REVIEW

Australian Energy Market Commission

POWER OF CHOICE REVIEW DRAFT REPORT

SUPPLEMENTARY PAPER

Principles for metering arrangements in the NEM to promote installation of DSP metering technology

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AEMC Paper

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About the AEMC

The Council of Australian Governments (COAG), through its then Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. In June 2011, COAG established the Standing Council on Energy and Resources (SCER) to replace the MCE. The AEMC has two principal functions. We make and amend the national electricity, gas and energy retail rules, and we conduct independent reviews of the energy markets for the SCER.

Summary

The rules for metering provision and other metering services facilitate consumers' choices in terms of their ability to have time varying pricing and other DSP products. In particular, appropriate meters are required for retailers to offer consumers' time varying tariffs that can reduce energy costs for consumers and assist the retailers to manage their risks.

The majority of small consumers still have accumulation meters. This supplementary paper to the power of choice draft report discusses the reasons why there is still a relatively limited number of interval meters used in the NEM and explores possible new arrangements which would better support commercial investment in metering provision and related services.

We considered how the metering arrangements should operate in order to facilitate a greater uptake of meters with interval read capability and remote communications– which could be either interval meter or smart meters. We refer to these types of meters as advanced metering infrastructure (AMI) and have proposed a minimum functionality specification for inclusion into the NER.

Our objective is to identify the appropriate metering arrangements to support efficient demand side participation and to provide consumers with a greater level of choice in terms of their metering services. Our analysis and recommendations are focussed on residential and small business consumers. We consider that the current arrangements are adequate for medium to large commercial and industrial consumers.

There are multiple reasons why the current arrangements are inhibiting the ability of consumers and market participants to invest in metering technology which supports DSP. To overcome these barriers, a policy decision is required to determine how meters should be provided for residential and small business consumers. Regarding this, we are considering two models:

- **Contestable roll out** – where metering provision is open to competition among AEMO approved service providers. Consumers would have the right to either contract directly with an approved metering service provider, or where the consumer does not exercise that right, the retailer is responsible for the metering provision and services at the consumer's premise. Under this model the consumers should be able to retain the same metering installation when it changes retailers.
- **Monopoly roll out by the local distribution network service provider (LNSP)**– where the local distribution network would have exclusive ability to install and operate interval or smart meters, when requested by the consumer or retailer/third party provider. LNSP would be subject to performance standards and metering charges would be regulated by the AER.

There is debate within the industry as to which model would result in the efficient delivery of metering services for consumers. The questions regarding the contestable roll-out relate to whether the additional functionalities to support smart grid operations will be captured and also whether the resulting investment in the supporting communication platform will be of sufficient quality. Regarding the monopoly roll-out, the main issues relate to whether it will inhibit innovation, the performance of LNSP is providing metering services, and the efficiency of the network metering charges.

Irrespective of which model is applied, it is important that consumers have an

effective choice in their metering technology and that the arrangements are simple and practical for them to exercise that choice. We consider that there are some specific recommendations that should be applied irrespective of which of these two models is adopted. These recommendations are:

- Unbundling of metering costs from network distribution use of system charges.
- The current distinction between responsibilities for type 4 and 5/6 metering installations (where the LNSPs have exclusivity) be removed as this can act as a barrier to consumers upgrading their metering installations.
- There is a clearly defined standard exit fee for an existing accumulation meter, when the consumer's meter is upgraded to AMI. We propose that the exit fee is set at of 30% of replacement costs[1] (with any residual being recovered from all consumers through distribution network use of system tariffs (DUOS)).
- Provision of the non-metering functions available in smart meters is contestable and open to a range of third party vendors (eg IT and telecommunication companies). Our proposals regarding metering data access, as set out in chapter 2 of the power of choice draft report, will support this recommendation.

To further promote discussion on amendments to the arrangements to encourage the roll out of AMI, we are putting forward an initial high-level model for consultation. Under this model the provision of metering services would be contestable but a distribution network business would also be able to do a targeted roll out AMI in its geographic area, as part of a DSP project.

