COLLECTING RESIDENTIAL END USE DATA FROM PRIMARY SOURCES: DO'S AND DONT'S

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Abstract

This paper addresses the "do's and don't's" of collecting primary (directly sourced) residential water end-use data based on experiences of the authors. Proper planning is fundamental. Insufficient consideration of important factors can affect the quality and usefulness of the data and in turn the model or outcome for which the data is being collected. Despite data collection often being perceived as a relatively simple process, many studies in the past have overlooked key considerations which can influence both the design of the study and the type of data collected. This paper provides a logical sequence of steps for guidance in clarifying data needs and understanding how it is best collected, based on four recent Australian case studies in Perth and Melbourne. Both the advantages and limitations of various techniques of collecting such data are described, as well as useful hints and practices to avoid. Also presented are ways to value add to the data collection study such that cost effectiveness, time and resource efficiency are improved and multiple outcomes are provided.

Keywords: End-use data, water use, primary data collection, residential, Australia

1 Introduction

Primary data collection refers to data collected from a primary or 'original' source, specific to the study area. In contrast, secondary data usually adapts data from other existing studies, in some cases extrapolating or interpolating such data. The collection of primary data is typically considered more accurate than the use of secondary data; however, this is only true if it has been collected using a sound study design and appropriate data collection technique. Reliable data is fundamental to forecasting water demand or predicting savings from demand management initiatives. Whilst the data collection process is often perceived as straight forward relative to the modeling or synthesizing stages of analysis that follow it, there are numerous factors which may be easily overlooked at this important first stage. This paper attempts to delineate a number of such factors.

Factors to be considered include:

- Being explicit about the objectives of the data collection study;
- determining the types of data best suited to the purpose of the study;
- looking for ways to value add to the study;
- considering appropriate data collection techniques, including the advantages and limitations of each;
- communication strategies with water customers participating in the study;
- ensuring samples are representative and stratified;
- collecting data in an appropriate season; and
- considering issues around gender and ethics.

2 Understanding data needs and study objectives

The collection and analysis of residential water end-use data is useful for a variety of different purposes. for instance, to better understand water use practices, or to develop end-use models. These two purposes require different levels of sophistication in the data collection. General trends and patterns in water use practices and equipment may be surveyed for the former type of study. An end-use model however, requires greater attention to quantitative detail as this model is likely to be required to:

- forecast demand for water infrastructure;
- predict savings from implementation of demand management initiatives; and/or
- identify and evaluate savings resulting from demand management initiatives;

Designing an efficient and effective data collection exercise therefore first requires a clear understanding of the purpose(s) of the study. Appropriate questions at this stage include: *What data do I need? What level of detail should I aim for? How will this data help answer the research questions I have? Will they fit into my model? How can this data be analysed in order to provide the outcomes I want?*

A recent data collection study which considered these questions prior to and during the study was the Melbourne End Use and Water Consumption Influences Study (ISF and CSIRO, 2002). This Study was conducted for the Water Resource Strategy Committee for the Melbourne Area to understand how and when water is used within the community and the factors influencing water consumption. The intention was to provide a summary of best current knowledge of end uses of water within Melbourne, and collate existing knowledge about the major influences on end uses of water, including penetration levels of water efficient fixtures and appliances. Data were sought that could provide inputs to an appropriate water end-use model for Melbourne. This purpose influenced the type and extent of data collected: for example, data were collected on *actual* water use of the different water efficient shower types. This issue of collecting appropriate data on water efficient showers is elaborated in the text and *Figure 1* in *Section 3*. Further, the study focused on collecting more reliable data for those end uses which were more significant to an end-use study, such as showers and toilets (which can each make up 30% of indoor water consumption), compared to dishwashers (which make up approximately 1% of indoor water use) (Water Resource Strategy Committee for the Melbourne Area, 2001; ISF, 1998).

