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# Show me the Change

A review of evaluation methods for residential sustainability behaviour change projects

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# REVISION SCHEDULE

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**EXECUTIVE SUMMARY**

This literature review has been prepared as part of the Victorian Local Sustainability Accord funded project to evaluate sustainability engagement programs. The review seeks to research existing literature on behaviour change evaluation in order to inform the development and trialling of a number of evaluation methodologies with the participant Councils: Whitehorse City Council, Knox City Council, Bayside City Council and the Shire of Ganawarra.

Sustainability is seen as a major issue by local governments and their constituents. Behaviour change programs are increasingly being planned and implemented to achieve sustainability targets in the residential sector in areas as diverse as energy use and greenhouse gas emissions, water use, transport, waste and consumption. The increase in number of, and funding for, behaviour change projects leads to an assumption that such projects are effective in achieving their intended outcomes. The effectiveness of behaviour change using a social marketing approach that targets "*small steps*" behaviour has come under some criticism for its failure to lead to the societal-level change required to confront the perils of climate change. The 'voluntary' nature of behaviour change programs means that monitoring and evaluation of their outcome is paramount in order to gauge their success or failure, and to determine the return on investment in such programs.

Evaluation can target project performance, project impact, and project outcome. Outcome evaluation measures the change in behaviour or resource use in relation to the target or goal of the project. Without thorough outcome evaluation, it is not possible to demonstrate whether a behaviour change project has had its desired effect. This review indicates a strong trend towards the use of surveys to obtain data on behaviour change. The surveys used a variety of mediums (written, phone, electronic) but generally relied on self-reporting of change in behaviour. Quantitative data was either based on the number of people changing behaviour, or through calculations of '*deemed savings'* where resource savings are attributed (based on assumptions) to a change in behaviour. Resource metering (electricity, gas, water) is also used in a number of interventions. The experience with metering, particularly for electricity in Australia, indicates difficulty in obtaining reliable and timely billing data. The advent of smart-metering allows for easier data capture, but the issue remains as to how to attribute the effectiveness of behaviour change to a proxy indicator.

There is an increasing trend to balance quantitative measures with qualitative evaluation methods. Australian behaviour change project evaluation shows that qualitative information is able to provide valuable feedback to improve program design, as well as capturing the process of change, and unintended consequences of interventions. Qualitative information provides a way to contextualise quantitative data, as well as information on the process of change which, contrary to many program designs, is not a linear cause and effect process but one that can take a long period of time and involve many influences.

The review indicates that effective evaluation of behaviour change projects targeted at the residential sector can be difficult to achieve due to the cost of evaluation, time involved, expertise required, and many constraints posed by what is essentially evaluating people's behaviours behind closed doors. Quantitative data is often preferred, or required, when numerical targets are set (eg. 10% reduction in greenhouse gas emissions by 2010). Qualitative data, in contrast, reveals insights into people's behaviours that numbers may not do. This provides information into the process of change, and provides context to quantitative data.

Some of the lessons learned from the review are that:
- Behaviour change projects that target multiple behaviours in one intervention are more difficult to evaluate,
- Behaviour change projects are most successful when designed for a target group that shows similar barriers to change,
- Behaviour change does not always follow a linear model of cause and effect, therefore it is important to ensure that evaluation of outcomes is carried out for a period of time following the implementation phase, and captures other sources of influence on the behaviour change.

This literature review provides the following recommendations for designing a toolbox of methodologies to evaluate household behaviour change programs.
- Plan the evaluation of the program at the outset, so that it aligns with project goals. This involves developing a program logic that clarifies the theory of change being used in the intervention, and who the target group is,
- Ensure stakeholders understand the difference between performance, impact, and outcome evaluation. This will facilitate collection of meaningful data that informs the evaluation,
- Decide  whether the evaluation seeks to solely show if change has occurred, or whether it also seeks to understand what change has occurred, and the process of change,

- Balance quantitative methods with qualitative data in order to provide context to change,

- Provide sufficient resources (staff and financial) to evaluation. As a general rule, 10% of a project budget should be allocated to evaluation.

## 1. INTRODUCTION

This paper has been prepared as part of the Victorian Local Sustainability Accord funded project to evaluate sustainability engagement programs. The project will enable the development of a behaviour change evaluation best-practice toolbox for local government. The project involves the partnership of Whitehorse City Council, Knox City Council, Bayside City Council and the Shire of Ganawarra, along with the National Centre for Sustainability at Swinburne University.

This literature review is the first stage of the project and researches existing literature on behaviour change evaluation in order to inform the development and trialling of a number of evaluation methodologies. The research will examine evaluation methodologies previously used in behaviour change projects, and will critically assess their usefulness in providing relevant information with regards to a projects success in effecting change as well as capturing lessons for project improvement. This includes examining case studies of behaviour change projects to examine what types of evaluation methodologies have been undertaken- their assumptions, constraints, and benefits- in order to develop an understanding of current practices. This research paper will also look at emerging methodologies arising from practices in other fields or from new technology that is applicable to residential behaviour change programs for sustainability. The paper will finally review key requirements in project design to facilitate evaluation, as well as elements of behaviour change projects that impede the process of evaluation.

The literature review will present key findings to inform subsequent stages of the project:
- developing and trialling evaluation methodologies with the Council partners, and
- developing a behaviour change evaluation best-practice toolbox for local government.

It is acknowledged that the final stage toolbox may not overcome the constraints of existing or widely practiced methodologies, but will at least highlight the constraints so that decision makers are aware that outcomes may be subject to the bias of the methodology used.

### 1.1 Structure of the report

The literature review commences with an overview of behaviour change, including its use, theoretical background and implementation. This provides context as to what evaluation can measure, and how it can be measured. The following section provides an overview of different levels of evaluation, and how this effects the choice of methodology used. This is followed by a review of methodologies employed in behaviour change projects, based on desktop research and interviews.

This is followed by an examination and summary of evaluation methodologies, grouped under quantitative and qualitative methods. The literature review concludes with lessons and recommendations to inform the development of evaluation methodologies for behaviour change projects.

## 2. BEHAVIOUR CHANGE

Behaviour change, merging the fields of sociology and psychology, is becoming an increasingly important area of research and action. Simply put, household sustainability behaviour change projects aim for a target group to take up a more sustainable behaviour. The complexity of behaviour change lies in the difficulties in changing behaviours, as opposed to raising awareness for change. A review on behaviour change models by the Sexton Marketing Group (2007) noted the difficulty in formulating a single strategy which manipulates enough internal variables to achieve a sustained behaviour change in the majority of individuals in a community. Furthermore, the review noted that the success of behaviour change programs was very mixed in terms of achieving change in awareness, attitudes and behaviour. Achieving sustained behaviour change is much less common than raising awareness or changing attitudes (Sexton Marketing Group, 2007). Crompton (2008) also comments on the difficulty of achieving the systemic change required to tackle climate change through a focus on small behavioural changes.

The literature on the different theories, frameworks and models for behaviour change for sustainability is extensive.  Though it is not the focus of this paper to review behaviour change models and theories, a brief overview helps to guide understanding of how behaviour change works and thus how it can be evaluated. There is extensive literature on behaviour change, with the British Government Social Research Unit providing a thorough review (Darnton, 2008a; 2000b). Behaviour change at the individual level can be broadly divided into models of behaviour, theories of change and frameworks for change (Darnton, 2008b). Models of behaviour help explain specific behaviours by identifying the underlying factors that influence them, whilst theories of change explain how behaviour can be changed over time (Darnton, 2000b). Frameworks for change are built around models and theories (see Figure 1) and provide a practical approach to designing and implementing interventions (eg. Community Based Social Marketing).

**Figure 1. Models of behaviour and theories of change provide the foundations for frameworks of behaviour change interventions**
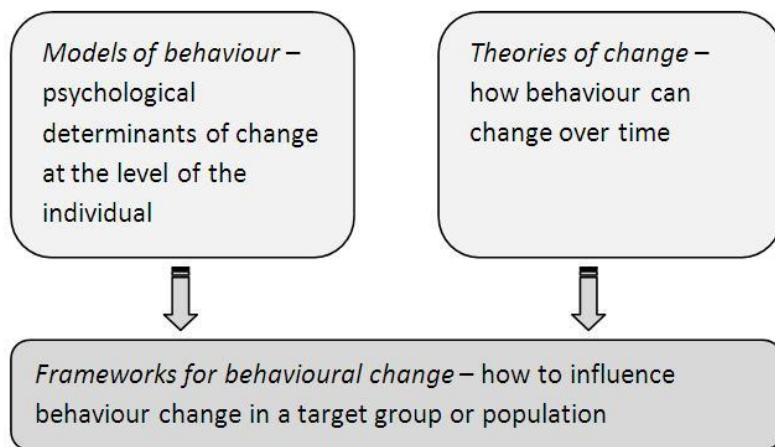


There are numerous examples of behaviour models, ranging from models based on economic theory, such as rational choice, as well as models based on values, beliefs and attitudes, norms, and societal factors. Table 1 presents a list of models of behaviour, as compiled by Darnton (2000b). What is important to understand about these models is that each has their own assumptions, which, like in economics, rarely hold true. These models are useful to explain underlying factors that influence behaviour; however there are multiple external factors that may also be in operation at any given time, with only some models taking these into consideration. The models also tend to be linear, and focus on change as a cause and effect event. This can lead to a belief that a single intervention (event) can lead to the desired outcome within a short period of time. Some theories of change however show that change is a process over time (Darnton, 2000b). Darnton (2000a: 19-20; 2000b, 34-38) provides the following notes of caution about models:

- **Models are concepts, not representations of behaviour** (i.e. they do not explain why people behave they way they do, they merely present broad underlying factors that influence behaviour),
- **There is a limit to how far models will stretch** (i.e. some models are more specific to behaviours that are being targeted),
- **Models don't tend to differentiate between people** (i.e. models don't segment the population, whereas successful interventions do),
- **Behaviour is complex, but models are deliberately simple** (i.e. most models are simple in order to make them usable in explaining behaviour, and they should be treated as an aid to intervention, and not an account of all the potential complexity),

- **Factors don't always precede behaviour** (i.e. it is possible to change behaviour before social-psychological variables, such as attitude; for example, the Theory of Cognitive Dissonance proposes that people will realign their values, beliefs and attitudes to achieve consistency),

- **Factors are not barriers** (i.e. simply changing factors will not lead to desired behavioural outcomes. People need to be engaged in the change process in order to realign their personal mental models).

**Table 1 – Models of Behaviour Change at the Individual Level** Modified from Darnton (2000b: 2-3)

| Category of study | Model of Behaviour Change |
|---|---|
| Economic Assumptions | Expected Utility (EU) Theory |
| Behavioural Economics | Principles of Hyperbolic Discounting, Framing, Inertia |
| | Simon's Bounded Rationality (1955) |
| | Tversky and Kahneman's Judgement Heuristics (1974) |
| | Kahneman and Tversky's Prospect Tehory (1979) |
| | Stanovich and West's System 1/System 2 Cognition (2000) |
| Role of Information | (Information) Deficit Models |
| | Awareness Interest Decision Action (AIDA) |
| | Value Action Gap (eg. Blake 1999) |
| Values, Beliefs and Attitudes | (Adjusted) Expectancy Value (EV) Theory |
| | Fishbein and Ajzen's Theory of Reasoned Action (TRA), (1975) |
| | Rosenstock's Health Belief Model (1974) |
| | Stern et al's Schematic Causal Model of Environmental Concern (1995) |
| | Stern et al's Values Beliefs Norms (VBN) Theory (1999) |
| | Fazio's MODE Model (1986) |
| Norms and Identity | Schwartz's Norm Activation Theory (1977) |
| | Sykes and Maza's Norm Neutralisation Theory (1957) |
| | Cialidini's Focus Theory of Normative Conduct (1990) |
| | Rimal et al's Theory of Normative Social Behaviour (2005) |
| | Turner and Tajfel's Social Identity Theory (1979) |
| | Turner's Self Categorisation Theory (1987) |
| Agency, Efficacy and Control | Ajzen's Theory of Planned Behaviour (TBP), (1986) |
| | Bandura's Theory of Self Efficacy (1977) |
| | Hovland's Theory of Fear Appeals (1957) |
| | Kolmuss and Agyeman's Model of Pro-Environmental Behaviour (2002) |
| Habit and Routine | Triandis' Theory of Personal Behaviour (TIB), (1977) |
| | Gibbons and Gerrard's Prototype/Willingness Model (2003) |
| Role of Emotions | Slovic's Affect Heuristic (2002) |
| | Loewenstain et al's Risk as Feelings Model (2001) |
| External Factors | Spaagaren and Van Vliet's Theory of Consumption as Social |

| | |
|---|---|
| | Practices (2000) |
| | Giddens' Theory of Structuration (1984) |
| Self Regulation | Carver and Scheier's Control Theory (1982) |
| | Bandura's Social Cognitive Theory of Self Regulation |

Theories of change build on the models of behaviour to explain how and when change happens. The theories of change are also influenced by other disciplines such as education and engineering (Darnton, 2000b). Darnton (2000a; 2000b) identifies several types of theories and provides a good explanation of each. The theories are broadly categorised as change in habit; change in stages; change via social networks; change as learning; and change in systems. The models are presented in Table 2. Janssen's (2005) Four Rooms model, though not included in Darnton (2000b), also presents a theory directed at organisational change that is relevant to behaviour change. Darnton (2000b) notes the constraints and critiques of several of the theories; for example, Roger's *Diffusion of Innovation*, based on how products and technology are adopted, may not be appropriate to behavioural change.

**Table 2 – Theories of Change** Modified from Darnton (2000b: 3-4)

| Category of change | Theory of Change |
|---|---|
| Changing Habits | Lewin's Change Theory (1947) |
| | Bandura's Mastery Modelling (1977) |
| | Gollwitzer's Implementation Intentions (1993) |
| Change in Stages | Prochaska and Di Clemente's Transtheoretical Model of Health Behaviour Change ('Stages of Change' Model), (1983) |
| | Janssen's Four Room Apartment (2005)* |
| | *(\* added to list by author)* |
| Change via Social Networks | Rogers' Diffusion of Innovations (1962 onwards) |
| | Gladwell's Mavens, Connectors & Salesman (2000) |
| | Network Theory |
| | Social Capital |
| Change as Learning | Information-Motivation-Behavioural Skills (IMB) Model |
| | Monroe et al's Framework for Environmental Education Strategies (2006) |
| | Vare and Scott's ESD1/ESD2 (2007) |
| | Argyris and Schon's Double Loop Learning (1978) |
| | Schein's Organisational Culture (1985) |
| Change in Systems | Systems Thinking |
| | Foresight's Obesity System Map (2007) |
| | Scharmer's Theory U (2007) |

Theories around change as learning are worth particular consideration due to the prevalence of 'community education and engagement' interventions by local governments in Australia (for example, workshops and seminars). Vare and Scott (2007) present a theory on education for sustainable development (ESD) that looks at two complementary approaches: ESD 1 and ESD2. Vare and Scott (2007, p192) note that: "*sustainable development, if it is going to happen, is going to be a learning process – it certainly won't be about 'rolling out' a set of pre-determined behaviours*". The two approaches are described in Table 3. The approaches are seen as complementary. The dominant approach of ESD 1 needs to be augmented by a participatory learning approach for long term sustainability. Interestingly, Vare and Scott ( 2007) deem social marketing as an ESD 1 approach, though it is our belief that this depends on the application of social marketing. Well researched and applied community based social marketing should lead to the critical thought and actions required to change towards a more sustainable lifestyle. In terms of measurement, Vare and Scott (2007) note that evaluation needs to go beyond the impacts on resource use, and capture the outcomes in terms of people's motivation, ability to think critically, and ability to take responsibility for change. The latter is related to the theory of double-loop learning (Argyris and Schon, 1978, in Darnton, 2008b), and is presented in Figure 2. The double-loop learning theory presents behaviour change as a non-linear process based on learning and feedback (Darnton, 2008b). In a practical example, the Sustainability Street program demonstrates the ESD2 approach, with a focus on *a "'transformative' rather than a transmissive education experience"*[1].

