																					Not in use but is connected.
Fred & Keira	Ceiling heat	living																				F - retired - casual (early mornings)	Thermostat set to 16°C overnight, at 6:30am to 17.5°C and 19.5°C during the day.
	Ceiling heat	Bedroom																					
	Bar heater	Bathroom																					For showering time only for Keira
	Ixl tastic	Bathroom																					For showering time only for Frederick. Two bulb heating.
Helen	Pureheat 7.2kW	Living																				F/t uni student	Uses the heater when required, usually on low. Has two little girls.
Henry	Stand alone electric (oil) column	Living																				Casual	Uses when needs it.
	Stand alone electric (oil) column	Bedroom																					
	Electric blanket																						Uses to warm up bed.

Household/ participants	Heater type	Area of house																				Time at home/work status	Comments
			5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11		
	Hot water bottle	in bed																					Uses to stay warm in bed.
Lorraine & Robert	Heat pump	Living																				L - p/t wk R - f/t wk	No heater use yet
	Heat pump	Dining																					No heater use yet
	Heat pump	rumpus (downstairs with concrete floor and walls)																					No heater use in autumn.
	fireplaces	living and dining/kitchen																					No heater use in autumn.
	Electric blanket		hatched																		hatched		Use electric blanket/s (may be one also in son's bedroom)
Mark	Pureheat Belmont Deluxe FW3/6	living/dining/kitchen		orange	orange																	f/t work	Has on a timer to turn on at 6pm at night. Turns off at 9 or 10pm depending how cold it is that day.
	Column heater (stand alone oil)	Bedroom	hatched	hatched	hatched											hatched	hatched	hatched	hatched	hatched	hatched		On all night
	Electric blanket		hatched																	orange	hatched		Unsure if uses all night?

Household/ participants	Heater type	Area of house												Time at home/work status	Comments										
			5 am	6	7	8	9	10	11	12 pm	1	2	3			4	5	6	7	8	9	10	11		
Mary and Martin	Heat pump	dining/kitchen				█										█							Martin - work from home M - unwell		
	Heat pump	Living				█										█									
	Electric wall panel	Bedroom								█															Use it on cold days (when no sun) when Mary resting in the room. Have used it 3 times since weather turned cold.
	Electric wall panel	downstairs office																						Switched off at time of interview because not using the office as need to paint it.	
	Column heater	Bathroom			█																			Used for shower time.	
	Oil central heating																							Tank still under house but do not use.	
	IXL tastic	Bathroom																						Installed by previous owners, unsure of use.	

Household/ participants	Heater type	Area of house	5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11	Time at home/work status	Comments
Mel	Heat pump	dining / kitchen / living		19												21						f/t work	Is regularly out at night, so regularly turns the heater on later when gets home. Potentially more use on the weekends. Goes to bed at 11/11:30.hp used at 19°C during the day and 21°C at night.
	Fan heater																						Uses the fan heater for a boost of more direct warmth eg when dressing in the morning if needed.
Olive	Pureheat electrical	Lounge																				Retired	
	Oil heater																						Used oil heater in this period when visitors were over.

Household/ participants	Heater type	Area of house	5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11	Time at home/work status	Comments	
	Electric (oil) heater stand alone																							Used as main heater after founda blanket and hot water bottle weren't enough as movement was constrained. Then trialled pure heat electric heater in lounge room as evening heater in early winter.
	Electric blanket																							Uses on low through the night.
	Hot water bottle																							When sitting in living room used with a blanket and also when went to bed.
Steve and Gwen	Electric	Living																					S - retired G - f/t work	Use for 2 hours at night generally.

Household/ participants	Heater type	Area of house	5 am	6	7	8	9	10	11	12 pm	1	2	3	4	5	6	7	8	9	10	11	Time at home/work status	Comments
	Fan																						Used when children were in the house to transfer the heat of the wood fire. Not used now.
	Hot water bottle	in bed																					Assumed only used in winter.
Trent	Heat pump	new lounge area (extension)	16												18/19					17			f/t work (wife at home with toddler) On coldest days will put the heater up to 18-19 degrees for periods of time. If out will turn it down to 12 until home and then gives 'it a burst'.
	Electric, wall mounted with 3 bars and fan.	lounge area																					Uses as the heat doesn't spread from the heat pump right through the house. Not on all the time. If sunny day, don't need.
	Unknown type	Kitchen																					
	Electric panels	bedroom 1																					Night time heating in bedrooms,
	Electric panels	bedroom 2																					Night time heating in bedrooms,

Household/ participants	Heater type	Area of house												Time at home/work status	Comments								
			5 am	6	7	8	9	10	11	12 pm	1	2	3			4	5	6	7	8	9	10	11
Troy & Nat	Heat pump	Dining																				T - retired N - casual?	Heats the dining/kitchen for dinner and then allows the heat to move into the living area so can use the living after dinner.
Vanessa and Paul	Heat pump	kitchen/dining																				Retired	Renovating in Autumn and not able to use heating in the house.
	Flat panel radiant wall heater	lounge																					
	Flat panel radiant wall heater	study																					

Winter

Table N-3: Heater use patterns for winter

Household participants	Heater type	Area of house	Time of day																			Time at home/work status	Comments	
			5am	6	7	8	9	10	11	12pm	1	2	3	4	5	6	7	8	9	10	11			
Cara Edward and Veronica	Heat pump	Living (open to dining and hallway)		18	18	18	16																C- f/t work outside home E - f/t uni student V - school	Use a ceiling fan to better circulate the heat. 6:45am-8:30 am 18°C. If Edward is at home, leaves the hp on. If out for a short time, turns it to 16°C. Can now use heat pump to heat other rooms of the house, including bedrooms and games room. This is because installed insulation. The hp can now heat the rooms to within a degree or two of the living room. Did feel the to use heat pump on a 15°C day. Don't use it higher than 18°C
	Bar heater																							Not needed now have insulation (and new fan) as heat from hp can be distributed easily.
	Large plasma tv	Spare bedroom																						Unsure length of time they use it for.

Household participant	Heater type	Area of house																				Time at home/work status	Comments		
			5am	6	7	8	9	10	11	12pm	1	2	3	4	5	6	7	8	9	10	11				
Del and Kirk	'Atlantic electronic heater' electric panel heater	Living/dining		full								econ					Full							Retired	6:30-11 on full, 4pm-11pm on full. Rest of day on econ. Needed full heat all day 5 or 6 days in winter. Thermostat turns heaters on and off as temperatures change.
Del and Kirk (cont)	'Atlantic electronic heater' electric panel heater	bedroom																							To warm up bedroom
	'Atlantic electronic heater' electric panel heater	Study																							Unsure of use

Household participant	Heater type	Area of house												Time at home/work status	Comments									
			5am	6	7	8	9	10	11	12pm	1	2	3			4	5	6	7	8	9	10	11	
Helen	Pureheat	Living			Low radiant									Low radiant									F/t uni student	Uses in morning until ½ hours before leaves the house so has it on for 1 hour 7-8am. Evening generally uses from when get home to 7:30pm. Helen may use after that. In really cold weather sometimes uses it on high.
Henry	Stand alone electric (oil) column	living																					Casual	Puts oil heater on if cold. Using it when needs it this year rather than holding off).
	Electric blanket																							Uses to warm up the bed only.
	Hot water bottle																							Uses to stay warm in bed.
Lorraine & Robert	Heat pump	Living																						Turn all heat pumps on together in the morning and if at home will leave them on if at home. If leaving the house (eg work days) turn all off at 9am and back on at 4pm. As finish using the room at night turn off the heater in the at room. All off by 10:30/11pm generally.

Household participant	Heater type	Area of house												Time at home/work status	Comments									
			5am	6	7	8	9	10	11	12pm	1	2	3			4	5	6	7	8	9	10	11	
	Heat pump	dining																					L - p/t wk R - f/t wk	
	Heat pump	Rumpus (downstairs with concrete floor and walls)																						
	Fireplaces	Living and dining / kitchen																						Do not use now that have heat pumps.
	Electric blankets																							Uses electric blanket/s (may be one in son's room as well).

Household participant	Heater type	Area of house												Time at home/work status	Comments										
			5am	6	7	8	9	10	11	12pm	1	2	3			4	5	6	7	8	9	10	11		
Mark	Pureheat Belmont Deluxe FW3/6	Living / dining / kitchen																						On whenever home, so uses during the day on the weekends.	
	Column heater	bedroom																					f/t work	On overnight.	
	Electric blanket																								Unsure if uses overnight.
Mary and Martin	Heat pump	Dining / kitchen																							If a colder day will use the heater at 19-20 for limited periods. Heat pumps if it is a sunny afternoon.
	Heat pump	living																						Martin – work from home M – unwell	To get an even spread of heat between the living and dining / kitchen areas Martin has worked out has to have the living hp set 2 degrees higher. Turn on this hp to take the chill out of the air and then turn off until come in o use the room.

Household participant	Heater type	Area of house																				Time at home/work status	Comments				
			5am	6	7	8	9	10	11	12pm	1	2	3	4	5	6	7	8	9	10	11						
	Electric wall panel	bedroom																								Used if Mary having a rest.	
	Electric wall panel	Down stairs office																									Using this heater now and use it more than the bedroom one is used and now using the room again (with new curtain on the stair to hold in the heat).
	Column heater	bathroom																									Used for shower time and to dry out the bathroom.
	Oil central heating																										Tank under house, but not in use.
	IXL tastic	bathroom																									Put up by previous owners, unsure of use - assume during bathing.

Household participant	Heater type	Area of house																				Time at home/work status	Comments
			5am	6	7	8	9	10	11	12pm	1	2	3	4	5	6	7	8	9	10	11		
Mel	Heat Pump	Dining / kitchen / living		19	20									21	22	23	24	25	26	27	f/t work	Uses at 21°C at night and 19 during the day (?). Will turn down to 16°C if wants to maintain the warmth. Uses during the day during the weekend if home. Is often out at night for periods of time and goes to bed lat at 11/11:30. Turns heater off then. Puts the hp on a timer to turn on half an hour before she gets home from work at 4:30pm.	
	Fan heater	bedroom			28																		Uses for boosts of heat in the morning to get dressed and if needed for short bursts at other times.
Olive	Pure heat electrical	Lounge																					Moved into this room to use as living room to test the heater. Used on fan only. Goes to bed fairly early
	Oil heater	Living / dining													29	30	31	32				Retired	Prefers the oil heat and has moved back into this room so that she can use this heater at night.
	Electric (oil) heater stand alone	Living / dining																					Uses one of three heaters - not all at the same time. By winter O had decided she preferred the heat of the oil heater.

Household participant	Heater type	Area of house												Time at home/work status	Comments								
			5am	6	7	8	9	10	11	12pm	1	2	3			4	5	6	7	8	9	10	11
	Electric blanket	Bed	Diagonal lines	Diagonal lines																Diagonal lines	Diagonal lines		Uses on low through the night.
	Hot water bottle																			Horizontal lines	Horizontal lines		Realised that might be unsafe to use with electric blanket so now either turns off electric blanket or removes hot water bottle.
Steve and Gwen	Electric	Living		Diagonal lines	Diagonal lines	Diagonal lines									Orange	Orange	Orange						Use from 5-8pm in the evenings. Gwen may use heater in the morning when by herself.
	Arm chair heater	Living room arm chair																		Diagonal lines	Diagonal lines	S - retired G - f/t work	Steve uses if needed but is often still warm from exercise in the garden or golf, so doesn't need it.
	Fan heater	2 nd bedroom			Diagonal lines	Diagonal lines									Diagonal lines			Had a son staying who used heating morning and evening.					
Susan	Pureheat Electric	living											Diagonal lines	Diagonal lines	Diagonal lines	Diagonal lines	Diagonal lines	Diagonal lines	Diagonal lines			Retired	Tries not to heat the house in the morning. Uses from about 3:30pm on in the evening until bed. Will use radiant plus fan.
	Plug in	Craft room					Horizontal lines	Horizontal lines	Horizontal lines	Horizontal lines													Uses when in craft room.

Cooling systems, strategies and use

Table N-4: Cooling systems, strategies and use

	Cooling system / feature / strategy	Area of house	Use	Comments
Cara Edward & Veronica	Fan	Living	No	Do not use it for cooling
	air conditioning function on hp	Living	No	Thought once about using the hp air conditioning function on a hot day, but chose not to.
	Curtains / windows	All rooms	Yes – regular on hot days	Veronica closes her curtains to reduce solar gain when a hot day.
Del & Kirk	fan	Mobile – mainly used in living	Yes – regular on hot days	Use fans to cool house in conjunction with venting through windows.
	Curtains / blinds / windows	All rooms	Yes – regular on hot days	Opens windows and closes curtains. Inside curtains inflexible as they cut out all the diffuse light as well as the direct. Opening doors problem due to strong winds going through dwelling.
	Outside blinds	External on living and main bedroom windows	Yes – regular	Use to reduce solar gain.
Frank	Fan	Living / study	Yes – when needed	Would like a hp for air conditioning/cooling.
	Curtains / windows	Living and other areas	Yes – regular when strong sun	Only when needs to use. Finds the lack of light when the curtains drawn is a problem and see that air conditioning would be useful. Outside winds can be strong (too strong to open up).
Fred & Keira	Fan	Living and other areas	Yes – on hot days only.	Overheating occasional. Living and main bedroom can overheat and this is where the fan is mainly used. Still using heating at certain times of the day.
	Curtains	Living/bedroom	Yes – regularity unknown	Heavy drape style.
Helen	Ceiling fan	living	Yes – occasional use	Often doesn't think to use it, even when feeling hot.
	Windows / curtains	various	Yes – when hot	Uses during the day as needed and for night time flushing of hot air. Heavy drape style.
	doors	various	Yes – when hot	For air flow
Henry			no	Unit has very little direct sun so would not warm up as much as other dwellings studied.

	Cooling system / feature / strategy	Area of house	Use	Comments
Lorraine & Robert	Air conditioning for cooling (hps)	Living / dining kitchen and Rumpus	Use for cooling once per year	Only use once per year on hot days when the house needs cooling. This is a 'cool' house.
	Doors/windows	various	no	Strong winds outside in afternoons in summer, which are cooling on the house.
Mark	curtains	Living, kitchen, main bedroom	Yes - regular use to moderate solar gain	Uses to mitigate effects of solar gain heat build up inside. Heavier drape style.
Mary and Martin	Thermal zoning / migration	various	Yes - regular	Uses different parts of the house according to temperatures. Closes up areas, such as the bedroom if they know will be a hot day.
	Curtains	various	yes	Use is know will be a hot day to mitigate solar gain. Block out curtains.
	Air conditioning cooling on hp	Dining/kitchen and living	Yes - irregular?	Did not mention was main strategy.
Mel	Air conditioning cooling on hp	Dining/kitchen / living	Yes - on hot days when home	Often isn't home during the day during the week, or in the evenings.
	Pedestal fan	Bedroom	At night on hot days	Likes to have the bedroom cooler for sleeping.
	Blinds	Living	Yes- regular	Closes to mitigate effects solar gain, especially when out of the house.
Olive	Windows / venting	various	Yes - on hot days.	Opens two windows in the house on hot days. Only one or two days a summer that she feels the need for a fan, but she doesn't have one.
Steve and Gwen	Pedestal fan	Living	Yes - on hot days, mainly afternoons	Fan is used in the living area in the afternoons.
	curtains	Living and main bedroom	Yes - on hot days	Close off to mitigate solar gain.
	Windows / doors / venting	Whole house	Yes - on hot days	Opens house up so the breeze can move through.
Susan	Fan	Living and Main bedroom	Yes - on really hot days	Uses fan function on her heater, or portable fan in the bedroom.
	Windows/curtains	Whole house	Yes - when goes out	Finds that when has closed up, the heat 'smacks her in the face' when she comes home.
	Windows / venting	various	Yes - regularly uses	Uses windows for fresh air
	Thermal zoning / migration	various	Yes - when hot	Moves around the house and uses the cooler rooms when hot. The craft room is quite comfortable.
Terry	Fan	various	Yes - 5 times	Not often

	Cooling system / feature / strategy	Area of house	Use	Comments
			a year at most	
	Water spray	various	yes	Only when hot
	Windows / ventilation	various	yes	
	Curtains / windows	various	yes	
	Thermal zoning of design	Bathroom and laundry	yes	To the west (blocks out the most intense heat).
Trent	Air conditioning on hp	living	Yes – on hot days	Use when over 30 degree day
	ventilation	various	-	Some significant and noticeable draughts between old and new sections of house, which is a permanent ventilation of the house.
	Thermal zoning	various	Yes – when needed	Close up various sections of the house.
Troy & Nat	Ceiling fan	living	Yes – about once a week on hot days	
	Air conditioning on the hp	Dining / kitchen	Yes – occasional on hot days (about once a year to cool)	
	Curtains / windows	various	yes	To manage solar gain.
	Windows / ventilation	various	yes	Use as needed.
Vanessa and Paul	fan	various	no	Have only used fan once over two summers. House is high thermal mass and tends to stay cool in most indoor areas.
	Blinds / windows	various	yes	To manage solar gain.
	Doors / windows / wall vents / ventilation	Front and back doors, all original walls and all rooms	yes	Lock security doors and open at night to flush out the heat. Wall vents permanently venting fresh air. Use windows for venting as well
	Thermal zoning / migration	Various rooms	yes	Use the most comfortable rooms in the house according to temperatures and climate.

