Gas Metering Review

Review of advanced metering technology

Prepared for

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Executive Summary

The New Zealand gas metering market is very small by international standards, so it is important to leverage technology developments and experience from other jurisdictions as much as possible, and as appropriate to the New Zealand market.

The gas advanced metering market is less developed than that for electricity advanced metering, primarily because of higher costs and lower benefits.

In New Zealand's case, the reliance on commercial (rather than government or regulatory) drivers and the lower market penetration of gas in homes compared to some overseas jurisdictions, are key factors that will make it very difficult to establish a positive business case for either meter owner or retailer led deployments.

Trials in New Zealand remain works in progress, but nevertheless are helping to shape the future for gas advanced metering roll-outs in terms of technology decisions. Deployment of gas advanced meters may be directed initially at new connections and replacement of meters at the end of their service life.

There appears to be a preference in New Zealand towards fully functional gas advanced meters, rather than an add-on communications module for existing meters, the preferred solution in some other jurisdictions. Ultimately the choice will be a commercial decision and whether there is a viable business case supporting mass deployment.

It appears retailers are not expecting a positive business case to support retailer led mass deployment of gas advanced meters, particularly as the same compliance and market conditions don't exist for gas as they did for electricity. However, in the absence of relevant information on costs and benefits (many of which are summarised in non-dollar terms in this report), it is inappropriate to speculate.

Meanwhile, retailer feedback suggests that while asset ownership is not that important, what is important is establishing a standard construct which includes the services and minimum dataset available to retailers. It is therefore recommended Gas Industry Co commence discussion with meter owners and retailers with a view to articulating the standard construct for the services and minimum dataset, out of which may come a desire to specify standard file formats.

Gas Industry Co should also commence discussion on whether participants consider there should be any registry changes to support a roll-out of gas advanced metering.

A note on terminology: although the term "smart meters" is often used, the Electricity Authority and New Zealand industry participants prefer the term "advanced meters", and there is a trend in other jurisdictions towards use of the term "advanced meters". Gas Industry Co also uses the term "advanced meter" in the switching rules. To be consistent, this paper uses the term "advanced meters" or "advanced metering" unless content attributed to other sources uses the term "smart metering".

Advanced metering infrastructure ("AMI") comprises advanced meters, a two-way communications network and back office systems.

Background

1. The Government Policy Statement on Gas Governance (April 2008) seeks a number of outcomes, one of which is:

   "An efficient market for the provision of gas metering….. services".

   This is supported in the Gas Act, at section 43G(2)(f), which allows the Minister to make regulations for the purpose of "*providing for terms and conditions of access to meters by gas retailers*".

2. Gas Industry Co intends to produce two papers as follows:

   a) a review of the current arrangements for provision of gas metering services by meter owners (including time-of-use (TOU) metering data management services but not manual meter reading services); and
   b) a narrative that provides Gas Industry Co and stakeholders with an up to date assessment of the current state of gas advanced metering technology and where it is heading, and the likely benefits in the context of the New Zealand gas industry so Gas Industry Co is well positioned to ensure the regulatory framework supports achieving the anticipated benefits.

3. Gas Industry Co has engaged Rod Crone Consulting to complete both reviews, this paper covers the review of advanced metering technology. The terms of reference for this paper are included in an appendix.

Overview of gas advanced meters currently available

4. A gas advanced meter is capable of two-way communication between the meter and the central system (head-end). It typically records consumption in intervals varying from an hour or less to one day, in one or several registers, and communicates the information daily, weekly, or monthly back to the service provider.

5. Gas advanced meters range from a traditional gas meter with a communications module installed which enables automated meter reading ("AMR"), to a fully functional advanced meter with two-way communications and additional functions such as remote disconnection and reconnection, temperature and pressure compensation (referred to as advanced metering infrastructure or "AMI").

6. The gas advanced metering market is less developed that that for electricity, primarily because of higher costs and lower benefits. In New Zealand's case, the reliance on commercial (rather than regulatory) drivers and lower market penetration in homes compared to some overseas jurisdictions are also key factors.

7. Traditional residential and small & medium sized [commercial] enterprise ("SME") metering has used mechanical diaphragm meters which are common in New Zealand.

8. Rotary, turbine and ultrasonic meters are generally considered more suitable for measuring larger volumes of gas and higher pressures and have been used for larger commercial and industrial ("C&I") sites.

9. Ultrasonic meters determine the gas flow by measuring the velocity of sound through the gas and are increasingly being used for residential and SME sites. Being digital, ultrasonic meters are easily adapted to gas advanced metering, however any electronic metering technology is of interest for the New Zealand market.