**Table 3 Comparison of ESD 1 and ESD 2 approach** Modified from Vare and Scott (2007) & Darnton (2008b)

| ESD 1 | ESD 2 |
|---|---|
| Promotes/facilitates change in what we do (expert driven knowledge) | Builds capacity to think critically about (and beyond) what experts say and to test sustainable development ideas (learning as a collaborative and reflective process) |
| Promoting (informed, skilled) behaviours and ways of thinking, where the need for this is clearly identified and agreed | Exploring the contradictions inherent in sustainable living |
| Can be measured through reduced environmental impact | Outcomes are the extent to which people have been informed and motivated, and enabled to think critically and feel empowered to take responsibility. |
| Can be viewed as single loop learning | Can be viewed as double loop learning |

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[1] http://www.sustainabilitystreet.org.au/evaluations-%26-results/

**Figure 2. Double loop learning** (Argyris and Schon, 1978, in Darnton, 2008b)
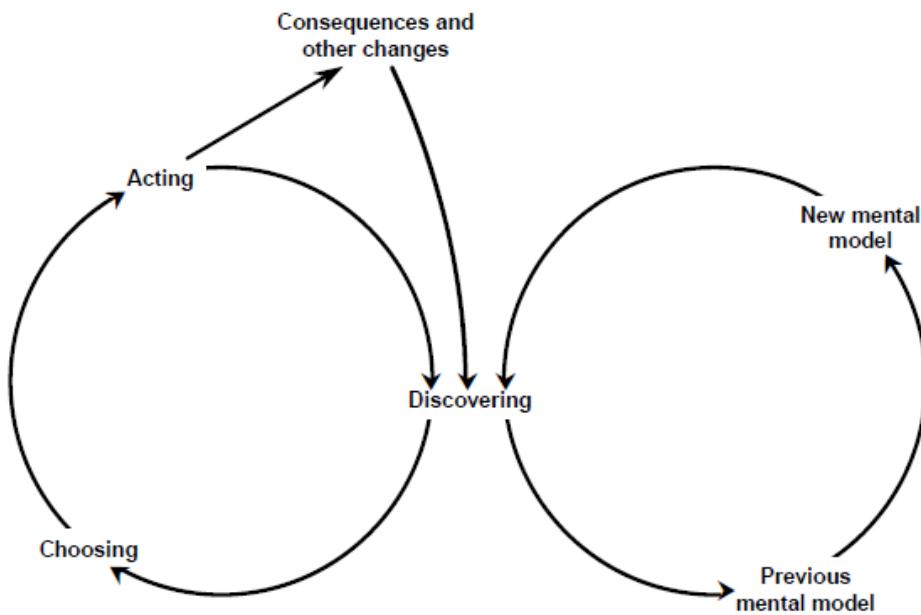


Frameworks for change are the practical implementation of theories of behaviour and models of change. Darnton (2008b) identifies several approaches, which include:

- McKenzie-Mohr's Community Based Social Marketing (2000)
- Andreasen's Six Stage Model of Social Marketing (1995)
- Gardner and Stern's Principles for Intervening to Change Environmentally Destructive Behaviour (1996)
- Batholemew et al's Intervention Mapping (IM), (1998)
- Defra's 4Es Model (2005)
- Knott et al's Cultural Capital Framework (2008)

Les Robinson's Seven Doors model (2001) can be added to this list. The Seven Doors model bridges a number of theories of change, including Roger's Diffusion of Innovation and the influence of peers, to provide a framework for change at the community level. According to Robinson (2001), change occurs at the collective level, rather than at the individual level.

Community Based Social Marketing (CBSM) is a framework that is increasingly being used by organisations and governments to change behaviour. The four Victorian Councils (three municipal, one shire) that form part of this "Evaluation of Behaviour Change Programs" study are undertaking distinct behaviour change programs targeted at a variety of sustainability objectives; some singular (for example, residential energy efficiency in the case of Bayside City Council), others multiple

(energy, water, waste in the case of Knox), and some undetermined (for example, Sustainability Ambassadors in the City of Whitehorse). The programs are briefly reviewed and compared in Table 4. The four interventions put CBSM as the framework on which the intervention programs are based (see Table 4).

The CBSM framework is a sequential process that identifies behaviour(s) to change, and then requires research to uncover the barriers and benefits related to the new behaviour(s) and the existing behaviour(s) (see Figure 3). It is only then that tools of change are matched to overcome the barriers, and amplify the benefits of the more sustainable behaviour being promoted. In this, it is important to note that barriers lie with specific activities that make up behaviours. It is also important to note that barriers are not homogenous to groups, so it is important to segment the population into target groups of like-individuals (for example, by socio-demographic, or gender). Once tools are identified, a strategy is matched to the tools. CBSM places great focus on the extensive research work associated to uncover barriers to behaviour change, as well as on the sequential process that places the design of the strategy (for example advertisements, home audits, workshops) as the final piece of the puzzle before piloting the strategy.

**Figure 3. CBSM emphasises a sequential process of research into barriers to change prior to developing strategies** (McKenzie-Mohr & Smith, 1999)

| Select Behaviour | Uncover Barriers & Benefits | Select Tools & Develop Strategy | Implement Strategy (Pilot) | Evaluate |
|---|---|---|---|---|

The difficulty (and also the rigour) of CBSM is that it relies on extensive research prior to determining a strategy. It focuses on very specific behaviour(s); the more behaviours that are targeted (eg. purchasing renewable energy, switching to energy efficient lamps etc), and the broader they are (energy efficiency, greenhouse gas reduction), the less successful the behaviour change is likely to be because the barriers to the multiple behaviours will be numerous. Thereby the focus of the intervention is lost and the ability of people to change is diminished (people are less able to change multiple behaviours at one time). Unfortunately, the way funding bodies operate is that proposals must contain a strategy for funding, thereby bypassing the critical stage of barrier research. Most organisations wanting to implement behaviour change programs, such as local government, do not

have the funds to cover barrier research ahead of applying for funding. As such, an assumption is made that the chosen intervention strategies, whether they be workshops, or home audits, are the best means to present the tools of change to overcome barriers to more sustainable behaviour. Circumventing the sequential process of research and design for expediency has implications on the evaluation of behaviour change. For example, it is possible that the evaluation method is attempting to attribute change to a variable which is not effective, or that the evaluation focuses on specific variables without regards for external effects or unintended consequences.

**Table 4**

| | **Bayside** | **Whitehorse** | **Knox** | **Gannawarra** |
|---|---|---|---|---|
| **Project Name** | Residential Energy Assessment Programme (REAP) | Sustainable Ambassadors | Greenleaf Project | Living Green in Gannawarra & Surrounds |
| **Description** | Trained community volunteers conducting free residential energy audits. Behaviour and energy efficiency measures suggested/committed | Accredited 'train the trainer' program to equip community ambassadors to mentor targeted Whitehorse communities through measurable behaviour change, including workshops on four topics | Establishing ongoing partnership by engaging households in behaviour change | The project intends to build on existing sustainable living programs (Green Homes, Sustainable Homes Program etc) but use existing networks and community groups to target the participants, rather than have open workshops. |
| **Aim of project** | Increase ability of Council to provide community with advice and information about practical actions to reduce greenhouse has emissions Participating residents to achieve 20% reduction in household greenhouse gas emissions Increased community connections | Increase capacity of Whitehorse community to implement their own behaviour change for sustainability . Empower sustainability ambassadors to lead and assist established networks to make behaviour change Reduce energy, water and waste consumption of Whitehorse residents Create a sense of community amongst Whitehorse residents | 10% reduction in water usage off baseline data 10% reduction in waste from baseline data going to landfill 10% reduction in energy usage off baseline data<br><br>Achieving zero net emissions by 2025 Actively promote water conservation to wide community Encouraging every household to embrace sustainability initiatives | • Understand the barriers to environmental behaviour change in rural communities<br>• Understand the opportunities that exist to educate rural communities about sustainable living<br>• Provide practical advice and resources to help households live more sustainably<br>• Achieve reductions in water and energy use and increase participation in recycling and sustainable consumption |
| **Behavioural model used** | CBSM | CBSM | CBSM | CBSM |
| **Tools of change used** | Home energy assessments Incentives and rewards Training sessions for volunteers Social diffusion | Workshops, incentives, commitments, Individuals running own projects | Themed, skills based workshops for residents that cover five pillars of environmental sustainability. Complimentary activities such as events, excursions to enable participants to see and experience ideas in action. Sustainability starter kits, and incentives to attend workshops | Themed, skills based workshops for residents:<br>• Energy conservation<br>• Water conservation<br>• Waste & recycling |
| **Planned monitoring and evaluation** | Recording of energy and gas bills, with Councils setting benchmarks (not developed) and rewards for those achieving benchmarks | Surveys of course participants Comparison of participants water/energy consumption Number of people impacted by participants' projects Program review Toolbox | Collecting billing data at start of each session | Post-workshop surveys, collection of billing data, workshop observations, participant self-recording, pledges and commitments, interviews |
| **Evaluation data collected** | Volunteer feedback to date Limited evaluation of | | Feedback forms Commencing billing data | |

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|---|---|---|---|
| householders who have completed audit and households who have pulled out | | entry – using Sustainability Victoria Utility Tracker software | |

### 2.1 Behaviour change for sustainability

Sustainability is seen as a major issue by local governments and their constituents. Victorian (and Australian) communities face increasing problems covering a wide range of issues; including energy use, waste disposal, water scarcity, loss of biodiversity, and transport, to name a few. The recently released Victorian State of Environment report[2] provides an overview of the many issues faced by policymakers and constituents. The 2008 Green Light report[3] shows that sustainability issues are of concern to Victorians, and that there is a general attitude and willingness to be part of the solution[4].

The sustainability issues in question are the result of many factors, including past and present policy decisions, disincentives, and organisational and individual behaviour choices. The complexity of the causes, the (perceived) remoteness of the problem and its effects, and how to manage or overcome the problems, characterise these issues as "*wicked problems*" (Ludwig, 2001; Brown, 2008). Dealing with such complex problems has been a critical issue for policy makers worldwide. Progressing sustainability can be undertaken in several ways; by regulation, compliance, or voluntary behaviour (McKenzie-Mohr & Smith, 1999). Where changes in legislation are not yet possible, voluntary behaviour change, both at individual and group level, is increasingly becoming central to the effective delivery of policy outcomes (Darnton, 2008a).  Faced with these dilemmas, councils, as the level of government closest to the community, are considered to have an important role to play in fostering sustainability (Langworthy & Brunt, 2008). As such, numerous councils are developing and implementing, or supporting, community behaviour change projects to foster sustainable behaviour.

Behaviour change programs are increasingly being planned and implemented across Victoria, nationally, and internationally, in particular across Europe, Canada, and the United States of America, to achieve sustainability targets in the residential sector.  These include areas as diverse as energy use and greenhouse gas emissions, water use, transport, waste and consumption. In Victoria,

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[2] http://www.ces.vic.gov.au/CES/wcmn301.nsf/childdocs/-FCB9B8E076BEBA07CA2574F100040358?open
[3] http://greenlightreport.sustainability.vic.gov.au/
[4] 68% of respondents strongly agreed to the statement that "*There is something I can do about the environment as an individual*" - http://greenlightreport.sustainability.vic.gov.au/victorians/environmental-attitudes/

the extent of behaviour change programs is unknown, and is the subject of a separate study[5]. The 'voluntary' nature of behaviour change programs means that monitoring and evaluation of their outcome is paramount in order to gauge their success or failure, and to determine the return on investment in such programs (GSR, 2007). Without knowing the outcomes of voluntary programs, it is all too easy to repeat mistakes, or fail to build upon successful programs. It is only through collective social learning that the *wicked problems* can be overcome (Brown, 2008).

The increase in number of, and funding for, behaviour change projects leads to an assumption that such projects are effective in achieving their intended outcomes. The effectiveness of behaviour change programs that use a social marketing approach that encourage *small steps* behaviour have come under some criticism for their failure to lead to the societal-level change required to confront the perils of climate change (Crompton, 2008). Crompton (2008: 5) states: "*The results of experiments examining the 'foot-in-the-door' approach (the hope that individuals can be led up a virtuous ladder of ever more far-reaching behavioural changes) are fraught with contradictions*".

Literature reviewing the success of behaviour change programs as a tool to progress sustainability is limited, as is literature on the effectiveness of current evaluation methods for behaviour change programs. In comparison, Australian examples of social marketing to change behaviour in public health and road safety have been shown to have positive outcomes (Langworthy & Brunt, 2008). Interestingly, these voluntary programs worked in tandem with legislation and punitive measures (Langworthy & Brunt, 2008), whereas many behaviour change programs for sustainability work towards voluntary change without the backup, or with limited support of regulations. This exemplifies the complex nature of the problems at hand: trying to change people's behaviour when there are many causes and when the problem may seem remote (this is particularly so with the issue of greenhouse gas reduction), and when there are many disincentives to change.

There are numerous case studies on behaviour change programs, particularly on internet sites dedicated to behaviour change for sustainability[6]. What is interesting in reviewing these case studies is that most report positive outcomes, yet communities worldwide face increasing problems in meeting sustainability outcomes. This begs the question of whether only successful case studies are being documented, or whether there is pressure to demonstrate positive results in behaviour

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[5] The number of programs in Victoria, their goals, and their success in achieving positive outcomes, is the subject of a separate study being commissioned by the Victorian Department of Sustainability and Environment, and undertaken by UrbanTrans ANZ.
[6] For exemple, www.toolsofchange.com and www.cbsm.com

change projects (to receive further funding, or to justify the project), or whether the evaluation methodologies being used do not capture the full and true outcome? Or are the largely positive results in many behaviour change projects a result of targeting people (or people self-selecting to participate) who are already undertaking sustainable behaviours? And are projects that show positive results with a small target group capable of being successfully scaled-up?