Appendix O – Ventilation and moisture management

Table O-1: Ventilation and moisture management methods

Household / participants	Season	Passive practices / methods	Mechanical venting systems	Comments
Cara Edward & Veronica	summer	Open windows. Opens doors on really hot days.	unsure	
	autumn	Keeps house closed Closed up wall vents	unsure	Closed up wall vents all around the house before win int. Unsure of long term effect.
	winter	Keeps house closed Closed up wall vents	unsure	Closed up wall vents all around the house before win int. Unsure of long term effect.
Del & Kirk	summer	Prop open doors (but winds a problem). Lock windows in open positions.	Fan to cool down Kitchen + bath vents to ceiling	
	autumn	No venting mentioned	Kitchen + bath vents to ceiling	
	winter	No venting mentioned	Kitchen + bath vents to ceiling	
Frank	summer	Open doors / windows (?)for fresh air	Fan to cool down Assume Kitchen + bath vents to ceiling	Outside much of the day of can be.
	autumn	Open doors for fresh air but close up at sunset.	Assume Kitchen + bath vents to ceiling	Outside much of the day of can be.
	winter	Open doors for fresh air but close up at sunset.	Assume Kitchen + bath vents to ceiling	Outside much of the day of can be.
Fred & Keira	summer	Opens doors for flow through air.	Fan on hot days. Kitchen, bath and laundry extract vents.	The door behaviours influenced by the movement of the cats.
	autumn	Opens doors, but less than sum (has cats coming in and out)	Kitchen, bath and laundry extract vents.	The door behaviours influenced by the movement of the cats.
	winter	None - Zones off and closes up	Kitchen, bath and laundry extract vents .	The door behaviours influenced by the movement of the cats.
Helen	summer	Open house to cooling breezes. Hole from removed chimney permanent vent.	Ceiling fan (occasional use)	

Household / participants	Season	Passive practices / methods	Mechanical venting systems	Comments
	autumn	Ventilate during the day of can, close up in afternoon. Hole from removed chimney permanent vent.		Vents house during the day for fresh air – partly as moisture management. Moisture challenges in the laundry area.
Helen (cont)	winter	Ventilate during the day of can, close up in afternoon. Hole from removed chimney permanent vent.		Vents house during the day for fresh air – partly as moisture management. Moisture challenges in the laundry area.
Henry	summer	-	-	
	autumn	No venting mentioned		Unsure of the ceiling vents in the unit.
	winter	No venting mentioned		
Lorraine & Robert	summer	Open up house. Vents in walls.	Air con (once a year) Kitchen and bath extraction vents	Vents in walls still open, and may offer some air flow through the house all year.
	autumn	None – shuts up house Vents in walls.	Kitchen and bath extraction vents	Moisture on windows in morning – so wipe them down.
	winter	None – shuts up house Vents in walls.	Kitchen and bath extraction vents	Moisture on windows in morning – so wipe them down.
Mark	summer	None mentioned – shuts up house to keep sun out	Kitchen and bath extraction vents	Unsure whether wall vents or other mechanical vents.
	autumn	None – shuts up house to keep warm	Kitchen and bath extraction vents	
	winter	None – shuts up house to keep warm	Kitchen and bath extraction vents	
Mary and Martin	summer	Not a significant strategy – predominantly keep sun out	Kitchen and bath extraction vents	Occasional condensation. The house is draughty
	autumn	None- closes up house for warmth	Kitch. and bath extraction vents	Some condensation
	winter	None- closes up house for warmth	Kitchen and bath extraction vents	Some condensation
Mel	summer	Opens up to allow in fresh cooler air during day if home, and at night when sleeping.	Kitchen and bath extraction vents	Laundry extraction? Traffic noise is a problem, but tries to open up anyway.
	autumn	No venting mentioned – closes up to keep warmth in.	Kitchen and bath extraction vents	
	winter	No venting mentioned – closes up to keep warmth in.	Kitchen and bath extraction vents	

Household / participants	Season	Passive practices / methods	Mechanical venting systems	Comments
Olive	summer	Opens 2 windows for fresh air (thermal mass keeps cool). Wall vents allow fresh air in all the time.	Unsure of extraction vents	Has most windows painted shut from previous owner. O doesn't find this a problem.
Olive (cont)	autumn	Non venting - Closes up. Wall vents allow fresh air in all the time.		
	winter	Non venting - Closes up. Wall vents allow fresh air in all the time.		
Steve and Gwen	summer	Opens doors to allow cooler and fresh air through the house.	Fan used in afternoons in hot living area. Unsure of extraction vents	Opening the doors offers a strong flow of air through the centre of the house, which vents the rooms on either side. Unsure of wall vent status.
	autumn	None - closes up house for warmth.		
	winter	None - closes up house for warmth.		
Susan	summer	Windows open for fresh, cool air. Whirly gigs in roof.	Fan when hot (day or night) Kitchen and bath venting	
	autumn	Opens doors for fresh air, but less often than in summer. Closes up in the evening. Whirly gigs in roof	Kitchen and bath venting	Whirly gigs in roof installed and then S noticed that windows didn't get as moist. Now only moisture when really cold and the moisture is minimal.
	winter	Likes to get in some fresh air during the day when can. Whirly gigs in roof	Kitchen and bath venting	Whirly gigs in roof installed and then S noticed that windows didn't get as moist. Now only moisture when really cold and the moisture is minimal.
Terry	summer	Allows in air	Fan (5 days a summer)	Terry is active on his property and therefore is outside regularly. Unsure whether kitchen and bath mechanical venting.
	autumn	Closes up for warmth.		
	winter	Closes up for warmth.		
Trent	summer	No window/door venting mentioned. Wall vents through half the house. Venting through join of old house and new extension.	Kitchen and bath venting	

Household / participants	Season	Passive practices / methods	Mechanical venting systems	Comments
	autumn	Closes up. Wall vents through half the house. Venting through join of old house and new extension.	Kitchen and bath venting	Keep doors open inside the house so that heated air can go through the house.
Trent (cont)	winter	Closes up. Wall vents through half the house. Venting through join of old house and new extension.	Kitchen and bath venting	
Troy & Nat	summer	Opens up to ventilate.	Ceiling fan (once/wk) Air con cooling (once/yr)	Regularly outside.
	autumn	Opens up doors for fresh air during the day (closes in afternoon) Opens up bedroom at night		
	winter	Opens up doors for fresh air during the day (closes in afternoon) Opens bedroom windows at night for fresh air.		Likes to sleep in a cooler room
Vanessa and Paul	summer	Use cool breezes through house. Night flush the house.	Kitchen and bath venting.	In temporary accommodation in summer. Generally outside in the garden a lot during the day.
	autumn	Close up to keep in warmth.	Kitchen and bath venting.	In temporary accommodation in autumn. Generally outside in the garden a lot during the day.
	winter	Close up to keep in warmth.	Kitchen and bath venting.	Generally outside in the garden a lot during the day.

Table notes:

Laundry extraction was generally not checked. Most households mentioned that they had a dryer, but did not have significant moisture problems, so most would have had some strategy for venting their dryer, possibly mechanical.

All mechanical kitchen and bathroom vents extracted to ceiling space, which can cause moisture issues in roof cavity, if there ventilation in the roof cavity is poor.

There was little evidence of persistent moisture problem turning into mould, except where mentioned.

Appendix P – Water heating

Table P-1: Water heating appliances

	HW type	Capacity (l)	Set up	Technology / method of heating water	Age of hws or year installed	Age or era of the house	Moved into dwelling	Temp (°C)	Comments
Cara Edward & Veronica	Solar Hot water evacuated tubes.	315	Solar collectors on roof to N-NNW. Tank in Laundry.	Solar energy with manual-thermostat electric booster	Late 2007	c. 1950s	c. late 2005	Mixed to bathroom @ 55	Manually turn on the electric booster if it is a cold day at the mains power box (not used much in sum and aut and used every 2 days in win). Physically able to walk to mains box. Apricus evacuated tube. Pump failed after installed and new one installed under warranty. Bought large tank as wanted a 'battery effect'. Noticed power bill impact.
Del & Kirk	Solar Hot water	@160-210	Solar collectors and tank on roof sloping to NW.	Solar energy with thermostat electric booster	Late 2007	c.1994/5	c. 1998	60 in tank, 50 at taps	Rely on the thermostat to monitor when the solar hot water needs to be electrically heated. Some mobility issues so walking out to mains box more problematic. Rinnai Beasley MP206682 flat collector. Impact of bill minimal (have AA showerhead). Noted that removing the hot water cylinder from inside had some implications.
Frank	Stand alone, electric element	Assume @300 as more occupants previously)	Outside house	Electric heating	?	c.1963 Extended c. 1980s	c. mid 1970s	?	Older tank so may be higher water temp.

	HW type	Capacity (l)	Set up	Technology / method of heating water	Age of hws or year installed	Age or era of the house	Moved into dwelling	Temp (°C)	Comments
Fred & Keira	Solar hot water	Assume smaller size – 160-210 as only 2 occupants.	Solar collectors on roof slanting to the NNW. Tank outside the SSE wall.	Solar energy with thermostat electric booster	Late 2007	c. early 1980s?	c. early-mid 2000s	Assume 60	Relies on automatic thermostat to turn on electric booster. Switch on mains power board. Pump was on constantly first number of months until F realised something was wrong when the bill came and then installation company assisted to correct the situation. Has some mobility problems due to diabetes. Apricus evacuated tube split system. 2 occupants.
Helen	Heat pump hot water	315	Tanks outside on western [?] side of house.	Air conditioning systems using warmth from air using electricity.	Late 2007	Originally housing department c. 1960/early 70s?	c. late 1990s	58	Works just like a stand alone electric hot water services, except there is some noise associated with the air conditioning. Quantum technologies, 3.6Kw systems.
Henry	Stand alone, electric element	Small size	Tank inside bathroom/laundry	Electric heating	Older – rental hot water service.	Unknown but possibly c.1970s ?	c. 2007	?	Oler tank so may be higher temperature.
Lorraine & Robert	electric element, copper core	Assume 210-310	Tank outside	Electric heating	Fairly new @2006- 7	c. 1950s or 60s underfloor extension c. ?	c. 2000	Assume 60	Told that copper core more efficient than standard. Replaced when failed.
Mark	Solar Hot water evacuated tubes.	Assume small as one occupant	Solar collectors on roof slanted to the NNW.The tank (used the existing tank) sits under the main floor of the house.	Solar energy with thermostat electric booster	Early 2008	c.1995/6	c.1995	Assume 60	Mark did not know much about how the solar hot water worked. The booster is downstairs under the main living in the mains power box. Evacuated tube system, split system. Has AAA showerhead.

	HW type	Capacity (l)	Set up	Technology / method of heating water	Age of hws or year installed	Age or era of the house	Moved into dwelling	Temp (°C)	Comments
Mary and Martin	electric element	?	Tank, assume under house	Electric heating		c. late 1960s	c.mid 2000s	?	May be an older tank so may be higher temperature.
Mel	electric element	Assume 210-310 due to 3 bed.	Tank inside laundry cupboard	Electric heating	c. 2005	c.2005	c. 2006	Assume 60	Newer tank.
Olive	electric element	Med? assume 210	Tank outside, no cover on the eastern side (water side).	Electric heating	older	c.1950s?	c. 1995	?	Older tank
Steve and Gwen	Solar Hot water	300	Tanks and solar collectors on roof slanting to the NNE.	Solar energy with thermostat electric booster (off peak)	2007	c.1930s or 40s	c. 2006	Assume 60	On off peak for the booster. Also AA showerhead which they enjoy (from energy saver pack).
	HW type	Capacity (l)	Set up	Technology / method of heating water	Age of hws or year installed	Age or era of the house	Moved into dwelling	Temp (°C)	Comments
Susan	electric element	Assume sm-med - 160-210	Laundry cupboard	Electric heating	1999 or 2000	c.1987	c.1996	?	Replaced when failed. Turns off hot water when goes away (which is for weeks at a time). Unsure whether 60 or higher. The hot water provides some warmth for the bathroom area.
Terry	Electric element (?)	Assume sm-med - 160-210	Tank in laundry	Electric heating	?	c.mid 80s ? under-floor extension c. 2000s	c. late 1980s	?	Unsure of age of hot water heater

	HW type	Capacity (l)	Set up	Technology / method of heating water	Age of hws or year installed	Age or era of the house	Moved into dwelling	Temp (°C)	Comments
Trent	Solar Hot water evacuated tubes.	Assume larger tank (family)310	Solar collectors on roof and tank outside on deck (under partial cover).	Solar energy with thermostat electric booster	2007	c. 1950s extension c. 2007	c. late 1990s	Assume 60	Pulled out 14 year old toank and replaced with this one. Same place for tank, same electrical. Apricus evacuated tube system. Bosster automatic on thermostat. Mains switch. T monitors the use and turns the booster off if not using water.
Troy & Nat	electric element (7.3max KW)	160	Tank outside on the S or E side of the house.	Electric heating	2008	c.1967	c.1967	70 degrees max (can adjust)	New hw installed after sum int.
Vanessa and Paul	Solar Hot water evacuated tube.	250	Solar collectors on roof slanting to the N. Unsure of tank position.	Solar energy with thermostat electric booster	2007/early 2008	c. 1940s extension c. 2008	c. 2003 ?	?	Stainless steel tank
	Electric element	Small – assume 160	Tank in laundry (plug in)	Electric heating	2006/2007?			?	Plug in 'holiday' style hot water system. V and P used this hot water when they were living in the garage/flat while the renovations were being conducted.

Table notes:

Hot water is generally wired into the cheaper tariff 42 with Aurora. All electric element water heaters were on mains supply water.

Due to the semi-structured nature of the interviews some interviews gleaned less about subjects discussed than others.

Appendix Q – Animal infrastructure and effects

Table Q-1 – Animal infrastructure and effects

Participant / household	Animals living at the dwelling	Infrastructure	Comfort and energy efficiency implications
Cara Edward & Veronica	Chickens Pet Rats	Chicken coop @12m2 Rat cage	Chickens ate food waste on site and eggs for food, reducing food impacts. The rats also ate food waste. Both species provide psychological comfort.
Del and Kirk	-	-	-
Frank	Small dog (shared with another lady) Birds (not pets) in roof!	Dog bed	Provide psychological comfort, motivated Frank to exercise (and keep physiologically comfortable) and provide extra body heat in the dwelling (although small amount). Frank may have left a door open for the dog causing heat loss from the house. Birds use gaps in roof cladding to get in, so the roof is gappy.
Frederick & Keira	Cats	Cat flap (assumed).	Provide psychological comfort, and provide extra body heat in the dwelling. Doors left open in the house for cats reducing zoning affects, and the cat flap would provide low heat resistance to external spaces.
Helen	Cat Dog Birds (not pets) in roof	Cat flap (assumed)	Provide psychological comfort, and provide extra body heat in the dwelling. Doors left open in the house for cats reducing zoning affects, and the cat flap would provide low heat resistance to external spaces. Dogs motivate walking which improves physiological comfort. Need supplies.
Henry	-	-	-
Lorraine and Robert	Cats Dogs Birds Fish Rabbits Guinea pigs	Cat flap Dog beds Cages Pond	Provide psychological comfort. Needs supplies. Cats provide extra body heat in the house space. Doors left open in the house for cats reducing zoning affects, and the cat flap would provide low heat resistance to external spaces. Cats have destroyed draught proofing strips around doors. Decision made not to buy blinds due to cats climbing and destroying them. Dogs motivate walking which improves physiological comfort.
Mark	-	-	-
Mary and Martin	-	-	-
Mel	-	-	-
Olive	Chickens Dog	Dog bed Dog bed Chicken shed	Provide psychological comfort. Needs supplies. motivate walking which improves physiological comfort. Chickens ate food waste on site and eggs for food, reducing food impacts. Dog can provide extra body heat in the dwelling (although small amount).
Steve and Gwen	Dogs	Dog beds Dog flap?	Provide psychological comfort. Needs supplies. motivate walking which improves physiological comfort. Dogs provide extra body heat in the dwelling. Dog flap would provide low heat resistance to external spaces.
Susan	-	-	-

Participant / household	Animals living at the dwelling	Infrastructure	Comfort and energy efficiency implications
Terry	Chickens Turkeys Native animals (not pets)		
Trent	-	-	-
Troy and Nat	Dog	Dog bed Dog flap in door	Provide psychological comfort, can motivate to exercise (and keep physiologically comfortable) and provide extra body heat in the dwelling (although small amount). Dog flap would provide low heat resistance to external spaces. Need supplies.
Vanessa And Paul	-	--	-

Appendix R – Householder opinions of power price rises

The opinions from householders below were taken from 2008 interviews.

Edward, Cara and Veronica: Felt that the fixed rates were high penalised the more frugal energy users, but saw that the higher fixed rates can also help to smooth the difference between winter and summer bills and therefore reduce bill-paying stress. Ideologically don't mind the price rises because they think that 'You should pay realistic prices, because people only value what they pay for' (interview 02/03/08). They were on pay-as-you-go when they bought their house and transferred to standard supply after a couple of years. They were actively trying to reduce energy use through home improvement and everyday practice. Their perception was that Aurora was still state owned. They had solar hot water installed just before the prices rises and the reduction in electricity use from this compensated for the price rises, so they had no net increase in costs.

Del and Kirk: Can see that prices need to rise for all sorts of things. At the autumn interview their bill had gone up \$10. They are retired and felt sorry for families having to deal with the prices rises because they could see that families would use lots of power and would probably be financially challenged.

Frank: His energy use was less than the year before. Has had experience before with Aurora mismanaging bills with mistimed readings, so he makes sure he checks his meter readings so he knows how much he has used.

Frederick and Keira: Conducted renovations (plastic double glazing, new kitchen and appliances) for comfort and energy efficiency which helped with electricity bills. They did not notice rises in costs after the prices rises. They had been able to reduce the temperature of the heating (Frederick is unwell and their house receives no morning sun, so their house is heated more often than other participant's houses).

Helen: Just prior to the price rises, Helen had installed a heat pump hot water that had significantly reduced their energy use for hot water heating. Helen was pleased and relieved that this installation negated the electricity price rises as her household was on a tight budget.

Henry: The price rises have and will have an impact for Henry, but he has been able to cope so far. He believes this is because he had a health care card and it reduced the electricity costs somewhat. Henry's accommodation was rented and the enclosure was energy inefficient. Henry did not have the financial capacity to make changes to the unit as he was financially challenged and living on income from a casual and seasonal job. He mentioned that he had noted that people he knew got despondent when public entities were corporatized and sold off.

Lorraine and Robert: See Tasmania's electricity supply as the dearest anywhere (and they have lived in various places around Australia, including the Northern Territory). 'It is a sore point' (summer interview). They commented that they only had one child left living at home since they had moved to Tasmania as two had grown up and moved out. They were gradually renovating their house and had been doing so over eight years. The latest changes of a new fridge, draught proofing in the dining/kitchen and replacing inefficient light bulbs with fluorescents had limited the

impact of the price rises. The electricity they had saved from these changes had, they believed, saved them from the cost impact of the first (and second) electricity price rises. Their autumn bill was up \$20 but their winter power bill was cheaper than they thought it would be. Lorraine commented that 'Virtually all the changes we did are going to benefit us nothing with the power going up.' Robert commented that 'We are supposed to have renewable energy, how they can justify putting it up again I don't know... If they use coal powered or gas powered turbines you could understand it but when they are using water' (winter interview 11/08/08)

Mark: Was aware that drought in Tasmania had caused lower dam levels which meant less energy was produced here in Tasmania. Mark thought it was a problem for Tasmania that Bass link was privately owned as Tasmania had to pay for its use. He compared the plan of selling energy across basslink from Tasmanian with the current situation where electricity was being bought across basslink to Tasmania. Mark also talked about the history of energy production. Mark is in a position to afford the price rises. He made no mention of changing practices for the energy price rises.

Mary and Martin: Mary and Martin resent that the price rises may have come from inefficiency and lack of control. Martin commented that: *'I resent the amount of the rise that is driven by hydro and aurora inefficiency and I don't like to pay for bull-headed schemes like bass link which means that – I appreciate that basslink is keeping the power on in Tasmania, but it means that we are buying at highest mainland market prices to do it - because of their planning and whatever. I know it is really hard for a hydro system when they don't get rain. I suppose I played a part in that when I opposed Lake Peddar, the Franklin Dam and all that sort of stuff. So in a sense I am partly responsible that we don't have enough dams. But I don't think that we would be in a much better position even if we had those dams on the Franklin because I don't think they have managed them well. The main reason I am saying that is because of the fracca with basslink. We are paying over the odds because the government wouldn't pay the money to buy it so we are paying this foreign company 90 million dollars a year just to have it... because someone had a dream to sell highly priced electricity to the mainland'* (summer interview 17/03/08). They had completed home improvements before the electricity price increases, so at winter had only had a \$10 increase. They were at home a lot as Mary was chronically unwell and Martin worked at home. They commented due to their regular use of the home, they would notice the price rises more than others who were out of their homes regularly.

Mel: Thought the price rises were too much. Mel was living alone, had a full time job and a mortgage. She commented that wages only go up 3-5% as compared to the electricity price increases of 25%. Mentioned bass link was meant to be in the favour of Tasmania. Mel commented *'Yeah I think it is too much, too high. I think the consumers are being made to pay for infrastructure decisions probably a way of putting it. So, you know we didn't get a say in bass link which is supposed to work in our favour and the percentage rise is just beyond what most people's budgets can cope with. We have to cope with it, but something else will have to give... Toast for tea every night! (laughs)'* (Summer interview 06/03/08).