The Domestic Water Use Study (DWUS), undertaken by Water Corporation of Western Australia in Perth 1998-2001, has become perhaps the largest residential end use data collection in Australia (Loh and Coghlan, 2003). The DWUS was intended to collect data on household water usage and identify patterns and trends in water use (Loh et al, 2002). It provided a snapshot of how water is used in the average Perth household and flow data on selected households. It is anticipated that a demand forecasting model and a water use efficiency program may be developed from this at a later stage (Coghlan and Higgs, 2000; Loh et al, 2002). However, although the size of this end use database is the largest in Australia, trying to use this database for purposes for which it was not originally intended makes it much more difficult to do so.

3 Data types

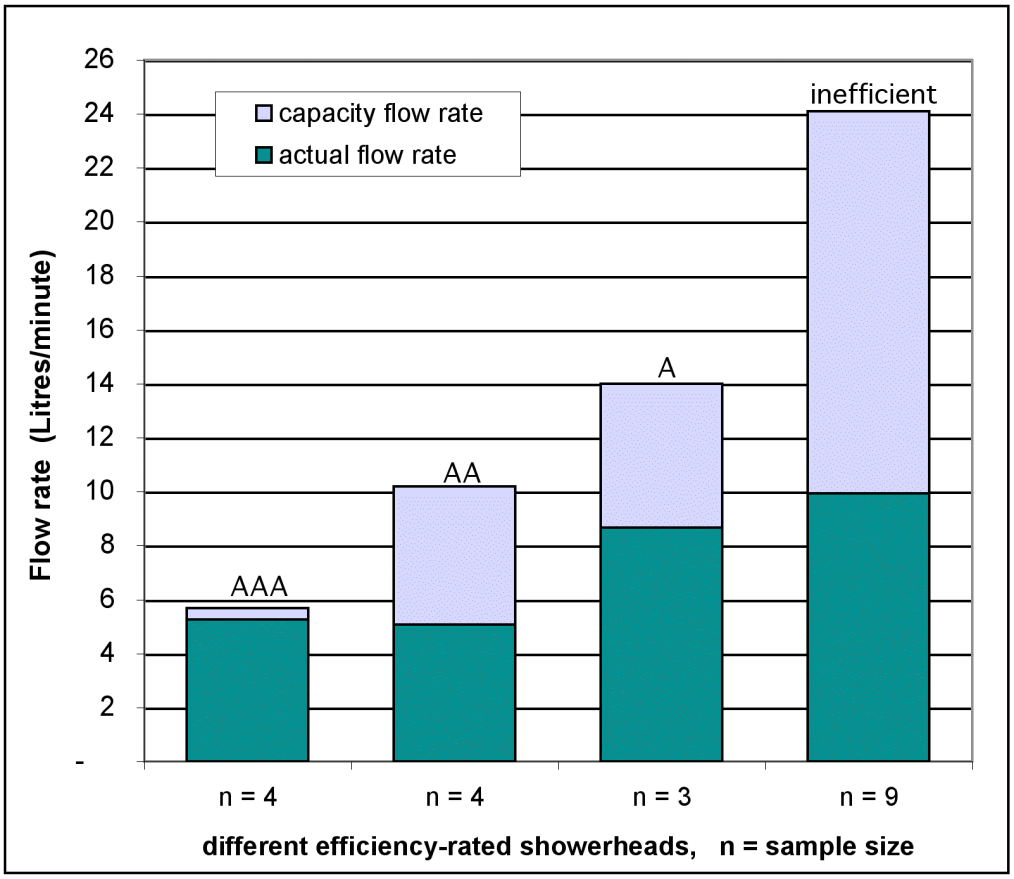
Once there is clarity on the purpose(s) of the study, specific and appropriate types of data need to be collected. It is often difficult or impossible to go back and collect further data which was initially overlooked. Thus it is important to think through this step carefully. This step can involve more than simply considering whether to collect data on different end-uses, it may require further consideration of the different parameters or characteristics of a specific end use which can be collected, and which are appropriate.

For example, the DWUS was designed to identify patterns and trends in water use behaviour (Loh *et al*, 2002) and as such data was collected using a survey including only two categories of water using appliances: 'efficient' and 'standard' (for showers). This is sufficient for understanding general trends; however if water and cost savings for the different appliances also need to be analysed, then further information is required about the water efficient appliances. The reason for this is that the word "efficient" is unclear in a technical sense. In Australia at that time, efficient shower heads could be A-rated (12-15L/min), AA-rated (9-12L/min) or AAA-rated (<9L/min). Categorising the showers as 'efficient' or 'standard' may be more straight forward and be useful for trend development; however it may not provide all the information that is desirable to calculate savings. Knowing the end goal is important.