The proposed model would work as follows:

- small consumers have the right to upgrade their metering installation;
- small consumers have the right to contract with any accredited provider for the provision of metering services;
- in most cases we envisage that the consumer will not actively exercise these options, but in such circumstances the retailer is responsible for ensuring the metering installation reflects the consumer's needs;
- if the consumer changes retailer for the supply of electricity it would not be required to change its meter. The new retailer will be oblige to continue any existing contracts with metering providers at that consumer site;
- the current retailer at the consumer's premises would be responsible for the costs of metering and managing metering services providers on behalf of consumers;
- in the situations where it is required that an interval meter should be installed (ie. new connections, consumers above large load consumption threshold) the current retailer is also responsible for ensuring that such meters are installed in a timely manner;
- the consumer will be liable for the costs of the metering and associated services over the life of the metering contract;

[1] The figure of 30% is based on a simple assumption that on average, the remaining life of accumulation meters could be roughly one –third of the total life of the meter.

- the network businesses can offer a discount on DUOS or a one off payment to those consumers who also install meters with additional functionality which delivers network operational benefits; and
- the local DNSP has the option to do a roll-out of smart meters as part of its DSP programs to defer network augmentation. This could be part of its allowed regulated expenditure. In this situation the network business is responsible for providing metering services (ie. the metering installation and data services) to the consumer. The retailer would still be responsible for managing these services on behalf of the consumer.

We favour a contestable approach because meter provision does not have the characteristics of a monopoly service and we consider it will drive innovation and metering services at efficient cost. A number of private third parties have indicated to us their keenness to enter this market and provide efficient solutions to consumers. Work is needed on the detail and practicalities of this approach and we are keen for stakeholder views on this.

We also need to consider how to facilitate the installation of the additional smart functionalities into these meters. There are potentially up to three components to a smart metering installation. These are:

1. The measuring element (or multiple elements) which measures and records the energy consumption.
2. Energy management system functions which could send messages into the consumer premise and communicate with its appliances (ie for load control, home area networks).
3. Smart Grid business functions, which enable market participants to communicate with the meter, to both receive information and send messages/instructions to the metering installation (ie. supply capacity control, loss of supply detection, energisation/de-energisation).

We have also considered what the minimum functionality specification for any AMI roll out. Our initial view is that a minimum AMI functionality of interval data recording and remote communication, (possibly with some additional functions), should be included in chapter 7 of the NER. Appendices B and C to this paper provide more detail on the proposed minimum functionality and the minimum standard for the communications.

This selection of a minimum functionality specification for AMI gives the consumer the choice to influence the characteristics of its metering installation and decide whether it is appropriate to include additional functions above this minimum functionality. That is, the consumer would have the ability to pay for the meter which best meets its ability and preference to do DSP, at the lowest costs.

We recognise that there may be merit to also expand the proposed minimum functionality to include some of the smart grid business functions. We appreciate stakeholder views on this. In addition, we advise that if new metering arrangements are implemented, then the governments could consider removing the possibility of a mandated roll-out of smart meters. The approach of mandating the roll-out of smart meters may no longer be required. This absence of a mandated roll out would facilitate commercial participants entering into the market and providing metering services.

1 Importance of metering in the context of the power of choice review

1.1 Potential benefits of more advanced metering infrastructure

There are many potential benefits to consumers, retailers and distribution businesses that can be realised by providing incentives to consumers to manage their consumption at times of high energy prices and network loading. These incentives can facilitate the following potential benefits including:

- lower energy costs for those consumers that do not consume as much at times of high energy prices and network loading and have the capacity to reduce their consumption at these time;
- lower risks to retailers who can, to some degree, share some volatility in wholesale prices with consumers; and
- potential reduction in network costs from incentivising consumers to reduce their consumption at times of high network loading.

The benefits of rolling out smart meters were identified by Deloitte in a cost benefit assessment of the Victorian AMI program.[2] Deloitte estimated the size of a number of benefits over the period from 2008 to 2028 of upgrading the meters. Table 1 summarises these benefits and shows a range of benefits for upgrading metering, including benefits to consumers, retailers and network businesses.