In regards to the price rises Mel said in winter: *'I haven't had a bill recently so I can't. I am anticipating it will have gone up. I believe the rate has gone up quite a bit. I know a friend who put a heat pump in for this quarter, so only had it a couple of months, and his bill went up \$60.00. Now he hasn't checked whether that was partly due to the extra use or whether the price rise, but I am anticipating my bill will be more. I would have to be because the tariff has gone up and using the little fan heater, I might have it on for say an hour at the moment, but it is 24 hundred watts or whatever.'* (Winter interview 25/08/08)

Olive: Was concerned about electricity costs before the price rises and had previously called Aurora regarding what she thought was a high electricity bill. She had been advised to turn off her freezer. Olive removed and sold her freezer. Her electricity costs didn't go down afterwards however and she regretted the loss of a place to store her seasonal fruits. She says that everything is expensive and she has to get on with living, so she won't make a fuss, despite her concern. Due to her concerns about using too much electricity and potentially not being able to afford it (she is a retiree), Olive is extremely careful with energy use.

Steve and Gwen: Their new solar hot water unit had helped them with the electricity price rises.

Susan: Lives alone and uses pay as you go carefully (she is resourceful). She read of other people's \$650 bills and couldn't imagine finding the money for a bill like that. She mentioned discussions on Charles Woolley's [a local journalist] radio show about the price rises.

Terry: uses forward credit so that he doesn't have a nasty surprise from his electricity bill. He also has 1 kW of solar power which reduces the electricity bill somewhat. Terry is also planning on adding more solar power whenever he can manage to afford it.

'Unbelievable and very unfair on the people who can't economise somehow. If you live in the suburbs most people can't have their own water, most people can't have solar panels and therefore it is just so unfair and so unnecessary too, especially the reasons the Treasurer gave which is, it will stimulate business, that is just so far-fetched. Check what he said, it made no economic sense to me because if you charge me more they get more money and how is that helping the economy? It takes my strength off spending where I could go and buy a good useful appliance or do something like buy a bike and cycle instead of going in the car. It is just incorrect, especially as the dividend that the hydro pays is still the same, they pay the same' (Summer interview 05/03/08).

Trent: Thinks that Tasmanian electricity costs are high and 'can't see why prices keep going up and up unless they are replacing a massive dam that is going to cost \$10 billion' (summer interview 15/03/08). Trent has a partner and a child and says 'we don't use anymore than we have to so it is just going to cost us what it is going to cost' (ibid).

Troy and Nat: They seem to manage to keep their electricity prices the same. They are resourceful and are careful with money and don't overspend. If the electricity went up \$50 then they would worry about it (this was said at the summer interview without an indication of how much higher their costs would be). By Autumn Troy

commented 'it has gone sky high now the electricity and the Hydro is in diabolicals with their finances' (Autumn interview 20/05/08).

Vanessa and Paul: Conducted a major renovation in 2008, so it was hard for them to compare electricity bills and discuss changes. Did notice while they were on a plug in, single element hot water system, while the bathroom and kitchen were being built, that their bill was high, so they rang Aurora and to check, and the Aurora representative concurred that the high bill would have been from the plug in hot water heater.

Appendix S – Chapter six practice adaptation analysis

Olive's experience of aspiring to comfort and energy efficiency

Table S-1: Olive's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / Problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influences	Other key influences (eg capacities, information, values, backgrounds)
2007?	Olive was concerned about the cost of an electricity bill, rang the electricity supplier who advised she get rid of her freezer. The removal of the freezer did not reduce her electricity bill.	Problem recognitions and identification of solution. Test of solution. Recognition problem not solved.	Affordability.	Consulted others. Prepared to reconsider practices for solution.	Electricity supplier.	Loss of capacity to store seasonal fruit.
2007	Sought advice re installing a heat pump believing it might resolve heating/comfort/efficiency/affordability challenge.	Problem id Exploring possible solution	New efficient technology for comfort	Sought advice and information	Heat pump installer/electrician?	Discomfort and financial concern Environmental care /resourcefulness Popularity of heat pumps? Technical confusion.
	Decided not to install heat pump as heat pump advisors either offended or confused her.	Problem de-prioritised due to issues with planning a sound solution.		Explortion and assessment of possible solution. Preparedness to halt solution process.		Overwhelmed and offended (not safe?). Expense.
Summer (interview) 08	Aware that needed to resolve on a heating strategy. Wanted comfort using least heating. Discussed house passive performance in interview and asked for further information on heaters.	Pre knowledge applied.	Comfort Affordable living	Sought advice.	Researcher (identified as having appropriate knowledge)	Discomfort and financial concern Environmental care. Capacity to process and try practice changes. Technical confusion and complexity.

Time	Story points	Decision-making / Problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influences	Other key influences (eg capacities, information, values, backgrounds)
Autumn 08	Attempted using hot water bottle and a blanket for comfort in the evening, but was still uncomfortable and felt this solution limited her movements. Then used plug in column heater. Used oil heater when visitors. Unsure what most efficient.	Attempting /testing solutions – not happy with the solution.	Warming the body as main strategy. If very cold also warmed the room with column heater. If visitors used more effective room warming. Heating evenings/nights only. Further developing of 'brief' and goals by better identifying priorities and key needs.	Flexibility for affordability. Stretching comfort zone.		Heard about the danger of using hwb with electric blanket on. Unhappy with sedentary night time activities. Threshold with discomfort. Emerging priorities.
	Due to cold was in bed early with hot water bottle and electric blanket. Found out that electric blankets are dangerous with hot water bottles.	Solution Problem recognition	Body warmth	Using outside advice. Changes practices for safety.	Radio show	Safety
Late Autumn (interview)	Discussed costs of different heating sources and their performance. Olive now using plug in heater when she wants. Thinks oil is expensive.	Knowledge gathering. New possible solution.	Room heating when needed. Only living heated and evenings only. Warming body strategies reduced to clothing. Realised may need to spend more for comfort.	Sought advice and information.	Researcher (as above)	Discomfort. Emerging priorities.
	A visitor provided advice regarding the perceived good performance of electrical pureheat heater (on fan) in larger living area.	New information. New possible solution created.		Absorbed advice given	Visitor to the house	Threshold with visitor advice. New information. Need to resolve finance/resource/comfort problem.
	Tries out electric pureheat heater.	Possible solution tested (in part).		Testing		
	Moved all small living room furniture into larger living room to use pure heat heater (on fan).	Attempting solution/testing.	Heating entire larger living room. Evenings only.	Using lived experience as a test.		Time and effort, assessment skills.
3 weeks after move	Still not comfortable and dislikes the noise of the heater. Moved furniture back to small room.	Possible solution assessment.	Heating small room. Evenings. Reassessed priorities and	Using pre-knowledge lived experience as a		Discomfort and experience.

Time	Story points	Decision-making / Problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influences	Other key influences (eg capacities, information, values, backgrounds)
	Decides to use oil heater despite the concern of expense as realises it is the only strategy that provides a reasonable level of comfort. Also happy that prepaids for oil heater.	Attempts/tests another possible solution.	Realised may need to spend more for comfort.	test.		
Late Winter interview 08	Describes the process with researcher.	Solution decided on.	Room heating small living area. Evenings only. Body scale warming in bed. Compromises on some of her intents (potentially will cost more).	Adjusted priorities and goals to work around problems of comfort. Adjusted money would spend.		Attainment of comfort. Flexible problem solving skills according to situation.

Del and Kirk's experience of improving comfort passively

Table S-2: Del and Kirk's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Early 2008 (and on prior occasions)	Del and Kirk had doonas cleaned and were advised by the doona cleaners that their summer doona was lumping and needed something done. Del and Kirk bought a new summer doona, kept the original one for autumn. They also had a heavier winter doona.	Known solution used seasonally as needed.	Body scale warmth. Comfort. Use different weights of doona according to the seasons. Clean doonas for health.	Open to suggestions from the business assisting them (who are more specialist in the matter than Del and Kirk). Using old practices with improved covers.	The business 'Foam, quilt and pillows'.	Used money to access other's capacity and skills. Other advice. Resolving two intents with the same effort.
Summer 2008	Del and Kirk thought the various weights of doonas were a good solution and reduced the	Solution assessment		Assessed the success of what they had done.		Time to think through the issues and ability

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	layers of blankets needed and simplified bed management practices.					and willingness to consult.
Post- doona cleaning	Del and Kirk found that there was not enough doona for them both during the night. The doona would slip to one side of the bed and the other person was left feeling cold.	Problem recognition	Doona for warmth overnight (<i>body-scale comfort</i>). Resolve the discomfort.			Discomfort.
Pre Autumn interview 2008	They went to the place that cleans their doonas and had their doona extended.	Solutions recognition – likely associated the new problem with other solutions (ie the doona cleaning company).	Improve the doona by extending it.	Using pre known solution paths. Possible that followed the advice of the doona cleaners. Appears that used a previous solution as a stepping off point. Used a known specialist to assist.	The business 'Foam, quilt and pillows'.	Known assistance.
Pre autumn interview	The extended doona improved their levels of comfort overnight and negated the need extra overnight heating. They only needed their electric blanket on for an hour at the beginning of the night to warm the bed up initially. They recommended their doona solutions to me as a solution for my doona issues at home.	Solution test Solution acceptance.	Body warmth. Energy efficient use of appliances.	Assessed the solution and thought was successful.	Solution proposed made to me in interview (and I have seriously considered it!).	Comfort Reduced energy use.

Mary and Martin's experience managing seasonal changes

Table S-3: Mary and Martin's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Early to mid 2000s	Mary and Martin experience bushfire event losing their home.	Problem recognition / definition Using pre knowledge		Moving to cooler climate		Traumatic natural event experienced. Lost house.
	Martin and Mary think about energy efficient design and go to workshops. Martin has environmental design background.	Knowledge gathering, possible solution recognition. Pre-knowledge.	Energy efficiency, sustainable design.	Knowledge gathering	Energy efficiency workshops and information (including government bodies). Sustainable design information.	Question of where to live and in what.
Mid 2000s	Mary and Martin moved to Tasmania, to get away from heat and spurred on by bushfire experience. Had prior knowledge of Tasmania as had lived here before.	Problem solution	Follow priority dwelling goals when choosing their dwelling.	Moving, finding new dwelling situation.	Local laws, local community, housing availability and affordability.	Tasmania's cooler summers. New location, need to settle.
	Mary and Martin use plug-in heaters, zoning and migration around the house as seasonal methods to assist in managing their comfort levels.	Problem recognition- problem solution	Comfort, zoning, migration around house.	Changing practices for effect.		

	Recognise that some rooms are overheating that they need to use and are challenged by the practices they need to keep up to stay warm in winter. These issues influence their decision to conduct physical adaptations. Mary also chronically unwell so needs improved comfort support.	Possible solution design.	Comfort and energy efficiency.	Reassess problem and move to other possible strategies.	Consultants, GERP.	Comfort unmet by practice changes. Mary's illness.
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Mel's experience learning new skills

Table S-4: Mel's practice adaptation story with adaptive characteristics.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Pre new house	Mel's husband did all the handy work.	Pre knowledge	Various [?]	Mel's husband conducted hardware related adaptations	Husband	
New house [date]	Mel separated from her husband and moved into a new home and needed someone to help her who had handy skills. Mel chose house because it suited her needs for low maintenance and had rooms for her children and had a heat pump for efficiecnt heating.	Problem identification	Accomodation. Low maintenance. Energy efficient heating for affordable living.	Moving. Mobilisation of finances and of her goods.	Friends and family and community.	Builder / designer of new home. Mels clear goals ensured house met most of her living need and expectations.
??	Mel traded accounting skills with friends for help with house.	Possible solution emerges and tested	Various [?]	Mel offered to trade skills she had for friends and families' handy skills.	Friends and family and community	Accounting skills. Planning and trading skills. Friendship.

??	Mel asks son to assist in installing a ceiling fan. Her son is unable to help for a long time.	New particular problem realised	Cooling in living area.	Asking others with appropriate skills to help.	Son	M has a lack of skills or understanding around the fan installation.
??	Mel buys tools and hangs a picture. Mel feels pleased she has achieved a hardware and handy skill related job.	Solution, new strategy to reach goal.	Aesthetics	Mel upsills to improve her capacity to make adaptations herself. Prepared to change so that can better manage in the house.	Hardware store.	Positive feedback through positive outcome. Money to buy tools and time to hang picture.

Del and Kirk's experience of physical change affecting practices

Table S-5: Del and Kirk's practice adaptation (**physical change affecting practice**) with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Late 2007	SHW installed and tank moved out of the cupboard in the laundry and a new one installed on roof.	Proposed and enacted solution.	SHW to reduce energy used to heat hot water.	Technical supplementation of old technology.	SHW suppliers, SLT, web sites....	Preparing for the future by future-proofing the house.
Late 2007	Realised that had lost the waste heat for drying and rising bread dough. Decided to think of new ideas to create an airing cupboard in the same spot. Wanted to maintain airing cupboard practices.	Problem recognition. Designing possible solutions.	Energy efficient but warm airing cupboard for drying and moisture management.	Find new solutions using the same cupboard.		Preference to continue with routine practices as they had been enjoyable, effective and useful.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Summer 2008	Discussed installing a heater in the airing cupboard. Electricians advised against it due to heat building up and causing a fire.	Problem processing, possible solution exploration.	Providing drying space. Adjusted priorities and efficiency less important in this solution.	Generate possible solutions. Discuss with 'experts' and researcher.	Electricians, Researcher (me)	Possible available solutions eg heaters are a known technology to create warmth. Driven by hope to reinstate practices.
Autumn 2008	Esky and hot water bottles purchased and used for rising bread dough.	Possible solution tested. Solution accepted as a new habitual practice to rise the bread dough.	Hot water but in an insulated space to prolong effects of the heat. Efficiency priority reinstated.	Being resourceful and using minimal impact and affordable solution.	Op shop	Background of resourceful living? Aim for a simple and non energy guzzling solution.
	Del and Kirk have realised after looking carefully at their electricity bills that the SHW system has not saved them any money or electricity. Booster was obviously on for long periods. PW realised that the issues may have come from: the types of shw system (tank on roof, flat plate collector); no reminder light; no electric booster reminder light; no timer on electric booster.	Testing / assessing solution. Solution currently fails.	Energy efficiency resolution. Affordability.	Assessment and monitoring of enacted solutions.	Electricity supplier and their bills. EE researcher.	Cost of the electricity bill. Lack of understanding of small installations that may help with the performance of the SHW.
	Continuing to process and think through possible airing cupboard solutions. Though that pet warmer may be enough heat. Realised the vent in the cupboard would cause a lot of heat to escape.	Possible solution exploration and assessment. No solution found.	Small and gradual heat supply. Seeking effective clothes management systems.	Hoping to return to prior practices that were successful.	Product suppliers.	Hoping to reinstate the useful drying practices.

Frank's experience of the importance of emotional influences and life changes

Table S-6: Frank's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
childhood	Gran used to resew sheets to be resourceful.	Pre knowledge	Use everything thoroughly.	Resourcefulness.		Background experiences and knowledge
adult	Lived in his home with wife. Used the oil heater regularly while oil prices were low but reduced their use as oil prices increased. Built and extension/renovation on the house. The children left home and practices then changed.	Time pressures, used quickest solutions.	Quick energy intense solutions to save time.	Used technolgy avaiable to get on with living. Adjusted physcial space according to need.	Work situations, community, family.	Lack of time, need of space. Partnership with wife. Need to accomodate comfort of many people.
@ 1998	Wife died. Frank was grief stricken and did less gardening and maintenance around the home.	Suspended		Retreated and did other things. Ignored house and garden.	Wife.	Grief and consequent lack of motivation.
	As recovered from the grief found enjoyment in the vegetable garden. Began sharing meals and domestic jobs with his wife's best friend. Managed house resourcefully.	Recognition of opportunities. Sharing solutions realised.	To be well and enjoy home activities. Food production. Resourecefulness.	Reinstating old practices and discovering new resourceful practices.	Wife's best friend and dog.	Companionship. Innate practicality and resourcefulness.
2004	Did less with the vegetable garden.					Using other activities to manage grief.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2006/7	Increased his efforts in the vegetable garden and felt that he had it in a good state.	Reinstating sharing solutions (a prerealised solution)	To be well and enjoy home activities. Food production. Resourcefulness.	Reinstating old practices and discovering new resourceful practices.	Wife's best friend and dog. Family members.	Family. Enjoyment of life? Enjoyment of gardening.
2007	Broke his ankle and couldn't walk or work in the garden or the house.	Using existing solution	Wellbeing.		Medical professions and suppliers.	Recovery and wellbeing first priority while healing.
2007/8	His wife's best friend helped in the garden and shared the produce. Frank's ankle gradually recovered and he began to work in the garden again. Spent a lot of his day either in the garden or maintaining the house. Went on walks with the shared dog. Has granddaughter to visit regularly. Neighbours are familiar with him and watch out for him. One neighbour brought over some curtains. Relying on collaboration in garden as leg heals.	Using set routines from previous solutions.	Supporting family members who need him. Resourcefulness in practices.	Collaboration. Worked to capacity as recovered from health problems.	Wife's best friend and dog. Family members.	Collaboration. Gardening. House maintenance skills.

Steve and Gwen's experience of priorities affecting useful practices

Table S-7: Steve and Gwen's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Late Summer 2008	Steve and Gwen had developed a vegetable garden over the two years they had been in the house. Steve mainly tended to garden. The vegetable garden produces so much produce is shared with family and friends.	Solution – garden produce	Food production Wellbeing / health Resourcefulness?	Growing own produce	Gifts to family and friends. Golf buddies.	Enjoyed having a garden.
Autumn	Steve's parent both have falls and his dad had a broken arm. Steve's mum doesn't tell Steve and Gwen about her fall and Steve's Dad is not caring for his arm due to dementia. Steve increases his visits to his parents. Steve and Gwen's garden receives less attention.	New problem New priority Solution – increased care for parents, reduced garden time	Wellbeing / health support	Recognition of more important priority. Vegetable gardening wound back somewhat.	Parents Parent's doctors? Aged care professionals?	Family care
End of Autumn interview 2008	Steve stressed from increased amount of care his parents need. Nursing home care being sought for his father.	New problem (stress). New solution proposed (nursing home)	Wellbeing / health support	Trying another solution for parent care to preserve Steve and Gwen's wellbeing.	Parents Aged care professionals, nursing homes, the government.	Family and personal care
Winter 2008	A nursing home is found for Steve's father so his family care responsibilities reduce somewhat. Gwen is advised that due to her illness she should close her small business and change her lifestyle.	Solution	Wellbeing / health	Change of practices for Gwen to prevent ill health.	Parents Nursing home.	Family and personal care
Winter interview 2008	About to make changes to their daily practices due to Gwen's ill health yet	Prior plan/solution reinstated	Aesthetic appeal and reinstating traditional	Working on their house again (as enjoyment).	Making a nice, comfortable, and productive dwelling	Gwen's doctors. Love of bringing

	seeing some possible opportunities to undertake the ornamental front garden remake sooner than later. Vegetable garden still going but with reduced effort.		design) ornamental garden). Food production (somewhat)		space.	back their house to a traditional look.
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Trent's experiences of working towards new comfort requirements and technology management

Table S-8: Trent's practice adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
childhood	Grew up on farm and had learnt to be careful with resources and practical.	Prior knowledge		To use resources carefully and practically.	Family.	Farm and family experiences.
Life in current house	Had undertaken improvements gradually since moved in to house.	Gradual problem solving processes undertaken.	Various functional and comfort related goals.	Changing the house so that it suits his purposes.	?	The state of the house and the goals he had for the house.
	Partner had their child. Trent worked full time and proceeded with improvements in order to maintain a comfortable and functional environment for his family.	New problem recognition. New problem solutions.	Worked towards new goal – comfort, safety and security of family.	Changing the house so that it suits his purposes.	Partner and child and their preferences and needs. Builder and trades.	Job and income
	Installed raised vegetable beds and extended the internal area of the house by adding a new living area, a bedroom, a utility room and a bathroom.	Problem solutions decided and installed.	More living area, comfort, better function.	Changing the house so that it suits his purposes. Food production.	Builder and trades, Engineers and Council.	Family needs
Pre 2007	Decided that didn't like fluro lights due to the colour so would only use them in the hallway of the house.	Solution assessment for lighting.	Good lighting prioritised over energy efficiency.	Discomfort avoided by using other technology.	?	Experience of discomfort from fluro lighting.
Late 2007	Used a GERP rebate to purchase a shw	Solution opportunity arises.	Prior decision to get shw	Opportunitistic when new	SLT	New capacity

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	system.		when could due to its reputation as being energy efficient and also as would be using the sun which seemed practical.	capacity appeared.	Shw sales and suppliers Plumber	opportunity. GERP
	Electricity price rise. Takes notes of how energy is used in the hosue.	Potential problem	Monitors energy use through bills.	Monitoring resource use and prepared to change tactics if need be.	Electricity suppliers.	Cost increase for energy.
Feb 2008	Was working out the best way to use the shw system by using in a certain routine and then monitoring the energy use. Was unsure that monitoring the energy use would be clear cut due to prices rises before and after.	Assessing /testing solution.	Energy efficiency, resourcefulness, affordability, practicality, effective use.	Resourcefulness, practicality, effective use.	Electricity company	Background in resourcefulness and there was a need to keep things affordable with a family to provide for.
	Discussed fluros and I said their light colour had improved.	Using new information to reassess	Comfort		Researcher in energy efficiency	Understanding of fluro lights potential to assist with energy efficiency.
	Due to this discussion Trent tried a daylight fluro and decided that he also thought the light colour had improved began to use more fluros around the house.	Reassessed problem and potential solution. Tested.	Energy efficiency	Using new advice. Using advanced technology (waited a few years until improved).	Fluro light suppliers / hardware store.	Fluro light improvement influenced Trent to reassess..
Early May 2008	Reported to me that he had found the fluros were better and that he was using some.	Solution decided on.	Energy efficiency and comfort	Prepared to try new solution.		