The same issue applies for dual flush toilets: currently in Australia, these can be 11/6L, 9/4.5L or 6/3L. In the future, 4/3L and other efficient toilets may become available. If quantitative data is required on savings achieved by replacing all higher water using toilets with 6/3L toilets, than the level of detail of toilet type and actual flush volumes is required. Washing machines and dishwashers can be more complex in terms of water use, as water use efficiency (eg. L/load) is *incrementally* being changed, perhaps even annually, compared to discrete water use efficiency categories as are found in showers and toilets.

Determining savings from the installations of various water efficient showers can be complex. It is thus important to use appropriate data to enable accurate calculation of savings. It is not always sufficient to use theoretical data, and assume an AAA-rated showerhead actually gets used at 9L/minute. That is, *capacity* (maximum) flow rate cannot (or should not) be used as a baseline measure to determine potential water savings from retrofitting water-efficient showerheads. If the efficiency (or "A") rating (maximum flow rate at a standard pressure) is accurately known, then data-loggers may be a reliable method for determining actual water use (L/min and duration) for a showerhead with a given efficiency rating. However, if the data collection technique is an in-house face-to-face survey, an alternate approach would be to ask the householder to turn on the shower (of known rating) to the flow they typically use. The graph in *Figure 1* indicates the average "actual" flow rate, the rate set by householders for showering, compared to the capacity flow rate, for the different range of "A" rated showerheads in the Pilot Toilet and Shower Water Use Study conducted for the Water Corporation of Western Australia in Perth (ISF, 2002a). Although this pilot study did not have a statistically significant sample size, the figures suggest that actual flow rate may be much lower than the capacity flow rate, especially prior to retrofitting. It is also important to note that the actual flow rate appears to vary substantially as a percentage of capacity flow rate (see *Figure 1*), depending on the "A" (or efficiency) rating of the shower head. The actual flow rate is a much lower percentage of capacity flow rate for high water using shower heads, whereas it is a much higher percentage for water efficient shower heads.

Figure 1: Indicative average 'actual' shower flow rates compared to the capacity flow rates, for A, AA, AAA and inefficient (no-rating) showerheads (Source: ISF, 2002a).



Other complexities exist in collecting appropriate and useful data in relation to dual flush toilet types. Identifying stocks[1] of the various dual flush toilet types in Australia may not be as simple as a superficial check of the toilet during a household technical visit. Even less accurate is asking the household themselves what type of dual flush toilet they own. This is because there are currently three types of dual flush toilets: 11/6L, 9/4.5L or 6/3L and unfortunately, there are no consistent, obvious markings on these toilets which enable easy identification. This situation is further complicated by the fact that some models of 9/4.5L toilets can easily be converted into a 6/3L and vice versa with minimal internal modifications. This means the porcelain 'shell' of the toilet can be identical for a 9/4.5L and a 6/3L. These difficulties may be overcome however by taking measurements of the volume of water inside the cistern. Whilst this latter technique may not be quick and straightforward, it may provide more reliable results. Another option yet to be trialled in Australia is the use of the *T5 Flushmeter*[2] to obtain instantaneous data on actual toilet flush volumes (claimed to be accurate to the nearest 0.1L).

4 Value adding

Data collection can be tedious and expensive. It is therefore worth considering whether there are other purposes that could benefit from the data collection exercise. Also it is important to consider such options before-hand, as once the data is collected, it may not be possible to undertake further analysis if there are any gaps in the data.

[1] For the purpose of this paper, 'stocks' refer to the quantity or percentage of specific types of water efficient fixtures.
[2] See http://www.t5flushmeter.com/ for further details on T5 Flushmeter.