10. Battery life is a key consideration and will depend on the electronic design, recording interval (e.g. half hourly, hourly), frequency of meter data communication (e.g. multiple times/day, daily, weekly, monthly), software upgrades, how often the remote disconnection/reconnection valve is used, temperature of the meter's environment, and form of communication (e.g. GPRS 2G/3G/4G, RF mesh).

11. Remote disconnection and reconnection will be scheduled when the meter next communicates with the server. Remote reconnections will require additional steps to ensure safety. The process for reconnections in the New Zealand context is still under consideration.

12. Technical requirements are specific to each market, and many options are available for New Zealand. Considerations include requirements for battery life, recording interval (and whether or not to record half hourly interval data as is done in electricity, or hourly as is currently the default for TOU meters), frequency of meter data communication, system alarms (e.g. low battery, tamper detection), remote disconnection and reconnection capability, and weather resistance (since meters in New Zealand are located outside).

13. While an AMR solution enabled by retrofitting a communications module to existing or new diaphragm meters may improve battery life and reduce the cost of gas advanced metering, discussions with meter owners, retailers and gas advanced metering suppliers indicates the preferred option for New Zealand is an AMI solution with a fully functional gas advanced meter.

14. Ultimately it will come down to a viable business case if mass deployment is contemplated, but in the meantime it is important that meter owners in consultation with stakeholders make the right choices for the New Zealand market and ensure that any technology issues identified from trials are addressed before wider deployment.

15. Retailer feedback suggests that asset ownership is not that important; what is important is establishing a standard construct which includes the services and minimum dataset available to retailers. Furthermore, retailers have also commented that while the drivers for mass deployment of gas advanced meters are weak compared to electricity, they would not want a situation arising where they have to manage a mix of traditional and advanced meters in the long term.

16. Even if mass deployment cannot be justified in the short to medium term, it is likely that meter owners will begin installing advanced meters with two-way communications capability for new connections and meter replacements, as signalled by Vector in its 2015 annual report.

17. Three gas meter suppliers have been interviewed - EDMI, Itron and Landis & Gyr. All have been involved in the traditional New Zealand electricity and gas metering markets and have gas advanced metering solutions at various stages of development and roll-out in other jurisdictions.

18. Energy News reported in December 2014 that several existing meter owners had commenced trials in New Zealand of the fully functional EDMI Helios D152A (0-10 scmh) ultrasonic meter which includes an integrated valve, tamper detect and alarms, and is suitable for residential consumers. Energy News also reported that EDMI was about to launch a 0-20 scmh model which would be suitable for most SME consumers.

19. It is understood that some advanced meters include temperature compensation, which would be an improvement on the relatively imprecise methodology currently used to apply fixed factor temperature correction, and would remove one variable from UFG.

20. In Italy, advanced meters correct for temperature, whereas neither the UK nor France requires such functionality.

21. It is not clear whether there is a gap between the advanced meters being trialled in New Zealand and traditional TOU metering (required for sites > 10TJ), but technology developments will likely fill the gap if there is one in the next few years.

22. It is understood that advanced metering trials are continuing and are providing valuable insights. Details on the trials and findings are considered commercially sensitive, and so cannot be included in this report.

23. Two-way communications tends towards GPRS (using the cellular network) for New Zealand because it provides point-to-point communication which is an advantage where there is low density of gas consumers. It uses an existing telecommunications network, and it allows a quick service activation with low investment cost yet offers very good performance. Other options include mesh radio (RF mesh), satellite, or shared infrastructure with electricity.

Other jurisdictions

24. European advanced metering has primarily been driven by European Commission directives requiring EU member states to conduct a cost benefit analysis (“CBA”) on a roll out of advanced gas meters. Countries that can demonstrate a positive CBA are then required to roll-out advanced meters, albeit setting their own timetable.

25. Advanced gas metering presents significant opportunities in Europe and North America due to the high penetration of natural gas; however, the market for gas advanced metering is still less developed than that for electricity. Even with large numbers of natural gas consumers it has been a challenge to achieve positive business cases, and in some cases it is apparent that the actual benefits realised have fallen short of expectations.

26. Common to many of the electricity and gas CBAs with a positive NPV was an assumption of consumer benefits from a reduction in energy bills through lower consumption, but there are doubts the anticipated savings will be realised. This argument makes sense for electricity with

time of day pricing, as consumers have the information and incentives to reduce consumption during high priced periods or shift load from high to lower priced periods. However, the same argument does not apply to gas.