Steve and Gwen's experience accommodating a consumptive guest

Table S-9: Steve and Gwen's practice adaptation (**accommodating a consumptive guest**) with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Years before interview	Steve and Gwen lived on a rural farm with the family where they collected their own water and produced their own energy and grew vegetables.	Problem – limited resources and no mains supplies. Solution – set up appropriate technologies and systems to collect and use resources, but efficiently.	Used firewood they collected in a stove that was also a wood fire. Autonomous energy and water systems. Food production.	Careful management of resources Practice in managing resource carefully through appropriate technologies. Training of the family in managing resources carefully.	Rural community Young family	Necessary lifestyle Community Surrounding environment
Autumn 2008	Steve and Gwen's adult son comes to stay at the house short term influenced by personal crisis. Their son's use of appliance significantly increases their electricity use. Their son was using a plug in fan heater for long periods and gaming appliances regularly.	Problem arises with new occupant. No solution to reduce their son's energy use is instigated. Instead Steve and Gwen resolve to wait out the stay.	Steve and Gwen generally used their heater for two-three hours a night. Their son used the plug in fan heater in a different room to try and stay warm.	Communicated the increase in electricity to their son, but this strategy appears not to have worked. Chose to leave the issues alone.	Adult son.	Son's current situation and needs. Family relationship.
Late Winter interview 2008	One son had moved out and another had come to stay for 'a while'. They made no mention of the impact of the second son on the electricity – instead they mentioned that the dog wasn't comfortable with him!					Family relationship. Son needing short term accommodation.

Appendix T – Chapter seven physical dwelling adaptation analysis

Overview of physical dwelling adaptations completed, planned and contemplated

Table T-1 – Physical adaptation overview of all participant dwellings

Household	Built home? Date?	Once-off physical renovation or many?	Major changes? ie extension or more than a single installation	Change priorities in order	Nature of planning	Rebate induced?	Changes by	Notes
Cara, Edward & Veronica	Moved in c.2005, 1950s house.	Many changes prioritised and made one by one	Backyard change (veggies, chooks, removed hardstand)	Sustainable living, comfort, ee concurrently	Preplanned goals and strategies around enacting the goals.	Yes – shw (ee)	Plans –C,E V; change –E; shw/elec – trades; assessment / testing - Edward	Moved in with awareness would renovate for sustainability.
Del & Kirk	moved in ‘as new’ 1998	Many changes	No - gradual	Comfort / function / age-in-place, then ee	Planned changes with gradual execution. Ided shw but thought not feasible	Yes – shw (ee)	Plans – D + K Changes - trades	Heating system in first round of changes as priority.
Frank	Wife originally rent-purchased from housing. Moved in 70s	Many – some maintenance	Extension / renovation in 90s	Space / aesthetics / comfort, then function	Idea certain ideas/goals as useful, but thought they were not feasible or for future.	no	Changes mostly by Frank except extension/cladding (builders)	Death of wife challenged home maintenance and renovations.
Fred & Keira	Moved in early-mid 2000s, 1980s house.	All renos around same time	Yes - many done at same time - kitchen, windows, bathroom, shw	Comfort / function / aesthetics	Rolled out action on previously idea goals.	Yes – shw (ee)	Plan – F + K Change - trades	When first moved – heating system first house
Helen	Partner bought house. Moved in late 90s. 1960s or 70s house.	A few changes made at intervals one-by-one	No	Health / comfort, then ee / affordability	Idea ideas/goals and waited until could achieve them.	Yes - hphw	Plan – H Changes –Trades + husband + friends	Very little capacity to make change so paced herself carefully.
Henry	Moved in 2007, 1970s unit.	Some small change one-by-one	No	Light / comfort / privacy	Had ideas but only enacted where sensible or could.	no	Henry	Rental situation limited what could so.

Household	Built home? Date?	Once-off physical renovation or many?	Major changes? ie extension or more than a single installation	Change priorities in order	Nature of planning	Rebate induced?	Changes by	Notes
Lorraine & Robert	Moved in 2000, 1950s or 60s house.	Many gradually	Yes – stairs, pantry, moved wc, but bit-by-bit	Function / aesthetics / remove redundant housing features, comfort	Issue-by-issue but thinking ahead	no	Plans – Lorraine and Robert Change - Robert	Worked as a team
Mark	Built 1994-5	Shw only	No	ee for shw	Ided as useful, but didn't think would happen	yes	Plan – other Building – vuilder / Trades Garden - Mark	Felt builder did shoddy job. Relies on trades.
Mary and Martin	Mid 2000s, 1960s house.	gradual changes but planned and list of possible	No – gradual (but lots in a row)	Comfort / indoor health, energy efficiency / sustainability	Thorough after move – planned and identified possible changes for ee and comfort	Yes – insul.	Plans – mary + martin Small Change – martin Major install - trades	Had challenges with the GAER renovation
Mel	Bought 'as new' 2006	Some changes only	No	Comfort / affordability	Limited as believed she would have trouble enacting changes herself.	no	Others in exchange for book keeping	Bought the house because it already met most of her needs
Olive	Bought 1995, 1950s house.	Maintenance and some changes (one-off when can)	No	Maintenance, then comfort	Ided possible changes as useful, but was not sure they were feasible.	Yes – insul. (comfort)	Plans – Olive Painting – olive Installations - trades	Installed heater many years ago when moved in
Steve & Gwen	Moved in 2006, 1930s or 40s house.	Many - gradual from a list,	No - major planned	Food production, then ee and comfort	Plan of things to achieve – gradual action.	Yes -shw	Plans- Steve + G Changes – Steve Electric install - trades	
Susan	Moved in c. 1996, 1987 house.	A number of changes bit-by-bit	No	Resourcefulness, comfort	As awareness rose about a problem would plan and attend to it.	no	Plan – susan Changes - Trades, family + friends	Lived in a rented house but landlords were family. Chose the house because it was basically what she needed.

Household	Built home? Date?	Once-off physical renovation or many?	Major changes? ie extension or more than a single installation	Change priorities in order	Nature of planning	Rebate induced?	Changes by	Notes
Terry	Built c. Late 1980s	Gradual improvements	Underfloor room added	Function / sustainability, then more ee	Gradual enacting of ideas/goals.	Yes – shw (but not through GAER)	Terry all except pvs - trades	Lived mainly by himself. Built the house as wanted it.
Trent	Moved in late 1990s. Substantial renovations for his young family. 1950s house.	Gradual and some coordinated with major extension	Yes - extension	Function for family / comfort for family, energy efficiency	Planned many changes and rolled them out over time as had capacity. Major extension planned and enacted with some other changes as well,	Yes - shw	Minor handy- trent Other - trades Assess / test - trent	
Troy & Nat	Rent-purchased from housing. C. 1967	Many - spread out	Yes eg reclad but spread out major changes	Function / aesthetics, then comfort	Intermittent response to ided ideas/goals. Some goals ided as not possible.	no	Plan - t + N Changes – troy Installation and major - trades	Were very happy with changes had made.
Vanessa & Paul	Moved in knowing would renovating c. 2006, 1940s house.	All changes in one big effort over first few years	Yes	Function / comfort / aesthetics, then ee	Planned all at once and enacted in one major effort	Yes for shw, insulation (comfort, ee and sustainability).	Plan - V + P Design – V/ P / Buider? Changes – builder + trades	Rebate allowed for ee to be a bigger priority.

Cara, Edward and Veronica's experience of moving towards sustainable living bit-by-bit

Cara, Edward and their child Veronica adapted their home bit-by-bit in order to be more sustainable. They are a family who actively try to reduce the environmental impacts of their dwelling activities and had taken this as far as adapting the physical features of the dwelling. Cara, Edward and Veronica's experience provides an example of strategic and driven, but incremental change being made to the home with the purpose of creating more sustainable living spaces. Their story shows that changes can be made if capacity is considered and managed carefully. The house was a detached house on a standard sized suburban block on a flat allotment. The house was a 3 bedroom 1950s timber and weatherboard structure, with a tile roof and a suspended timber floor that sat on a low brick apron.

Table T-2 – Cara, Edward and Veronica's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realize goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Childhood	Cara lived in a co-housing community with an underlying environmental ethic.	Value development and exemplars for Cara. One problem identified.	Sustainable living.	Cooperative community and agreed values and guidelines.	Cooperative housing community.	Responding to discontent with normal living patterns. Care for the environment.
Previously (adult)	Edward adopts Buddhist practices and philosophies. Cara doesn't like the heat.	Identified value alignment.		Entered a 'religion' with practices and philosophies that aligned with his.	Buddhists / ism	Job offer
2005	Social care job offer so moving to Tasmania. Intended to live as sustainably as could. Planned to buy block of land a little way out of Hobart city.	Proposed solution. Prioritised environmental care over want for new house and more land. Tried different possible solution.	Setting up for self-sufficient living.	Land for food production and facility. Natural setting to connect with natural world (?).	Unknown	Natural environments (?) Common/popular ideas about sustainable living.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realize goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Edward did a passive design course and attained software in order to passively design proposed new house.	Tool to assist problem solving.	Comfort and sustainability.	Sustainability. Using prescribed strategies and tools.	Victorian freeware for passive design.	Various – Edward and Cara sought outside information on sustainable living and housing.
	Looking for houses – realized that house near public transport and shops would be less impacting.	New possible (better) solution emerges.		Close to services.	Real estate agents.	Real estate media. Visit to Tasmania
2005	Chose and bought a house near services, shops and public transport in Glenorchy council area. House older, with yard. Planned to adapt the dwelling.	Assessed action needed to meet solutions.	Buy and upgrade existing to suit purposes.	Incremental changes.	Real estate agents.	Various information sources.
	Began adaptations according to decided priorities: fluorescents installed; constructed raised vegetable beds; removed large amounts of unwanted concrete paving; and installed a chicken coop.	Acting for priority. Incremental change. Using prior knowledge. Acting out parts of solution.	Food production; energy efficient lighting.	Incremental changes, energy efficiency, self sufficiency, new technology.	Hardware/landscape suppliers. Poultry suppliers.	Hardware/landscape supply. Poultry supply, Sustainability, making a place.
Mid-late 2007	Planning to insulate the ceiling.	Initiating a pre-determined solution path.	Thermal resistance to support comfort and energy efficiency. Improving thermal resistance of building shell.	Energy efficiency, comfort.	Improving the assets that they have.	SLT, SLT website, Glenorchy local council.
	GAER rebate becomes available. Reconsider what adaptation to make next as the rebate made more expensive thing possible. Decide to apply for GAER for shw.	New possible solution arises.	Energy efficiency, sustainability, comfort. Technological solution.	Use extra money (capacity) while it is available. Take opportunity available.	Replacing a poor performing technology.	Had time dedicated to their home improvement efforts.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realize goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Receive shw rebate offer from GAER.	New solution integrated into plan.	Reducing electricity use through solar energy supplementation.	Technological solution.	GAER, SLT	Literate, have set up for communication.
	Applied and took out personal loan.	Barrier to solution removed.		Capacity supplementation through loan.	Bankers	Bank, internet.
	Spoke to the plumbers, decided on a plumber whilst also choosing SHW system through research and trade advice. Chose oversized hills evacuated tube.	Refining solution. Gathering information to help assess.	Solar energy for hot water.	Choosing most appropriate technology (technological solution). Use trades and borrowed money to supplement own capacity.	Hills, Apricus and other hot water distributors, other suppliers and business who installed.	SHW suppliers, plumber. Edward influences plumber's choice of shw systems, solar hot water information, and internet. Valuing the knowledge of others.
	Some stress involved organizing the loan and setting up according to GERP deadlines.	Stress will be remembered for later solution design.		Pushed on to use opportunity. To gather finances for making change.	SLT, Bank	Deadlines moved to completion but stress is also remembered.
Late 2007	Shw system installed. V could see it being installed from school.	Solution	Better efficiency in energy hungry exercise through new technology	Relying on technology to reduce environmental impacts.	Plumber, electrician	SLT, available supplies. The visible change to the house observed by students.
	Organizing Federal government shw rebates.	Financial aspect of solution	Financial viability	Gather finances used to make change.	Federal government	SLT, Federal government
Few weeks after installation	Pump on shw failed whilst had family visitors from interstate. Called and had pump replaced.	Challenge	Maintaining technology, comfort, hot water supply.	Need technological solution due to embedded use of technology.	Shw supply business, plumber.	Warranty. Family care and accommodation.
	Shw works well. Change shower lengths to longer as feel comfortable. Cara a little concerned about the strong winds on the roof.	Solution registered as successful, with concerns.	Comfort, energy efficiency.	Assessment of solution	C, E and V, the shw system.	Comfort in shower, convenience, enjoyment.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realize goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Three months after installation	Federal government rebate is received. This is stressful because they have to pay more of a personal loan for longer.	Financial aspects of solution needed to be pursued after main solution path ended.	Financial security.	Utilising social capital and government capacity to complete a change.	Federal government, Bank	Government information/communication, government terms and conditions, bank terms and conditions, Cara's regular pay.
January 2008 (?)	Electricity price rise. Electricity bill stays at same cost and know it is due to shw.	Solution assessment	Affordability, financial viability.	Use available measure (electricity costs) to assess success.	Electricity supplier.	Electricity prices.
Late 2007/early 2008	Found electrical problems when replacing ceiling fan and had to get the house rewired. 4 people 1.5 days work, \$5400. Had to hold off insulating until had paid for electrical rewiring.	Problem recognition when enacting solution to another problem.	Ventilation, heat transfer, body cooling, and safety.	Safety	Electrician (a friend of theirs)	Legislations around safety and wiring. Old house and old wiring.
Mid 2008	Ceiling insulation installed by Edward. Edward plants foot through ceiling and Veronica, being much smaller and lighter decided to assist.	Prior solution reprioritized. Enacting solution reassessed. New capacity introduced. Solution	Thermal resistance to support energy efficiency.	Management of own home space to limit environmental impacts and maintain affordability. Utilizes other capacity (Veronica is small and light).	Insulation suppliers.	Understanding of how to attain thermal comfort.
	Note that insulation allows heat pump to heat to the further rooms successfully.	Solution assessment	Thermal efficiency, comfort.	Test practices and comfort outcomes to decide on best way to set up the home.	Edward and house/heater performance.	Thermal comfort

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realize goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Mid-late 2008	Investigating pelmet and curtain installers and ways to do themselves. Edward begins on adjusting pelmets himself.	Recognizing new priority problem. Possible solution identification. Enacting solution gradually.	Thermal resistance.	Using own knowledge and capacity.	Curtain supplier (pushed own product – Edward unimpressed).	Thermal comfort. Energy efficiency

Susan's experience being resourceful

Susan bought a new fridge when her old one was failing, but also adjusted its position and hung heavy curtains behind it in winter due to advice from various sources. Susan had lived in her strata-titled, standalone 2 bedroom house for about 11 years when we met. Susan's townhouse a brick veneer, with a corrugated roof with single glazed aluminium windows. The house was on a hill, so the floor of the living areas was suspended and accessed from the point where the floor met the ground. The house did have access to the sun with the living area receiving the sun in the afternoon. Susan enjoyed the garden and had ornamental plants. The townhouse was built before energy efficiency requirements were in and consequently had little thermal resistance. Susan lived on a pension. The townhouse had been purchased by her extended family and she rented it back off them. She was close to her family and was often involved with looking after the children. Due to Susan's physical limitation, physical changes in the house like curtain cleaning or retrofitting and changes of appliances had to be planned very carefully and assistance from the family had to be booked in. The fridge change-over was no different.

Table T-3 – Susan's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
childhood	Lived on a farm with a father who would deduct money if the children wasted electricity. Lived with tank water.	Pre knowledge.	Limited and efficient use of all resources. Father deducted money to teach resourcefulness.	Training in more sustainable living practices.	Father, mother, family. Economic situation.	Background experiences: economics, farming, living with few resources.
adulthood	In the civilian military	Pre knowledge		Discipline in activities.	Civilian military.	Background experiences.
Prior to 2007	Visited her sister. Saw her sister's chest freezer was covered to protect it from sun.	Pre knowledge, recognition of priority of keeping sun off.	Energy efficiency - Reducing heat load on freezer.	Learning from (trusted) others.	Sister's strategies.	Exposure to another dwelling environment and different solutions.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2007	Fridge was old and Susan was thinking of replacing it. A friend suggested the fridge may have been underperforming due to the direct sunlight hitting it.	Problem recognition. Possible solution ideas. New priority recognition of the needing to keep sun off new fridge for efficiency.		Taking advice from a friend.	Friend – advice.	Friend’s suggestion that could be more resourceful.
	Susan went looking for a new energy efficient fridge and was told that it was important to keep the sun off the fridge.	Possible solutions assessment of both technology and practices.	Using new appliance to gain better energy efficiency and affordability.	Collecting advice and information from various sources.	Fridge sales people	Available technology, promotions, sale people knowledge. Possible solutions limited by current idea about food storage and by available technology.
	Susan purchased a new fridge. Susan organised her family to help her move the new fridge into place (a new place in the kitchen). She also instigated the practice of using a systems of curtains that are changed seasonally. Susan has her sister help her hange her curtains seasonally.	Food storage solution chosen.	Reducing heat load on fridge for energy efficiency and affordability.	Using technology and practice changes to secure and adaptation to better energy efficiency and affordability. Making two adaptations at the same time. Negotiation and project management of others.	Assistance in installation of curtains and fridge by others.	Used outside capacity to move the new fridge into place. Fridge suppliers.
2008 summer and autumn interviews	Related the story to me as an example of energy efficient management.	Background knowledge used in exisiting solutions (practices) that had been assessed as working.		Relating and explaining efficiency technique.	Researcher (me) – to transfer the learning?	Knowledge from experience.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Autumn interview	Susan explained she had organised her sister to help her hang the cold season curtains. She was planning and saving to make new curtains for the living room gradually. Susan was house sitting at a family member's house whilst they were away.	Existing solution path reused.	Thermal resistance through curtains. Aesthetics of new curtains.	Repaying and contributing to mutual care in family. Maintenance of thermal resistance in her house.	Family movements.	Susan lived alone, so no problem house sitting. Other family had houses she could stay in. Susan able and prepared to mind animals.