An example of value adding to an existing study concept is the proposed Melbourne Stock Study and Retrofit for Yarra Valley Water, which is currently being designed to achieve multiple objectives. These include:

- to collect data on current residential customer stocks of water using fixtures and appliances;
- to monitor changes in water use following a retrofit, allowing water savings to be determined for individual water efficient fixtures/appliances;
- to collect current data on customer water use at the end-use level which can be compared with two previous residential forecasting studies conducted for Yarra Valley Water to ascertain trends in water uses; and
- to develop techniques for obtaining high quality data on appliance and fixture stocks and associated water use, on a regular basis, at minimal cost while working in cooperation with customers, and, which can be used for future stock studies to track changes in stocks.

It is anticipated that data for the stock study will be collected via in-house visits for a sample of up to 1000 households. The value added component will involve data logging of a smaller sample of the households (approximately 100) which will be retrofitted with water efficient fixtures. This data emerging from the data logging exercise will provide specific parameters on water using practices which can subsequently be directly feed into, and refine, a residential end-use model for Melbourne. The retrofit component of this study may be further 'value-added' by trialling for the first time in Australia the use of 4/3L dual flush toilets (ISF, 2002b).

5 Data collection techniques

There are numerous techniques for collecting primary residential water end-use data. Each displays both benefits and limitations. Techniques include metering, data logging, household surveys (doorstep and in-house), telephone surveys, market surveys, government statistics and diaries. These are described below. Advantages and limitations of each are described in *Table 1*.

5.1 Metering

Metering customer water usage is an essential prerequisite for charging fees based on actual customer use. Monitoring water use by metering can provide baseline information on overall water use, the seasonal and hourly patterns of water use, and the quantities and quality of water use in individual single households (Brown and Caldwell, 1990). Water use is currently metered extensively for single residential dwellings in Australia, and little or none on multi-residential dwellings. It is also possible to meter individual end uses within a household, however this may be resource intensive and hence costly.

5.2 Data logging

Data logging involves an electronic device attached to a water meter, which monitors an individual water customer's water flow rates over time, at periodic intervals (this can be monitored as frequently as seconds). Data loggers are an addition to water meters, not a substitute.

5.3 Surveys

Household surveys are usually conducted face-to-face or via telephone, or occasionally using a mailed questionnaire. Surveys are very helpful in understanding attitudinal and behavioural determinants of water use. While mailed questionnaires are relatively inexpensive, unless the content is very important to most recipients, low response rates are common and their value for collecting end-use information is very limited.

5.3.1 Face-to-face Doorstep

Surveys conducted in person between the interviewer and the interviewee, without entering the house.

5.3.2 Face-to-face in house

Survey/questionnaire conducted in person between the interviewer and the interviewee, which involves the interviewer entering the house and often inspecting the water using fixtures during or after the survey.

Figure 2: conducting an in-house face-to-face survey (ISF, 2002a)

5.3.3 Technical survey (fixture inspection)

The technical survey, like the face-to-face in-house survey, involves the person conducting the survey entering the house. It is aimed at identifying the stock of various water using appliances by inspection. Details of the appliances/fixtures which may be of use include model, age, leakage, type (eg "A" or "efficiency" rating for a shower, or dual flush toilet type).

5.3.4 Telephone

Telephone surveys are very similar to face-to-face doorstep surveys, a principal difference being the survey is undertaken via telephone rather than in person.

5.3.5 Market surveys

Market surveys involve data collected via historical and/or projected sales data. This can aid assessment of stocks of end-use technology (eg breakdown of various dual flush toilets).

5.3.6 Governmental statistics

Government statistics include any data compiled by a government body. This can include data from ABS[3], state departments, councils, etc. Useful types of data for end-use studies may include demographic, economic, labour and bulk water consumption.

5.4 Diaries

Data collection via diaries involves household members tracking their water use and documenting it in a diary. Data most commonly recorded is frequency of use for a particular end use, duration of use and sometimes volume of water used.

As the range of advantages and limitations in *Table 1* indicates, there are trade-offs between cost and reliability of data depending on which technique is utilized. It may be that the optimal strategy is a combination of techniques, as different parameters are often best collected by different approaches. It is important to consider what type of data is required and which technique(s) may maximize the cost-reliability efficiency.

[3] Australian Bureau of Statistics.