These questions are pertinent especially with regards to residential energy, and greenhouse gas reduction, as this is the focus of many behaviour change programs, and poses significant challenges in terms of evaluation. The section below reviews trends in residential consumption of electricity, water and waste.

### 2.2 Sustainable behaviour trends in the residential sector

The residential sector accounts for a significant contribution of Australia's stationary energy use. The greenhouse emissions from the residential sector are even more significant due to the prevalence of coal as the major source of electricity (Energy use in Australia, 2008). This has resulted in an ever increasing number of behaviour change projects targeting household energy efficiency and greenhouse gas reduction. General population surveys show a high level of attitude to sacrifice home comfort to save energy[7]. One hypothesis is that per capita demand should decrease over time as successful interventions are replicated or scaled-up to the wide community. Energy use in the residential sector however continues to increase, both in gross terms and on a per capita level.

Over the twenty years between 1983-84 and 2003-04, residential energy use grew by 52%. This growth of about 2.2% per year was the result of several factors; population growth, an increase in the number of dwellings requiring energy, as well as an increase in per capita use. The increase in per capita use is both a result of greater use of appliances, as well as a decrease in the average number of people per dwelling (Australian Bureau of Statistics, 2006). Recent modelling of residential energy use forecasts a continued increase in residential energy consumption, with a 56% increase over the period 1990 to 2020. The study predicts a 6% decline in energy use per household in 2020 compared to 1990, due to existing and planned programs looking to improve energy efficiency of both buildings and appliances. Conversely, the study forecasts a 20% increase in per capita energy consumption over the same period, in  part due to the decline in the number of persons per household  (Energy Use in Australia, 2008).

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[7] 76% of respondents stated an attitude that they willing to sacrifice home comforts to save energy- http://greenlightreport.sustainability.vic.gov.au/victorians/environmental-attitudes/

Behaviour change projects focussing on residential energy use face an interesting dilemma; on one hand dwellings are becoming more energy efficient, but on the other hand per capita energy use is increasing. The increase in per capita consumption is being driven by an increase in the number and use of electrical appliances, as well as being driven by fewer persons per household. Certain electrical appliances such as air conditioners and dishwashers, which were once considered luxury items, are now more prevalent in dwellings (ABS, 2006). Behaviour change, in regard to energy consumption, is set against a household's desire for more time, convenience, comfort and mobility. Changing lifestyles, including the increased value placed on (leisure) time, is seen to be leading to a large increase in residential energy demand (Anker-Nilssen, 2003).

Modelling over the period 1990 to 2020 forecasts growth in energy consumption by end-use type for:

- electrical appliances by 4.7% per annum – driven by various factors including increased uptake of personal computers and televisions, increased on-mode power consumption by both computers and televisions, and increased hours of operation of computer and televisions.
- space heating by 1.3% per annum, and
- space cooling by 16.1% per annum - the large increase in space cooling is due to several factors, including the increase penetration of air conditioners, now at 65% of dwellings, and the increase in floor area per occupant (ABS, 2006; Energy use in Australia, 2008).

Generally, energy use from residential lighting is predicted to increase even with the phasing out of incandescent lights, due to the increase in number and size of dwellings, as well the continued popularity of low voltage halogen lighting. Water heating is the only end-use type predicted to decrease in energy consumption due to increased uptake of solar and gas hot water, and improved energy performance of electric water heaters (Energy use in Australia, 2008). Crompton (2008) notes that gains in energy efficiency from one change can be offset by increased demand from more electrical appliances- commonly termed as the rebound effect.

Water consumption has been a significant issue in Victoria due to the prolonged drought and increasing population resulting in a sharp decrease in water storage levels. Behaviour change programs targeting residential consumption have focussed on promoting targeted levels of per capita water use (such as 155 L per person per day[8]). Voluntary behaviour change programs for water consumption are also supplemented, or reinforced, with compliance measures such as staged

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[8] http://www.ourwater.vic.gov.au/target155

water restrictions. The current water restrictions (3a) prohibit much outdoor water use, and therefore assist in the overall decrease in per capita water consumption. Household water use decreased by 8 per cent from 2000–01 to in 2004–05[9]. In Melbourne, residents have demonstrated a significant change in behaviour over the last 20 years, dropping from an average per capita use of over 400 litres in the 1990s to just over the target level of 155 litres in 2008[10]. It is interesting to compare the differing trends of water consumption and electricity use. The former is a more tangible resource and voluntary change programs have been backed up with compliance measures. In contrast, it is harder to people to see or touch electricity, and behaviour change programs have been solely voluntary.

The generation of waste is another target of residential behaviour change programs, though it receives less focus than energy and water. Behaviour change programs tend to target a reduction in waste to landfill, whilst getting households to increase recycling and home composting. There is also a focus on getting households to reduce the overall amount of waste generated, through less-wasteful consumption patterns (reduced consumption or consumption of reduced packaging). Waste generation however continues to increase in Victoria, with per capita waste increasing by 40kg over the period 2004-05 to 2005-06, though recycling rates have also increased, which means that the overall amount of waste to landfill has not increased[11].

[9] http://www.water.gov.au/KeyMessages/WaterUse200405/index.aspx?Menu=Level1_1_7
[10] http://www.greenlivingpedia.org/Melbourne_water_usage#_note-0
[11] http://www.resourcesmart.vic.gov.au/documents/TZW_ProgressReport05-06.pdf

## 3. EVALUATION

Project management places strong emphasis on monitoring and evaluation, and there are a number of comprehensive guides on the subject from a range of fields (see for example, UNDP Guidebook; Bowes *et al*'s Little Book of Evaluation, 2001; GSR's The Magenta Book: guidance notes for policy evaluation and analysis, 2007; Guijt & Woodhill's A Guide for Project M&E, 2002).

It is important to recognise that monitoring differs from evaluation. Broadly, the terms can be defined as follows:

- Monitoring refers to setting targets and milestones to measure progress and achievement. It is an ongoing activity to ensure the intervention is implemented in a manner consistent with the design,
- Evaluation refers to mechanisms to assess the effectiveness of the project and to reflect on the lessons learned.

(Bowes *et al*, 2001; Lennie *et al*, 2006)

Several categories of evaluation have been identified in the literature. A major distinction that can be considered is between *formative* and *summative* evaluation. Broadly, formative evaluation looks at what leads to an intervention working (the process), whereas summative evaluation looks at the impact of an intervention on the target group (GSR, 2007). Formative evaluation lends itself to qualitative methods of inquiry whereas summative evaluation is often associated with more objective, quantitative methods.

Evaluation can be further considered in several ways (as outlined below):

- Performance evaluation measures variables such as the number of people interviewed or homes visited, the number of brochures distributed, or the number of products (eg. energy efficient lights) given away,
- Impact evaluation measures variables such as responses to surveys, requests for further information, or number of products taken up (eg. lights installed),
- Outcome evaluation measures the change in behaviour or resource use in relation to the target or goal of the project. Without thorough outcome evaluation, it is not possible to demonstrate whether behaviour change project has had the desired effect.

The terminology used in many evaluation texts tends to be interchangeable. For example, the first two examples above align with the definition of monitoring by Bowes *et al* (2001). Impact and outcome evaluation can also be found to be used interchangeably.

Lennie *et al* (2006) outline a number of further approaches to evaluation, such as participatory evaluation and Most Significant Change (MSC), but these will be considered in this review as complementing more traditional approaches that fall under the broader umbrella of quantitative and qualitative dimensions.

Looking at project evaluation from a development focus, Crawford & Bryce (2003: 366) note the importance of de-linking monitoring from evaluation. They define monitoring as an internal process of data capture and analysis to determine project efficiency, whereas evaluation focuses on the effectiveness of a project in meeting its goals. Crawford and Bryce's criticism of the logical framework matrix (typically used in development projects) for monitoring and evaluation is also applicable to behaviour change projects. The critique focuses on such aspects as the absence of a time dimension and how to come up with proxy indicators that are representative of behaviour change (Crawford & Bryce 2003: 366).

Crawford *et al* (2004) delineate three classes of 'actors' in a change project: the implementation team (who manages the project), the boundary partners (who are in touch with the implementation team, and who's capacity is built through delivery of the project), and the ultimate beneficiaries (the wider community). Crawford *et al* (2004) propose that monitoring and evaluation should enable the analysis of a project's efficiency (management team's inputs, outputs, and budget), efficacy (the extent to which the project builds the capacity of boundary partners), and effectiveness (contribution to wide-scale change). In terms of residential behaviour change projects, the management team could be the Council, the boundary partners could be workshop participants, or home auditors, and the ultimate beneficiary is the wider community. According to Crawford *et al* (2004), the boundary partners are the leverage with which the project uses its limited resources to effect change to the wider community. Therefore, if the behaviour change is restricted to the boundary partners, the effectiveness of the overall project is limited. Crawford *et al* (2004) have developed what they term a *Soft System Methodology* to monitor the complexity of monitoring and evaluating human change projects (see Figure 4).

**Figure 4. Using soft systems methodology to monitor and evaluate community engagement and change projects.**
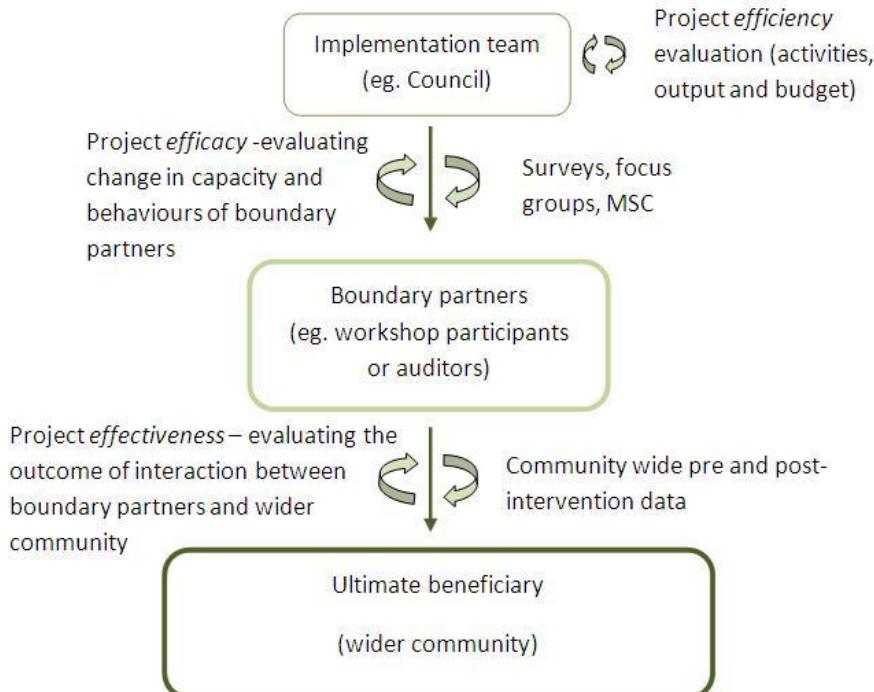


Bowes *et al* (2001 p10) note that there are six main components of an evaluative framework:

- Key feature: the broad aim and objectives of the project,
- Rationale: the underlying reasons for what you want to achieve and why,
- Process: how you are going to approach the evaluation and how you will go about it,
- Inputs: the resources needed to achieve your aims and objectives,
- Indicators of success: the measure of whether the purpose has been achieved,
- Reporting and dissemination strategy: the methods use to present and promote outcomes and findings.

In terms of 'indicators of success', two different measures can be used:

- goals-based evaluation, and
- goals-free evaluation (GSR, 2007).

Goals-based evaluations are based on objectively-set targets usually determined by people responsible for the funding or implementation of the project.  Goals-based evaluation does not

question whether the selected goals are valid and appropriate measures of effectiveness (GSR, 2007). Crawford *et al* (2005) associate this with a *functionalist* perspective, where the focus is on the process and deconstruction of the goal into functional components. Relating back to behaviour change programs, goals-based evaluation is the typical approach, exemplified though numerical targets such as a set reduction in resource use by a certain date. Goals-based evaluation lends itself to quantitative measures that support a cause and effect, or linear model, where the intervention is considered as the sole possible source of change, which in turn leads to choosing indicators and evaluation methodologies directed to supplying the desired data (a linear model of evaluating change is presented in Figure 5). For example, the Zero Carbon Moreland project, funded by the Federal Government Solar Cities program, requires the capture of quantifiable greenhouse gas emission reductions. As such, the evaluation method needs to capture this data[12]. In terms of environmental education and behaviour change, goals-based evaluation aligns with the ideas of expert-driven education (Vare and Scott, 2007) and single-loop learning (Argyris and Schon, 1978 in Darnton, 2008). However, with behaviour change, the 'change' often takes place unobserved, and is unobservable, therefore, it is inferred that the change in data is attributable to the change in behaviour resulting from the intervention in question. Describing a development context, but transferable to the behaviour change for sustainability field, Crawford (2008) notes the difficulty in measuring amorphous social change processes- especially coming up with meaningful proxy measures to attribute changes that take place in open systems within which that are multiple factors that can enhance or impede the success of the intervention.

**Figure 5. Behaviour change as a linear cause and effect event limits the data captured in the evaluation**



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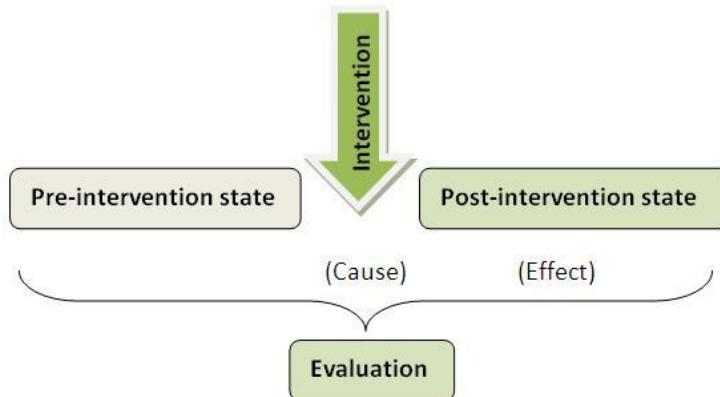
[12] Personal Communication, Jessica Steinborner, Moreland Energy Foundation, 15 January 2009.

By contrast, goals-free evaluation looks at unintended consequences of a project, by looking at the actual effects without pre-empting what these may be (GSR, 2007). This type of evaluation can be seen as favouring an *interpretist* perspective, which focuses on the role of human actors within the change process (Crawford et al, 2005). This aligns with the notion of environmental education as a collaborative and reflective process (Vare and Scott, 2007) and double-loop learning (Argyris and Schon, 1978 in Darnton, 2008). The goals-free evaluation parallels the social learning process outlined by Measham (2008) as a way to evaluate programs targeting complex problems. A social learning approach to evaluation is desirable where the goal of a project seeks to build capacity of people to manage a complex issue, as it is difficult to quantify a process of change and capture change which one may not anticipate. This relates closely to sustainability behaviour change projects, as these deal with people's understanding and ability to take action in the face of complex issues, and where change may not be a one-off event but a continuous process of adaptation to ever-changing scenarios (such as that posed by climate change). This is described by Vox Bandicoot as a process whereby "*participants 'learn how to learn' about living more and more sustainably*"[13]. Goals-free evaluation contrasts to the linear model of change by having many possible other factors that influences the desired behaviour, as well as a time scale that may stretch well past the completion of the intervention (see Figure 6).