Henry's experience being disempowered within the home

Henry, a recently separated man, lives in a cheap and basic rental unit. Henry is the final story that is shared in detail for this chapter. Henry's experiences provide some insight into a situation where making physical changes is both hard and doesn't make logistic or financial sense. Whilst Henry was restrained in what he could achieve at home, he was proactive in other areas of life which also reminds that a lack of capacity in one situation in life, doesn't mean that a person or householder is uniformly disadvantaged. It may just mean that they adjusting their response according to their available capacities. Henry's ground floor unit is a basic rectangular space with minimum sized living, bedroom, kitchen and bathroom/laundry areas. Besides the bathroom/laundry, the house is semi-open-plan with no doors between rooms. The walls are concrete block, with a corrugated iron roof. The house receives little direct sunlight. The house also doesn't have any vents or exhausts in the kitchen or bathrooms.

Table T-4 – Henry's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Childhood 1950s/1960s	Remembered childhood in the Brighton region. It was cold. He remembered liking high school because he could wear long pants to keep warm. Remembered coming across the Bridgewater bridge in winter, looking towards Hobart and seeing the river valley air heavy with smoke from wood fires in homes. Recalls that prevailing breezes would blow away the smoke. Recalls the afternoon sea breezes were strong.	Background understanding of place.	Staying warmth at the level of the body.	Comparison with memories. Body-level warmth.	The Greater Hobart area and community.	

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Adulthood	Owned own house with wife and renovated the bathroom and various other parts of the house himself. Had insulation installed in the ceiling.	Engaged with problems and solved where could for the house within capacity.	Maintenance of house, creating better function in house, cleanliness, comfort and energy efficiency, resourcefulness. Through maintenance and renovations of building and building shell.	Changed/improved building, the building, shell and technologies.	Wife, family, and others (unknown).	Understanding of the benefits of insulation. A motivation to have and improve his home.
	Lost a permanent job in his 50s and had to find a new job.	New problem arises – unemployment, which creates other problems.		Had developed significant skill focused in one area.	Workplace	Attitudes/cultural attitudes to employing people 50 and over, economic influences over his job and job availability. Possibly also due to skills/preparedness to speak up?
	One of the jobs he had was in a hardware store.	(Temporary?) Solution enacted – by getting another job in something that wasn't originally trained for.	To remain in paid employment to support himself and his family.	Would fit to the need and the job. Attempted another option. Learnt on the go.	Workplace – hardware store	Was able to respond with adaptability and engage in a new experience.
	Also had a job in production where he became the workplace health and safety officer because he was willing to speak up when there was an issues. He watched managers ignore issues when raised inside the factory and learnt ways to notify authorities around the management.	(Temporary?) Solution enacted – by getting another job in something that wasn't originally trained for.	To remain in paid employment to support himself and his family. To ensure that he and other workers were not abused, and had some level of a safe and healthy work environment to work in.	Attempted change through acknowledged procedures.	Workplace health and safety laws. Manager at work Workplace	Motivation for what is right and equitable. Bravery. Ability to communicate and work with laws and regulations. Need to stay employed.
	Got a casual job in seasonally affected production.	Possible solution for short or long term.	To remain in paid employment to support himself and his family.	Would fit to the need and the job. Attempted another option. Learnt on the go.	Employer	

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2007	Separated with his wife (but on friendly terms) and moved out of his home. Found a cheap unit that he could afford on the casual/seasonally affected wage he was on as a place to stay during this time of transition to a new living situation.	New problem – needed accommodation that was not too expensive due to employment status.	Shelter and basic accommodation for the transition after the separation.	A new place to dwell that is simple and cheap.	Wife, available houses, real estate agents and media.	Still attitude of providing for wife – let her stay in the house. Rental availability.
	Found the smoke alarm was broken in the unit, so bought a new battery, but found it still didn't work. The washing machine came with the unit, but didn't work either. Was concerned that mentioning it would make the landlord think he was a trouble maker. There were also no proper curtains and the window wall in the living room had steel frames and was single glazed. There were some blinds on the windows, but they were old and broken with large gaps (and wouldn't have kept the heat in even if they were new). The unit was also quite dark, especially in the inner section and the kitchen.	Identified problems in the unit. Assessed the possibilities of fixing them and the likelihood of fixing them.	To have sunlight inside through reflectance. To be warmer (comfortable). To be safe. To be able to wash clothes.	Acted on the things he felt he could and left the other issues alone until a solution became available.	Landlord / real estate agent Tenancy laws	Tenure. Concern about the attitude of the landlord to problems in the units. Also had experienced difficulty chasing up the real estate agents to act on issues with the unit.
	Saw the GAER rebate offer in the 'North side News' gazette and applied, thinking that it was worth considering installing a curtain along the large window-wall in the living area.	Possible solution opportunity through capacity provision.	Warmth and privacy.	Taking up the opportunity of other capacity while it is available.	'North side news' gazette SLT / GAER program	Reading of the gazette. Awareness of value of curtains.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Didn't buy an energy saver pack as thought there was no payback in it and he thought the water pressure was poor so the showerhead would be problematic.	Solution assessment and disposal.		Limit effort where think it might be wasted.	SLT Water authorities	Experience with water pressure in Brighton area in his own home and his use/test of technologies in his own home.
	Bought and inserted some strips of material using electrical tape on the blind runner to cover the largest gaps in the blinds so that he could have some privacy.	Temporary, fast solution option.	To increase privacy and warmth.	Utilising a quick approach to limit the immediate problem while think through other options.	Material and hardware suppliers.	Lack of easy improvement options for blinds. Lack of perceived responsiveness from landlord and real estate agent.
	Another tenant in the unit block gave H a mirror. It was too heavy to put up, so was leant in a position that allowed light to be reflected further into the unit.	Passive solution	For increased light through reflection into house. Affordability.	Utilising passive solution and available furniture that will not require ongoing input of energy.	Another tenant in the unit block.	H's access to furniture. H's time to think and resolve.
	Considered removing an old wall cabinet in the living room because the real estate people said he could. He had a conversation with the maintenance man for the units and realised it very heavy and therefore difficult to move. He realised it took up a volume of air that wouldn't need to be heated and decided to leave it where it was.	Passive solution	Affordable warmth.		Real estate agent. Maintenance man	Lack of enthusiasm from unit maintenance man. Henry's need to heat as little air as possible.
	Decided not to use a GAER rebate for the curtains because the curtain would have to be specially made, and it would be expensive. On top of that he wouldn't be able to take the curtain with him, so his would lose a lot of money.	Disposed of possible solution path. Prioritised limiting financial outlays.	Affordable living – minimising financial outlays to the absolute basics.	Living within financial means and limiting extra expenditure to ensure security for the future –outlays of money without being sure of positive outcomes avoided.	Curtain sales media.	Financial capacity was limited and money was precious and not to be wasted. The unique set up of different buildings.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Had an accident at work whilst doing an awkward job that wasn't properly supported by appropriate equipment. H was annoyed that the manager misreported the accident, using vague, inexact language. This meant the accident sounded all H's fault. The fall had hurt his back.	Background understanding to human nature and the lack of care of authorities.	Wellbeing	Engaging with systems and structures, laws and guidelines to try to make change.	Workplace occupational health and safety standard and laws Managers at work	The facilities at work to complete jobs were not safe / sensible. H felt he had little power in his position.
Autumn 2008	Met with H in the unit. He thought it was a good idea to participate in the research because he didn't think that many people in his situation would have spoken up or joined in the research. H tries to keep things affordable and is driven by comfort and cost effective heating. H explained that one of his hobbies was to observe and critique the way public infrastructure was performing and how social systems were working and he would write or call councils, media and the state government about issues he noted.	Sharing learning and experience of problems that are difficult to solve.	Affordability, comfort. Passing issues around housing who may be able to affect the bigger scale social systems that influence. Through collegiality and reporting what is happening.	Communicate with someone who may be able to do something about the disempowerment. Engagement with other scales and systems that may influence change in housing situations.	Me. The university. SLT. GAER. Newspapers Government public relation and representatives.	Communication skills, motivation to make change. Care of people. Rental cultures and rental availability. H had an ability to see the interconnections in the community and also to see how societal systems could affect change to various issues.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Phone call June 2008	Henry noted all the activity in the media and government around climate change and report releases. H had also seen a report on arctic ice melt and felt that there were things that everyone could do and combined they would make a difference, but we would also need massive change programs through government as well. H felt Australian had an isolationist mentality and that this was a problem. H also thought the answer lay in early education of children.	Acknowledgement of interconnections between scale of the problem. Identified that there were many problems that related to sustainability and people wellbeing, including environmental degradation and isolationist attitudes. Problem id / solution id – educate children.	Affect the bigger scale social systems that influence housing outcomes through engaging with me.	Connecting problem to influences at other scales and through different systems in society. Could see fixing some other issues such as education and cultures of isolationist who didn't want other is the country we could begin to engage with climate change.	Children Education systems Media reports effects of climate change.	Concept of the combined effect of people's efforts. Environmental care, social care. Belief in the ability to change for good.
Winter 2008	Met for another interview. H was cold and had been using the plug in heater when he needed it to stay warm, despite the issues with cost. He used to try to limit the heater's use, but decided he would rather be warm. He used an electric blanket and a hot water bottle in bed when he first got in to bed in order to stay warm. The hot water bottle was really helpful with his back injury that occurred at work.	Identified that had to compromise due to problem of cold.	Warmth (comfort) through use of heater, electric blanket and hot water bottle. Pain relief through hot water bottle.	Reassessment and revisiting a planned solution and deciding on another strategy and the use of some extra money.	Electricity cost House Plug in heater	Original commitment to resourcefulness probably from his background.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	H believed that many in Tasmania just learnt to put up with cold weather and then think that heating is too much. He believes though that the perseverance with cold weather that he has observed would have affected people's health.	Identified common problem for community.	To manage affordably.	Being tough and putting up with the situation.	The Tasmanians H knows. Images and perceptions of Tasmanians.	Background and experience with people in the context. 'Perseverance' value seen in the community
	Henry had experience with circumstances where no matter how motivated he was, if there was a lack of capacity, his action alone wouldn't help. Henry saw the government and commercial systems as coupled to his own personal agency and because of this spent time writing to governments and advocating in his workplace on health and safety.	Identified that some barriers to solutions of problems requires having a look at the problem from another point of view.	Affordable housing. Housing of a reasonable quality that supports comfort and affordable living. Engage in bigger scales and societal systems in order to solve basic housing quality issues.	Engage in bigger scales and societal systems in order to engage with an issue. Be a voice encouraging change.	Government and commerce in Tasmania.	The housing systems does not support reasonable affordability for renters and the rental housing can be very low quality.
	H was concerned about a neighbour who had moved out (or been evicted) who only bought small amounts of food and was a drug addict. The neighbour had been fairly young and H used the neighbour's predicament as an example of why there is a need for better support for the youth and a need to educate and guide youth in the community. He felt that there was a bigger issue with a lack of hope and a lack of learning around strategies to engage positively with problems in life.	Problem recognition relating to housing problems.	Community care, education and nurture for housing resilience.	Relating problems with managing housing and dwelling with larger societal problems – if problems of hope and capability are ameliorate in society, then housing resilience would be higher.	A neighbour	Hi experience with youth, and young adults living in despair or with dysfunctional living practices.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	<p>He cared about this happening to others in society as well and when he couldn't help himself, he focused on other issues and tried to act on these issues. This meant that because it was difficult for Henry to change the situation in his unit, he began to talk more broadly to me about issues in Glenorchy and Tasmanian society. Henry used capacity that was available to him such as his skills and his strategic planning to incite change - the capacity and opportunity just wasn't often in the home.</p>	<p>Identified problems outside his own problem set (as sometimes hard to engage with his own problems).</p>	<p>To have a society more supportive of wellbeing through better quality housing.</p>	<p>To engage in another way when personal change is difficult. To engage on many levels for change.</p>	<p>The people H had seen and knew of in Tasmania. His drug-addicted neighbour, workmates etc</p>	<p>Care for people and society. Motivation to continue to try and engage with issues, despite set backs. Skills, strategic planning.</p>
	<p>H would still like to install heat saving curtains, upgrade the broken washing machine, have more light and a working smoke alarm.</p>	<p>Still aware of the problems, but as he can't solve them, H had put the problems on 'the back burner' until a possible solution present itself.</p>	<p>Comfort, functional living, cleanliness, sunlight inside.</p>	<p>Improving house to support easier, better, more affluent ways of living.</p>	<p>Real estate, government tenancy laws, man conducting unit maintenance, design and building laws for unit accommodation.</p>	<p>Lack of passive design in the building, lack of quality building or heat flow resistance in the building. H's lack of money to afford a better rental space.</p>

Vanessa and Paul's physical adaptation

Vanessa and Paul, who had lived a couple of years in Hobart previously, moved back to Glenorchy, Tasmania in 2006 beginning their retirement with a significant extension and renovation of their newly purchased house. They tried to do as much as they could in one go: extending, future-proofing and sustaining. They extended the house while living in the renovated garage and also undertook to plant a large and productive cottage garden. Their story provides an example of extension and significant change being made in the home. They also provide an example of people with a strong sense of purpose and citizenship and how this informs adaptation. Vanessa and Paul found the house over the internet and purchased it because it met most of their primary selection criteria: it was an older style house on one level with a flat block, it was brick construction and had off street parking. They bought it knowing that its age meant that it would need renovation if they were to make it a comfortable home. They moved to Tasmania in 2006 and found that as they had guessed, their house was cold and some extension work would be needed. Their house is a standalone double brick house with a corrugated iron roof with a suspended floor just above the ground. The original house was built in the 1940s. The house sits on a flat, standard suburban sized block with, after the renovations a large garage/granny flat, a large cottage garden, and the house.

Table T-5 – Vanessa and Paul's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
1990s	Lived in Tasmania and enjoyed it. Had hills on the walk home.	Prior learning about place.			Employer, Hobart community, the context.	Money flow, affordable rental accommodation.
1990s – 2006 ish	Moved back to Melbourne for a job. Experience with heritage homes and upgrading them. Solving living situation challenges through renovations / adjustments of their homes.	Prior learning about place. Active problem-solution process in houses.	Moving and living according to jobs. Renovations for home function, better aesthetic, water/energy efficiency, recycling old buildings, reduced environmental impacts from living.	Refitting to re-life houses.	Paul's brother shows how to work with heritage windows.	Employment options. Melbourne laws and social norms. Melbourne's / Vic' water shortage. Care for heritage.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2006	Retired and decided to return to Tasmania to live. Searched for older style houses.		Moving for comfort and lifestyle.			Good previous experience. Superannuation and house value to use in new house.
	Found house over internet and purchased according to goals (older style house, on one level, view, brick, off street parking). Understood would have to renovate.	Utilised clear priorities in choice. Identified a problem.	Prioritised liveability, car spaces and style.	Learnt from previous Tasmania and Melbourne experiences to search house according to key criteria.	Real estate site information.	Internet real estate sales.
	Moved to Tasmania. Lived in the house before the renovations and found it cold and dark.			Planning to adjust the house according to needs/intents/purposes. Utilising own resources where could.		Took with them what they could for the renovation.
2007	Designed and planned extension and renovations.	Assessed a problem solution.	Comfort, financial management and health, environmental care, sustainability (esp. for grandchildren), making a home and a place to live. Achieving through adding floor area to the house, and improving the building shell, improving food production, and adding effective technologies.	Remaking a home for better provision.	Designer? Planners Superannuation scheme. Their Children and grandchildren.	Had time and savings to use. Local community and local situation.
	Engaged builder. Decided to project manage themselves.	Refined solution according to capacity. (No chance to test solution.)	Affordability of the build.	Using other's skills. Fixed quote contract to reduce uncertainty.	Builder/ trades.	Used own skills where could. Current builder availability and labour