27. Below is a summary of the benefits driving advanced meter roll-outs in other jurisdictions, some not particularly relevant to New Zealand:

    a) Europe - One of the core elements in European policies is the targeting of environmental sustainability and the competitiveness of the gas (and electricity) markets. Energy saving is the largest among the financial benefits considered in most CBAs.
    b) UK – The Government's plan is to bring the energy system up-to-date and to enable every consumer to be able to use advanced meter technology to see exactly how much energy they are using and what it is costing them, so they can cut their consumption and bills and do their bit for the environment. It is also laying the foundation for Great Britain's move to a lower carbon economy and more secure energy supply.
    c) Italy - A significant difference between Italy and the rest of Europe is that the case for the roll-out of advanced gas meters in Italy was not supported by a strong emphasis on energy savings, but rather a focus on increasing efficiency of the Italian gas market (referred to as "industrial" processes).
    d) Common gas advanced meter benefits:

        i. Firstly, advanced gas meters are expected to contribute to making consumers' behaviour more energy efficient via two mechanisms:
            1. Thanks to more frequent and accurate information on energy consumption and cost, consumers become more aware of the economic and environmental impact caused by their energy uses and, thus, they may reduce and/or shift their gas consumption.
            2. Thanks to more accurate billing, advanced meters send correct price signals to consumers, who are then expected to make more efficient choices in their energy uses.
        ii. Secondly, advanced gas meters can contribute to improving "industrial" processes in the gas supply chain:
            1. More accurate and timely information on gas withdrawals of each consumer from the network allows a quick estimate of suppliers and shippers' actual balances.
            2. Meter reader savings

3. Improved switching procedures
4. Reduce supplier costs managing consumers' debts.

iii. Thirdly, remote disconnection capability provides a more effective deterrent to consumers considering not paying their bills and therefore reduces the number of defaulting consumers. More accurate bills also lower the risk of defaulting consumers arising from high bills (either high estimated bills, or high actual bill following a low estimate bill).

iv. Lastly, and not considered particularly significant:

1. Network benefits from operating, maintaining and developing distribution networks.
2. Improving safety within consumers' premises

28. In the time available for this review it was not possible to obtain the up-to-date information on the current state of gas advanced metering roll-outs in a lot of other jurisdictions, nevertheless the following reflects the trends and themes where information has been obtained.

29. The following provides an overview of gas advanced metering initiatives in the EU based on information available at the time of writing the paper, however this is a moving target.

a) UK (~23m gas consumers) - the government has set the framework (targets and established roles and responsibilities for the national roll-out) expecting energy suppliers to install gas and electricity advanced meters in every home in England, Wales and Scotland (~ 23m gas consumers) by 2020, although increasingly this looks unachievable. Northern Ireland is not proceeding due to a negative CBA. More information has been provided on the UK roll-out than other jurisdictions, reflected in the following summary and key point:

i. Department of Energy and Climate Change (DECC) is leading and monitoring the roll-out. It has also set the rules and technical standards to ensure consumers are protected and the needs of vulnerable people are met.

ii. Smart Energy GB is the voice of the advanced meter roll-out, independent of government, tasked with giving everyone the enthusiasm and confidence to say yes to having an advanced meter and making sure everyone benefits from the advanced meters, while also laying the foundation for a lower carbon economy (environmental benefit) and secure energy supply (energy efficiency benefit).

iii. Data and Communications Company (DCC) is responsible for establishing and managing the common data and communications infrastructure necessary to support the main roll-out of both gas and electricity advanced meters. The infrastructure will connect advanced meters to the business systems of energy suppliers, network operators and other authorised service users. The wide area network (WAN) communications network is being delivered by two communications service providers, and single data service provider. DCC is regulated by Ofgem and will not themselves store any customer data.

iv. Because energy suppliers have a direct relationship with their customers, they are installing the advanced meters, in home displays, and communications hubs in every customer's premises.

v. The advanced meter security system is very secure, having been designed by top cyber security experts to ensure that security best practice has been incorporated at every stage. There are very strict controls around who can access the data and how the consumer (who owns the data) can choose to share it.

vi. Every consumer will have an advanced meter display in the form of a handheld digital device which shows their energy use (updates every half hour for gas, every 10 seconds for electricity) and what it's costing them, in near real time. The consumer is able to view how much energy they have used in the last hour, week or month.

vii. There is no obligation to have an advanced meter installed, consumers can choose, however their supplier must offer an advanced meter by 2020.

viii. It is intended next day customer switching via a new national centralised switching service run by DCC will be enabled by 2018.

