Some advantages and disadvantages of “smart” water metering for single and multi-unit developments

Dr Cara Beal
IPIQ Seminar & Expo
Urban Brisbane Hotel, Spring Hill, November 29th, 2013
• Background on our research centre & why I am here today
• What makes a meter “smart”? 
• Sub-metering requirements in Qld
• Recent review of smart metering in Australia
  ➢ Results from the Survey
  ➢ Business Case Drivers, inc. sub-metering
  ➢ Conclusions and Insights
- Strategic partnership between industry and universities
- Laboratory services, education & training, research programs
- Water resource science & research team
  - Smart metering and residential water end-use projects (SEQ, FNQ, UAE)
  - Nation-wide review of smart metering / intelligent water networks
What’s smart about it?

VERSUS
• Several definitions, e.g. WSAA states:
  • Automated collection of meter reads:
    • requiring meter reader to be nearby (Automated Meter Reading)
    • Remote, wireless collection (Advanced Metering Infrastructure)
  • Some have two-way communications
What is an “Intelligent Water Network”?

- Again, several definitions/opinions but in general:

“The integration of intelligent devices including water meters, pressure sensors, data into business process and using this information to guide and improve strategy, investment and customer service”

— WSAA definition
Intelligent Water Networks

WBKMS

GSM/GPRS Network

Internet

Modem

Data Logger

Smart Water Meter

Residential Households

Commercial End-Users

Water Authority

Maintenance & Control
WATER BUSINESS X: INTELLIGENT METERING SYSTEM

Welcome: 5 Smith Street, Brisbane, Queensland

Day - 19 October 2012, Water Consumption End Use Report

Quick Summary: My Usage

Target Usage Per Day: 480 L/hh/d
Yesterdays Usage: 496 L/hh/d
Yesterdays Average Daily Household Consumption: 510 L/hh/d
Last Weeks Average Daily Household Consumption: 472 L/hh/d

Leak: 2.92%
Toilet: 15.87%
Tap: 14.81%
Shower: 35.58%
Clothes washer: 13.5%
Irrigation: 15.87%
Dishwasher: 2.33%

<table>
<thead>
<tr>
<th>Fixture Category</th>
<th>Water Usage (L/hh/d)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak</td>
<td>15.28</td>
<td>2.92</td>
</tr>
<tr>
<td>Toilet</td>
<td>83.08</td>
<td>15.87</td>
</tr>
<tr>
<td>Clothes washer</td>
<td>70.59</td>
<td>13.49</td>
</tr>
<tr>
<td>Shower</td>
<td>186.21</td>
<td>35.58</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>12.20</td>
<td>2.33</td>
</tr>
<tr>
<td>Tap</td>
<td>77.52</td>
<td>14.81</td>
</tr>
<tr>
<td>Irrigation</td>
<td>78.54</td>
<td>15.01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>523.42</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Sub-metering in multi-unit properties
**Sub-metering**

- Condition to sub-meter multi-unit properties (MUP) introduced in 2007 for 2008 start
- Very narrow window (1 week!) for stakeholder comment prior to introduction of policy
- Help track individual dwellings water consumption, streamline water charges and promote customer equity (pay for what you use)
- AMR or basic smart meter requirements
- Developer required to ensure master and sub-meters are installed........
Sub-metering – challenges!

- Costs high - for developer and building owners & for LGA’s to inspect, assess, approve
- Difficult to streamline the installation process as requirements differ across LGA’s and water service providers
- Ambiguity of sub-metering requirements on existing buildings and extensions
- Often, water service provider does not read / bill from sub-meter
Who is doing what with smart metering?

- SWRC engaged by WSAA to conduct an Australian review of smart meter projects
- Online survey send out to all water utilities who registered for the WSAA Smart Metering Workshop (August this year)
- Follow up interviews with selected utilities
On-line survey

Smart Metering and Intelligent Water Networks - WSAA Workshop Participant Survey.

This survey is required to be completed by all utility participants of the WSAA Smart Metering and Intelligent Water Network Workshop (13-14 August 2013).

The purpose of this survey is to gather information on “who is doing what” in the area of smart metering (SM) and intelligent water networks (IWN) across Australia.

Results from the survey will be collated, analysed and then summarised at the WSAA workshop in August.