To realise these benefits it is necessary to apply time varying tariffs for energy and network usage. Time varying tariffs requires metering technology that differentiates consumption at different times so that the consumption is responsive to tariffs.

We consider that the most flexible meters in terms of enabling demand side participation and facilitating consumer choice are remotely read interval meters. Interval meters record the energy consumption for each half hour interval which matches the trading intervals in the NEM metering and settlements systems. Interval meters enable:

- retailers to be settled on the actual consumer consumption;
- the possible of more frequency billing which could help to reduce consumer exposure to bill shock
- a high degree of flexibility for retail tariff structures that can be offered to consumers; and
- the possibility of peak demand pricing for network DUOS and TUOS pricing.

In addition, recording consumption using an interval meter means that:

- time varying tariffs (such as peak, off-peak and critical peak pricing) or other DSP related products can be offered by a retailer or energy services company (ESCO);
- the demand data is available to support maximum demand usage charges by LNSPs; and

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[2] "Department of Treasury and Finance – Advanced metering infrastructure cost benefit analysis", Deloitte, 2 August 2011. The Deloitte report references two similar earlier studies undertaken by Futura and Oakley Greenwood.

- stakeholders (including consumers, retailers and LNSPs) have access to consumption data that can facilitate consumer response. This consumer response is further enhanced if the interval meter data is remotely read and available immediately.

Table 1 Benefit over the period 2008-28 (Deloitte Report)

Benefit category	$m (NPV at 2008)
Avoided cost of replacing accumulation meters	649
Avoided cost of manual meter reading	154
Reduction in unserved energy due to faster detection of outages and restoration times	66
Remote special reads and de-energisations	149
Remote re-energisations	209
Avoided additional cost of energy and peak demand from time switch clock errors	26
Savings from reduction in non-technical losses (theft)	27
Avoided cost of proportion of transformer failures on overload and avoided unserved energy	29
Ability to set emergency demand limits to share limited supply at times of network stress or supply shortage	82
Value of avoided network and generation investment due to peak demand response to TOU tariffs	11
Avoided network and generation augmentation resulting from critical peak incentives	217
Energy conservation from in home displays (IHDs)	77
Reduced peak demand due to direct load control of air conditioners	184
Other	150
Total	2030

There are also significant business operational efficiencies to be gained from improving current metering technology. These efficiencies form a part of the cost benefit analysis and relate to avoided meter reading costs, reduced network operational costs, and improving retailer practices and risk managements.

While the current arrangements in the NEM allow for time varying pricing and the commercial roll out of advanced metering installations by retailers or the LNSPs, about 88% of small businesses and residences still only have accumulation meters.[3] This includes a number of LNSPs that have installed interval meters but are reading them on an accumulation basis to reduce their metering data handling requirements. This is despite the significant potential benefits for market participants that more advanced

[3] Table 5.1 of the power of choice review directions paper provides a breakdown of metering types and customer size.

metering installations can provide such as avoided metering reading costs and network operational benefits.