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
						costs.
	Submitted planning and building applications. Garage planned close to fence, so also building permit. No complaints from neighbours.			Following laws and guidelines.	Council and planners.	Planning ordinances and building code.
	Built garage extension and adjusted existing sheds. The shed had a new small laundry/bathroom which meant that visitors could use it after they had moved into the house.	1 st solution stage. Also answered problem of guest accommodation later.	For interim shelter priority.	Incremental change so could stay at property.	Family visits to V and P.	Resourcefulness
	Began designing and installing extensive cottage/vegetable garden.	Begin with part of the solution.	Resourcefulness, sustainability, enjoyment/pleasure. Through improving food production and microclimate.	Creating a self sufficient home space. Creating enjoyable outdoor environment.	Nurseries.	Gardening skills. Sustainability values. Place making.
	Applied for the GAER rebate.	New opportunity so reassessed solution.	Sustainability.	Opportunity to use supplied finance – outside capacity.	GAER program, SLT.	Internet information, sales information.
	Extension work began. Living in garage converted to a granny flat. Sought and refinished old windows and doors for the renovations. The windows need new pulleys. Some doors/windows were freighted from Melbourne 2 nd hand suppliers. House being extended for new kitchen/dining and living space rewired, new light fittings, heating installed repainted, windows refinished, new curtains. Insulation	Enacting solution and constantly reassessing detail of the solution as progress.	Affordability of the build.	Utilising own and other's skills. Gathering building products from known suppliers in Melbourne.	Builder, product suppliers, trades, Melbourne 2 nd hand stored.	Difficulty of living in garage (cold and small) was a continual motivation. Place making.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	and shw hoped for with GAER.					
	Developing garden, helping with the build where could and repairing windows and doors.	Enacting solution with all capacity available.	To make the adaptations happen. To stay well and warm. Through improving food production and microclimate.	Food production. Maintaining health and comfort by staying active.	Builder, product suppliers, nurseries.	Utilising gardening skills and building skills. Resourcefulness.
	Got the GAER rebate for a number of items and therefore selected solar hot water system and insulation.	Assessing possible solutions for solar hot water.	Energy efficiency, sustainability, comfort, aging-in-place.	Utilising opportunity when arose (financial capacity through rebate). Asking others regarding shw selection. Gathering information, assessing information.	SLT, Suppliers,	Gathered information carefully for product selection. Resourcefulness, care for future generations.
Summer (interview) 08	Extending/renovation continued. Met for first interview.		All as above.	Sharing learning from the renovation with me. Utilising my knowledge if possible.	Builder, trades, solar hot water suppliers, SLT website.	Discussion with neighbours as they were interested.
	The building timeline was extended as the extension was taking longer than first planned.	Carried on with planned solution path.		Kept with the plan, despite the extension of time needed.	Builder, trades.	Superannuation savings carefully managed. Doing as much as could themselves.
	Heat Pump installed and electrician tells them to leave it on at all times. They think this is odd advice. Previously had central heating vented under floors in Melbourne and hadn't left it on when not at home.	Knowledge gathering/assessment of ways to practices with new technology. Background experience.	Comfort and energy efficiency though installing (effective / efficient) technology.	Listen for hints and tips from the electrician. Deciding on effective dwelling practices for comfort. Aiming to be resourceful. Comparison of previous.	Electrician.	Heating myth shared by electrician.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Contacted and wrote to State then local government about the lack of rebate for water tanks. State and Local government said there is no problem with water. V and P disagreed and see that there is a problem. Awareness of water issues raised in Melbourne. Observing huge water waste in Tasmania.	Seeking solutions, seeking agreement of the problem.	Water storage and efficiency.	Looking for financial assistance with water tank purchases.	State government: Mr Sturgess Local government: David Pearce	No water rebates as no water supply problem recognised in local government area or in Tasmania. Citizen involvement and care for community and environment.
Autumn 08	Second interview. Discussed the blown out timeframe and their frustration watching the slowness and disorganisation of the trades. Recognised trades wanted in many jobs at the time and that was slowing it all down. Nevertheless happy with the quality of the builder/trades work. V discussed the difficulty of living around a renovation and the loss of privacy. Aware the probably wouldn't recoup the money invested in energy efficiency in the house.	Enacting solution, with new problems emerging continually in terms of product selection and enacting the renovation and therefore constant possible solution being assessed and sought.	Cost effectiveness, product efficiency in use. Maintenance of some privacy.	Encouraging timely solution. Trying to work with the builders to keep things on track, friendly and calm.	Builder, trades, suppliers.	Trade supply not enough to meet demand in area. Utilising own skills, time and other capacities. Home privacy lacking causing stress.
	At time of interview making decision about the floor surface coating – chose water based, least impacting	Defining selection criteria, assessing available solutions.	Indoor health, environmental impacts, durability. Improving the house.	Asked around for information from suppliers etc.	Floor covering specialists.	Knowledge gathering.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	At time of interview also upgrading, refitting sash windows. Painting and installing new pulley systems proved to be time consuming.. Paul's skills developed as progressed.	Enacting solution (upgrading old windows to install) and refining retrofit systems as went along.	Aesthetics, beauty, maintaining consistency of style in house through refitting / refinishing.	Refinishing for reuse.	2 nd hand suppliers, hardware suppliers.	Paul's brother had previously shown Paul how to upgrade.
	Installed front garden apple trees/more in vegetable gardens.	Enacting planned solution	Aesthetics, food production, garden pleasure	Food production / multiple usage	'Stoneman's' nursery	Time and energy and fitness to plant. Understanding of gardening.
	At time of interview some minor health challenges causing V and P to think about costs and self care needs.	New problem. Assessment of possible solutions and reprioritisation.	Health.	Reassessment of capacities and plans and priorities according to dental health issue.	Dentists. Media stories (sensationalist?) on dental issues.	Self care. High costs of dental systems.
	Got water tanks for \$3500 with no rebates.	Solving efficiency solution.	Water independence and efficiency.	Small scale resource collection.	Water tank sales and installers (plumbers). BCA and Australian standards.	Lack of government support. Victorian water laws and practices. The mainland water shortage. Good citizens are water efficient when they can be.
	Had problems with floor surfacing, but only realised after moving furniture in and had to move furniture out for refinishing.	Assessing solution as poor.	Durable and consistent floor surface finish.	Retried the solution using trade person.	Floor surfacing trades person.	Stress. Trying to attain a certain standard.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Discussed the extension, heat pumps and other topics with their neighbours.	Feedback, sharing learning and reflection of process.		Sharing learning, providing encouragement for others to make changes where they thought they had been successful.	Neighbours	Community values, relationships with neighbours, something to share.
Late Winter interview 08	Met for last interview. Renovations almost complete. V and P were living in their house again, utilising heaters. Reported they were happy and warm and were learning how the extended and adjusted house worked. Using the heat pump to maintain comfort when required. Still very active in the garden and try to keep active. Shared information and conversation about the renovations and installed technologies with the neighbours.	Experiencing solution. Learning new patterns of practice.	Comfort, energy efficiency, sustainability, lifestyle.	Food production, resourceful living	Me. Their adjusted, adapted house. Neighbours.	Now in home, so day-to-day functioning easier. Their time and effort can be put into developing habits and practices, resource collection and sustainable home practices.
	Focussing on using garden produce in the new kitchen.	Extending a solution.	Food production and processing.	Providing own food.	?	Time and effort, health and fitness and motivation. Preservation technologies and cooking facilities. Resourcefulness and self sufficiency.
	Decided not to use heat pump as	Resolving and a solution	Warmth, comfort,	Listening to others and	V and P, and practical	Their own critical

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	advised by electrician.	path.	efficiency, affordable use.	critical thinking to decide on practices with technology.	sustainability/efficiency advice (?)	thinking.
	Discussed current solar power offers currently available.	Identified other efficiency problem - assessing possible solutions - decided not realistic.	Efficiency, sustainable energy source.	Considering a new way of gathering energy to be more sustainable.	PW and solar power companies' advertising.	Generous federal government rebate available. Solar companies working the rebate.

Helen and her family's physical adaptation

Helen is a woman, who at the time of the interviews was a postgraduate student and a mother of two children. She lived with her two children, her husband and a dog and a cat. Her husband didn't take part in the interviews. Helen and her family's house was built with single skin brick with a corrugated iron hip roof and timber floors. The house sat on a steep slope so the single living floor was accessed via external stairs and the garage and storage area sat under. The garden was mainly ornamental or lawn, with an area out the back for their dogs. The house was of a similar style of many of the houses that surrounded it, which had been built by the Tasmanian housing commission in the 1960s-1980s. The house received all day sun with the living room receiving the middle day sun and the kitchen receiving the afternoon sun. The house shell had limited thermal resistance despite having some insulation in the ceiling. The insulation had been laid by Helen's husband, but it had since moved due to strong air movement and disturbances when the fireplace chimney was removed. The wall and floors, as with most Tasmanian houses were not insulated. Helen had moved into this house when she married her husband so had not chosen the house herself. Helen's husband had trades skills. She felt that that house needed general upgrading and some retrofitting for energy efficiency. When Helen could, she engaged in making changes.

Table T-6 – Helen's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Late 90s	Moved into a home that H's partner already owned. Helen had been used to living closer to the city and had been able to walk or bus to most places.	Pre-given housing solution – no choice.	Living with loved one.		Husband	Lack of property, so moved into husband's house.
	Was a member of 'Environment Tasmania' (the precursor to SLT) and was aware of alternative technologies and environmental design, but had not thought to apply it due to having been a renter.	Collecting information / understanding		sustainability	Environment centre	Gathering information. Environmental care.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2000s	H's eldest child's asthma was exacerbated by the smoke from the wood heater in their living area. Other than the wood heater only used a plug in heater in the child's room when needed. Decided to remove the fireplace and install an electric radiant/fan heater.	Problem identification and prioritisation, solution identification	Healthier indoor environment, Changing heating technology	Change technology to reduce localised pollution.	Heater sales, and supplies	Background understanding, unwell child, poor heating options
2002	H and Husband put insulation in the ceiling.	Solution	Comfort, energy efficiency, affordability through building shell resistance.	Improving building to improve lifestyle/efficiency/affordability	Insulation provider, installer?	H's understanding
	H's husband removed wood heater and gave to a friend for their shack. H was pleased the fireplace had a new home and wasn't wasted.	Substitution of technologies as solution.	Comfort and indoor health through change of heating technology.	Improving building heating technology through substitution.	Friends	Prioritised valuing the redundant technology – found it a new home
	Had an electric (pureheat) radiant/fan heater installed by electrician who was a relative in the living area. The hole in ceiling where the chimney had been was covered but needed to be better sealed. The heater was meant to be put onto the heating tariff, but H had trouble getting her husband to do the last things needed to get the electrician to provide the certificate so that they could register it with the cheaper hot water tariff. Husband said not to bother because the difference in rates was not much [at interview I informed H the rates had changed].	Partial solution reached and new problem (hole in the ceiling) identified.	Comfort and indoor health.	Improving building heating technology through substitution.	Relative electrician Husband	Time was limited so didn't finish ceiling plastering, and didn't hook up to hot water tariff. Utilised available and borrowed capacity. Lack of understanding on H's part about the tariff pricing. Reliance on husband's efforts and skills.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	H was very busy with study and the children and found that most physical adaptations had to be made slowly and in between other pressures.	Solution boundary/definer was H's significant capacity limitations.		Could only engage in most pressing changes that were needed – prioritised, as time was limited.	University	Low capacity in terms of time, energy and money.
2007	Installed a ceiling fan with family electricians.	Problem of being hot potentially solved with a ceiling fan.	Cooling, Comfort	Introduction of a technology using family skills to achieve.	Husband Relative electrician Ceiling fan suppliers	
	Saw the GAER rebate offer at the library and thought it would be worth applying for. When received the offer could get insulation (but already had) and other things, including hot water. Although their hot water was still working, the rebate meant that they could get a good offer. Could also use family electricians and would only need a plumber. Approached her husband, but husband wasn't as convinced it was a good idea and friends and family were sceptical and thought it would have a long pay back and it was too expensive.	Possible solutions identified and one solution path (replace technology).	Energy efficiency, comfort through replacing technology. Reducing electrical usage to limit brown coal use.	Using opportunity that presented. Replacing a technology.	Library GAER SLT Husband Relative electrician Opinions of friends/family SLt information SHW information Hphw information	Rebate provided affordability. Friends dissuaded. Environmental care.
	SLT called H to let her know she could have the rebate. H thought it through, convinced husband and ignored others. H's called SLT back just when the SLT group were meeting to decide who would be offered the rebates. But at this stage H not sure what on offer besides all in one shw units that sit on the roof.	Possible solution path pursued.		Utilising the capacity provided by others. Reprioritising according to opportunity.	SLT Husband Others	Communication skills. SLT communication. Prioritising change according to opportunity.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	H received information regarding various hot water unit choices from SLT. H called a few people regarding roof systems and then chose a hot water unit primarily because it sat on the ground. The shw units would have required a frame on the roof, which seemed complicated to H.	Possible solution paths investigated.	Efficiency of installation / maintenance, affordability	Gathering information from others for decision.	SLT and SLT information Called shw suppliers.	H rang around and gathered information.
Late 2007/early 2008	A Quantum energy technologies family size heat pump hot water unit was selected according to information SLT supplied. Ordered and purchased selected system for \$2500. The tank was larger than the old one - they had regularly run out of hot water with the old one.	Solution choice	Efficiency of installation / maintenance, affordability, comfort.	Purchasing technology that utilises solar energy (through air conditioning technology).	SLT information Shw and hphw suppliers	Rebate H's time and decision making
	A small concrete slab poured by H's husband and family for the hphw.	Enacting some of the solution.	Affordability, efficiency of installation	Utilising own resources before using capacity of others.	Hphw specifications Family / friends assistance Hardware store	Concrete information Do-it-yourself approach and values.
	The hphw delivery person had trouble getting the 207kgs hphw system out of the truck and the hphw fell on top of him. H called an ambulance, but the fellow said that he was alright and he was sub-contracted so wasn't covered by work cover that he would be ok. Called another person who came to help and H, and the two other people dragged it on a trolley up the hill.	Solution enactment. Prioritised the hurt man.	installing	Using the capacity of others. Prioritising human care over achieving solution. Working together to achieve.		Delivery driver's lack of capacity and lack of capacity provision by the company. A heavy technology.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Plumbers came and connected it efficiently – it was straightforward. The plumber who came quoted confidently because had completed a system before. The family electricians installed a plug for the system which was straightforward and didn't require priori installation knowledge of the hphw units.	Solution enactment	Efficient and affordable installation.	Utilising other capacity through paid trades and family help.	Plumber Family electricians	Communication and borrowing of capacity
	Passed on old hot water unit to Husband's parents who have a shack. If they hadn't taken it H would have asked around further to find out who could use it. If that hadn't worked would have taken it to the tip shop to be resold.	Solution enactment	Resourcefulness and minimising consumption effects.	Ensuring old technology used. No waste.	Husbands' parents Community Tip shop	Prioritised valuing the redundant technology – found it a new home/or family communicate they would like it. Resourcefulness.
Summer/autumn interview 2008	1 st interview. The hphw had reduced hot water component of the bill from \$350 to \$50 so she was pleased.	Solution performance assessment Use	Energy efficiency, affordability, comfort, environment impact reduction.	Using a more effective technology.		Family care and management Environmental care
	Works hard to use the heater sparingly and have short showers so that she is limiting her environmental impact.	Problem solution – use only what needed.	Affordability, making available supplies for other.	H using only what needs and no more.		Not wasteful – resourceful. Environmental care.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Currently H and husband were in the middle of looking for a replacement toilet due to problems with flushing mechanism. H was also thinking about replacing shower head, but was looking for a good replacement with a specific sort in mind. Had only looked in catalogues at this stage, but would look further before choosing.	Toilet – problem prioritisation and possible solution identification, and solution enactment. Shower head problem identification, brief development, possible solutions identification begun.	Functioning toilet through replacement. Waste management. Cleanliness.	Replacement of ineffective system.	Hardware and plumbing supplies Husband Catalogue supplies	Time to find a new toilet and to install it. Time to find an appropriate shower head.
	Helen explained that she was currently very pressed for time. She had to look after her children, was completing her research and consequently their household was also managing on one wage. Helen said that time and money were two challenges to capacity to make changes. She also explained that she would prefer to think through and find materials and products that were appropriate and reasonable quality and fit for task, rather than choosing something in a hurry that was inferior, inappropriate or not durable. Finds that the looking for good quality and the right product takes time.	Takes care with briefing and possible solution identification so not having to repeat the solution path again soon.	Functionality, durability, family care.	Careful consideration of options and possible solutions for durability of solution.	Suppliers of products. Supply catalogues.	Shortage of time and money. Intent on finding appropriate solutions that fit the brief and are durable. Family care and education values priority.
Late winter 2008	Met for interview. H's sister's had large winter bills and she was waiting for hers. Her sister's house is cold and they found they had to sit around the heater. Her sister's house has little sun and moss grows in the backyard.	Pre-knowledge Information collection	Comfort	Comparisons to understand and identify opportunities for improvements.	H's sisters' experiences and houses.	Family care and connections. Comparative learning about house.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	H is vigilant in turning off heating and lights after the children are in bed so she doesn't waste any energy or money. She and the girls will use blankets when sitting.	Uses a solutions that has worked before.	Comfort practiced through body regulation as much as indoor air temperature regulation.	Uses body scale tactics to limit house management resource use.		Vigilant practices.
	Had just noted that the Federal budget had announced the possibility of loans for green upgrades in the home. H didn't know anyone who would have 10s of thousands to use on upgrades like PVs	Information gathering for potential solutions design in the future.		Possible use of provided or borrowed capacity to achieve outcomes.	Federal government Media Government budget and reports.	Awareness of politics and social systems. Cost barrier for both H and her community. Recognition of the importance of appropriate government activity. Knowledge of community financial capacity.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	<p>Plans to finish paying the mortgage and then renovate. Looking forward to bath renovation. Pull up carpet.</p> <p>When mortgage paid will renovate and put deck out the front to enjoy the view.</p> <p>Garden in back yard. Underfloor insulation.</p> <p>Aiming to adjust store room downstairs later on in life.</p> <p>Chimney hole in ceiling - cover to be sealed.</p> <p>Door between laundry and kitchen (partly to manage heat and moisture for laundry).</p> <p>Besides a lack of money, H sees logistics as the biggest problem. Gradually replacing lights as they blow with LEDS from the shops.</p> <p>Had been sent a 'safe and secure' brochure from council.</p>	<p>Briefing on identified problems that are not yet prioritised.</p>	<p>House functions, health, aesthetics, facility, natural connection, storage, energy efficiency, comfort, moisture management.</p>	<p>Improving space for better function.</p>	<p>Safe and secure brochure from council.</p>	<p>Home making / improvement intent. Care for house. Must pay off mortgage first. The carpet change seems a big task to H, so it has been left. Logistics always challenging.</p>
	<p>Although recognises the benefits of solar power but feels they are too expensive.</p>	<p>Possible energy efficiency solution currently discarded due to barrier.</p>	<p>Energy provision through sustainable / available sources.</p>	<p>Changing sources of resources / energy.</p>	<p>Available solar power information.</p>	<p>Knowledge / information gathering and problem/solution identification skills.</p>

Troy and Nat's physical adaptation

Troy and Nat are an extremely careful and resourceful couple who were part-retired and lived at home with their dog. Troy and Nat lived in a three bedroom vinyl clad, weatherboard house with a corrugated roof. They had bought the house from the State Housing Authority in the 1960s. Over the years they had made home improvements as they could afford it. Their yard was a large suburban yard with lots of sun and great views. It was mainly grassed, but there were also fruit trees, a vegetable garden and ornamental plants. Troy and Nat were happy with their house which was sunny and provided them with most of what they felt they needed in a house. Troy and Nat had a resourceful routine and were involved with, and enjoyed living in, their community. Troy and Nat decided to install a door to assist to hold in the heat air in one area of the house. Their experience of installing a recycled door to zone off their dining area from the hallway provides useful insight into to intricacies involved in making a single change to a home. Their relationship with their dog is also a reminder of the part that animals play in the home as occupants and companions creating someone else to consider as well as providing some of the comfort of home themselves.