The survey should take no more than 20-25 minutes. It is recommended you have information about any SM / IWN projects (e.g. costs, time-frames, equipment specifications, customer engagement strategies, key business case points) in front of you before you begin, as there is no capacity to save the survey responses - the survey must be completed all in one go. AS A GUIDE, PLEASE REFER TO THE ATTACHED PDF FOR AN EXAMPLE OF A COMPLETED SURVEY. Thank you for your participation.

* Required

Name of utility or organisation *
  e.g. Water Corporation of Western Australia

Project or program name *
  e.g. “Kalgoorlie Smart Metering Trial”.

Current status of project / program *
  □ Initial discussions only
  □ Currently developing business case
  □ Trial phase being developed
  □ Trial phase underway
  □ Trial phase completed and no further work likely to occur
  □ Trial phase completed and developing business case for larger roll-out
  □ Operational roll-out currently underway
  □ Operational roll-out completed and no further action
  □ Operational roll-out completed and subject to ongoing evaluation and assessment
  □ Other:

Key challenges and lessons learnt from the project (dot points are sufficient)*
  e.g. “Timeline for roll out was unrealistic; budget, customer apprehension/complaints, integrating with existing billing system was very difficult.”

If you have any background documents, presentations, business case material or other information that you are happy to share with us, please email to Dr Cara Beal:
c-beal@griffith.edu.au

Please indicate if you are happy to be contacted for a brief telephone discussion of your project.*
  This is also an opportunity for you to share further relevant information if you have been unable to do so while completing this survey.

Any other comments or observations that you have regarding the program or proposed program??
If you have any questions regarding this survey please contact: WSAA on +61 (0) 3 8665 7666

This is the end of the survey.
Thank you very much for completing it, your responses are valued.

Submit
Never submit passwords through Google Forms.
• From the 26 water business respondents, 4 were selected for an in-depth interview

• Water businesses that had completed at least a pilot roll-out of a SM/IWN project

• Seeking to extract empirical evidence of benefits of such SM/IWN project
2013 Australian Review of Smart Metering and Intelligent Water Networks

A study of Australian urban water utilities activity in smart metering and intelligent water networks, the challenges they face and the business cases justifying investment.
Project status

- **Operational roll-out completed and subject to ongoing evaluation and assessment**: 2 (7%)
- **Operational roll-out completed and no further action**: 1 (4%)
- **Operational roll-out currently underway**: 3 (11%)
- **Trial phase completed and developing business case for larger roll-out**: 2 (7%)
- **Trial phase completed and no further work likely**: 1 (4%)
- **Trial phase underway**: 6 (21%)
- **Trial phase being developed**: 1 (4%)
- **Currently developing business case**: 4 (14%)
- **Initial discussions only**: 4 (14%)
Project Timing

- Project underway: 9 (34.50%)
- 5+ years: 1 (4%)
- 3 - 5 years: 0
- 2 - 3 years: 1 (4%)
- 1 - 2 years: 4 (15%)
- 1 year: 9 (34.5%)
- Unsure: 2 (8%)

70% SM/IWN project underway or starting in next 12 months
### Applied Technology

<table>
<thead>
<tr>
<th>Applied technology</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>4 (15%)</td>
</tr>
<tr>
<td>IWN</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>SWM</td>
<td>5 (19%)</td>
</tr>
<tr>
<td>AMI</td>
<td>9 (33%)</td>
</tr>
<tr>
<td>AMR</td>
<td>6 (22%)</td>
</tr>
</tbody>
</table>

Over 50% are pursuing 2 way communications.
11% business integration.
### Customer type breakdown

<table>
<thead>
<tr>
<th>Category</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsure / Not applicable</td>
<td>6 (24%)</td>
</tr>
<tr>
<td>Industrial</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Commercial - School</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Commercial - Other</td>
<td>3 (12%)</td>
</tr>
<tr>
<td>Agricultural - Farm</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Non-residential (unsure of...)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Residential - Multi residential</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Residential - Dual reticulated</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Residential - Single residential</td>
<td>9 (36%)</td>
</tr>
</tbody>
</table>

Residential properties typically metered.
### How many meters?