**Figure 6. Behaviour change as a non-linear event allows capturing a wider range of data and a more thorough evaluation**

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[13] http://www.sustainabilitystreet.org.au/evaluations-%26-results/

**Monitoring other sources of influence**

**Intervention**

**Evaluating the process of change**

**Pre-intervention state**

**Post-intervention state**

**Evaluating how much change is attributable to other influences**

**Evaluation of change in behaviour (resource consumption)**
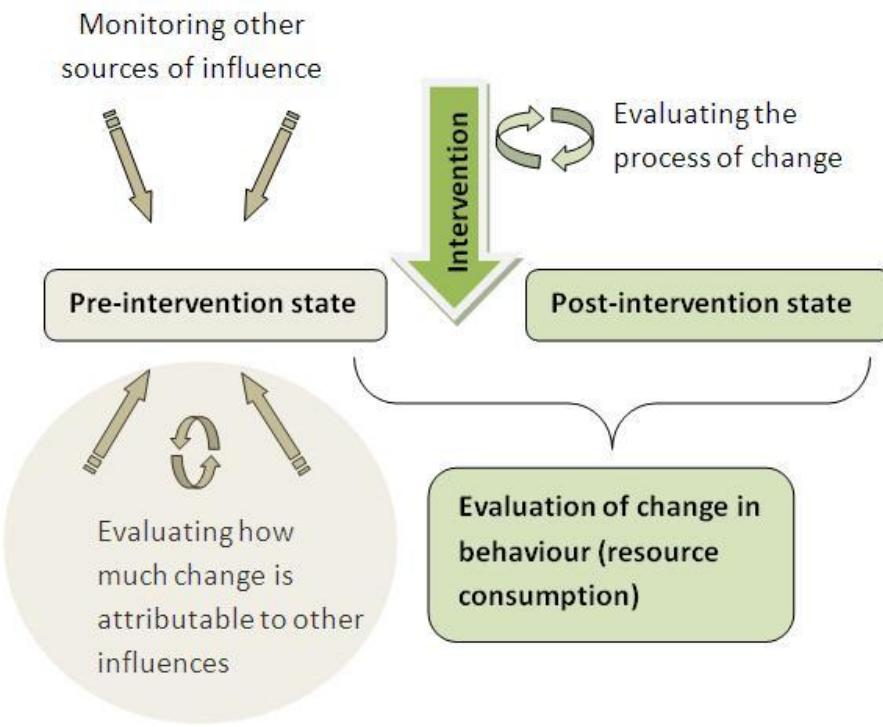
### 3.1 Evaluating behaviour change projects

Evaluation is a critical component of behaviour change projects due to the complexity and urgency of the issues that are being tackled, and the human element that creates a great deal of unpredictability. Monitoring and evaluation provides a process to test the effectiveness of the theory of change being implemented (Crawford et al, 2005). Sexton Marketing Group (2007) note that the literature available on how to measure success of environmental behaviour change programs is very limited and that many programs lack adequate measures of evaluation. Mullaly (1998) undertook a review of behaviour change programs, with a focus on reducing residential energy use. The review examined the failure of previous Australian studies to find significant relationships between people's behaviour towards energy and energy consumption. In the example of a residential survey in Manningham, reports of residents undertaking energy efficiency behaviours was not matched by a decrease in energy consumption at the meter. It was suggested that this was due largely to the reliance on self-reporting of behaviour, which can tend to lead people responding to what is referred to a 'social desirability' bias (Mullaly, 1998). The important point to note is the failure to link consumption metering to behaviour- an important factor in behaviour change evaluation. Where behaviour is not observable, it is very difficult to attribute change in gross metering to actual change in the desired behaviours. This is supported by Abrhamse *et al* (2005), who note that households may have adopted energy-saving behaviours without decreasing overall energy use.

Referring to the international aid and development field, but equally as valid for household sustainability behaviour change projects, Crawford (2008) notes the following dilemmas that project staff face in designing and implementing monitoring and evaluation plans:

- Balancing the need for project-specific performance information, with the need for generic information to enable interpretation and aggregation from the program-wide perspective,
- The need for brevity and simplification of performance issues, whilst program performance issues are inevitably complex and require elaboration,
- Balancing the need for quantitative information that can be aggregated and disaggregated to meet specific requirements, though this form of data frequently lacks meaning,
- The need for qualitative information to shed light on participants' changes (type, extent, and process of change), though this form of data cannot be easily aggregated or manipulated.

### 3.2 Review of evaluation methodologies for household sustainability behaviour change projects

Table five summarises a review of evaluation methods for behaviour change projects both in Australia and overseas. The review was conducted by phone interviews and desktop research of two prominent internet sites that list behaviour change for sustainability case studies (www.cbsm.com & www.toolsofchange.com).

The review indicates a strong trend towards the use of surveys to obtain data on behaviour change. The surveys used a variety of mediums (written, phone, electronic) but generally relied on self-reporting of change in behaviour. Quantitative data was either based on the number of people changing behaviour, or through calculations of '*deemed savings*', where resource savings are attributed (based on assumptions) to a change in behaviour. Concerns with self-reporting and deemed savings are covered later in this review.

Resource metering (electricity, gas, water) is also used in a number of interventions. The experience with metering, particularly for electricity in Australia, indicates difficulty in obtaining reliable and timely billing data. The advent of smart-metering allows for easier data capture, but the issue remains as to how to attribute the effectiveness of behaviour change to a proxy indicator. The most accurate quantitative data obtained by metering involved 'in-line' metering of a household's water consumption as part of the Barrie Water Conservation Program, where a profile of water use by

fixture was obtained. Even though this was done for only a small subset of participants, it provides a way to contextualise data from gross metering.

There is an increasing trend to balance quantitative measures with qualitative evaluation methods. Australian behaviour change projects are noticing the merits of qualitative information in providing valuable feedback to improve program design, as well as capturing the process of change and unintended consequences of interventions. Paralleling overseas experiences, participants often indicate that one of the main benefits of behaviour change programs is the sense of community that is developed. Qualitative information provides a way to contextualise quantitative data, as well as revealing information about the process of change which, contrary to many program designs, is not a linear cause and effect process, but one that can take a long period of time and be influenced by other factors as well as the desired intervention.

**Table 5. Review of evaluation methodologies for household sustainability behaviour change projects**

| Programme | Evaluation Method | Notes |
|---|---|---|
| Castlemaine 500[14], [15] | Electricity and gas billing data complemented with Most Significant Change (MSC) and surveys. At first, billing data showed increase in energy use for GreenPower customers, but this was found to be a scripting error in data provided by utility. Energy consumption data indicates a reduced electricity (8%) and reduced gas (15%) but from a very small sample. MSC shows a buzz around the topic of energy efficiency, and a capacity to change has been developed in the community. One of the findings is that the creation of social spaces was important to participants. | Billing data provided constraints, especially with de-regulated electricity market, and different gas and electricity retailers. 13% of participants had valid consumption data. Qualitative data provides a balance to the lack of change recorded by metering. Importance of participatory evaluation methods. |
| Moreland Energy Foundation Zero Carbon[16] | Currently in project planning stage to develop evaluation methodology, based on learnings from previous projects. In the past, the focus on evaluation was limited, as projects were based on 'action research' with evaluation on the go. Evaluation methods for 'Zero Carbon' driven by different reasons to evaluate, including funding requirements (quantification of reduced GHG emissions), and project improvement. Quantification likely to be through self-auditing, including developing a carbon footprint of participants before and after project, and collection of billing data. A web interface will be developed for the self-auditing/carbon footprinting, which will assist in calculating 'deemed savings' (similar to the black balloons by Sustainability Victoria). Recognition that billing data is fairly fraught in terms of accuracy as an indicator of change (subset of 250 homes from 1000 in total). Smart meters will also be installed in a subset of homes. Qualitative data will be collected through interviews and short films. | Recognition that there are strengths and weaknesses of many evaluation approaches. Several approaches will be trialled, allowing for a comparison of methodologies. Focus on collecting quantitative data driven by funding body requirements for the project (funded under Solar Cities program). |
| Magnetic Island Solar Suburb (Townsville: Queensland Solar City)[17] | Entire island is being monitored by metering the single feed-in line, which allows for evaluation against baseline data. 2500 homes have had Ampy Smart Meters installed. Individual homes are being monitored with half hourly data. High quality and timely information compared to billing data, but does not provide information on where electricity is being used (what appliances, rooms etc), and cannot accurately say which behaviour intervention is leading to changes as household audits engage residents in multiple interventions. | Special circumstances allow for bulk metering. Smart meters better than billing data but still has limitations. |
| ACF Greenhome Program[18] | Pre- and post-evaluation surveys (after 6 months) of participant's behaviour. Resource | Potential bias from self-reporting. Resource |

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[14] Personal Communication, Geoff Brown (Project Manager), 25 September 2008

[15] Information from personal communication was supplemented by information from the Castlemaine 500 report that was released prior to finalisation of this document - http://www.cvga.net.au/main/index.php?option=com_docman&task=doc_download&gid=34&&Itemid=72

[16] Personal Communication, Jessica Steinborner (Project Officer), 15 January 2009

[17] Personal Communication, Julie Heath (Community Engagement Manager), 13 January 2009

| | savings based on self-reporting of behavioural change. Have moved from written surveys to electronic survey (emailed to participants) using 'Survey Monkey' (www.surveymonkey.com).  Evaluation has shown that consistent resource savings have been achieved. | savings are estimates- accuracy can vary. For example, water savings can be relatively accurately estimated based on shower time; electricity savings harder to quantify, unless knowledge of usage time and wattage of lights/appliances is known. |
|---|---|---|
| Environment Victoria Regional Sustainable Living[19] | Previous interventions have used written surveys (self-reporting) but found that the data was not strategic in terms of improving program. Have also looked at using billing data to quantify savings, but this failed due to: difficulty in getting accurate data, especially data for 12 months prior; difficulty also in comparing earlier 12 months due to weather correction; resistance in providing data; and the number of different utility providers that use different formats. Billing data also fails to clearly identify behaviour change, as savings from positive behaviours can be offset by other behaviour (such as purchase of plasma TV). Have revised evaluation process and now using MERI framework (Monitoring, Evaluation, Reporting, Improvement). Now undertaking post-program impact survey, and 6-month follow up facilitated workshop, that includes quantitative data and qualitative data. Will also commence using Most Significant Change (MSC) to provide strategic input into program. | Have moved away from solely self-reporting surveys to include more qualitative methods (MSC) in order to provide strategic input into program. |
| Sustainable Homes Program[20] | First year of program evaluated using a post-program survey that asked questions on pre and post intervention behaviours. Second year of program shifted to using separate pre and post-intervention written surveys. Different response rates for the pre (around 45%) and post (around 30%) surveys, so that data is aggregated and general comparisons made, as surveys are anonymous. Program funding requires quantification of savings- now looking at how to best calculate savings from self-reporting of behaviour (eg. number of lights changed, etc) | Self-reporting surveys make it difficult to accurately quantify resource savings. Changing response rates and anonymity in surveys does not allow for monitoring of change in individual participant. |
| Sustainability Street Program[21] | Residents taking part in program asked to commit to the release of billing data. Commitment is followed up with a permission form for consent to release data. Resource consumption (electricity, gas, water) compared to average municipal use. Baseline data shows that participants already have lower consumption than average prior to program, and that program increase positive behaviour change. Use of short surveys and longer interviews to get information on process of change, including other influencing factors. | Balancing quantitative and qualitative data to get measure of change, and process of change. Also asks residents to attribute the percentage of change attributable to the intervention, and to other factors. Community interaction a strong factor in overall benefits from residents' |

[18] Personal Communication, Rebecca (Project Coordinator), 14 January 2009

[19] Personal Communication, Murray Irwin (Project Manager), 14 January 2009

[20] Personal Communication, Emily Physick (Project Coordinator), 14 January 2009

[21] Personal Communication, Dr Colin Hocking (Evaluation specialist, Victoria University), 17 February 2009

| | | viewpoint. |
|---|---|---|
| Global Action Plan for the Earth (GAP) - USA[22] | Average resource savings, based on self-reported data from the participants. United States Average results from participating in the program:<br>• 42 percent less garbage sent to landfills<br>• 25 percent less water used<br>• 16 percent less CO 2 produced<br>• 16 percent less fuel used for transportation<br>• an annual average savings to participants of US$400 per household | Self reporting can lead to bias based on socially-desirable answers. Also, the longer the period between the behaviour taking place and the survey can lead to a memory-effect. |
| GAP - Netherlands[23] | Pre and post-program survey and resource consumption (electricity, gas, water, waste) data in questionnaire.<br><br>Survey indicated that over the two-year study 46 out of a possible 93 environmentally relevant behaviours were adopted by 205 EcoTeam participants. Forty percent of people indicated that they had also changed behaviour at work, and 26 percent had become more active on environmental issues in the community.<br><br>Quantitative data on consumption parameters compared with the data before, directly after and two years after participation. All data presented as average weekly consumption per household member (except for household waste which is presented as average daily production). Data about the used amount of natural gas was corrected for outside temperature. | Self-reporting of behaviour change, and resource use. Only two-weeks worth of resource use data collected as baseline. |
| Portland EcoTeam[24] | Portland Ecoteam Phone Survey.<br>Multiple objectives including:<br>• Measure participants' awareness of City of Portland sponsorship<br>• Gauge overall impressions of the program and identify areas for improvement<br>• Determine whether participants want the program to provide more local information<br>• Assess how the program has affected interaction among neighbors<br>• Measure participants' interest in continued involvement with their EcoTeam<br>• Describe participants in terms of their involvement with neighborhood associations and environmental organizations | Phone survey using scale rating of aspects of the program. Mostly impact evaluation, with limited outcome evaluation.<br><br>Participants identified need to keep paperwork to a minimum. |