Table 1: Advantages and limitations of using various data collection techniques (source: ISF and CSIRO, 2002).

Technique	Advantages	Limitations
Metering	• Meters typically have an accuracy of ± 2% when new (White, 1998). • Digital electronic meters differ from standard electronic meters as they have the added benefit that they can transmit not only electronic pulses to be read by other equipment, but also the actual reading from the meter. This added feature provides a double-check mechanism so reconciliation of data with the actual meter reading is not required. • Smart metering in conjunction with a differential pricing structure has the potential to save money for customers and for the water supply utility by sending differential price signals automatically to customers during drought times or when water storages become low to encourage water conservation (ISF, 2000); • Tenants can be made responsible for their own water consumption through sub-metering; • Meters can be read remotely using a computer and modem.	• Problems associated with faulty or inaccurate meters; • Digital electronic meters are typically more expensive than standard electronic pulse meters (ISF, 2000); • Metering cannot decipher between different end uses in a household or commercial premise.
Data loggers	• Non-intrusive measurements; • Generally a high level of reliability (assuming the meter from which they are reading is accurate); • Effective at identifying leaks (Milan 2001, pers. comm., ACNielsen, 28/8/01).	• High cost associated with collection and analysis of data, therefore number of households in sample is often smaller than desired; also need clear purposes for data in policy terms, and thus the degree of accuracy required; • Potential difficulties in distinguishing between concurrent water uses; • Behavioural, attitudinal or social issues cannot be directly addressed; • Only as accurate as the water meters they are recorded from; • Requires the analyst to interpret flow traces emerging from data logger;
Surveys: ***Face-to-face doorstep***	• Behavioural issues can be addressed directly (i.e. by asking the water customer questions related to behaviour);	• Subjective responses, potentially low level of accuracy on volume of water use; • Potential adjustment of response bowing to perceived social pressure of the 'correct' answer; • Answers on water usage practices may only be true for the individual respondent and not other household members.
Face-to-face in-house	• Allows for a direct observation of technology type, flow rates and leakages, as well as having the same advantages as face-to-face doorstep in obtaining attitudinal and behavioural information.	• Can be seen as more intrusive than doorstep or telephone surveys; • Potential adjustment of response bowing to perceived social pressure of the correct answer. • Answers on water usage practices may only be true for the individual respondent and not other household members.

Technique	Advantages	Limitations
Technical survey (fixture inspection)	• More reliable than asking householder to identify the details of the water using fixture.	• Can be seen as more intrusive than doorstep or telephone surveys; • More time consuming and higher cost compared to telephone surveys.
Telephone	• Behavioural issues can be addressed directly (i.e. by asking the water customer questions related to behaviour); • Relatively less intrusive than face-to-face surveys. Respondents may not feel as threatened or find survey as intrusive over the telephone. • Typically cheaper than conducting surveys via household visits.	• Subjective, potentially low level of accuracy on volume of water use; • Potential adjustment of response bowing to perceived social pressure of the 'correct' answer; • Answers on water usage practices may only be true for the individual respondent and not other household members.
Market surveys	• Good for cross-checking primary historical (or other) data being used (Milan 2001, pers. comm., ACNielsen, 28/8/01);	• Behavioural or social issues cannot always be directly addressed. • Provides theoretical water flow rates and volumes of water using appliances, however this may differ significantly from actual flow rates and volumes in-situ.
Government Statistics	• Non-intrusive measurements; • Data already exists, so no further time and resources are required for further data collection; • Usually reliable data collection techniques and well documented.	• Cannot tailor data or questions to specific needs as it is usually designed and developed for other purposes.
Diaries	• Useful for determining frequency of use. This may be more reliable than a survey which relies on peoples' ability to recall; • Useful for cross-checking data logger or other data.	• Subjective measurements. Volumes often unreliable as they are significantly underestimated; • Depends on consistency of use by household members over an extended period of time: some people are very methodical about recording use as it occurs, a few complete forms when they must be submitted • May in some cases influence behaviour to reduce record-keeping (such as drawing off large amounts of water and keeping it in the refrigerator or in containers to avoid having to record each glass drunk) • May influence behaviour to reduce use by increasing awareness of quantities used. • Can be highly intrusive and onerous.

