



# SMART METERING AND BILLING

## Information to guide household water consumption

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### ABSTRACT

Until now householders have received limited information on their water consumption patterns. Smart water metering presents far more detailed information resources and the opportunity to transform the existing flow of information to consumers for improved efficiencies in water usage. However, a balance is needed between delivering current minimal information and the full detail smart metering can provide on time of use and end uses. It is critical to understand what information is of value to householders. This paper presents results from a recent householder survey at MidCoast Water (NSW), which improves our understanding of the customer perspective on water consumption information.

### INTRODUCTION

Until recently, householders have had limited knowledge of water consumption beyond their quarterly paper bill, which has traditionally displayed little more than the total volume of water consumed over the period, pricing information and the total amount due. More recently many water utilities have begun to introduce additional information in their water bills. This new information typically includes bar charts depicting past consumption in monthly or quarterly blocks for the previous year. Other utilities have gone further to include some means of comparison with other households according to size, e.g. the number of occupants or the dwelling size.

Recent developments in smart water metering technology make far more detailed information available at end-use level, creating new opportunities for water utilities to manage water more efficiently (Boyle *et al.*, 2013). If correctly harnessed, the technology and information resources offer the potential to transform urban water management for both water utilities and their consumers (Giurco *et al.*, 2010). Indeed, through tailored water use information, householders can more readily identify opportunities for increased efficiencies.

Significantly, any changes in consumption patterns and behaviours that lead to efficiency gains in water usage can make important contributions to the achievement of a sustainable urban water future.

The wealth of new water consumption information that can be acquired by water utilities through investment in smart metering technology can be used internally for water demand forecasting and planning. However, to maximise benefits on the consumer side, a key challenge is to understand what additional information is of interest and value to consumers. Within the energy sector, a number of studies have tested the impact of increased information through smart metering on household electricity consumption (Abrahamse, 2005; Fischer, 2008).

In the water sector, still more work is required to understand the role for additional information. In particular, it is essential to gain a deeper understanding of the voice of the customer in order to strike a balance somewhere between providing the current minimum levels of information and the breadth and depth of information that can be presented through smart metering.

Key questions that have yet to be explored include whether customers want more detailed information and, if so, what specific information they are interested in. In parallel, water utilities considering smart metering technology and information also need to carefully consider what their underlying goals are vis-à-vis their consumers. A move towards improved customer relationship management might be envisioned; or, more complexly, the empowerment of consumers through increased access to information to enable water saving behaviours. There are, naturally, both costs and benefits in using smart water meters and in providing additional information to consumers. However, the potential benefits are more likely to be realised through a clearer understanding of customer needs.

### METHOD

The Institute for Sustainable Futures at the University of Technology, Sydney, Griffith University and MidCoast Water are collaborating on an Australian Research Council project from 2012 to 2015 that investigates the role of intelligent water metering in a sustainable urban water future. The project was established to gain a better understanding of the intersection between water consumption, access to information, technology and behaviour practices, and will explore the hypothesis that householders are likely to reduce their water consumption through the increased availability of relevant and detailed consumption information.

This paper presents key findings on informational preferences of householders regarding their water consumption, gauged through the use of a householder survey. This detailed survey was distributed by post in November/December 2012 to a total of 262 householders in MidCoast Water service areas in New South Wales. The survey was designed to measure a broad range of aspects of household water consumption pertinent to the age of smart water metering and a parallel need for sustainable urban water management.

In addition to capturing informational preferences, the scope of the questions included water appliance stock, water related practices, attitudes towards conservation and new technologies, and household demographics. A financial incentive involving a \$50 water bill rebate was offered to respondents to compensate for the time taken to complete the extensive survey.

This paper focuses on the subset of results pertaining to the household surveys that were distributed to 141 households within the Tea Gardens, Hawks Nest, Swan Bay and Windy Whoppa areas of New South Wales. Through a first mail-out, 53 households returned surveys, yielding an initial 38% response rate. It is on these respondents that we report in this paper. However,



a second mail-out with an extended deadline is currently underway in an effort to increase the overall survey response rate.