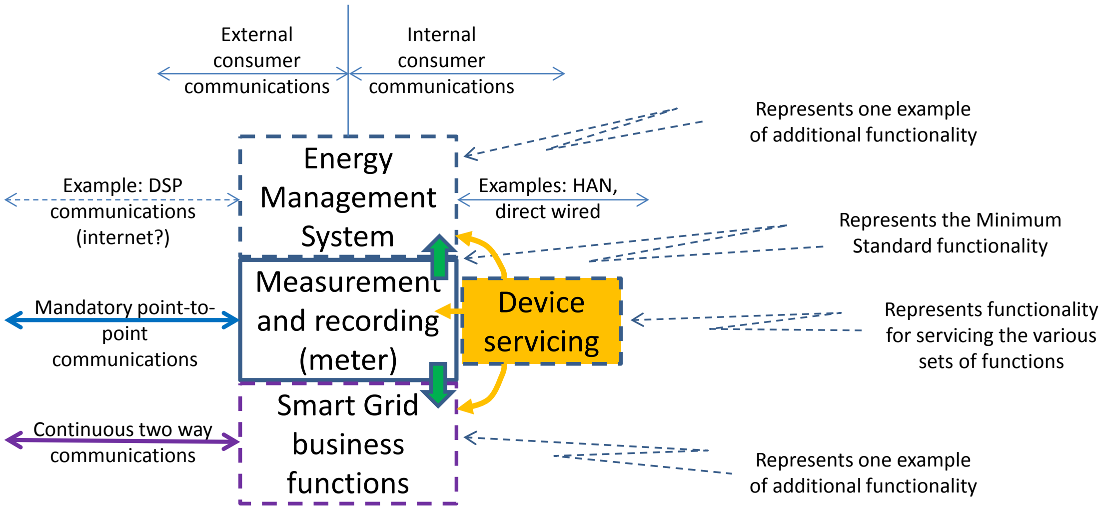
1.2 Defining advanced metering infrastructure – interval and smart meters

For the purposes of this document we will refer to upgraded metering technology required to facilitate the benefits described above as advanced metering infrastructure (AMI). AMI can be achieved by installing either:

- a remotely read interval metering installation[4] that is compliant with the requirements of Chapter 7 of the NER; or
- a form of smart meter that meets the metering requirements of Chapter 7 but also provides additional non-metering functions such as remote energisation/de-energisation and direct load control.

Appendices B and C of this supplementary paper discusses the minimum functionality specification of the AMI that we are proposing to be adopted in the NEM. The choice involves a trade-off between the benefits available from the additional functionality and the associated extra cost. Appendix B also discusses recommendations of the National Smart Metering Program (NSMP) undertaken by the National Stakeholder Steering Committee (NSSC).

The following diagram assists in the explanation of the selection of functionality and architecture for the meters.



The functions of the meter are divided into three categories:

1. The measuring element (or multiple elements) which measures and records the energy consumption.
2. Energy management system functions which could send messages into the consumer premise and communicate with its appliances (ie. for load control, home area networks).

[4] A type 4 metering installation, as defined in the NER, is a remotely read interval meter for a load that consumes less than 0.75 GWh per annum. This corresponds to the consumption of approximately 100 domestic residences.

3. Smart Grid business functions, which enable market participants to communicate with the meter, to both receive information and send messages/instructions to the metering installation. These could support such functions as supply capacity control, loss of supply detection, energisation/de-energisation etc.

The architecture for the communications to a smart meter can either be:

- **point-to-point** – between the meter itself and the AEMO metering database (the current arrangement), with separate communications for the business and energy management functions; or
- **meshed communications system** – used for all the functions included in the smart meter.

We consider that all meters should include the ability for point-to-point communications of the metering data to the AEMO metering database.[5] This does not prevent the metering installation from supporting other additional forms of communication access, for example mesh radio or Distribution Line Carrier. This method is an established approach that provides security for the data. Appendix C of this document discusses the choice of communication systems for AMI.

1.3 Background information – supporting Appendices

This document includes background material that relates to our discussion and recommendations in the following Appendices[6]:

- Original Design Principles for Metering Arrangements in the NEM (Appendix A)
- Developing a Minimum Functionality Specification of DSP enabling meters (Appendix B)
- Additional functionality to that Minimum Functionality Specification (Appendix C)

1.4 Key metering terms used in this paper

This section provides brief descriptions of some of the key metering concepts used in this paper. These concepts are expanded on as required throughout the paper and the associated appendices. Further details on these concepts are available in Chapter 7 of the NER and from the AEMO website.

<u>National Metering Identifier (NMI)</u>

A NMI is an identifying code that uniquely defines a 'metering installation' for the purpose of NEM settlements.

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[5] The requirement to ensure that point-to-point communication is supported by each metering installation is not specifically identified in the SMI minimum functional specification, but is a feature of the current NER Minimum Standard. This does not prevent the metering installation from supporting other additional forms of communication access, for example mesh radio or Distribution Line Carrier.