In the DWUS study in Perth (Loh and Coghlan, 2003), data to identify dual flush toilet stocks were initially collected via a face-to-face survey, however no physical inspection of the toilets was made. Towards the end of the study, this data was cross-checked via an examination of the flow trace data emerging from the data loggers and by an in-house technical survey. The in-house technical survey involved researchers entering the house and examining the toilets to increase the level of accuracy in identification (ISF, 2002a). The toilet identifications from the in-house survey technique and review of data logger outputs were reasonably consistent, while they differed considerably from those initially estimated by participants during the DWUS telephone survey. However, because toilet flush volumes can be different than those obtained in a lab setting, collection of data using in-house surveys can produce better identification than the use of dataloggers alone, and based on this

Perth pilot study, identification techniques have been further improved. For example, in the proposed Melbourne Stock Study and Retrofit Program, it is proposed that dual flush toilet types be identified by taking digital photos of: a) the inside of the cistern prior to flushing, b) immediately following flushing, and c) a top view. These images will be sent to the leading toilet manufacturer in Australia for quick identification. These three types of photos required were developed in unison with the toilet manufacturer (ISF, 2000b).

6 Representative and stratified samples

Studies undertaken to collect data on a representative sample of the population, must be randomly selected. The final participant group should be stratified by available variables, including:

- owner occupant status;
- single-residential versus multi-residential;
- household size;
- age of the building;
- geographical distinction; and
- income levels and other socio-economic variables (such as pensioner status).

Issues of self-selection by a participant group who volunteer participation can often be overcome by testing the sample against the required characteristics of the population (as listed above). Cluster sampling may save the study significant costs and time, (in terms of transport time for household visits) however can increase the risk of losing some representativeness. For example, unknowingly selecting clusters (based on socio-economics) which may have high water pressure due to geography or other factors which could distort the results.

The proposed Melbourne Stock Study and Retrofit aims to overcome the issue of self-selection by proposing that there would be no cost to the customer for the toilet, shower and tap aerator retrofit component of the study, to ensure the sample will be selected as part of the study and not self selected.

7 Data collection and seasons

The season in which the primary data is collected may influence the resulting data. It is important to not only choose an appropriate season for data collection, but also to be aware of the influence of the season on data collection. This is well recognized for collecting water use data via meters and data loggers. For example, metered household water use in winter is almost entirely composed of indoor uses, as little or no irrigation is being performed. Less obvious is the effect on telephone and face-to-face surveys. If questions on water use practices are being collected via in-house face-to-face surveys, householders may answer questions relative to how they are currently using water. For example, if the interviews take place during winter months and the participants are asked about their frequency and duration of garden/lawn irrigation, their responses may be skewed towards their current winter practices, and/or less accurate about their summer practices (which may be of greater interest). This is because people are relatively more accurate at recalling recent events (in the past week) compared to recalling events in say the past 6 months. (Ayres and Wood, 1999).

8 Communication with water customers

Whether the data collection technique is to be intrusive (such as an in-house face-to-face survey) or non-intrusive (such as data logging), it is important to have a good communication strategy planned for the customers who will potentially participate in the data collection exercise. This is relevant both prior to, during, and following the data collection. It is also desirable to build a level of respect and trust with the participants.

An example of a good communication strategy is the one developed for the Perth Pilot Toilet and Shower Water Use Study. This study aimed to develop techniques for obtaining high quality data on appliance and fixture stocks and associated water use, at minimal cost while working in cooperation with customers. The

available number of potential households for this pilot study was limited, and other households could not be substituted. Thus it was necessary to develop a strategy that maximized the participation rate out of the few available households. Participation was maximized by sending out a letter to all desired participant households prior to telephoning them, and by providing rewards to show participants the value that the Water Corporation placed on the household's contribution to the study (ISF, 2002a).

The objectives of sending the introduction letter were to:

- introduce the study's purpose and scope;
- inform the householder what their participation would involve;
- prepare the householder for a follow-up telephone call to arrange an appointment; and
- provide a consent form as an attachment to the letter.