### DISCUSSION AND RESULT ANALYSIS

The potential level of detail that can be presented to householders through smart water metering is very high and could theoretically go as far as itemised billing, which parallels billing for communications, e.g. mobile phone and broadband usage. The flow data collected through smart water metering can be disaggregated through smart meter data management software (e.g. Trace Wizard® or SmartMon) to single events. That is, for each water-consuming event (e.g. each shower, toilet flush, tap use, etc) it is possible to capture start time, duration, volume and flow rates (i.e. average, minimum, maximum and mode).

Smart water meter data can therefore be presented to consumers as informational content at a variety of different levels of detail, with varying degrees of accompanying analysis or interpretation. The challenge for water utilities is to find a suitable balance and to provide information that can be readily interpreted by consumers and can elicit favourable responses, e.g. more efficient behaviours. It is therefore critical to understand how much information consumers need or want, and what informational content resonates with consumers.

Our overall survey results from 145 respondents showed promisingly that the overwhelming majority (84%) agreed with the statement "I want more detail about my water use". This result seems to bode well for the potential use of smart water metering to enhance information for householders. Within the sub-group of survey participants in Tea Gardens, Hawks Nest, Swan Bay and Windy Whoppa, which are presented in detail in this paper, more than three-quarters agreed with this statement, showing a similarly high level of demand for more detailed information about water use.

Regarding information content itself, householders were asked what additional information they would like to have about their water use. They were also asked about their preferences in terms of how often they would like to receive information about their water use and mode of information delivery. The survey also gauged householder perceptions

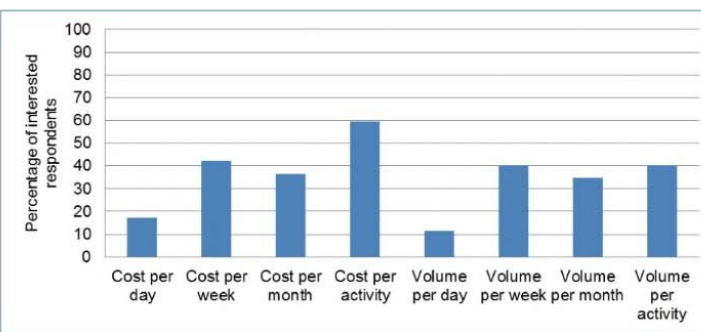


Figure 1. Householder preferences in terms of cost and volume information.

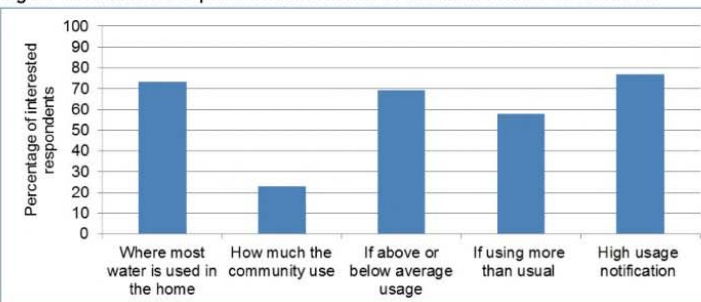


Figure 2. Householder preferences in terms of informational comparisons.

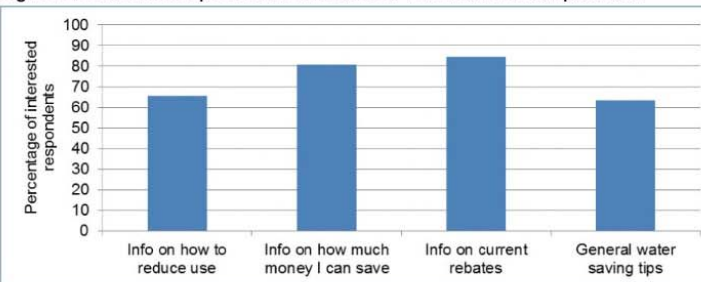


Figure 3. Householder preferences in terms of advice.

on the potential impact of additional information.