[22] http://www.toolsofchange.com/English/CaseStudies/default.asp?ID=9
[23] http://www.empowermentinstitute.net/files/Leiden_study.html
[24] http://www.empowermentinstitute.net/files/Portland_study.html

| | | |
|---|---|---|
| | • Investigate how participants perceive the impact of the program on their daily actions<br>• Determine whether EcoTeam participation has led to increased volunteerism | |
| Columbus Ohio EcoTeam[25] | Written survey covering quantitative and qualitative parameters.<br><br>Results from survey state that 100% of program participants reduced their household's use of natural resources | Quantitative based on self-reporting. Qualitative responses to question "what has been most valuable about the program" identify aspects such as social connectedness and personal growth, awareness and action. |
| Rockland County EcoTeam[26] | Written survey covering quantitative and qualitative parameters. 33 responses from total of 100 sent out. Results indicate that program helped reduce household's use of natural resource for 100% of participants. | Quantitative based on self-reporting. Qualitative questions yield rich and diverse answers. |
| Issaquah Sustainable Lifestyle Campaign[27] | Long-term evaluation written survey. Survey did not look at quantitative savings, but take-up of behaviours, and sustaining behaviours through time. Participants reported taking up 91% of actions promoted in program. After completion of program, participants sustained or improved their behaviour changes in 85% of the actions, took action for the first time in 2%, reported partial recidivism in 5%, and reported total recidivism in 7% of the actions<br><br>Issaquah Overall Program Evaluation[28]: mail survey, including asking respondents how they viewed their sustainability before program, after program, values and benefits from participating in program. | Incentive to complete survey. Response rate greater from participants who had recently completed program. Participants provided with range of possible answers to whether behaviour has been taken up or sustained, rather than simple "yes" or "no". Scale rating for range of questions. Many questions evaluate project delivery, with outcome questions focussing on uptake of sustainable activities following completion of program. |
| Deshutes County EcoTeam[29] | Written survey looking at certain aspects of program delivery and self-reporting on resource consumption, and areas where resource efficiencies being made.<br><br>Deshutes County overall evaluation[30]: Looks at pre and post consumption, such as amount of waste (weight) to landfill, based on comparison to "lifestyle assessment" prior to | Perceived savings through behaviours undertaken, but no quantification of actual savings in survey. No information provided as to how measure of consumption data collected- whether participants responsible for providing data (such as weight of garbage, water use etc). |

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[25] http://www.empowermentinstitute.net/files/Columbus_study.html
[26] http://www.empowermentinstitute.net/files/Rockland_survey.html
[27] http://www.empowermentinstitute.net/files/IsWaSurvey.pdf
[28] http://www.empowermentinstitute.net/files/IsWaEval.pdf
[29] http://www.empowermentinstitute.net/files/DeschutesSurvey.pdf

| | implementation. | |
|---|---|---|
| Home composting kitchen wastes to reduce landfill waste[31] | Evaluation of a pilot program. Participants required to weigh both compostable and mixed waste for one month, and report on the advantages and disadvantages of home composting. Overall, sixteen families of different backgrounds were chosen.<br>The pilot program lasted for 8 months and results indicated that mixed waste could be reduced by 30% by home composting | Detailed evaluation with both quantitative and qualitative aspects easier due to small scope of pilot program. |
| 1-2-3 Campaign Against Global Warming[32] | Participants were asked to commit to three actions 1) reduce their household thermostats by 1 degree in the heating season; 2) reduce their driving speeds by 2 miles per hour from the speed they'd normally drive when traveling 60 m.p.h. or more; and 3) replace 3 regular light bulbs used extensively at home with compact fluorescents. These three actions estimated to reduce carbon dioxide generation by 1,300 pounds per year. Evaluations based on number of pledges made, and follow up survey to see if pledge had been followed through. Estimated annual $CO_2$ reduction by approximately 580,000 pounds. | Looked at number of pledges acted on based on self-reporting and calculations of CO2 savings per action. This provides a very simple to achieve, though general figure of savings. Should ideally describe assumptions on calculations of savings per action. |
| Pacific Gas and Electricity Home Audit[33] | Trained auditors using tools of change, following earlier unsuccessful program based on residents self-selecting to request home audits. Measurements based on number of residents applying for loans and cashback for retrofits. Against control group, residents served by trained auditors were 3-4 times more likely to retrofit homes and 36% more likely to apply for finance. However, there was no difference in electricity consumption data. | Interestingly shows that change can occur in behaviour, but not necessarily in resource consumption (electricity). This may be due to evaluation being undertaken too soon after program completed. |
| Reducing Electricity and Natural Gas Consumption Using Feedback and Incentives in Voorschoten, Netherlands[34] | Compared a group that received information only, to groups with different types of intervention. Data was collected for 3 weeks prior to treatment and for 12 weeks during the pilot program. Both electricity and natural gas consumption was measured. The information-only group had the least reduction in energy savings in both electricity (7.6%) and natural gas (0%). All three intervention groups had substantial reduction in energy and gas consumption compared to information only group. | Short data collection period for both baseline and post intervention does not provide for variability in consumption through time, or whether changes are sustained over a longer term. |
| Reduction of Residential Consumption of Electricity | Individuals were unaware that they were participating in a study. Participants in the feedback group were sent a letter each month stating the percent change in consumption | Meter data collected monthly and fed back to intervention group, providing incentive to |

[30] http://www.empowermentinstitute.net/files/Chapter5.pdf
[31] http://www.cbsm.com/CasesDatabase/Detail.lasso?-KeyValue=145&-KeyField=ID
[32] http://www.cbsm.com/CasesDatabase/Detail.lasso?-KeyValue=138&-KeyField=ID
[33] http://www.toolsofchange.com/English/CaseStudies/default.asp?ID=17
[34] http://www.cbsm.com/CasesDatabase/Detail.lasso?-KeyValue=109&-KeyField=ID

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|---|---|---|
| Through Simple Monthly Feedback[35] | compared to the same month both one and two years ago. Feedback group reduced electricity by 4.7% when households received the feedback letter. The control group was never contacted and their consumption information was simply gathered from the meter. | reduce further. Actual meter reading at shorter intervals than billing data more effective in tracking change and as impetus for further reduction. This would require cooperation of electricity utility. |
| Iowa City – using public commitment to reduce electricity[36] | Participants made a public commitment to consume less electricity and natural gas for one month.  Baseline meter readings were collected by the local utility company and evaluated by researchers. Consumption of electricity and natural gas for participating households was initially tracked for a one-month period. In order to determine whether changes in consumption levels would persist over time or whether they were only a result of "energy conscious" behaviour for a few days after the home visit, the meter readings were tracked for a full 12-month period. Evaluation after one month revealed that public commitment had reduced energy consumption by 10-20 % and that this behaviour change was evident throughout the year as their meters were monitored. In comparison, those making a private commitment had no significant change in energy use. | Used electricity utility collection of metering data, and tracked post-intervention data for 12 months, providing good long-term evaluation. |
| Actions by Canadians (ABC)-count me in[37] | The climate change workshop was a one and a half or two- hour interactive workshop focused on developing awareness and understanding of climate change, and the actions which individuals could take to reduce their own greenhouse gas emissions. The ABC program developed and designed a follow-up and monitoring program to track longer term behaviour changes as a result of the workshop and to encourage further action. Data collected during the workshop delivery (e.g. participant name, email, evaluation form and pledges) were entered into a sophisticated program designed using Microsoft Access. <br><br> Two and six months after the workshop delivery, each participant was contacted by email. The email message reported the progress of the program and asked the participants to click on a personalised website address where they could report what pledged activities they had completed. The interactive website urged participants to answer a series of questions relating to their pledged actions and calculated the amount of greenhouse gas emissions saved as a result of their achieved actions to date. This site also included a survey that queried participants on the changes to their attitudes and behaviour as a result of the workshop. Those without email received a letter through mail or fax requesting | Use of information technology to track changes in behaviour. Email reminders leading to website where people could state whether they had completed their commitments. Estimated resource consumptions savings of each action provides an estimate of total savings. The use of information technology reduces ongoing personnel and time commitment for evaluation. |

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[35] http://www.cbsm.com/CasesDatabase/Detail.lasso?-KeyValue=125&-KeyField=ID
[36] http://www.cbsm.com/CasesDatabase/Detail.lasso?-KeyValue=85&-KeyField=ID
[37] http://www.toolsofchange.com/English/CaseStudies/default.asp?Id=178

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| | participants to complete a hard copy of the pledge and fax back, the returned forms were also entered into the database. | |
| Barrie Water Conservation Program[38] | Residential water conservation using retrofit of low flow showerheads and toilets<br>The success of the program was gauged using five parameters:<br>1. The number of households that joined the program.<br>2. The amount of water consumed before and after the installation of the toilets and showerheads. Water consumption in 1,866 households was compared for six months after the installations with rates prior to installation. A further, more detailed analysis was done on a sample of 15 households using in line water metering to obtain a water use profile for the house from all water using fixtures. This was done for one to two weeks prior to the installation and again for one to two weeks after installation.<br>3. The wastewater flow reductions estimated from water consumption savings.<br>4. The public's reaction to the program. Follow-up interviews with randomly selected households were conducted, and householders were asked about the performance of the toilets, the quality of the installation work, if the program guidelines were easy to follow, and why they participated in the program.<br>5. The cost effectiveness of the program as measured by net deferral of capital expenditure attributable to the program.<br><br>The results indicate that water consumption was reduced by an average of 62 litres per day per person, 12 litres (24%) over the goal of 50 litres per day per household, with an estimated total savings of 1,782,500 litres per day or 1,782 cubic meters per day. | Thorough quantitative and qualitative evaluation of program. Detailed study of water consumption in 15 households to support findings from larger number of homes (water rates data). |
| Flex Your Power[39] | Californian program aimed at cutting load by 14% in five months and shifting peak load to off-peak.<br>The evaluation had three components: consumer focus groups, advertising reach and frequency verification, and quantitative savings. Gross energy use was monitored directly by the utilities as direct energy savings were considered difficult and costly to measure. Reductions came from changes in conservation and load shifting behaviour rather than purchasing behaviour. An important contributor to lower consumption was consumer willingness to turn off air conditioners. One year later, when asked why they had stopped conserving a year after the crisis, 46% stated "Just easy to slip back into old ways" and 46% | No residential measurements of energy use taken. Measured the impact of marketing campaign on "Willingness" and "Propensity to take action". One year after program, a number of people stopped conserving. |

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[38] http://www.toolsofchange.com/English/firstsplit.asp (follow link to Case Studies, then Barrie Water Conservation)
[39] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then Flex your power)

| | said "No need after summer / crisis". | |
|---|---|---|
| Jasper Energy Efficiency Program (JEEP)[40] | JEEP home audit teams completed home visit reports, noting for each residence the number of products installed, their wattages, and whether the products were used during peak hours. Energy savings were calculated using this data and energy output levels at the Alberta Power Plant monitored. Overall demand for power in Jasper between 1991 and 1994 was reduced by 9.6 percent, while demand elsewhere in Alberta increased by 17.5 percent. Reduction in residential demand for electrical energy was 490 kW, very close to the 500 kW objective.<br><br>Other evaluation measures included a follow-up telephone survey of audited homes, and mail survey of homes that did not participate in the program. | Use of auditor collected data to estimate potential reductions, and actual reductions based on power plant demand. Difficult to replicate where there is no "point source" for energy, such as in deregulated energy market operating in national grid. |
| Residential Conservation Assistance Program (ReCAP)[41] | Evaluation of personalised home audit via a six-month follow-up telephone survey of participating householders, designed to obtain information about the success of various marketing strategies, what motivated a response to the program, the degree of uptake on recommendations made during the home visit, and to collect general feedback.<br>The following results were achieved during the first year of operation, based on a six-month follow-up period:<br>• approximately 2,500 home visits were made<br>• 40 percent of all recommendations were carried out<br>• 9,300 individual conservation-related actions were undertaken<br>• an average of US$1,000 was invested per household which translated into an estimated $2.5 million for all homes visited | Evaluation based on follow-up survey that looked at number of recommendations completed, not at actual resources saved. Estimation of household savings on resource costs based on household investment in energy efficiency. Recommendations that were most taken up were those that included installation demonstration and a free sample. |
| Water – Use It Wisely [42] | To determine residents' perceptions and attitudes about water conservation, a baseline survey of 1,055 residents was conducted by the Behavior Research Center prior to the campaign's launch in April 2000. A Follow-up survey of 1,128 residents was conducted in November 2001 to assess the campaign's effectiveness and investigate changes that needed to be made to reach the campaign goals. | Survey examined program impact (recognition of messages) and outcome via change in attitude and number of people self-reporting their take up of sustainable water-use behaviours. Potential for self-reporting bias. |
| Water Efficient Durham[43] | Monitoring commenced through observing and timing lawn watering habits of homeowners in the study areas. Students also asked homeowners detailed questions about how much they irrigated and whether or not the contact with students had helped | Bulk metering by water utility through isolating to a single feed-line to neighbourhood. Allows unobtrusive monitoring of behaviour. Behaviour |

[40] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then Jasper Energy Efficiency)
[41] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then The Residential Conservation Assistance Program)
[42] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then Water Use it Wisely)
[43] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then Water Efficient Durham)

| | |
|---|---|
| them change their habits. During the summer of 2000 water utility bulk-metered 400 houses in the study area by closing valves in order to isolate a single feed into the neighborhood and installed a data logger in the water main to measure water use. Data logger took regular readings from July to October. As watering stopped at the end of September, October data provided several weeks of baseline (non-watering peak) data. Bulk metering allowed the region to monitor homeowners without their knowledge, circumventing the *Hawthorne Effect*, which asserts that people tend to modify their behaviour when they know they are being monitored.<br>Results indicate average 30% reduction in first year following intervention, and around 17% in subsequent years. | targeted accounted for a large consumption of the resource, allowing for easier comparison against background variability. Bulk metering is a cheaper alternative than individual metering. Magnitude of weather variability potentially makes year to year comparisons difficult. |

## 4.  EVALUATION METHODOLOGIES

In selecting an evaluation methodology, key points to consider are its usability (what special skills are required); data collection and processing time; reliability of data; validity of objectives to be evaluated; and contact with the respondent (Stokking et al, 1999).

Quantitative data, as the name suggests, deals with obtaining counts or numbers. Qualitative data deals with words, or communication (whether that is text, voice, or visual). Both quantitative and qualitative data have strengths and weaknesses, and the use of one type of data set is not exclusive to using the other. In fact, combining both provides a way to provide a measurement of change, as well as providing context for the change.

The following section examines quantitative and qualitative methodologies for evaluating behaviour change projects, and provides summary tables of pros and cons for the methods.

### 4.1 Quantitative methods of evaluation - show me the numbers

There is great appeal in collecting quantitative data and running statistical analyses in order to demonstrate that a project has had a significant impact in changing behaviour. For instance, Mullaly's (1998) review of home energy use behaviour projects for local government implementation advocates quantifiable savings as a measurable effect of the project outcome. Such a positive outcome backed by statistics is often the goal of project evaluation. In their review of behaviour change programs, the Sexton Marketing Group (2007) advocate that a statistical approach in planning behaviour change programs is needed, rather than causal approach. The justification is that many programs to not include measures of effectiveness, and if they do, many do not include rigorous tests of the reliability of these measures. The use of multivariate statistics is also recommended by McKenzie-Mohr & Smith (1999).