#### Number of end points

<table>
<thead>
<tr>
<th>Organization</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unitywater, QLD</td>
<td>8</td>
</tr>
<tr>
<td>Hunter Valley, NSW</td>
<td>15</td>
</tr>
<tr>
<td>Barwon</td>
<td>100</td>
</tr>
<tr>
<td>SA Water</td>
<td>150</td>
</tr>
<tr>
<td>Goulburn Valley, VIC</td>
<td>150</td>
</tr>
<tr>
<td>ACTEW</td>
<td>190</td>
</tr>
<tr>
<td>Armidale-Dumaresq</td>
<td>200</td>
</tr>
<tr>
<td>Townsville, QLD</td>
<td>289</td>
</tr>
<tr>
<td>Sydney Water, NSW</td>
<td>300</td>
</tr>
<tr>
<td>South East Water, VIC</td>
<td>1,500</td>
</tr>
<tr>
<td>Yarra Valley, VIC</td>
<td>2,000</td>
</tr>
<tr>
<td>City West Water, VIC</td>
<td>5,000</td>
</tr>
<tr>
<td>GM Water, VIC</td>
<td>12,700</td>
</tr>
<tr>
<td>Water Corp, WA</td>
<td>13,800</td>
</tr>
<tr>
<td>Albury, NSW</td>
<td>21,000</td>
</tr>
<tr>
<td>Mackay, QLD</td>
<td>36,000</td>
</tr>
<tr>
<td>TasWater, TAS</td>
<td>57,920</td>
</tr>
</tbody>
</table>

Range of trials and full scale roll-outs
## Communicating... how?

<table>
<thead>
<tr>
<th>Communication system</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>4</td>
<td>12%</td>
</tr>
<tr>
<td>Not applicable</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>Drive-by technology</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>Mobile phone network (3G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wireless wide-area network (WAN)</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>Low-power radio frequency (RF mesh)</td>
<td>6</td>
<td>18%</td>
</tr>
<tr>
<td>Power line communications (PLC)</td>
<td>1</td>
<td>3%</td>
</tr>
</tbody>
</table>

46% using or plan to use mobile phone and radio frequency comms.
## Communicating...when?

### Communications frequency

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>8 (32%)</td>
</tr>
<tr>
<td>Daily</td>
<td>8 (32%)</td>
</tr>
<tr>
<td>Hourly</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>15 minute intervals</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>As per billing cycle</td>
<td>2 (8%)</td>
</tr>
</tbody>
</table>

- "Selected by council"
- "Variable, 3 times per day"

Over 50% communicating at least daily.
### Engaging the customer

#### Customer engagement / recruitment strategies

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><img src="chart1.png" alt="Bar chart" /></td>
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<td><img src="chart3.png" alt="Bar chart" /></td>
<td><img src="chart4.png" alt="Bar chart" /></td>
<td><img src="chart5.png" alt="Bar chart" /></td>
<td><img src="chart6.png" alt="Bar chart" /></td>
<td><img src="chart7.png" alt="Bar chart" /></td>
<td><img src="chart8.png" alt="Bar chart" /></td>
<td><img src="chart9.png" alt="Bar chart" /></td>
<td><img src="chart10.png" alt="Bar chart" /></td>
<td><img src="chart11.png" alt="Bar chart" /></td>
<td><img src="chart12.png" alt="Bar chart" /></td>
<td><img src="chart13.png" alt="Bar chart" /></td>
<td><img src="chart14.png" alt="Bar chart" /></td>
<td><img src="chart15.png" alt="Bar chart" /></td>
</tr>
</tbody>
</table>

- **Letter mail out**
- **Hand delivered brochure**
- **1300 number**
- **Community group consultation**
- **Door knock/Direct phone call**
- **Shopping centre kiosk**
- **Website**
- **Media - newspaper**
- **Media - radio**
- **SMS / email**
- **Marketing company**

*Most utilities doing some form of customer engagement*
Frequency distribution of customer engagement strategies

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing company</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>SMS / email</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Hand delivered brochure</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Shopping centre kiosk</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Media - radio</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>1300 number</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>Media - newspaper</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td>Website</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td>Door knock/Direct phone call</td>
<td>5</td>
<td>13%</td>
</tr>
<tr>
<td>Community group consultation</td>
<td>8</td>
<td>21%</td>
</tr>
<tr>
<td>Letter mail out</td>
<td>9</td>
<td>23%</td>
</tr>
</tbody>
</table>

Traditional methods of engagement and consultation adopted
## New customer services planned