The presentation of our results begins with householder preferences in terms of informational content and the level of detail that is of interest. Figure 1 shows the survey results on both cost and volume data given on per activity, per day, per week and per month levels. Here we observe that the respondents' greatest interest lies in receiving information on an activity level (i.e. an end-use breakdown between different water consuming events such as showering, watering the garden etc). Of respondents, 60% expressed an interest in receiving cost information per activity and 40% on volume per activity.

Householders showed a stronger preference for cost information (i.e. in

dollar terms) over information presented in terms of volumes (i.e. litres). This we interpret as a reflection of the fact that financial data is more tangible and easier for householders to relate to and think in terms of than are litres, and especially larger units (e.g. kilolitres or megalitres). The respondents further revealed a preference for information to be presented in weekly terms, rather than the figures representing daily or monthly values. This is the case for both cost and volumetric data. This probably reflects a tendency for other costs and personal budgeting to be considered in weekly terms; e.g. rental payments and salaries are often thought of in weekly terms.

Figure 2 shows the informational preferences of householders expressed using a variety of possible comparators.

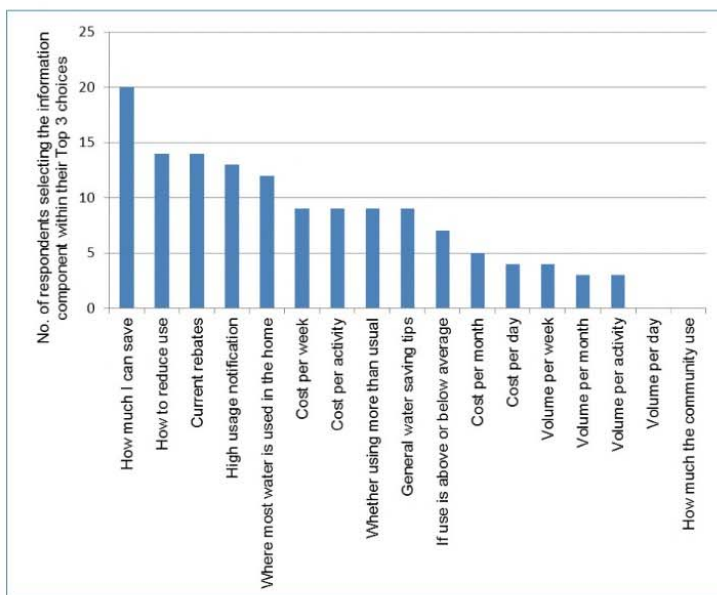


Figure 4. Ranking of householders' strongest information preferences.

There is a strong interest in end-use information. Almost three-quarters wished to receive information on where most water is used in the home, which would allow for comparisons between different water using activities.

Householders were similarly keen to be notified of high usage and if using above or below average. More than half were interested to know if they were using more than usual. These results reveal an interest among householders to compare their consumption both with themselves (historically) and with others. Interestingly, though, when asked directly if they wished to know how much the community use, the level of interest was surprisingly low at just under one-quarter. This perhaps signifies that knowing where they stand in comparison to the average might suffice rather than any further details on community usage.

With regards to information given in the form of advice, we found a greater level of interest among the surveyed householders (see Figure 3). The vast majority of respondents displayed interest in receiving information on how much they can save, and specifically on current rebate programs. Information on how to reduce water use and general water saving tips were also popular. These results show householders are keen on information about how much they can save and how they can practically achieve this.

To understand information priorities, householders were additionally asked to select their top three from all the options presented above. The results are shown in Figure 4. Again we see the strongest preference of householders is for more practical information on how much they can save and how to reduce use.