### 4.2 Metering

Metering is a commonly used method to collect and evaluate data for behaviour change projects for both energy and water efficiency. Most residential dwellings have individual electricity and water meters, and where town-gas is available, a gas meter. Metering provides consumption data that can be collected at various points in time, such as before a project commences, and after the implementation phase, thereby providing a before-after comparison which can be analysed statistically. In Australia, behaviour change projects

frequently use billing data to provide metering measurements. Energy utilities generally provide quarterly metering bills. This means that data collection intervals may not match the billing period. All participants in an intervention do not receive bills at the same time, so data input and analysis is made more difficult. As the Australian energy retail market is deregulated, the collection of data can be hindered by households changing retailers. In comparison, a British study of behaviour change was able to access historic consumption figures for each participating household directly from the utility (Brandon & Lewis, 1999).

Collecting billing data can also be difficult, and experience from projects in Australia reveals a certain level of unwillingness by participants to disclose billing data to an external party (as per the Regional Sustainable Living program- see Table 5). Ways to overcome this include the option for participants to sign a consent form for the utility to release billing data, or the use of an incentive (such as the chance to win a solar panel system) to get people to provide data. Where projects have used consent forms for utilities, it has been found that utilities may not be cooperative, or timely in the release of accurate data. The deregulated energy market also complicates the matter, with data sometime being held and therefore requiring access to a number of utilities (as per Castlemaine 500 experience- see Table 5). Furthermore, billing data can sometimes be inaccurate, especially if meters have not actually been read, but have been estimated, for a quarter. Metering data must also be compared to the equivalent seasonal period, as weather can influence resource consumption Therefore a weather correction factor may need to be included in the calculations. Example of interventions utilising a weather correction factor with their metering data is the Netherlands GAP program (see Table 5), where data about natural gas consumption is corrected for outside temperature, and a residential energy use study in Britain (Brandon & Lewis, 1999). By comparison, billing data for water consumption is more reliable and easier to obtain (Colin Hocking, pers.comm.)

Another way to collect metering data is to have someone read the meter at shorter time intervals deemed to be more suited to the monitoring and evaluation plan. This also provides an opportunity to provide participants with feedback on the consumption in between billing periods (Brandon & Lewis, 1999). However, this can be labour (and cost) intensive, and therefore not feasible in many instances. Smart metering (electronic metering devices that can relay data to a central database) provides a solution for timely and accurate data collection. Smart meters are being used to collect electricity consumption data in

Magnetic Island and will be included in the Zero Carbon Moreland behaviour change projects, which are both funded under the Solar Cities[44] program. The benefit of smart meters is that data is collected at frequent intervals (half-hourly in the case of Magnetic Island), and the measurements can be sent remotely for data collection and analysis. Smart meters can also be combined with an in-home display that tracks consumption information. This serves as an effective feedback and awareness raising tool for households. The roll-out of smart meters to all Victorian homes is due to commence mid-2009. However, the change from analogue to smart meters will take some time, and is determined by the electricity distributor, and not the retailer. Furthermore, in-home displays are not part of the roll-out. New smart meters such as the Eco-meter can provide electricity, gas and water consumption data to an in-home display[45].

In the case of the Magnetic Island project, smart metering is complemented by bulk metering of the electricity feed-in line to the island. This is made possible by the fact that the island is supplied by one electricity cable. Bulk metering allows for unobtrusive measurement of a population. The Water Efficient Durham project used bulk metering of a water supply line in order to avoid the *Hawthorne Effect*[46]. The *Hawthorne Effect* suggests subjects in behaviour change studies change their behaviour as a response to being observed[47].

A particular constraint about metering data, whether it is gross, quarterly billing, or even half-hourly measures, is that it fails to provide information as to where electricity is being used. This is of particular concern where behaviour change interventions target a number of varied behaviours across a household (such as switching off lights, reducing standby power, reducing the hot-water temperature, installing insulation etc). In such cases, if a measurable change is recorded through metering, it is not possible to know whether the change is brought about by a single behaviour, or numerous ones, and whether some behaviours were not successfully changed in the intervention. The converse can also occur, where metering data shows no change, but participants indicate through other evaluation methods (namely qualitative) that they feel they have changed behaviour (Mullaly, 1998; Geoff Brown, pers.comm.). There is continuing research and development in smart meter technology but

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[44] http://www.environment.gov.au/settlements/solarcities/
[45] http://www.ecometer.com.au/
[46] http://www.toolsofchange.com/English/firstsplit.asp (follow links to Case Studies, then Water Efficient Durham)
[47] http://www.library.hbs.edu/hc/hawthorne/09.html

in-line metering is not likely to be commonly available in the near future, without extensive rewiring of households.

The Barrie Water Conservation[48] program undertook detailed metering of water consumption from small sample (15 households) to complement total water consumption data from households. This was done by using in-line water metering to obtain a water use profile for the house from all water using fixtures. Though only representing a small sample, the data collected provides a context to the collection of a wider sample of gross metering data.

A summary of the pros and cons of metering is provided in Table 6.

**Table 6.  Pros and cons of metering**

| Billing Data | |
|---|---|
| Pros | Cons |
| <ul><li>Provides a numerical value of the resource</li><li>Most people receive household bills</li><li>Provides before and after data for statistics</li><li>Easily replicated</li></ul> | <ul><li>Can be difficult to obtain (participant privacy, or release from utility)</li><li>Provides a gross value over the quarter, and daily average, but no indication of daily variation</li><li>Time lag between data and intervention</li><li>Intervention period may not coincide with billing data collection</li><li>Can be inaccurate, especially if reading is "estimated"</li><li>Deregulated energy retail market in Australia means that households often switch utility retailers, leading to incomplete or incompatible data sets</li><li>Does not provide information as to where in the home electricity is being used</li></ul> |

| Meter reading | |
|---|---|
| Pros | Cons |
| <ul><li>Timely data collection (reading intervals can suit evaluation design)</li><li>Accurate data</li></ul> | <ul><li>Requires human resources for data collection</li><li>Requires consent from participants</li></ul> |

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[48] http://www.toolsofchange.com/English/firstsplit.asp (follow link to Case Studies, then Barrie Water Conservation)

| | |
|---|---|
| | • Location of meters may not be easily accessible<br>• Participants aware that they are being observed, which may effect intervention |

| Smart Metering | |
|---|---|
| Pros | Cons |
| • Accurate and instantaneous data collection<br>• Allows monitoring of daily variation | • Cost<br>• Does not provide information as to where in the home electricity is being used |

| In-line Metering | |
|---|---|
| Pros | Cons |
| • Point-of-use metering provides more accurate indicator of behaviour | • Cost may limit to small sample<br>• Sample may not reflect wider population |

| Bulk/Feed-in Lines Metering | |
|---|---|
| Pros | Cons |
| • Allows for gross metering of many participants without their knowledge<br>• Does not require consent | • Requires participation/consent of utility<br>• Restricted to isolated populations that are supplied by single feed-in line<br>• Gross data, with no indication of variability in between participants<br>• Does not provide information as to where in the home electricity is being used |

### 4.2.1  Quantitative surveys

Quantitative surveys, or questionnaires, are one of the most used methods of collecting data to evaluate behaviour change projects. Participants are asked to respond to questions that either provide a scale of responses (for example- agree, neutral, disagree), or they are asked questions as to the number of a particular product they have (for example, energy efficient lights), as well as how often they undertake a particular behaviour. Quantitative surveys may also ask whether a participant has committed to undertake a particular action. Quantitative questions are generally close-ended. Many interventions use written surveys that ask participants to self-report on behaviour change, either by comparing before and after surveys, or through a single post-intervention survey. The degree of change is collected through questions that compare the number or extent before and after an intervention of

factors such as energy efficient lights present in a home, the number of water efficient shower heads, time spent watering lawns, the amount of waste recycled etc. Sexton Marketing Group (2007) note in their study that the emerging preferred method of measurement is self-report surveys, combined with the objective observations of evidence of behaviour change. Stokking *et al* (1999) also indicate that learner reports (self-reporting) with closed-questions has repeatedly produced '*good results*', but the question that must be asked is whether the *good* refers to reliable and accurate information for the evaluation of the intervention, or whether *good* refers to data that indicates a positive change towards sustainability based on respondents' answers, and potential bias.

Surveys can vary in their detail and length. Surveys can analyse comparisons of individual participants (where a pre and post survey, or all-inclusive post survey is collected), or data can be aggregated and comparisons for the entire participant sample are made. Where data is collected via a pre and post survey, individual participant analysis may not be possible if either of the surveys are not completed or returned, which is a common constraint of written surveys. An important consideration in developing surveys is to have experts assess the draft, and have representatives of the respondents assess the draft, and preferably pilot the survey in order to ensure that the questions are understood and the data that is collected fulfils the need of the evaluation (Stokking *et al*, 1999).

In the Netherlands GAP program (see Table 5), questionnaires were used before and after the project to record participants' behaviours. Two post-test surveys were used, one immediately after the intervention, and a long-term follow up. The surveys looked at ninety-three relevant household behaviours targeting water, waste and energy, as well as attitudes to behaviours.  The survey results indicated that over the two-year study 46 out of a possible 93 environmentally relevant behaviours were adopted by 205 participants. Participants maintained the practices six to nine months later and in some cases continued to improve on them. Such areas of improvement included increased car-pooling and the installation of water-saving devices in the bathroom. Forty percent of people indicated that they had also changed behaviour at work, and 26 percent had become more active on environmental issues in the community.

Pickens (2002) reviewed survey data from the Deschutes EcoTeam program to look into the effectiveness of CBSM as a behaviour change planning tool. The Deschutes survey asked

participants whether they felt that their behaviour had changed, and, whether or not participants believe that the CBSM approach influenced their ability to change their own behaviours. Though the survey results indicate that the CBSM approach led to sustained behaviour change, Pickens (2002) provides a cautionary note that self-reported data is not an absolute proof that actions are taking place. Pickens (2002) also notes that behaviour change programs do not exist in a vacuum, and that other factors could be influencing behaviour during the same time period as programs are taking place: "*For example, new laws, other programs dealing with similar topics, in-migration or out-migration of populations, and shifts of the larger social consciousness are all scenarios that could influence behavioral change at the same time-period in which a community-based social marketing program takes place*" (Pickens, 2002: 46). This relates back to the idea of change as a non-linear process and the double-loop approach to learning (Darnton, 2008b).

Following on from the constraints raised by Pickens (2002), using self-reporting of behaviours for evaluation can also be affected by 'social desirability' bias. A survey of residential energy use behaviours in the City of Manningham revealed that residents were undertaking many energy conservation actions. However, this information was not matched by electricity metering data. Mullaly (1998) pointed to the potential for 'social desirability' bias being a cause of the discrepancy, where people indicated they changed behaviours when the data showed otherwise. Other factors proposed to explain the lack of correlation between behaviour and consumption include the wording of questions and memory effect on the survey method. Proposed methods to counter this include the use of personal diaries to record behaviours while they are still fresh in subject's minds. However, Mullaly (1998), referring to research by McKenzie-Mohr, points out that keeping personal diaries can lead to lower response rates. Self-reporting can be constrained by unreliable reporting ('false-positive responses'). There are a number of suggested ways to overcome this, such as repeat measures, disguising the focus of surveys, and lie-detection questions (Sexton, 2007).

Another constraint of surveys is that they do not account for the potential of a '*rebound effect*', where the benefit from one change in behaviour is countered by a change in other behaviours. This is highlighted by Crompton (2008), who cites cases where people changing from incandescent to energy efficient lights subsequently leave the new lights running for longer periods of time (direct rebound). An indirect rebound effect arises, for example, when participants undertake sustainable behaviours that lead to savings in utility bills, and

where these 'savings' are subsequently being spent on consumer items, or flights, which can have a greater environmental impact than the original behaviour.

The use of information technology provides new opportunities to capture evaluation data over a long term. In the Actions by Canadians (ABC) program, participant information including contact details and pledges was inputted into a Microsoft Access database. This allowed for easy storage and retrieval of participant data. Participants were subsequently contacted by email at two and six month intervals following workshops. The email message directed participants to a personalised website that asked what pledged activities they had completed.  The website also asked participants to answer a series of questions relating to their pledged actions and calculated the amount of greenhouse gas emissions saved as a result of their achieved actions to date. The website also included a survey that queried participants on the changes to their attitudes and behaviour as a result of the workshops. Those without access to internet facilities were sent a hardcopy of the survey to be manually entered into the database (Tools of Change, 2000).

The Australian Conservation Foundation (ACF) Green Homes project has moved from hard copy surveys to using an online program (www.surveymonkey.com) to collect survey data. The Zero Carbon Moreland is also planning to use electronic survey to capture data for evaluation. The benefits of using an electronic medium are several: there is a reduced need to manually collect and input survey data; electronic reminders can be sent to participants to complete surveys; and electronic survey programs such as the one being used by the ACF can analyse and provide reports on the data that has been collected.

Surveys can also be undertaken by telephone interviews. This medium is best used where the number of questions is limited, such as a follow up to a home audit intervention. In the Residential Conservation Assistance Program in the USA (see Table 5), participants were contacted by telephone to determine the degree of uptake of recommendations following a home audit. Participants were also invited to provide general feedback on the program. The take up of recommendation from the home audit allowed the program personnel to calculate estimated resource savings from the intervention. Estimate of resource savings can also be calculated from written/electronic self-reporting surveys.

### 4.2.2 Deemed savings

Deemed savings provide a way to quantify a change in resource consumption from data collected through self-reporting surveys. This can be in lieu of collecting metering data, or as a complement to metering data. For resource measures of waste (waste to landfill or rate of recycling and composting), deemed savings are the preferred measure as there is generally no other objective measure. Deemed savings has been used extensively in Australia (for example, ACF Green Homes, Sustainable Homes Program) and overseas (for example, GAP USA, 1-2-3 Campaign Against Global Warming- see Table 5).  Using self-reporting of behaviour change or pledges to undertake a new behaviour is however fraught with constraints, and can lead to overestimates of change in resource consumption, as evidenced by Mullaly (1998). It is for this reason that McKenzie-Mohr (1999) avoids self-reporting as a method of collecting evaluation data.