Table T-7 – Troy and Nat's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
1960s	Bought house off the State Housing Authority through a rent to pay scheme. Their house was among many others that were being bought in the same way.	Pre set elements to solution	Ownership of house, shelter, comfort through shelter.	Using opportunity to buy as made affordability by a home purchase scheme.	State housing authority and rent-buy scheme.	Regular income. The availability of such as scheme. Drive to settle in a home in this location.
	Gradually added to their house and added a deck and added a layer of vinyl cladding to improve the look of the house and to limit maintenance. Changed their timber windows to aluminium. Found the vinyl helped somewhat with indoor comfort. They found that the aluminium windows didn't rattle as much as the timber ones had. They had been freezing in the house before the vinyl but felt much warmer after and were impressed enough to remember the difference.	Identified problem, chose and enacted solutions. Discovered unexpected solutions to other problems.	Low maintenance through a durable cladding and aluminium framed. Improved function through deck. Improved comfort through extra cladding.	Adjusting and replacing materials to make living easier.	Various – product suppliers, builders, and unknown others.	Commitment to the house and the place. Aesthetic preferences. Busy due to family. Labour intensiveness of painting.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Had partially insulated the roof space, but had stopped as had got stuck under a rafter because the roof space was small.	Attempted solutions – but barrier halted enacting solution.	Comfort Safety	Attempted a change himself and stopped when realised too difficult.	Insulation companies	The roof space meant the d-i-y was not enough
1999	T and N 'bit the bullet' and installed a heat pump in the dining area with flow through opportunities into the living area. Insulation installed at the same time as they had read that hps work better if the house is insulated. They thought about getting cellulose insulation but were aware there were breezes through the roof and though the cellulose would get blown around, so got glass fibre batts. The insulation assisted to keep their house warmer and the heat pump allowed then to heat more effectively and affordably. The heat pump replaced an old oil heater that had been expensive to run.	Used a prior recognised solution using financial capacity that was normally kept in saving or used elsewhere.	Comfort through passive and technological improvements in the home – building shell thermal resistance and installing efficient heating technology.	Used housing improvements to create a more comfortable space. Used other's and their capacity to achieve.	A very keen and cool or cosy (cellulose) sales person. Information on insulating. Glass batts suppliers. Hp sales electrician	Went with their own decision making and how they felt. Wanted to be as economical with hp as could in use. Influenced by information on the benefit of insulation in conjunction with hps.
2004	A new corrugated roof was installed by local tradespeople. There are no dedicated ventilation holes in the roof.	Replacing failing element of the house after assessment of the function of the house.	Shelter through re laying roof.	Maintaining / refreshing building. Used other's capacity.	Local trades people. Roof materials suppliers.	T and N assessed the need for a new roof and engaged when the roof was needed.
2007	Saw GAER advertised at the council chambers when paying the rates and made the decision to apply together. They were thinking of purchasing a shw system. T and N didn't see the energy saver packs.	Identified an opportunity to use a pre devised solution.	Energy efficiency, resourcefulness, affordability and comfort through shw system.	Considering the use of offered capacity for something that was otherwise not a priority and maybe wasn't achievable otherwise.	Council chambers and rates payment. Shw information.	T and N consistently reviewed their housing needs and applied themselves to achieving them. Did not see the energy saver packs.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Received an offer (?) and information for installing a shw system. Looked into purchasing a shw system, but found out it would be \$6000 all up and were surprised. T had assumed that a shw would just need new panels on the roofs and the old tank could be used. The price, the length of pay back and the 'miles of pipe' needed put them off and T and N decided not to use the GAER rebate.	Assessment of the possible solution and found that wasn't a realistic solution.	An affordable and efficiently built solution.	Taking care not to overextend financially and weighed up pros and cons.	Shw sales and information sheets. SLT GAER	Limited understanding of how much the shw would cost and the various ways they can be installed. Stopped with limited information and made a decision.
	Had been thinking about ways to be comfortable affordably and resourcefully. Thought a door in the hallway might be useful to stop heat leaking out of the dining area.	Problem - solution exploration. Possible solution devised and stored in memory.	Comfort through zoning the house.	Thought out possible solutions despite not having the ability to achieve straight away.		Time to plan and devise.
Late 2007	On their regular walk around the neighbourhood they found a plum tree cut down and decided to jam the plums, rather than see them wasted.	Opportunistic decision and devising of solution.	Food provision through harvesting locally	Use of what is available and unwanted by others.	Local people and their cut down plum tree.	T and N walking everyday provides them space and time to see what is going on n their neighbourhood.
	On their regular walk they also walked past a renovation and had noticed that a door had been pulled out of the house.]The door was glazed, so they could install it to hold the heat and limit the transfer of noise, but they would still have some light into the hall. T and N asked the owner and they had intended to take the (old front) door to the tip, so T offered to take it away and was given the ok. They took the care around to pick it up and found it was really heavy.	Possible solution becomes available (for a problem that had been thought through previously, but no resourceful solution had yet been found).	Comfort through zoning the house. And daylight provision through glass sections of the door.	Took opportunity when material to meet solution provided.	Renovators in the neighbourhood not wanting their old door.	Prepared to ask. Time to think it through and reuse the door. A positive attitude to reuse.
	Purchased two water tanks. Received the first one for garden water. Had taps installed but found that it was hard to engage a plumber.	Water efficiency and sustainable water use.	Water supply through water collection and storage,	Collecting resources on site. Using technology to collect and storage and supply water.	Tank suppliers. Plumber, electrician.	No government rebates.
	Got the plumber to put in a twin flush toilet and a	Identified	Functions, cleanliness,	Using other's capacity and	Toilet suppliers,	T and N prepared to

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	more water efficient shower head and now don't use as much water (unsure whether had an efficiency rating, but made a difference). Now don't get buckets of cold water as water heats up.	inefficiencies as problems and resolved through replacement solutions.	water efficiency through installing new technologies.	new technology to replace items and achieve goals.	plumber, hardware store.	think through and solve inefficiencies in the house.
	Replaced incandescent with fluoro around the house.	Identified inefficiencies as problems and resolved through replacement solutions.	Energy efficiency	Using new technology to create efficiency.	Hardware supplies.	T and N resourceful and thinking through problem and have time to engage with solutions.
Late summer 2008	First met with T and N. T thought that the vinyl, and insul had helped to raise the temp 5-10°C inside in winter. Don't feel draughts which they think is due to the insul. T and N manage the house during the day to maintain comfortable temperatures. They were happy with their house and felt it was beautifully place receiving all day sun and receiving sea breezes in summer, but do get strong winds as well. The house is easily maintained. In comparison to neighbours they find their house performs much better in terms of retaining warmth. T and N only occasionally use the ceiling fan for cooling in summer and rarely use the hp (air con) to cool. Not worried about the electricity increase yet as haven't got a bill.	Assessing solutions – thought successful. Comparative assessment with other's situations.	Maintenance, comfort, energy efficiency	Assessing outcomes. Communicating success to me.	Neighbours.	Compare with neighbours. Reflect on own situation. House performing to their standards. Both have a drive to be resourceful.
	T and N's dog was deaf and was therefore a little nervous around new people, so the dog was outside while I was at the house. She was an old dog and was part of the family. She had a dog flap to get into the house and lived both inside and outside.	Practice solution for new visitors	Animal love and enjoyment through owning a dog, having a dog flap and managing their practices around the dog.	Living with an animal for enjoyment and companionship.	?	Preparedness to adjust according to occupants. Love of animals.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Were waiting on the second water tank to arrive. It was supposed to have arrived the week before. Wanted to get levers on the taps so they could use the taps as they aged and when they eventually got arthritis.	Enacting solution but barrier / hold up.	Water collection, self sustainability, aging-in-place.	Creating self sufficiency, planning ahead.	?	Reliability of supply of products.
	The curtain backing on the wool curtains fatigued and fell apart so N pulled the backing off and kept using the curtains as they still looked ok and did the job.	New problem (curtains falling apart). Piggy back solution.	Used available capacity and existing materials and skills.	Using own capacity to solve problem.		Resourceful attitude, Nat's skills.
	Explained that they had heard something like my research (ee discussion) on the radio - they thought it was an ad in disguise from an energy efficiency company.	Using prior info to develop picture of the issues (radio program introduced the ee concept prior to interviews).		Connection (and utilisation of) two different information sources.	Radio - ABC - and energy efficiency group	Having radio and programs talking about ee. Time and a place to listen and absorb the radio.
	Only use heating when really need it and have been in Tasmania their whole lives and so are used to the climate. They reported being very careful with resource and make sure they limit their energy use - they only have a couple of showers a week. They said they were 'just like that' and been like that a long time.	Pre designed solutions, ie resourceful living.	Efficiency wherever could in practices.	Efficiency, resourcefulness.	?	Resourceful attitude. Agreement and shared goal between both occupants in the house.
	Explained were planning on installing a door and they had the glass panelled door outside. The door 'weighed a tonne' and we discussed the installation of the door.	Enacting solution for energy efficiency and comfort.	Zoning by adding a door. Using second hand door for affordability.	Utilising own skills, reusing materials, establishing better passage design in the house.	Local people giving away door.	Troy had skills to retrofit the door. Nat agreed with the retrofit.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Had the plumber out recently as their hot water unit was old and the valve was getting stuck. The plumber said that if they needed to replace the valve, they should replace the entire hw unit. They have noticed that in comparison they pay a lot less for hot water than other people. T had thought about encasing the hw, but people had laughed at him and the plumber said it had enough insulation and that the cylinder was designed to be outside.	New problem – old hw tank needed replacement and wanted to make the hw tank efficient.	Replace broken hw tank.	Questioning whether the tank was efficient enough.	Plumber	Plumber (an apparent specialist in insulation capacity). Resourceful goals and practices.
	I was given some of the jam N had cooked up from the cut-down plum tree. T makes model aeroplanes.	New opportunity – ie the plums creates opportunity for jam. T enacting a regular solution.	Use what is available.	Maintain skills and make their own and use resources available when ever can.	T's clients for model planes. Local cutting down plum tree.	T and N's regular exercise in the neighbourhood. Their shared resourceful goals.
After summer interview	New hw system installed. Got the hw system moved from old spot inside to a spot outside so they could install a pantry inside. They were very pleased with this change.	Solution enacted with new problem solutions – that is the hw tank was moved.	Replace technology.	Utilise technology.	Plumber / electrician, product supplier.	Saw the solution as positive – were pleased. Plumber / electrician knowledge and skills. Ability to pay plumber.
Late Autumn	Spoke to T as N was at work.					
	T leaves the door open to hear the phone, so the house is quite open during the day. T and N only heat the house at night. Concerned about the electricity price increases and the financial vulnerability of the commercial set up of the electricity company, which he read about in the news that day. Kath will read info provided at this meeting when she comes home. Have a dog flap for the dog.	Pre existing solutions.	Fresh air through house. Close down and zone off for short period of heating indoors.	Careful use of heating.	Newspaper. Electricity supplier.	Keeps in touch with what is happening through the news. Kath processes detailed information like the ee SLT booklet. T keeping an eye on trends.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	The water tanks were installed and the pump was in, but a wet weather power point was still needed. T had a friend who is an electrician who is going to install the power point, but he was very busy. T said that he is great but has to be caught at the right time. He assured the elec. That the job was very simple.	Enacting solutions.	Water collection.	Being self-sufficient and resourceful.	Electrician (friend) – waiting on.	Tank installers – plumber, product suppliers, information brochures. Time.
	Discussed carbon footprints and climate change and T was annoyed because of all the arguing and misinformation on both sides and was concerned about the actual impacts – that we are affecting and even losing rivers, our soil, our trees. He made reference to the ecology being connected and all affected. The burn offs annoyed him – and he had read in the newspaper and on the radio that the smoke went 20000 feet up in the atmosphere. Talked about water shed systems in Hobart and Tas and explained that water levels weren't high everywhere.	Problem – government and decisions makers are disagreeing about energy use and sustainability without appearing sensible.		Staying aware of policy decisions and greater social and ecological issues. Trying to encourage thought about environmental issues that living impacts.	Newspaper, radio, carbon foot-printing and public climate change discussions, government, media.	T attentive to the goings on and public discussions and paid attention to details. Critiques the discussions. Awareness of interconnections of ecology and also the multiple scales of social influence.
	T and N on pensions and limit their consumption but see friends and acquaintances on pensions buying luxury items, new tvs, new cars etc and thinks it is excessive. He questions why 6 litre capacity engines are produced at all in cars.	Problem – maintaining affordability.	Resourcefulness.	Awareness about greater trends and personal response to trends.	Friends and their consumption.	Perspective on consumption - try to limit their consumption.
	T feels the federal budget which was just announced is all baloney and he doesn't feel that government is trustworthy or thinking through the real problems as they spend too much time arguing. The state government he thinks has gone ahead without consulting and also hides things they do.	Problem – government and decisions makers are disagreeing about energy use and sustainability without appearing sensible. Decision		Staying aware of policy decisions and greater social and ecological issues. Trying to encourage thought about environmental issues that living impacts.	Government, media	T attentive to the goings on and public discussions and paid attention to details. Critiques the discussions. Awareness of interconnections of ecology and also the

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
		makers not trustworthy.				multiple scales of social influence.
	Also discussed that all ee things have issues – eg fluoro lights have poisonous gas.	Assessment of risks of solutions.	Energy efficiency	Sees there are pros and cons to each decision and choice.	Information providers on ee and health.	Awareness of impacts of products
	Thinking about underfloor insulation (as have a suspended floor) using hard Styrofoam. Talked about it at the first meeting and had been thinking about it.	Exploring possible solutions for lack of floor insulation.			Me – ee discussion	Problem solving processing all the time. T has skills to conduct change in the house and so had thought through the details of installing Styrofoam underfloor.
	Had considered getting a ceiling fan in the bedroom but had decided just to get a pedestal fan instead. Also got a AAA showerhead.	Considering solution options. Chose solution.	Air movement for comfort. Use fan as uses minimal energy for cooling. Water efficiency.	Considerations of multiple solutions.	Product suppliers. Hardware store.	Skills to install showerhead.
	Discussed the hw cylinder again – the valve issues had taken T to the hardware store and the store man had said that 1.5 cups of water loss wasn't much, so don't worry. I mentioned wrapping/encasing the tank again. T said was thinking about building a cover himself.	Problem – water leakage. Gathering of knowledge about the problem.	Energy efficiency and water efficiency.	Consulted others for more knowledge.	Hardware shop assistant with hot water knowledge. Me as ee researcher.	T's time and problem solving persistence. T's maintenance practices on the house (observed the leak).
	The door was being worked on, but the wind blew and smashed all the glass, so T had installed new safety glass.	Enacting solution – problem with solution – resolution of the problem.	Same solution, but with more modern material.	Persistence at engaging solution.	Glass suppliers.	T's handy skills – could reinstall the glass.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Late winter 2008	Third discussion. The dog sitting inside with us – as I am a little better known. The door had been hung. It had been challenging because the floor sloped a bit. The door had been helpful limiting heat leakage and also still allowing light through. The door glass cost \$265 in the end. T is planning on adding draught sealant to it.	Problem resolution and physical adaptation finished. Still looking to solve draughts around the door (new problem, or extension to the problem).	Thermal zoning with door.	Persistence with solutions.		T's handy skill set and his time. N's commitment to the goal(and trust of T's judgement).
	T said his winter bill was very good at \$200 – they hadn't had to use much morning heating either. But T and N's son lived in a cold rental with plug ins and the bill was expensive and his son was depressed. T consequently helping source some 2 nd hand carpet for his son to put down.	Assessment of preexisting practices and solutions – with a positive outcome. New problem – uncomfortable living situation for son.	Energy efficiency / resourceful living.	Physical resolution for his son's cold place.	T's son and his living situation.	Resourceful behaviour. Care for family. Connections to 2 nd hand materials.
	Had seen a solar energy guy down at Salamanca and he had said that it could cost as little as \$1500. Had discussed solar power with N.	Reassessment of possible solutions and priority for the solution due to change.	Energy efficiency. Passive living (sun instead of other electricity).	Keeping idea in the back of mind in case new situation arises that makes it possible. Consulting with others with information.	Solar power installer small business owner.	Plans with N.
	The tanks are fully installed and T and N are using them in the garden.	Solution resolution.	Water collection for efficiency. Garden production.	Installed collection technology (physical solution).		T and N's garden practices.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Discussed that the pulp mill seemed in direct contrast to climate change action. Talked about the rail lines and T was disappointed and annoyed with the railway management. Also discussed the proposed canal estate for Ralph's bay - T and N recalled adverse tidal and storm activity there and wondered when it would be washed away. T recalled a particularly bad 1 metre surge in 1983.	Problem – government and decisions makers are disagreeing and decision makers not trustworthy.		Memory and background experience and knowledge of the area. Staying aware of policy decisions and greater social and ecological issues. Trying to encourage thought about environmental issues that living impacts.	Government , media.	T attentive to the goings on and public discussions and paid attention to details. Critiques the discussions. Awareness of interconnections of ecology and also the multiple scales of social influence.
	Thinking about further renovations / installations. Would like to install a whirligig to take away extracted cooking air, a skylight in the hallway for light as the hallway is quite dark, and rolling draught excluders on the bottom of the doors. T would also like to install solar power, but he thinks it is too expensive and thought that things like this should be supplemented by the government. Still intending to insulate hw. T and N were also helping their son improve his rental house a little because it was really cold. Discussed many of these during the three interviews. Getting tradespeople T reports is hard though. 'They suggested that if I ever got hold of a plumber I should kidnap him!' T thinks that things happen because of T and N working together.	Planning around currently recognised problems and goals (not yet prioritised for action). Barriers with number of goals trying to reach and cost.	Moisture management and ventilation. Natural daylighting indoor where dark. Draught exclusion. Comfort, energy efficiency. Solar power as passive electricity source. Affordability.	Processing goals and strategies ahead and project planning to gradually achieve.	Son. Various information suppliers on physical renovations. Government.	Lack of rebates. T's limits of time and skills. T and N working towards goals together.

Mary and Martin's physical adaptation

Aspects of Mary and Martin's housing decision-making were shared in chapter five.

Mary and Martin purchased their house around 2005 when they moved to Tasmania. The house is brick veneer, corrugated roofed house with a suspended timber floor for the main living area with an office and storage under. The house was originally built by its owner in the late 1960s. The original owner was quite progressive for the time and had included some insulation in the building shell in the walls and roof space. The roof was gable ended but with a low angle fall and there was evidence that at some point the roof had leaked at some point. The windows were single glazed with aluminium frames. Mary and Martin were gradually adapting their home for comfort, hoping to be energy efficient and create a less environmentally impacting house. They change a large number of things in their house, a few of which are discussed in this table.

Mary and Martin used were in their home a lot. Martin worked from home and Mary was chronically ill and therefore spent a lot of time in their home. Their story highlights the way that when people are unwell or regularly at home, the house has to perform even better in terms of comfort and indoor health. After moving into their home Mary and Martin replaced the heaters and then, with the opportunity the GAER rebate program provided, also added curtains and insulated the roof space. Whilst their physical adaptations provided significant changes to comfort levels and allowed Mary some relief, the insulation was not entirely successful, providing an example of some of the issues that can arise when retrofitting older buildings.

Table T-8 – Mary and Martin's physical adaptation story with adaptive characteristics