The purpose of the telephone call was to:

- make appointments with households agreeing to participate;
- follow up from the letter;
- reiterate the purpose of the study and what was required from participants;
- answer any questions about previous studies and/or the current study; and,
- survey a person in the household, who had read the letter or who was willing to commit the household to participate in this study, on demographics, any changes in water-using appliances and levels of satisfaction with their dual flush toilet.

The survey questions asked over the phone were identical to those asked in the face-to-face survey. The purpose of asking these questions over the phone was to collect data from more than one member of the household to account for variation in individual responses among household members.

Once an appointment had been made, the household visit involved both the technical survey (fixture inspection) and face-to-face survey (usage behaviour). These could be conducted simultaneously as there were two researchers conducting the household visit. The objectives of the face-to-face survey were to:

- understand people's toilet usage practices which could help clarify data previously gathered using a different data collection technique;
- understand people's patterns of use of their dual flush toilet; and
- determine how satisfied households were with the operation of their dual flush toilet to contribute to research on the most likely cause(s) for higher than expected average flush volumes for 6/3 litre dual flush toilets.

The technical survey aimed to identify the stock of various water using appliances.

The household visit was completed by offering the participants a choice from a range of rewards. Rewards included AAA-rated showerheads capable of matching different bathroom décor, tap aerators, peat, mulch, tap timers or greywater diverters for washing machines. The majority of participants chose AAA-rated showerheads, and the researchers were able to install these immediately. Participants appeared to respond positively to the immediacy of the rewards (compared to a say a reward which could be redeemed at a later date).

All participants were sent an evaluation form following the study. This was designed to help the study team look for opportunities to improve the way the household visits were conducted and to affirm any positive aspects. The evaluation by participants revealed that in general they were very satisfied with the processes which had been used in the study. This affirms the success of the communication strategy used in the Perth Pilot Study and the importance of incorporating a good communication strategy in the data collection study to ensure participants are treated with respect, to maximize their participation and cooperation and to establish or further build customer relationships with the organization.

9 Gender, ethics and primary data collection

This section addresses further issues around engaging participants in an appropriate and effective way. This is especially relevant when the data collection technique involves an interview of some sort. Participants in a face-to-face survey may feel least threatened and willing to participate when a male-and-female combination conduct household visits (compared to two males, two females, a single male or a single female). Research also indicates that both male and female participants are generally more receptive to a female interviewer (Warren, 1988). For this reason, the Perth Pilot Toilet and Shower Water Use Study used a female and male pair to undertake the household visit, where the female conducted the face-to-face interviews with all participants, while the male undertook the technical survey.

Ethics and communication is also important, especially when conducting face-to-face surveys about issues which may be confronting for some participants. In the Perth Pilot project, prior to asking the face-to-face survey questions, the participant was informed that some of the questions related to the efficiency of dual flush toilets and how satisfied customers are with them. This was to ensure participants weren't taken aback by the nature of questions which were related to the use of the dual flush toilet in that household. With the context properly set, no respondent appeared uncomfortable either with being asked such questions, or answering them. The interviewers were careful to ask the householders the potentially sensitive questions using the toilet as the subject, rather than the user and their behaviour. For example, participants were asked "*Does your toilet sometimes require double-flushing to work properly*?" or "*How often is the half flush button used*?". All survey questions and methodology were reviewed and approved by the University of Technology Sydney Ethics Committee. All participants were sent an evaluation form following their participation (ISF, 2002a).

10 Conclusion

The data collection phase of a study can be perceived as relatively straight forward compared to the later stages of analysis and modeling. However prior to design and implementation of a data collection study, there are several questions which should be asked, such as why the data is needed? The type and quality of data needed is determined by the questions asked (or by the purposes of the study). The data required may be qualitative or quantitative and this will again affect the data collection technique ultimately utilized. If quantitative data is sought, the level of accuracy needed will differ with the specific questions which need to be answered. Data which are satisfactory to answer one question on a subject may not be able to answer a different question on the same topic. There is a need to be clear about the entire range of questions which could be answered by such a study prior to collecting the data. Opportunities for value adding to the data collection study should also be considered to maximize the cost effectiveness, time and resource efficiency.

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