ix. There are some significant differences to the NZ market, including that gas and electricity advanced meters are being rolled out at the same time and using the same communications infrastructure, most meters are located inside buildings (compared to outside buildings in NZ), and gas networks are largely low pressure networks (compared to medium pressure in NZ).

b) Ireland (~6m gas consumers) – has mandated roll-out of gas advanced meters, target 100% by 2019.

c) Italy (~22m gas consumers) – is said to be most aligned to NZ because both Italy and NZ have medium pressure gas networks. It is following an ambitious deployment program set by the regulator which has had to be modified several times, and aims to have more than 12m gas advanced meters (60%) installed by 2018.

d) France (~11m gas consumers) – has mandated that gas advanced meters must be rolled out, however functionality is limited to one-way communication of consumption data to consumers and suppliers. GrDF, the main public distributor of natural gas to 96% of the gas market, has designed its own gas advanced meter to be manufactured and supplied by several meter suppliers. Target is 100% deployment by 2022.

e) Germany (~14m gas consumers) – has opted for a roll-out of “intelligent” advanced capable meters which will only record interval data and communicate to consumers’ in-home displays. Initially at least, the interval data will not be collected centrally.

f) Netherlands (~7m gas consumers) – has mandated that gas advanced meters must be rolled out, and expects 80% deployment by 2020.

g) Belgium (~3m gas consumers) – at a national level made a decision not to mandate gas advanced meters based on a negative CBA. However, Belgium has three regional regulators who are conducting their own CBAs, and this has resulted in a trial roll-out in one region.

30. North America –

a) The North American market is fundamentally different from Europe, with roll-outs focusing on upgrading old meters with a two-way communications module rather than replacing with fully functional gas advanced meters.

b) United States (~72m gas consumers) - Many US utilities have previously deployed AMR (automated reading) which limits the opportunity for an AMI solution. Furthermore, because gas prices are relatively low, consumers are less concerned about reducing their consumption which typically makes up a significant portion of the benefits business case. Nevertheless, several utilities have initiatives in progress towards gas advanced metering roll-outs, the biggest being the Southern California Gas Company (~6m gas consumers) which is deploying meters capable of transmitting regular reads and receiving instructions for a read on demand.

c) Canada (~ 6m gas consumers) – Very limited deployment of gas advanced meters; initiatives have primarily targeted installation of communications modules (AMR).

d) While there has not been much of an appetite in North America to move beyond AMR to for fully functional advanced meters and an AMI solution, at least in the medium term, that may be changing as utilities realise AMI broadens the scope of AMR beyond just meter readings with additional features enabled by two-way data communication.

31. Australia – it appears the focus in Australia is on the electricity advanced metering market, and there is not a lot happening with respect to gas advanced metering.

32. Functionality of meters being rolled out across Europe varies, but at a high level:

    a) All countries require two-way communications
    b) All but France require remote disconnect capability
    c) System alarms (e.g. tampering) are only required in the Netherlands and Ireland

Costs and Benefits

33. There has been a reluctance on the part of meter owners and gas advanced meter suppliers to share cost information as the information is considered commercially sensitive, and so cannot be included in this report.

34. It appears retailers are not expecting a positive business case for retailer-led mass deployment of gas advanced meters, as that the same conditions don't exist for gas as they did for electricity (compliance, market).

35. The key benefits relevant to the New Zealand market are:

    a) Improved customer service

        i. More accurate gas bill using an actual read where a retailer is currently reading meters bi-monthly and estimating every second bill. A retailer can of course change from bi-monthly to monthly meter reading as one retailer already does as a point of differentiation.
        ii. Dual energy billing – enables easier alignment of dual energy billing based on an actual read for both electricity and gas.
        iii. More flexible billing options - would enable retailers to provide more choice of bill frequency and date (e.g. daily, weekly, fortnightly, monthly – with a nominated day of week or month) using an actual read.
        iv. Security – removes need to provide key or security code access to meter readers (e.g. behind a locked gate providing security to owner or owner's pet(s), inside a secure area protected by a burglar alarm).
        v. Potential to reduce bills – provides more transparency around usage profile and gas cost drivers which may encourage more efficient appliances and reduced energy consumption/cost.