<table>
<thead>
<tr>
<th>Service</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage alert</td>
<td>18 (30%)</td>
</tr>
<tr>
<td>Benchmarking - with similar demographic households</td>
<td>5 (8%)</td>
</tr>
<tr>
<td>Benchmarking - with street or suburb</td>
<td>7 (12%)</td>
</tr>
<tr>
<td>Predictive alerts</td>
<td>5 (8%)</td>
</tr>
<tr>
<td>Personalised consumption budgets</td>
<td>6 (10%)</td>
</tr>
<tr>
<td>Demand-based tariff reforms</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Self service</td>
<td>8 (13%)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>6 (10%)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (6%)</td>
</tr>
</tbody>
</table>

- **Portal for communication with utility**
- **Comparing school with previous performance and school benchmarks**
- **Customers to check their smartphone app**
- **Customers could subscribe to auto-SMS alert**
Hey! You’re leaking!

Non-traditional methods of alerting, popular choice for utilities

<table>
<thead>
<tr>
<th>Customer leakage alert method</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>5 (11%)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>7 (16%)</td>
</tr>
<tr>
<td>Mail</td>
<td>6 (14%)</td>
</tr>
<tr>
<td>Next bill</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Smartphone app</td>
<td>7 (16%)</td>
</tr>
<tr>
<td>Email</td>
<td>8 (18%)</td>
</tr>
<tr>
<td>SMS</td>
<td>9 (21%)</td>
</tr>
</tbody>
</table>

- Web portal
- Direct phone call or mail
- Letter with information brochure
- Site visit if severe
- SCADA
Still leaking…!

Customer leakage alert frequency

- **Dependant on severity**
  - 3 (10.5%)
- **Not applicable**
  - 7 (24%)
- **Unsure**
  - 7 (24%)
- **14 - 28 days old**
- **7 - 14 days old**
- **4 - 7 days old**
  - 2 (7%)
- **1 - 3 days old**
  - 5 (17%)
- **< 1 day old**
  - 3 (10.5%)
- **Other**
  - 2 (7%)

- **Big leak will be notified faster than smaller leak**
  - Alarm activation >90 days over a standard 120 day billing cycle

- Around 35% alert customers within 7 days
Business case drivers
BUSINESS CASE REVIEW FOR MULTI-LEVEL DEVELOPMENT AMI PROJECT
(CITY WEST WATER, VIC)

- Using WSAA definitions – CWW 10k AMR meters existing in field, (walk-by remotes). This has been part of CWW remote metering strategy for a number of years and is still being rolled out for single meters that are deemed as inaccessible.

- 6-month trial for Everblu AMI was on 100 endpoint development, which after successful trial, a decision was made to purchase Everblu hardware installed at site. Included in $45k purchase price was a software licence for a further 5000 endpoints, to be implemented for new developments.

- CWW AMI Strategy is now that any application for a development that exceeds 4 levels will now need to have an AMI installed (Everblu), with the costs being met by the developer.
<table>
<thead>
<tr>
<th>Business Case Driver</th>
<th>Outcome relating to driver</th>
<th>Comments / assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>More accurate meter reads</td>
<td>• Identified previously that approximately <strong>50 kL</strong> of water underestimated for several years.</td>
<td>Assuming 440 L/meter at Step 1 (1.78c/kL). Conservative estimate.</td>
</tr>
<tr>
<td>Business Case Driver</td>
<td>Outcome relating to driver</td>
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</tr>
<tr>
<td>----------------------</td>
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<td>------------------------</td>
</tr>
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<td>More accurate meter reads</td>
<td>• Identified previously that approximately <strong>50 kL of water underestimated</strong> for several years.</td>
<td>Assuming 440 L/meter at Step 1 (1.78c/kL). Conservative estimate.</td>
</tr>
<tr>
<td>Reduced operating costs</td>
<td>• <strong>Estimate $45k annual savings</strong> associated with improving manual &amp; special read efficiency&lt;br&gt;• If 50kL now accounted for = <strong>$89k savings in future.</strong>&lt;br&gt;• <strong>Reduced customer contact calls due to accurate and remote reading</strong></td>
<td>Based on costs of scheduled reads, $0.70c, and out-of-cycle (OOC) reads, $7.00 (approx. costs), with 5000 endpoints on Everblu and 20% of meters requiring an OOC read:&lt;br&gt;5000 x 4 reads p.a. = $14k&lt;br&gt;1000 OOC reads = $7k&lt;br&gt;Totals cost of reads = $21k&lt;br&gt;Cost of annual Everblu licence = $4.5k</td>
</tr>
<tr>
<td>Leak detection and improved customer services</td>
<td>• Internal <strong>leaks detected more regularly</strong> and informed customer.&lt;br&gt;• <strong>Reduced customer queries and complaints</strong> due to inaccurate billing – from 270 to almost none.</td>
<td>Customer service improvement through leak detection and alert, more so a secondary driver.</td>
</tr>
</tbody>
</table>
“Water supplied to town had reduced by almost 834 ML (2010-2012), resulting in a $3M savings for water supplied”