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
2005	When Mary and Martin moved in the house was cold and the original ducted oil heating system was no longer a viable option for heating. Mary and Martin had to use plug in heaters.	Problem recognition, assessment of solution (ie of the move to a different house in a different climate).	To rehouse, to be comfortable and healthy.	Assessed performance of the house and engaged in thinking about ways to change.	Real estate agents/media. Solicitors, house sales laws.	Removalists, family (see previous mary and martin story).
	Mary, being at home regularly due to her chronic issues with illness, generated a brief of needs for the house and used it to plan and prioritise out home improvements. EE was considered. Ma and M had previously been to passive design information sessions, had read about passive	Briefing Planning	To be comfortable and well as possible	Structured processing of the problem	'Cool communities ' talk HEAT team, Canberra Canberra policy	Background experience and information. Mary's time important to the planning and orchestration.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	design and ee and Martin also had some design experience. M and M also felt their old state (Canberra) was more motivated about ee and they had learnt from that.					
2006	Invited over an ee specialist to walk through the house and advise them. The auditor made a big deal of every ee failing in the house and 'supersized' suggested changes which was overwhelming and off putting. Martin also thought he was grumpy. Therefore Martin began not to trust what he said.	Gathering information/possible problem solutions	Energy efficiency, environmental care, comfort	Looking for expert advice and guidance	EE specialist consultant	Offensive, unbelievable
	Invited two different eco-designer businesses over for some advice and found them helpful. The designers explained thought that it would not be wise to engage them to conducted small ee changes and that ot would be more cost effective to do it themselves. The designers said that getting the insulation in the roof would be hard.	Gathering information/possible problem solutions	Energy efficiency, environmental care, comfort. Listened to expert advice.	Looking for expert advice and guidance	Eco-designers, Feng shui advisor	Good advice, but job the wrong size and couldn't link idea with products, suppliers or installers. Had to look elsewhere for these.
	M and M found there was a hole in the services around ee as they required someone to tell them what would be best to do and then also to make/organise the changes. Nobody covered from design to organising the trades. Ma and M also didn't want to overcapitalise as they knew they wouldn't be able to recoup their costs in the area.	Identified issues with action strategy to solve problem	Energy efficiency and comfort.	Ided information/assistance gap that proved a barrier to solving their problem. Communicated with me about that.	House value, real estate markets.	There was no one who could assist with retrofitting all the small things that needed to be changed, and knew where to get all the products and who could be afforded to do all of this.
Mid 2007	GAER advertised at shops, so put name down and then also saw the offer elsewhere. Had already been thinking about getting insulation and curtains so this was a good opportunity. They also applied for heat pumps, but they weren't offered a rebate for the hp.	Engaged with possible solutions path. Used background understanding and known possible	Energy efficiency, affordability, sustainability, comfort	Engaged with opportunity for rebate (capacity) provision	GAER /SLT Local shopping centre Glenorchy council	Used pre knowledge and design planning and expert advice.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
		solutions.				
	Had an energy audit for the GAER program. The GAER auditor thought that their house was challenging due to the volume, the stairwell and the building shell.	Gathering information/possible problem solutions. Identified issues with action strategy to solve problem	Listened to expert advice.	Engaged with information provision from expert.	Energy auditor for SLT	Were communicative and engaged.
	Went to a GAER information evening at Council.	Gathering more information for solution provision	Comfort and energy efficiency through possible use of supplemented financial capacity.	Gathering information about (rebate) strategy.	GAER /SLT presentation Glenorchy council	Were engaged and prepared to collect information.
	GAER offered to provide a rebate for the curtains and the insulation. There was concern over the short time and trades were difficult to get so there was stress. They were not offered heat pump rebates, likely because the energy auditor realised that improving the building shell heat flow resistance was more of a priority.	Solution offered through supplementation of capacity. Motivation.	Comfort through heat flow resistance. Purchase of curtains (with rebate) and use of trades and Mary's skills.	Combining capacities. Improving the building.	GAER /SLT Trades	GAER rebates. Trade availability. Mary's skills. Curtains supplies.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Mary needed better heating in the house so they installed two heat pumps and some panel heaters and also bought a bathroom heater. These were not rebated through GAER. These heaters provided more comfortable environments. An appropriate bathroom heater was hard to find. The only other choice they had had was ducted oil heating which they felt was outrageous. The heat pump sales person told them it was more efficient to leave the hp running all the time \. They had also heard that from other friends [I had also heard it from other participants]. The house orientation was such that the living and eating areas did not receive sun for most of the day.	Problem of ill health combined with discomfort from cold pushed for the solution to be found.	Comfort and wellbeing through installing modern and more efficient and affordable heating technology.	Installed new heating for indoor comfort - ie a technological solution.	HP / heater sales Hp /heater installers Friends as advisors Previous information. Electrician.	Heat pump efficiency myth in sales and installation circles. Orientation of living areas was poor and heating was therefore very important. Aurora (electricity supply) and lower heater tariff.
	The time to achieve the installations for GAER ended up being shorter than M and M needed because tradespeople were hard to get. Rang SLT about once a week to check on specifics of products that were allowed, to get the conditions clear and other reasons. Found in the end that as long as the installation met the project's aims, SLT were pretty flexible.	Solution execution	Comfort and energy efficiency through improved heat flow resistance in the house.	Proactive communication on Mary's part and receptiveness on SLT's part. Rebate manager flexible to overcome barriers.	Tradespeople SLT	Lack of tradespeople available. Availability of SLT to clarify and smooth out administrative issues around installations.
Late 2007	Bought some readymade curtains and some material for Mary to make some curtains herself. Some of the curtains were on sale, which helped, because Mary realised that the curtains plus the extras and pelmet renovations were going to become costly. Gradually made up the curtains. Had considered getting honeycomb blinds but they were not cost effective. Had also considered	Problem identification regarding curtains installations - through to finding solution.	Comfort and energy efficiency through improved heat flow resistance in the house.	Improving building heat flow resistance. Creating a warm and more enjoyable space to live, providing resilience.	Curtain sales shops SLT	Mary could sew and had the time to make the curtains. Magic seal inappropriate technology for the windows. The building is constructed in a way that allows change to be made.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	using 'magic seal' to 'double glaze, but the magnetic technology on the magic seal did not work that well on aluminium windows. Ma and M didn't have the money to replace the windows, which leaked a lot of air and transferred heat out.					
	Chose glass batt insulation as were concerned that the cellulose would settle and compact. The roof space was tight and hard to access and they were a little concerned because insulating was likely to mean pulling up the roof.	Possible solutions explorations, solutions identified according to criteria and logistics.	Comfort and energy efficiency through improved heat flow resistance in the house – reducing heat flow through ceiling.	Improving building heat flow resistance. Creating a warm, more affordable and more enjoyable space to live, providing resilience.	Insulation sales and information	Previous insulation product knowledge. The building limited insulating solutions.
	Engaged a business to do the insulation and also to relay and paint the roof at the same time. The business was an insulating business who had an employee with roof laying experience. Felt confident in them at this point and had spoken to come companies that didn't feel as comfortable or confident with. The installers were a small family business and therefore not always contactable. Also got the insulators to install light covers for ee and fire protection, which took a little extra leg-work and thinking. They had got the idea about the protectors from one of the designer's visits when Martin had mentioned the problem of halogen down lights (which their house had) losing heat. M and M had to source them and each cover was \$20. Had considered installing drought stoppers with fan blades but had been advised they could be a problem. The roof was originally put on upside down, so when it was lifted to lay the insulation the roofers re-laid it, resealed it, painted it and de-	Enacted a problem solution after careful thinking through various possible solutions, and the details of the solutions.	Comfort and energy efficiency through improved heat flow resistance in the house – reducing heat flow through ceiling.	Utilising others skills and/or expertise. Engaging help they felt were trustworthy. Paid attention to details in planning and were prepared to engage with assistance to create a detailed outcome. Got a few jobs done at once, solving a few problems at once.	Insulators, Lighting shop Hardware store? Designers advice Draught stopper media.	Added an extra task to the insulating which wasn't part of the normal trade job. Sourcing extras took time. Business engaged had two sets of skills required: insulating and roofing. The small scale of the family business implied a trustworthy business - but also meant that there were capacity issues. Ma and M; knowledge about halogen energy use. Expense of light covers. Issues with roof and the lack of cavity space.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	rusted it.					
Dec 2007	Gradually made and hung the curtains. The pelmets were open at the top so M and M had got a handyman in to cover the tops of them. Purchased triple insulating lining to add to the existing curtains in the house.	Enacting solution	Comfort and energy efficiency through improved heat flow resistance in the house by replacing or improving curtains.	Mary's DIY utilising her own skills and capacity, combined with using other capacity.	Handyman Martin	Availability of someone to fix pelmets.
Jan-Feb 2008	Various visitors arrived and stayed with Ma nd M.	Distraction from enacting solutions.	Maintaining comfort and facilities for visitors via house management and technologies.	Made space for loved ones to stay.	Visitors and their comfort.	Requires significant time and effort, especially if Mary unwell.
Late summer 2008	Met to discuss ee with them. Thinks that the rebate offers are useful and was pleased to see the council was involved but thinks that the curtain rebate was quite small considering how much it costs to purchase, make and hang energy efficient curtains. Although that had appreciated the rebates, they felt that governments were more interested in putting money into flashy technologies for retrofitting rather than the basic ee retrofits. The curtain rebate in the end hadn't covered much of the change that needed to be made. Were annoyed by the approach the state government took to electricity and how they subsidised large companies so much, but understood that energy needed to be paid for.	Sharing/transferring learning and experiences for other scales of problem /solution assessments (ie research and government assessment).		Making change to the home utilising supplemented capacity. Sharing learning and opinions with me to feedback.	Local government. Me	Making a point about ee and sustainability in the home in relation to government and state activity. Curtains are expensive to hang and pelmets also increase the cost causing affordability issues. Electricity supply issues and unfairness of electricity subsidies.
	Planning on installing underfloor insulation, but have to get an electrician out first which was proving difficult.	Problem with solution execution.	Comfort and energy efficiency through improved heat flow resistance in the house.	Understanding of various things can change. Enacting changes gradually as have the capacity.	Electricians The insulation company.	One job had to come before the other. Electricians unavailable or wouldn't come out and quote, even when they said they would.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	Mary has time to retrofit the old curtains now the visitors are gone.	Opportunity arises for solutions enactment.	Comfort and energy efficiency through improved heat flow resistance in the house - improving old curtains that weren't replaced.	Uses own skills and time. Upgrading existing facility.		Martin supporting through working at home. Identification of roles in solutions enactment. Broad and strategic understanding of passive design influences on the home.
Late Autumn 2008	Met for second discussion. Mary offered a house and garden magazine that they had got via a subscription (she had not meant to get this magazine). The mag had a low carbon challenge in it over a number of the issues. Mary thought it was a bit of a token story, but was impressed with the lengths that various houses went to to lower their carbon emissions. Aware of various retrofit programs in other states. Considering a deck and also retrofitting with their street side patio to block wind. Discussed the hp myth with me.	Learning / comparing/ assessing possible ideas. Assessing brief for further changes. Assessing advice.		Using available resources to learn from. Compared and assessed own experiences and practices against others. Critical considers advice from trades.	House and garden magazine's carbon reduction push. Examples of other family experiences and practices around ee. Victorian and local government retrofit programs on the mainland.	Preference to look through magazines. Critical thinking with some ee understanding. Resourceful attitudes.
	M had been feeling the draughts from the heat pumps and preferred the panel heaters due to radiant heat when she was unwell. They had heard about the heat pump air-flow issues before installing but had thought that if they installed it at the floor it wouldn't be too much air movement. Said that ducted gas felt better. M showed me a passive design book.	Discomfort causing new problem recognition. Assessment of solution – prefers radiant heat.	Comfort and health.	Responding proactively to problem experience. Assessment using background information.	Passive design book/author	Martin thinking it through. Background experiences with other forms of heating. Passive design resources.

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
Late winter 2008	Third discussion. The hp had been adjusted and felt more comfortable. Mary had found some block out lining on special and so had retrofitted more curtains with lining. The curtains were all in and the old ones were lined. Had added the curtain to stop air going up the stairs. Were aware that the curtains somewhat darkened the office area, but were managing it. Martin was in the middle of painting the downstairs office. Probably won't build the deck as it would limit the sunlight that came in downstairs. Talked about the hp myth being a myth, and Mary said had also read somewhere that turning off the hp was more ee. Martin related the fluoro myth re: leaving fluoros on. Talked about LEDs still being hard to get affordably in Tas.	Solution and assessment of solution for hp issue. Decided that darker room due to curtain ok compromise. Made decision not to try and add amenity through deck. Stalling on solutions due to availability.	Comfort and energy efficiency through improved heat flow resistance in the house - improving old curtains that weren't replaced and adding one to the open stairwell.	Following through gradually with a list of changes for the home. Prepared to compromise. Able to assess information provided critically. Waiting to make some changes until LEDs available.	EE tips in a publication. Electronics specialist store Hardware stores.	Mary looking out for specials. The availability of price reduced products. Martin painting skills. Background understanding that cannot always immediately believe advice (remembered fluoro myth). Lack of LED supplies.
	The roof was leaking and dripping into various rooms due to recent rain. They were concerned that the insulation was holding more water than it was letting through. They called the company to come and fix it but the company didn't answer the phone. Eventually got onto the insulation company and they came out. They were coming back to fix it. Talked about feeling private and renovation opens up the house and its uncomfortable.	Critical issues with leaking roof - problem identification - high priority.	To ensure roof repaired for shelter. Attempted to get the roofer/insulators back. The need to (limit discomfort) retain privacy through the times of change.	Using specialists and existing contract agreement to leverage the roof being fixed. The importance of privacy needs.	Consumer laws, the insulation company.	M and M's energy and effort to pursue. Communication skills.
	There are still some venetian blinds on windows in the dining area which they considered replacing, but replacement blinds were quite expensive. The windows are a weak point and transfer a lot of heat out.	Problem identification, assessment of priority of the problem.	Comfort and energy efficiency through improved heat flow resistance in the house - replacing thin window coverings.	Considering the importance of each problem.	Window finishing suppliers. Honeycomb blind technology.	Expensive replacement product. The extra cost of ee blinds.
	The insulation and the curtains made a	Assessment of	Comfort and energy	Adjusted the physical		Critical assessment skills

Time	Story points	Decision-making / problem-solution process	Goals and strategies employed / attempted	Adaptive methods used / attempted (to realise goals/strategies)	Stakeholder influence	Other key influences (eg capacities, information, values, backgrounds)
	difference and kept out the cold better and the curtain on the stair keeps the heat downstairs.	solutions to date.	efficiency through various passive and technical strategies.	environment to support their needs, using energy efficient strategies where possible.		and personal experiences before and after changes were made.
	Has given up on inside plants because the hp dries things out.	Problem due to shift in physical situation.	Health, aesthetics	Changing practices around the new technology and assessing the outcome.		Lack of understanding of the impacts of the installed technology.
	Leaking roof was still a problem. The original company who installed it would not return their calls and so they eventually were able to access insurance money for the leaks and then it was fixed. Had a similarly problematic experience with trades helping with home improvements back in Canberra. Both Ma and M saw the Canberra experience as a bad one which they remembered with negative emotions.	Problem difficult to resolve – priority, especially in wet weather. Found solution through insurance (back up capacity).	Shelter, being dry, comfort.	Kept trying to make contact with the insulating company to resolve the issue. Used communication skills. Used back up capacity (insurance).	Insulation company, issues with trades following up on poorly completed jobs. Insurance policy / company.	M and Ma past experiences. Ability to think through difficult problems together.
	Felt the house comfort levels and the lifestyle they could have in the house had improved due to the changes they had made, but had found the leaking roof very stressful.	Assessment of solutions to date.	Comfort and energy efficiency through various passive and technical strategies.	Adjusted the physical environment to support their needs, using energy efficient strategies where ever possible.		Critical assessment skills and personal experiences before and after changes were made. Bad experience remembered and will be factored in in the future.
	Still looking for an electrician on and off to deal with wiring before they do the underfloor insulation. Concerned about overinvesting as they are not sure how long they will stay in the house.	Solution enactment difficulty.	Comfort and energy efficiency through improved heat flow resistance in the house.	Looking for capacity to complete the task. Gradually working towards around other responsibilities.	Electrician availability and professionalism.	Possibly moving.

Appendix U – Values related to dwelling adaptation

This appendix lists values householders reported drove their adaptations for comfort and energy efficiency.

The primary values that drove adaptations were:

- Care
- Respect
- Interconnections and relationships
- Responsibility and active citizenship
- Community
- Aesthetics, and
- Resourcefulness.

Care Values

Care values were commonly expressed through conversation about family, people, community, animals and Tasmanian environmental issues. Care values included:

- Family, people and community care
- Animal care
- Environment and ecological care (including climate change, interconnectedness, pollution, water systems, Tasmanian issues).
- Youth mentoring, and
- Caring for and good management of community infrastructure.

Eleven of the household participants had people, social and community care related (regular or volunteer) jobs. Social justice issues were regularly discussed and included concern for neighbours, local youth, East Timorese, indigenous Australians and workers rights.

Concerns about the state of the environment and issues with climate change were expressed by 13 out of the 26 householders. Outside the dwellings environmental care activities were undertaken by six householders, for example, replanting natives, volunteering or activism roles. Households were concerned about the Tasmanian timber industry, misuse of timber stocks and the issues with carbon footprints and felling timber. Steve and Gwen said

S - And I can't understand the Federal Government that is talking about joining in with the United Nations and paying poor countries to stop chopping down their trees and they are clear felling Tassie and the hinterlands, to me it just doesn't comprehend (Steve and Gwen Autumn interview 23/05/08)

Gardens often communicated householders' attachment to natural and growing things and were often highly valued and cared for parts of the dwelling. Animal care was a concern that was mentioned by ten out of the 17 households. Nine of the households also had animal occupants who were all well loved and cared for.

Self care values were evident through activities discussed, but were less often mentioned. Householders cared for themselves through maintaining a comfortable home, making sure they went out for walks and spent time outside in the garden. Self care was also a driver for adaptive preparations for ageing-in-place in the home.

Respect values

Respect values were related to:

- Human rights
- Workers right's, and
- Do your bit.

These values were often implied in conversation and were implied or more directly communicated by at least ten households.

Interconnections and relationships

There was appreciation of the importance of interconnections and relationships and the need for them to be maintained and nurtured, including connections with other people and the environment, for example:

- connections children gain from doing something caring for the environment and other people
- the connections children have when caring for and growing a garden, and
- The value of connections for motivation and recognition.

Interconnections were discussed by all households.

Responsibility and active citizenship values

Responsibility values were discussed as a part of being an active citizen. That householders were responsible to contribute to their community, their local area, social stability, and wider issues of the State was discussed by at least ten households.

Examples of responsibility and active citizenry:

- being involved in local community
- staying vigilant on how the Government was managed the local area and the State, and
- being careful with water and energy resources, and picking up litter.

Lobbying the government and paying attention to urban infrastructure issues was made explicit by eight participants, but citizenship values were obviously part of most, if not all the households. Energy supply, subsidies and management were discussed from the perspective of concerned and aware citizens.

Community values

Community was an important value expressed through value for:

- Community generally

- Social connections, and
- Local and neighbourhood advice.

Community values are closely connected to respect, interconnection and being an active citizen.

Aesthetic values

Aesthetics and aesthetic quality were clear value sets that interacted with many other values. Aesthetics were important to householders when, for example:

- preserving the history of the dwelling
- communicating that the owners kept their dwelling clean and cared
- to show the community responsible citizens live in the dwelling
- create a sense of comfort, and
- and to maintain a modern look.

Most households had at least one occupant who clearly had a drive to maintain a certain style of aesthetic in the home.

Resourceful values

Resourcefulness was a strong general driver expressed through various descriptions of values including:

- Resourcefulness and efficiency in regards to energy, water, food, money and other
- Financial management, and
- Personal management.

Resourcefulness emerged as an important and regularly expressed value and was also a goal, a definer of adaptive strategies and also was a capacity in most (15) of the households.

Appendix V – Acronyms and Abbreviations

Abbreviations were used in tables and initials are used in interview quotes to note the person that is speaking.

Abbreviation	Description	Participants	Names of different householders are identified in full in each table. The first letter of their name is then used to identify them in their row only.
ABS	Australian Bureau of Statistics	I	Interviewer (Phillipa Watson)
aut	autumn		
BCA	Building Code of Australia	C	Cara
bn	between	D	Del
bv	brick veneer	E	Edward
cc	climate change	F	Frank (used in separate row to Frederick)
cfl	compact fluorescent (light)	Fr	Frederick
cnc	concrete	G	Gwen
db	double brick	H	Helen
e	east	H	Henry (used in separate section rows to Helen)
ee	energy efficiency	K	Keira
eehw	electric element hot water	K	Kirk
fl	floor	L	Lorraine
f/t	full time	M	Mary
GCC	Glenorchy City Council	M	Mark (used in separate rows to Mary)
GGAER	Glenorchy Greenhouse Action Energy Rebate	Mt	Martin
HCC	Hobart City Council	M	Mel
hi	home improvement	N	Nat
hp	heat pump	O	Olive
hphw	heat pump hot water	P	Paul
hw	hot water	R	Robert
int	interview	S	Susan (used in separate row to Steve)
LCA	Life Cycle Assessment	S	Steve
LED	Light emitting diode	T	Terry (used in separate rows to Trent and Troy)
LIEEP	Low Income Energy Efficiency Program	T	Trent
MEPS	Mandatory Energy Performance	T	Troy
n	north	V	Veronica (Used in separate rows to Vanessa)
n.a.	not applicable	V	Vanessa
NGO	non government organisation		
PST	Power Savings for Tenants	In quotes:	
PAYG	Pay As You Go	//	pause
p/t	part time	-	Interruption in one person's contribution as another person cuts in.
pv	photo voltaic	[word]	Square brackets denote an explanation in the quote written by the researcher to clarify meaning.
R	thermal resistance	FGP	Focus group participant

reno	renovations	I	interveiwier
s	south		
shw	solar hot water	In tables:	
SLT	Sustainable Living Tasmania	(?)	uncertain or approximated
sum	summer	gdn	garden
TasCOSS	Tasmanian Council of Social services	Veg	vegetable
tim	timber		
u	thermal conductance		
UNDP	United Nations Development Program	Focus groups:	
UNEP	United Nations Environment Program	CEFG	commercial enterprise
UTAS	University of Tasmania	LGFG	local government
w	west	SCSFG	social and community support
WHO	World Health Organisation	SGFG	state government
win	winter		
wl	wall		

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