b) Operational efficiency and lower cost to serve

i. Call centre costs - elimination of estimated reads will result in a significant reduction in customer bill queries, and cost of receiving and processing customer own reads.
ii. Switching – eliminates switch read disputes
iii. May reduce metering service fees – this will depend on the advanced services fees advanced meter owners will seek to charge retailers for meter leasing and data services versus the existing standard meter lease fees charged by meter owners and physical meter reading costs incurred by retailers (which will likely increase disproportionately to number of meters as meter reading providers seek to recover the fixed costs of fewer meter reads of traditional meters).
iv. Satellite technology can be used to track meter location

c) Revenue and revenue assurance

i. Vacant property risk – enables early detection of vacant consumption and confirmation of move-in date, and supports early sign-up of uncontracted occupiers.
ii. Reduction of fixed charges - enables a more timely [remote] disconnection after a final bill (if there is a vacant period or gas is no longer required) and avoidance of fixed network charges and meter lease fees (provided the disconnection is a transitional disconnection and the ICP status in the registry is changed to inactive)
iii. Remote disconnection and reconnection – defaulting customers and vacant properties can be remotely disconnected
iv. Tamper alarms and access to more timely consumption data increases ability to detect theft

d) Safety

i. Dogs – removes safety risk for meter readers from dogs
ii. Hard to read meters – reduces safety risk for meter readers required to access hard to read meters
iii. Remote disconnection enables more timely response to recover from a loss of widespread gas supply to an area or network outage, i.e. all ICPs which have lost

supply must be disconnected before the network can be repaired and gas supply reinstated to the network, and then ICPs must be reconnected one-by-one.

e) Market

i. More accurate energy and network reporting
ii. More accurate billing of network charges
iii. More accurate gas allocations and related settlements
iv. Reduction in seasonality of UFG, particularly if temperature compensated meters are widely deployed
v. Reduction in theft and vacant consumption
vi. Mass deployment may discover unrecorded meters

f) Network benefits

i. Hourly data and network analysis tools should enable improvements in planning and design of networks, and investigation and resolution of supply issues.
ii. Distributors with access to TOU data for both gas and electricity may be able to offer incentives to shift peak electricity load to gas, reducing electricity network capacity constraints and investment.

Is there a need for regulatory intervention?

36. Should Gas Industry Co specify information exchange formats and protocols (GIEPs) and require participants to use those formats and protocols when interfacing with AMI back office systems? It is noted that the Electricity Authority considered regulating standard formats, but did not do so. Retailer feedback suggests that while asset ownership is not that important, what is important is establishing a standard construct which includes the services and minimum dataset available to retailers. Meter owners suggested that so long as the data is available it can be reported in any format required by each retailer, and will probably leverage formats used for exchange of electricity metering data. It is therefore recommended Gas Industry Co commence discussion with meter owners and retailers with a view to articulating the standard construct for the services and minimum dataset, out of which may come a desire to specify file formats.

37. Should Gas Industry Co establish rules around access to and security of data? The commercial agreements developed for electricity advanced metering would appear to set the benchmark for access to and security of gas advanced metering data, flowing from customer contracts and reflected in use of system agreements and advanced metering services agreements. As a

consequence, there should be no need to regulate access to or security of gas advanced metering data.

38. Gas Industry Co should also commence discussion on potential registry changes, for example whether a switch of an ICP with an advanced meter should be a standard or TOU switch, whether there should be separate meter owner codes for standard and advanced meters, whether the registry should record communicating or non-communicating.

Appendix: Terms of reference

1. The purpose is to gather information so Gas Industry Co and stakeholders are up to date with the current state of gas advanced metering technology and where it is heading, and have an understanding of the likely benefits and issues in the context of the NZ gas industry so Gas Industry Co is well positioned to ensure the regulatory framework supports achieving the anticipated benefits.
2. The initial phase aims to produce a narrative covering the following topics:

    a) overview of gas advanced meters currently available, including intended application (e.g. domestic, small business, etc.), communications channel(s), additional capabilities (e.g. remote disconnect/reconnect, soundness testing), battery life (and trade-off with remote reading frequency), etc.;

    b) experience from other jurisdictions, e.g. the advanced meter rollout in the UK (see www.smartenergygb.org) and any formal reviews and/or lessons learned;

    c) experience from trials held within New Zealand, in particular whether the hilly terrain and/or sparse population indicates any issues with reliability of communications channels and/or drives the choice of technology;

    d) any indication of timeframes for rolling-out gas advanced meters in NZ;

    e) comparison of the supply and installation costs of advanced meters vs existing gas metering technology;

    f) interviews with key participant classes to identify classes of benefits that may be expected from advanced metering technology, including retailer/customer benefits and advanced network benefits;

    g) high-level assessment of the costs/benefits of a programme to replace existing meters with advanced meters (taking into account estimated savings in meter reading costs, potential for more accurate readings and customer bills, potentially more accurate energy conversions if the advanced meters compensate for temperature and/or pressure); and

    h) any lessons from New Zealand electricity AMI rollout that may be relevant to the gas industry.