Finally, householders were also given the opportunity to state any other information about water use they would like to receive; however, the householders declined to make any additional suggestions.

In retrospect, this question could have been given more space within the questionnaire as it may simply have been missed by some survey participants.

To gauge whether householders believe additional information would help them to better manage their household water consumption they were asked if they agreed with the statement "I think that additional information would help me to reduce my water consumption".

Figure 5 shows that three-quarters agreed additional information would help, of which one-third strongly agreed. About 10% responded neutrally, showing more uncertainty about the role additional information might play. The remaining 10% disagreed that information would help, but no one strongly disagreed.

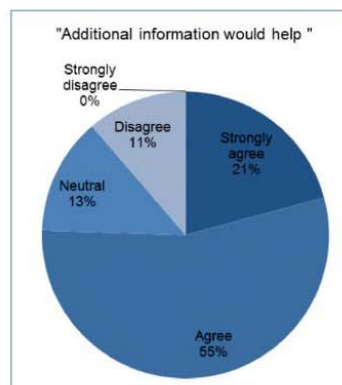


Figure 5. Householders' belief that additional information would help them to save water.

We also asked householders if they agreed with the statement that their water utility "should do more to help me save". Half the respondents agreed, while one-third was undecided. A minority of about 10% of householders were of the opinion that the water utility does not need to do more to help them save water. The survey also questioned householders as to whether they believed that their existing (quarterly) bill gives them all the information they need.

Figure 6 shows one-third of respondents were dissatisfied with the current levels of information in their water bills. A quarter of responses were neutral, suggesting these householders were uncertain about the potential benefits of additional information. Overall, about 40% of respondents agreed their bill gives them all the information they need, but a handful of these strongly agreed.

Householders were also asked if they felt informed about their household water use. Figure 7 shows more than

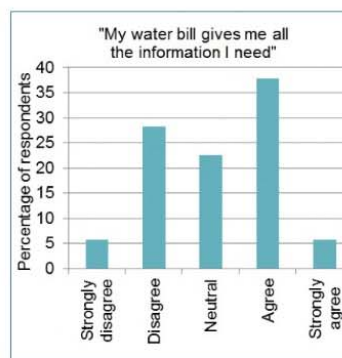


Figure 6. Level of satisfaction with current water bill information.



one-third felt informed, but slightly fewer than this did not. As in the previous question, about one-quarter of responses were neutral.

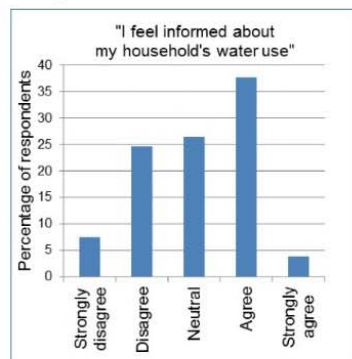


Figure 7. How well informed householders feel about their water use.

The survey instrument was also used to gauge householders' preferences in terms of how frequently they would like to receive information and through which mode of delivery (e.g. by post, email, etc).

Figure 8 depicts householders' preferred frequency of water consumption information. Almost two-thirds of respondents preferred the current (quarterly) frequency of information. One-third would prefer to receive information on a monthly basis. A very small minority is interested in either fortnightly or real-time information.

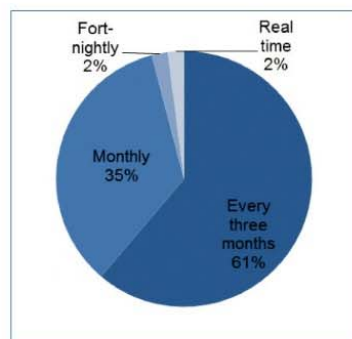


Figure 8. How often householders prefer to receive water consumption information.

In order to understand preferred modes of information delivery, the survey requested respondents to rank seven choices. Few respondents went as far as to rank all options, with progressively fewer responses provided towards the least preferred end of the scale – i.e. seventh choice (where just two responses were supplied). We therefore only

present the top three choices, which we believe summarise the opinions well.