Deemed savings relies on calculating estimated resource savings based on a behaviour. For example, a participant reporting changing from incandescent lights to energy efficient lights allows for an estimate of deemed savings, but this is based on assumptions of the wattage and length of time that the light is on. However, the light may have indeed been changed, but it could be in a fitting that is seldom used. In essence, this indicates that there is more than one behaviour involved: there is the action of changing to more energy efficient lighting, and using the lighting more efficiently. Deemed savings requires capturing both behaviours. This type of discrepancy is not solely the reserve of self-reporting, as it can also occur in home visits, as reported by a Swedish study (Bladh & Krantz, 2008). When comparing information on lighting fixtures collected during a home audit to what was observed during a later home visit, a number of differences were found that led to substantial differences between measurement data and observed data. This led the researchers to state that the number of lamps (or any other appliance or fixture) cannot be used as a proxy for consumption as only a small number of lamps may be responsible for a large part of consumption. Such a situation points to the benefit of detailed monitoring (Bladh & Krantz, 2008), which goes beyond what even smart metering can achieve. Another constraint arising from deemed savings is that there is the possibility of participants undertaking other 'negative' behaviours such as purchasing high-consumption appliances (for example, plasma televisions), which may not be accounted for in the survey. Jensen (2008) remarks that environmental practices in everyday life are often overshadowed by consumption practices in other areas, with the latter influenced by different rationales

rather than environmental considerations. A recent Australian example of this is the Federal Government stimulus package, brought on by the financial crisis. The stimulus package encouraged consumers to spend, without pointing them to spend on sustainable products or services. This again points to the potential for a rebound effect negating the benefits of behaviour change, and therefore the importance of capturing unintended consequences as well as data on the desired behaviour change.

Eco-footprint calculators[49] provide a tool to calculate deemed savings based on answers to a set of questions. The eco-footprint has been to evaluate a behaviour change program based on community sustainability workshop, with a reduction in aggregate footprint from the pre-intervention calculation and the post-intervention calculation (Donlen *et al*, 2005). In this case, the footprint was not the sole method of evaluation, and was complemented by pre and post written surveys. The use of the eco-footprint as an awareness raising tool for sustainability has been demonstrated to be of great benefit (Sutcliffe et al, 2008), but its use as a method of evaluating behaviour change is questionable, especially when the focus of behaviour change interventions don't match the questions asked in eco-footprint questionnaires. The eco-footprint provides an aggregate measure of environmental impact based on a set of limited questions which do not reflect the small step changes most behaviour change interventions target. Using the eco-footprint to evaluate small step changes poses the risk of disillusioning participants into thinking that their behaviour change has had no great outcome. Recognising the limits of the eco-footprint, Vox Bandicoot, as part of their Sustainability Street program, have developed an '*eco-fingerprint*'[50] tool to measure the impact of future changes in behaviour.

A summary of the pros and cons of quantitative surveys is provided in Table 7.

**Table 7. Pros and cons of quantitative surveys and deemed savings**

| Written Surveys (Hard Copy) | |
|---|---|
| Pros | Cons |
| • Easy to develop and distribute<br>• Allows for a large number of questions<br>• Provides quantitative data that can be statistically analysed<br>• Standardised questions allow for | • Good survey design requires expert input<br>• Reliability of answers (self-bias)<br>• Potentially low response rates, especially in long-term follow up surveys |

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[49] http://www.epa.vic.gov.au/ecologicalfootprint/calculators/default.asp
[50] http://www.sustainabilitystreet.org.au/eco-fingerprint/application/randwick-ecological-fingerprint/

| | |
|---|---|
| reproducible and comparable surveys | • Data input can be cumbersome<br>• May not capture unintended consequences |

| Written Surveys (Electronic) | |
|---|---|
| Pros | Cons |
| • Easy and cheap to distribute<br>• Reminders can be sent<br>• No need for manual data input<br>• Software or survey program can analyse results and  generate reports | • Requires access to computers<br>• Good survey design requires expert input<br>• Reliability of answers (self-bias)<br>• Potentially low response rates<br>• May not capture unintended consequences |

| Surveys (Telephone) | |
|---|---|
| Pros | Cons |
| • Fast mode of data collection | • Length/number of questions is limited<br>• More costly than written and electronic surveys<br>• Must catch people when they have time to talk |

| Deemed Savings from surveys | |
|---|---|
| Pros | Cons |
| • Provides an estimate of resource savings from individual or grouped behaviours<br>• Provides context to changes in resource consumption patters<br>• Overcomes constraints of collecting metering data | • Subjective estimate of calculations<br>• Potential for unreliability based on untrue answers, or inaccuracy of assumptions for calculations<br>• May not capture unintended consequences |

Evaluation of behaviour change programs often rests on quantitative methods of data collection and analysis, and will remain so whilst funding bodies and program designers seek to measure change in resource consumption. However, it is important to realise that collecting quantitative data can be misleading, and running statistics on misleading data can lead to a desired outcome, but not necessarily the true outcome. Numbers and statistics are very pliable, and quotes to this affect abound[51]. It is important to understand the constraints

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[51] For example: Torture numbers, and they'll confess to anything (Gregg Easterbrook); 98% of all statistics are made up (Author Unknown); Statistics are like bikinis.  What they reveal is suggestive,

of different types of data prior to collecting and using the data for evaluation. For instance, gross metering data (as collected by typical residential electricity, gas and water meters) cannot be attributed to specific behaviours; and change in consumption related to behaviour is implied, but not observable or attributable. The constraints of quantitative methods are increasingly recognised in the design of evaluation plans, leading to a shift towards the use of qualitative methods of data collection, sometimes as a replacement, but more often as a complement to quantitative techniques (for example, Castlemaine 500 project, Regional Sustainable Living, Zero Carbon Moreland). Qualitative data provides context to quantitative information. This is articulated by Abrahamse *et al* (2005) who state that evaluations on intervention effectiveness should be focussed on changes in behavioural determinants as well as changes in energy-related behaviours, as most evaluations reveal only the extent to which interventions have been successful without providing insight into the reasons why.

### 4.3 Qualitative evaluation – beyond numbers

The UNDP Guidebook on Participation notes that it is important to move beyond traditional evaluation approaches (eg. change in resource use) in order to evaluate the process of change. This is particularly relevant for behaviour change projects, as these interventions are about people participating in a change process. Traditional quantitative approaches are noted to be inadequate for understanding the outcomes and effect of participatory development projects. In comparison, qualitative methods allow the study of motivations, and provide rich data on how individuals interact with their environment and cope with change (GSR, 2007). This entails moving from a focus on measurements (quantitative) to describing the process of change and the change that has taken place (qualitative). The key elements proposed by the UNDP Guidebook are outlined below (Table 8).

**Table 8. Key principles in monitoring and evaluating participation**

| Qualitative as well as quantitative | Both dimension of participation must be included in the evaluation in order for the outcome to be fully understood |
| --- | --- |
| Dynamic as opposed to static | The evaluation of participation demands that the entire process over a period of time be evaluated and not merely a snapshot. Conventional ex post facto evaluation, therefore, will not be adequate |
| Central importance of | The evaluation of a process of participation is impossible |

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but what they conceal is vital (Aaron Levenstein). From http://www.quotegarden.com/statistics.html, Accessed 22/10/08

| monitoring | without relevant and continual monitoring. Indeed monitoring is the key to the whole exercise and the only means by which the qualitative descriptions can be obtained to explain the process which has occurred |
|---|---|
| Participatory evaluation | In the entire evaluation process, the people involved in the project have a part to play; the people themselves will also have a voice |

The benefit of qualitative evaluation is that it takes evaluation 'beyond the numbers game' (UNDP Guide, p3), and provides a story behind any numbers that are collected. As previously mentioned, quantitative data collected as an evaluation of unobservable behaviour is a proxy indicator, and based on an inferred link between behaviour and the quantitative data. Yet, numbers may not adequately indicate the success or otherwise of a project. The prevalence of quantitative data in many behaviour change projects (see Table 5) is a reflection of the reductionist theory of science that has been the dominant paradigm in recent history. In contrast, qualitative evaluation is holistic and inductive, and is more to do with the process of change (UNDP Guide). Qualitative evaluation also provides a way to look into the future and improve on the design of behaviour change projects (Robinson, 2001).

### 4.3.1   Qualitative surveys (written)

Written surveys provide the opportunity to ask qualitative (open-ended) questions on top of quantitative (close-ended) questions. This allows respondents to identify aspect of programs that may be beyond what can be achieved with quantitative questions. For example, the evaluation of the Columbus Ohio EcoTeam program was conducted via a written survey that covered both quantitative and qualitative parameters[52]. Participants responses to the question "What was it that you found most valuable about the program?" identify aspects such as social connectedness and personal growth, awareness and action, which may not necessarily be drawn out from a quantitative evaluation. Some of the interesting responses include:

- *Building awareness; having a support group for change; learning more ways to cut down on waste; to become an agent for change in the community.*
- *The program gave our family the feeling that we really can help improve the quality of life in our family, our neighbourhood and our city.*
- *Neighbours working and playing together to create healthier homes and a more connected community.*

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[52] http://www.empowermentinstitute.net/files/Columbus_study.html

- *Working together - brainstorming ideas.*

- *Networking with neighbours.*

- *Being reminded of the goodness I used to do that I need to continue with my husband and family.*

- *Meeting my neighbours, learning simple ways to make a positive difference in the environment.*

These responses demonstrate that behaviour change programs can have benefits beyond environmental sustainability, and that change processes can also bring greater social cohesion.

### 4.3.2    Interviews

The Barrie Water Conservation Study[53] used interviews to complement quantitative data on water savings. Interviews examined the public's reaction to the program by asking questions about a variety of aspects including the performance of the toilets, the quality of the installation work, if the program guidelines were easy to follow, and why they participated in the program.

Bladh and Krantz (2008) used detailed interviews to gain qualitative data on determinants of habits leading to use of lighting in Sweden.  This was combined with observational data of household lighting fixtures and metering data. Qualitative data revealed that people were primarily interested in lighting function rather than consumption of electricity. This provides a good example of the benefits of conducting in-depth surveys of underlying behaviours towards resource consumption. Bladh and Krantz (2008) however also note that a drawback of qualitative studies is the small number of observations that is practical to undertake due to the large input of information from households.

### 4.3.3    Focus groups

Focus groups provide a cost and time effective method of interviewing larger groups of people. In a British study looking at reducing household energy consumption, it was found that focus groups provided rich data on the participants' own accounts of their behaviour and what could encourage changes in household consumption (Branson & Lewis, 1999). In the British study, focus group participants interestingly noted that making energy consumption visible (via an electronic display) may be the key to behaviour change. This in

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[53] http://www.toolsofchange.com/English/firstsplit.asp (follow link to Case Studies, then Barrie Water Conservation)

effect is part of the 'barrier research' that is required prior to undertaking CBSM interventions. There are a number of constraints to the use of focus groups. For example, group dynamics need to be facilitated in order to allow all participants to contribute honestly.

### 4.3.4    Outcome hierarchy

As mentioned previously in this literature review, behaviour change is a process that can take time, and may not be evidenced through the use of indicators such as metering. In any case, quantitative indicators do not provide evidence as to what influenced the change, and thus there can be little valuable information to improve behaviour change programs. Qualitative methods provide a tool to gather valuable data on the process of change from the participants' viewpoint. This can be used to strategically improve future or further program design. One participatory evaluation method that has been used to gather qualitative information is the use of an '*Outcome Hierarchy*'.

Outcome Hierarchy provides a participatory approach to evaluate the impact and outcome of an intervention through the use of a focus group. Participants are asked to reflect on the intervention to produce insights into the program that would not be realised by participant surveys or metering alone. The Outcome Hierarchy process provides an interpretist perspective to evaluation that reveals strategic information on the process of change, as well as unintended consequences, and information on the built capacity. The Outcome Hierarchy was used by Hornsby Shire Council to provide participant interpretation of existing data as well as participant experience of the behaviour change program (an energy efficiency intervention). Participants provided their interpretation of the capacity that was built from the project, and informed the council about how to build the program at a strategic level (see Appendix 1 the full case study). This strategic level information is often lacking from quantitative evaluation, as the process of change and participant capacity is inferred from indicators or close-ended questions, rather than examined through in-depth analysis.

The Outcome Hierarchy method was used to evaluate the Bayside Council Residential Energy Assessment Program in mid-December 2008.

### 4.3.5   Most significant change

As qualitative methods become more prevalent in evaluating behaviour change projects, techniques that have been used in the overseas development field, where participatory evaluation is the norm, are being trialled in Australian interventions. The Most Significant Change (MSC) method is a form of participatory evaluation that involves all stakeholders, including participants of the intervention, to decide on the type of change that is to be evaluated and how to analyse the data. The MSC method relies on the collection of *significant change* stories at different levels of the intervention (for example program staff, change agents, intervention participants) and collectively deciding on the most significant change stories based on selected domains[54]. The domains reflect broad categories, such as change in capacity to take action, or a change in participation in an activity, as well as lessons learned.

Benefits of using the MSC method are listed as[55]:

- It is a good means of identifying unexpected changes.
- It is a good way to clearly identify the values that prevail in an organisation and to have a practical discussion about which of those values are the most important.
- It is a participatory form of monitoring that requires no special professional skills. Compared to other monitoring approaches, it is easy to communicate across cultures. There is no need to explain what an indicator is. Everyone can tell stories about events they think were important.
- It encourages analysis as well as data collection because people have to explain why they believe one change is more important than another.
- It can build staff capacity in analysing data and conceptualising impact.
- It can deliver a rich picture of what is happening, rather than an overly simplified picture where organisational, social and economic developments are reduced to a single number.
- It can be used to monitor and evaluate bottom-up initiatives that do not have predefined outcomes against which to evaluate.

The Castlemaine 500 project used the MSC method to complement quantitative data collected through bill collection.  An interesting aspect of the evaluation was that there was

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[54] The MSC Quick Start Guide provides an overview of the MSC process-
http://www.clearhorizon.com.au/wpdl/DD-2003-MSC_QuickStart.pdf
[55] http://www.clearhorizon.com.au/page.php?pid=24

no significant change in electricity consumption between the intervention group and the rest of the community. The MSC method however showed a community-wide excitement around the topic of energy efficiency, and that a capacity to change had been developed in the community (Geoff Brown, Pers. Comm.). The indication of a capacity to change within the participants reflects the shift in values from individualism to collectivism that Crompton (2008) sees as critical to meeting the challenges of climate change. This underscores the reason why it is important to balance quantitative data with qualitative information, especially for projects that involve people changing behaviours. Behaviour changes, unlike the models of behaviour suggest, is not a simple process, and occurs through time, and amongst other supporting and conflicting influences and factors. In the case of the Castlemaine 500 project, if evaluation had solely rested on quantitative methods, the project could be construed as not having met its goals, whereas the use of qualitative data shows otherwise. The Regional Sustainability Living Program coordinated by Environment Victoria is planning to use the MSC to complement other quantitative methods of evaluation.

A summary of the pros and cons of the qualitative methods described above is provided in Table 8.