“Reduced OPEX”

“Reduced manual meter reads”

“Reduce customer complaint handling”

“Reduced OPEX”

“Reduced manual meter reads”

“Reduce customer complaint handling”

“CAPEX deferral”

“Residential water use reduced by 11% to 310 kL/year in 2011-12”

“Bulk water reduced by 3,800 ML”

“By reducing monthly peak demand by 10%, can defer $100M infrastructure for 4 years, representing savings of $20M NPV”

“Deferring $20M WTP upgrade for 7 years, representing capital efficiency savings of $7.9M. Deferring $5M pipeline upgrade for 5 years, representing capital efficiency savings of $1.6M.”
Increase Revenue

- Reduced non-revenue water
- Improve accuracy of meter reads
- Underpin tariff reform
- Streamline special meter reads

"Identified approximately 50 kL of water was previously underestimated."

"Two-part pricing able to be introduced (variable and fixed) from July 2012. Now all 20 mm connections = same service fee and one rate of 0.90c /kL."
The customer benefits...

Customer Satisfaction:
- Reduced water bill due to leak alerts
- Informative and personalised billing
- Instant verification of water bill queries
- Eliminate need to access property

"Customer billing now includes trending data and comparative benchmarks for water usage for average households"
The community benefits too..

- Increased goodwill in community
- Proactive approach “approved” by community
- Better education & awareness of water value

“Before and after survey showed customers clearly happier with greater focus on them and a more equitable price structure”

“WaterSense campaign and polling indicated 75% of customers likely to change behaviour toward water use”
Challenges & Limitations
Technology became out-dated and easily damaged
Compatibility of meter – communication systems
Difficulties with customer portal – privacy concerns
Variability in walk / drive by signals

Strong opportunities to narrow the gap between what we want to do in the field, and what we can currently do
Knowledge limitations

LIMITED KNOWLEDGE BASE

- Lack of know-how of suitable technologies: “what, where & why”?
- Few existing business cases showing quantifiable outcomes
- Limited industry knowledge & experience in rolling out projects

Need to improve the knowledge base:
- further pilot trials
- research and development
- education and training
Making a case...

DEVELOPING BUSINESS CASE

- Reluctance from internal hierarchy
- Silo nature of water utilities / councils
- Lack of precedence of other SM/IWN
- Existing industry standards insufficient for business needs
Practical issues

- Length of time to install and commission meters
- Absence of existing business systems and workflows
- Data management and data analytics – how to maximise benefits of data
- Engaging non-residential customers to act on leak alerts

“We have a lot of information, but didn’t have anything to tie it together”
• Almost 150,000 meters currently installed or planned
• Appears to be a business case for deployment of smart metering technology
• The value of smart metering and the specific business case drivers are highly contextual to location.
• There is a limited knowledge of the capabilities of current and future technology in the smart water metering space
• System only as “smart” or “intelligent” as the know-how of the user
• A need for an agreed, standardised set of definitions
Is there a business case for (sub) smart metering?

• Case study interviews suggest that while the numbers are still being crunched, there is good evidence to suggest economic, environmental and social benefits.

• Business drivers: operating cost savings, reduction in bulk water supplied, deferred augmentation of infrastructure.

• Business drivers: customer satisfaction, community acceptance and improved customer engagement and trust.

• BUT – water utilities need to read and bill the sub-meters!!
Acknowledgements

• Joe Flynn (Joe Flynn & Associates)

• WSAA Smart Metering group

• Water businesses who took the survey!
Thank you
c.beal@griffith.edu.au

I don’t get it. You smartphones give off radiofrequency radiation... your cellular carrier can track every call, text message, and website visited, but people love you!

If you really were a smart meter, you’d fire your P.R. people.

Don’t be ridiculous...

The smart meter is not watching us!