Figure 9 shows there was a surprisingly clear overall preference for information to be received via post. Almost two-thirds of respondents ranked post as their first choice mode of delivery. Email was the next most popular choice with a quarter of respondents selecting this as their most preferred option. All other options (i.e. website, SMS, smartphone applications, in-home displays and phone) were unpopular among respondents. Between zero and three households included these options within any of their top three choices.

Finally, we also asked householders if they would like to be able to choose the mode of information delivery. Here more than three-quarters agreed they would appreciate the choice, showing potential for increased flexibility in how household water information is transmitted to householders.

## CONCLUSIONS AND IMPLICATIONS

Smart water metering carries a wide range of potential new opportunities, including a contribution towards creating better informed consumers. In this regard, the key challenge for water utilities is to sort through the mounds of data that can be collected by water utilities through smart metering in order to transmit information that is useful to householders.

Our survey examined three key components of informational content, namely information units, comparators and advice. The results of our survey show that householders' greatest interest lies in receiving advice on how to save. It is understandable that consumers can more readily act if armed with practical tips and information. In terms of information units, we found that data presented in terms of volumes does not resonate well with customers.

On the contrary, consumption data in dollar terms makes data more meaningful to consumers. In addition, householders showed a preference for information at the activity level (i.e. end-uses); and in

weekly terms, as opposed to either daily or monthly units.

In terms of comparisons, we found householders are interested to know if their own use is particularly high (either between end-uses within the home; or compared to usual). We found little interest in the community's usage, beyond a simple average.

The overwhelming majority of survey respondents identified a paper bill as their preferred mode of information delivery, which is the existing mode of communication used by water utilities. Email was a distant second choice. In terms of frequency, the vast majority are happy to receive information every quarter (which is also the status quo). One-third would prefer more frequent information on a monthly basis.

Only a handful of respondents were interested in real-time information, which was also reflected in the lack of interest in communication via a website, SMS, smart phone applications and in-home displays. Smart metering has been hailed for end-use and real-time information; however, for consumers here it is the end-use component that seems to be of greater interest than the real-time aspect.

Our results show strong support for water utilities to continue providing water consumption information to households via quarterly paper bills, and that most customers would welcome specific informational enhancements made possible through smart metering.

In terms of next steps, the project team is currently working to develop a smart water bill for households. The "smart bill" will be used to present end-use data collected via smart meters to a subset of the householders within the present study area to test the impact of smart meter information on household water consumption. Questions that arise through working on this current paper include:

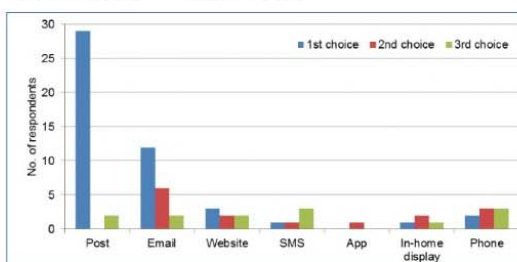


Figure 9. Householders' preferred mode of delivery for water consumption information.



- What information is useful for household water users; and what can householders understand?
- Should householders have choice regarding what information they receive; and how far should water utilities go in providing advice from the general to the very specific, or indeed personal?
- What information is practical for water utilities to produce for householders and what new data management processes does this entail?

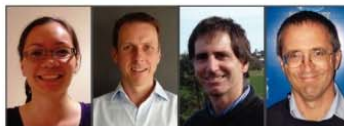
An important limitation of the present analysis is the relatively small sample size, with mostly two-person households and slightly older householders.

However, through the combined analysis of other surveyed areas within New South Wales (e.g. Taree and Forster) and a second mail-out of surveys, we should capture a broader demographic and understanding of customer perspective on additional smart water meter information to inform a potential future involving smarter water billing.

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