**Table 7. Pros and cons of selected qualitative methods**

| Written surveys | |
| --- | --- |
| Pros | Cons |
| • Allows participants to provide detail and personal insight into personal process of change<br>• Can provide information on unanticipated outcomes of an intervention<br>• Rich and valuable data that can be used to improve program design | • Data entry and analysis can be difficult, especially with larger samples<br>• Participants may not be comfortable writing about personal experiences |

| Interviews | |
| --- | --- |
| Pros | Cons |
| • Interviewer can probe to get deeper understanding of process of change | • Small sample size<br>• Interviewer needs to be articulate and not push participants towards particular viewpoints<br>• Data capture and analysis |

| Focus Groups | |
|---|---|
| Pros | Cons |
| • Ability to interview larger groups at one time<br>• Participants can comment on others thoughts, enabling exploration of different views | • Requires a facilitator<br>• Sample size limited<br>• Group dynamics may affect participation |

| Participatory Evaluation – Outcome Hierarchy | |
|---|---|
| Pros | Cons |
| • Provides multiple mediums to explore issues<br>• Reflective process as well as participatory input into program improvement | • Requires a facilitator<br>• Participants need to be comfortable with the process<br>• Sample size limited |

| Most Significant Change | |
|---|---|
| Pros | Cons |
| • Participatory process of evaluation involving all stakeholders<br>• Focus on learning and process of change | • Requires all stakeholders to accept method<br>• May require training in MSC<br>• Time consuming |

## 5. CONCLUSION, LESSONS & RECOMMENDATIONS

Effective evaluation of behaviour change projects targeted at the residential sector can be difficult to achieve due to the cost of evaluation, time involved, expertise required, and the many constraints posed by what is essentially evaluating people's behaviours behind closed doors. There are a number of methods to collect both types of data, and there is numerous literature providing examples of methodologies from the social science and psychology fields. These are complemented by resource consumption data that can be collected from utilities, metering, direct measurement, or approximations. Evaluation of behaviour change projects should include both quantitative and qualitative data. Quantitative data is often preferred, or required, when numerical targets are set (eg. 10% reduction in greenhouse gas emissions by 2010). Qualitative data, by contrast, provides information into the process of change, and provides context to quantitative data. Currently used evaluation methods have both benefits and limitations. The limitations, such as the risk of self reporting bias, or assumptions of deemed savings, or the potential for other influences affecting metering, are often overlooked when reporting on outcomes. This poses a problem in deciding whether behaviour change programs for sustainability are truly effective. In focussing on quantitative data as a measure of evaluation, it is not possible to reflect on the process of change that may have occurred. Understanding the process of change from participants' personal experiences provides rich insight that can be used to improve future program design.

### 5.1 Lessons

The lessons learned from this report are summarised below as key points to consider in evaluating behaviour change projects. This is followed by some recommendations for developing a toolbox of methodologies for evaluating household behaviour change projects.

### 5.1.1   Focussing interventions to make evaluation easier

Behaviour change projects that target multiple behaviours in one intervention are difficult to evaluate, especially if the evaluation process is designed to provide lessons about what works and what does not. It is also important to ensure that the goal of a behaviour change project is articulated as accurately as possible. For example, it is important to differentiate between energy efficiency or greenhouse gas reduction. Though these are linked, they are both significantly different to warrant individual focus in terms of program development and

evaluation. For example, white goods and electrical appliances account for, on average, 30% of total residential energy consumption and 53% of greenhouse gas emissions (AGO in ABS, 2006). This means that significant reductions in both energy use and greenhouse gas emissions can be made by targeting use of electrical appliances. In comparison, residential space heating accounts for a much lower share of greenhouse gas emissions compared to its share of energy use, due to the prevalence of gas (which is less greenhouse gas intensive) as an energy source. However, residential greenhouse gas reduction could be more easily attained, and measured, by focussing on uptake of alternative sources of energy, including solar hot water, and accredited GreenPower[56].

### 5.1.2 User behaviour is not homogenous

Behaviour change projects are most successful when designed for a population that shows similar barriers to change. Research undertaken by Defra (2008) indicates that the population can segmented into clusters of people that share distinct attitudes and beliefs towards the environment, and behaviours. This means that effective projects should ideally be targeted to clusters of similar people, based on background research that identifies the ability and willingness of people to undertaken target behaviours. Where behaviour change programs target a heterogenous population, evaluation methodologies need to consider variation within the sample, and not aggregate data to the whole population.

Patterns of resource consumption may also vary within homes. The Energy Use in Australia study (DEWHA, 2008) recommends further research into what drives particular behaviours, as there is a wide variation in energy use patterns within households. This recommendation is supported by the micro-level residential study into lighting use in Sweden that was referred to earlier (Bladh & Krantz, 2008). The study noted the wide variability in energy consumption from lighting, based on the use of certain lights (both low and high wattage) within dwellings and the hours of use. Thus, Krantz and Bladh (2008) recommend the importance of detailed metering at the point of use, combined with qualitative information, to uncover some of the underlying mechanisms that cannot be traced in the measurement of large samples alone. Though detailed metering can be costly, it may be practical and worthwhile to undertake this in a small subset of a sample to provide quantitative context to any change in resource consumption, especially where the change is unobservable.

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[56] This is dependent on the inclusion of voluntary abatement measures in the Federal Carbon Pollution Reduction Scheme.

### 5.1.3   Project and evaluation timing

Project evaluation is often instituted once at the end of the intervention. This model of evaluation tends to assume that there is a direct linear relationship between behaviour change implementation and outcome. However, household sustainability behaviour change is complex, and such a linear result may not be applicable. Though it is important to commence evaluations following project implementation, it is just as important to ensure that evaluation of outcomes is carried out for a period of time following the implementation phase. The trans-theoretical model of behaviour change (eg. Prochaska & Di Clemente) suggests that sustained behaviour change takes a long time to achieve (Sexton Marketing Group, 2007). In addition, failure to have a prolonged evaluation risks not noticing ephemeral changes in behaviour following a project, as can be the case when subjects become highly motivated following the implementation phase but revert back to less-sustainable behaviours after some time. Mullaly (1998) pointed that long term effectiveness was a criteria which needed to be assessed for behaviour change projects.

The evaluation of the EcoTeam program in the Netherlands demonstrates the benefits of conducting evaluations over a period of time, in order to identify whether changes are sustained. In their evaluation of resource use (electricity, gas, water and waste), the evaluation of participants shortly after the program ended, showed that savings had been achieved on household waste and natural gas, while the savings on electricity and water were not statistically significant. However, a repeat evaluation over the long term appeared to show that participants had made savings in all four areas of resource use (Empowerment Institute, 1997). It must be noted that baseline data on resource use only covered a two-week period, which most likely wrongly assumes that average resource use is relatively constant over the long term.

In a home audit program instigated by Pacific Gas and Electric in the USA, the evaluation consisted of measuring changes in behaviour by the number of residents applying for loans and cashback for retrofits, as well as changes in resource consumption (electricity). Interestingly, against the control group, residents served by trained auditors were 3-4 times more likely to retrofit homes and 36% more likely to apply for finance. However, the evaluation found no difference in electricity consumption data (Tools of Change, 1988). One possible explanation for this is that the evaluation took place too soon after completion of

the program, and that residents had not had sufficient time to complete retrofits. Undertaking a longer term evaluation could rectify this, and provide an indication of the time process for behaviour change to lead to change in resource consumption.

### 5.2 Recommendations

This literature review provides the following recommendations for designing a toolbox of methodologies to evaluate household behaviour change programs:

- Plan the evaluation of the program at the outset, so that it aligns with project goals. This involves developing a program logic that clarifies the theory of change being used in the intervention, and who the target group is.

- Ensure stakeholders understand the difference between performance, impact, and outcome evaluation. This leads to collecting meaningful data that informs the evaluation. Use of a framework like Soft System Methodology would assist in designing a thorough monitoring and evaluation plan.

- Decide  whether the evaluation seeks to solely show if change has occurred, or whether it also seeks to understand what change has occurred, and the process of change

- Balance quantitative methods with qualitative data in order to provide context to change

- Provide sufficient resources (staff and financial) to evaluation. As a general rule, 10% of a project budget should be allocated to evaluation[57].

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[57] http://www.utas.edu.au/pet/sections/costing.html

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**Participatory evaluation: Hornsby Shire Council's evaluation of a Low-Carb Emission Education Program** (Case study provided by Dr Susan Goff, Twyfords Consulting)

Hornsby Shire Council is located on the Northern urban fringe of Sydney. Its environmental services have been delivering a long-term community education strategy looking into energy reductions in the residential sector on several fronts. In 2007 it requested an evaluation of its latest education program. The Council had been monitoring the extent, type and satisfaction of participant engagement with each of the program's nineteen educational workshops for a year. As such the evaluation had a wealth of existing monitoring data to analyse.

To complement this monitoring data the Council requested some more in-depth information to cover process, impact and outcome evaluation perspectives:

a) Viewpoints from the education program manager, presenters at the workshops and service suppliers (solar panels, insulation, solar hot water systems and energy auditors) about the challenges of contributing to the program

b) Participant viewpoints at a more in-depth level than a workshop feedback sheet can reveal about how the various aspects of the program worked together for residents

c) Participant interpretation of the existing data and experience to inform Council at a strategic level of where to take the low carb strategy next.

This case study considers the third aspect of this evaluation. While the interviews with the manager, presenters and suppliers were insightful, other than providing open-ended responses they were not "participatory" in nature. We understand a "participatory approach" to mean those who are affected by the issues having degrees of parity regarding how they are addressed. The degree of parity is strongly influenced by many factors including the nature of the issue, the organisational culture, participation histories and available resources.

Method:

Seven program participants, (6 males) attended the three-hour workshop. The thematic concern that they were invited to look into was the question:

> *What capacity has the low-carb emission program built in Hornsby Shire Council and community?*

Once this capacity was mapped, the participants were invited to explore the question:

*What should council do with this capacity to achieve its 2012 target (reduction of 10% 1996 emission levels across the Shire)?*

Using Action Learning approaches, participants were invited to:

- Work in pairs, to reflect on their experience of using the program, each participant mapping the other person's story on story maps, and also mapping the participants' questions and learning outcomes arising from their engagement with the program

- Work in plenary, to study all the story maps and analyse the data collaboratively to identify the kind of capacity that the program had built (including critically reviewing the capacity that was lost, overlooked and the indirect enablers and barriers)

- Work in triads, to ask strategic questions about where council should go next and identify program goals that would progress council and the community towards the 2012 target

- Work in plenary to collaboratively map out a rough outcome hierarchy that would guide council's future program designs

- Give anonymous feedback on workshop approach and output

This approach enables participants to work from their lived experience of the program and the issue it attends to, as the *raw data*. The data is given additional rigour through collaborative learning about the experience – story telling, analysis, question development and responses. It is given another level of rigour through collaborative critical analysis – viewing the gallery of stories and conceptual maps, and challenging assumptions or asking questions about it.

With this shared and developed knowledge base to their work, the participants then gathered around a table and created a large (3metre by 2 metre) Outcome Hierarchy. They plotted the new needs that the Council now faced having delivered its program and these participants having identified the new level of capability.

Overleaf is a copy of the Outcome Hierarchy given to this compendium with Hornsby Council's permission.

For those unfamiliar with the method, an Outcome Hierarchy is read from the bottom of the table up, tracking impact and outcome from outcome, over time.

| Outcome hierarchy element | Participants' recommendations |
|---|---|
| *Ultimate Outcome (2012)* | 10% reduction on 1996 levels of carbon emission across the board of HSC residents and business |
| *Program goals to achieve this target* | Goal 1: Involve more people<br><br>Goal 2: Simultaneously increase renewable energy resources in the Shire while reducing consumption |
| *Intermediate outcomes from new program's immediate outcomes (2010)* | Exponential growth of participation<br><br>Moving the scale of change from individual households to street level participation<br><br>Significant increase of utilisation of roof space for energy generation<br><br>Significant reduction of consumption across the important emitting sectors including transport and industry production<br><br>Community participation in lobbying government and power companies to invest in renewable energy systems<br><br>More efficiency, less waste, less pollution<br><br>Rethink workplace policies to relocate work locally<br><br>Community and council participation in rethinking local economic development to progress low emission solutions<br><br>Relocate government services to local hubs<br><br>Build community (networks, activities, resources) around low emission solutions<br><br>Work with low emission systemic shifts such as carbon taxes<br><br>Build the role of local government to facilitate systemic change as it applies in the local community |

| | |
|---|---|
| | 3-5000 people directly engaging in the program |
| *Immediate outcomes from such new activities* | Increased number of installations |
| | Measurable reduction in emissions |
| | Public awareness of problem and progress increased |
| | The existing capacity of thinkers converted to "doers" (eg: 1000 people directly associated with the program actively installing, education and changing habits) |
| *A New Program Activities* | If available, access more State and Federal funding programs |
| | Use education networks (schools, TAFE, other) to bring low emission knowledge and activity into a) curricula b) facilities management c) social events |
| | Set up competitions and rewards for low emission success between Shire wards or suburbs |
| | Significant increase of marketing of programs, solutions and rewards off the back of other council activities |
| | Wide community education program - send out checklist with rates, identify what the target means and communicate it, publish performance results on a weekly basis |
| | Identify and be transparent about the limits to carbon emission reduction |
| | Divide the community into clear sectors for participation so there is equity and balance between emission success and displacement is minimised (reduction in one sector resulting in increase in another) |
| | Review all council policies and mechanisms and insert emission targets across the board |
| | Identify people doing the right thing and reward them |
| | Break standard rules (like putting a water tank in your front garden) to catch public attention |

| | |
|---|---|
| *New current needs* | Increased awareness of more people, including professionals and community leaders, about the reality of the problem and the capacity to act |
| | To legislate and enforce compliance to reduce emissions |
| | To make Basix stronger (beyond Basix) |
| | To build council's internal capacity and the community's capacity to enable emission reduction |
| | To build enthusiasm across the board |
| | To know more about the transition from thinking to doing |
| | To know how the target will be measured and to communicate progress to the public |
| *New current capacity* | Capacity to learn and use better knowledge, improved awareness and understanding of green solutions to reduce our carbon footprint |
| | Capacity to reduce consumption and increase renewable energy resources in the Shire through rebates and changing habits |
| | Capacity to educate others formally and informally |

The participatory aspect of this evaluation is not the evaluation strategy itself, which in pure participatory terms, lacks participatory rigour. For authentic participation the program participants would have negotiated the evaluation strategy approach.

However, their engagement with the Outcome Hierarchy means that the participants have had input to future program design, drawn from the real life experience of the immediate past program.

It is through their eyes of what they learned and how it is in local reality with local neighbours, business and relationships with their Council, that they devise the next strategic step. Their identification if built capacity also means that the strategy is standing on sustainable ground. It shows a highly integrated use of local infrastructure including legislation, educational institutions, cultural qualities like "enthusiasm" and a clear understanding of moving from thinking to doing. Without community engagement in naming this capacity Council planners risk underestimating the change potential they had to work with. Moreover, should Council listen to such participant input the quality of trust between Council and community has a chance to strengthen to support even more ambitious development in the years to come.

When asked to give their feedback about the process, the participants reported:

- Informative, great ideas
- Optimistic about contributing to future directions for council
- Felt slightly hampered by not understanding council's powers, operating procedures etc
- Professional facilitating, a bit long
- Good forum, not too large; good ideas generated and identified also; needs to sell the concepts and the goals
- Good ideas generated from brainstorming sessions; would be great to see some real results/outcomes or policies from these ideas; would have been nice to see more participants