[6] These Appendices were prepared with the assistance of Phacelift Consulting Services

Metering installation

The metering installation is the assembly of components required to measure, process and make available for collection the energy data for a connection point, including:

- measurement element(s) (meters);
- current and voltage instrument transformers (if required);
- recording and display equipment; and
- communications interface (if required)

The device called a 'meter' is only one of the components of a metering installation. The metering installation may include the combination of several meters at various metering points to derive the metering data for a connection point. These multiple meters may be at the same site, or at different sites.

Metering installation type

The type of metering installation and its accuracy requirements for a metering installation are determined in accordance with the NER and depend on the size of the load.

Size of load (annual energy consumption)	Metering installation type
Greater than 1,000 GWh	1
Between 1,000 GWh and 100 GWh	2
Between 100 GWh and 750 MWh	3
Between 750 MWh and zero	4, 5, 6 and 7

Type 1 to 4 metering installations must be capable of:

- measuring energy flows in 30 minute intervals in both directions; and
- being remotely read (ie data extraction via a communications link).

Type 5 to 7 metering installations accommodate past technologies and practice limitations.

- Type 5 metering installations include interval meters that are manually read (ie local data extraction)
- Type 6 metering installations include accumulation meters that are manually read; and
- Type 7 metering installations do not include a meter and may be used where the load is miniscule and unmetered.

Responsible Person

Under the NER, the Responsible Person is the person responsible for the:

- the provision, installation and maintenance of a metering installation;
- collection, processing and delivery of the metering data to the AEMO metering database and to parties entitled to that data; and

- decides the meter provider and meter data providers (accredited by AEMO to provide meters and meter reading services).

The role of the Responsible Person:

- is technical (ie technology) in nature, and not financial;
- allows accountability for meter errors and meter security to be traceable to a NEM ‘participant’, rather than a Rules accredited ‘service provider’; and
- is fundamental in the process for registration of a NMI for each metering installation used in NEM settlements.

The Responsible Person for a type 1 to 4 metering installation is

- the financially responsible market participant (FRMP), usually the retailer, can choose to be the Responsible Person; or
- the FRMP can request the local network service provider to be the responsible person or engage a third party.

The Responsible Person for a type 5 to 7 metering installation must be the local network service provider, usually a distribution business.

Metering Data Provider

The Metering Data Provider (MDP) is accredited and registered by AEMO, and is the only person authorised to:

- collect metering data from a metering installation;
- validate, substitute and estimate metering data;
- archive the data; and
- deliver that metering data to Registered Participants and AEMO for the purpose of NEM settlements, retail billing and DNSP billing.

2 Why more AMI has not been installed in the NEM

While there are potential benefits from the installation of AMI the majority of consumers only have an accumulation meter. There are many reasons for this lack of investment in AMI but the main reasons relate to three areas:

- the current regulatory practice of making retailers responsible for remotely read interval meters while LNSPs are responsible for the regulated provision of manually read interval and accumulation meters;
- uncertainty in relation to government policy, especially on the regulatory treatment of smart meter services; and
- misalignments between the party who pays for the costs of the metering installation and the parties who benefit.

2.1 Responsibility for remotely read and manually read metering installations

The current NER defines the role of Responsible Person as the person responsible for:

- the provision, installation and maintenance of a metering installation; and
- collection of metering data from each metering installation for which it is responsible.[7]

Under the current NER, retailers have the primary responsibility, ie the Responsible Person,[8] for remotely read interval metering installation (type 4),[9] while LNSPs are responsible for the regulated provision of manually read interval metering installation (type 5) and accumulation meters (type 6). This assignment of responsibilities can create inefficient incentives on LNSPs, retailers and third parties.

For example, LNSPs have the incentive to install manually read interval meters for which they are exclusively responsible for providing (ie. they are the Responsible Person). If a LNSP wanted to install a remotely read metering installation, which may be cheaper to read and lead to lower long term costs, the retailer would be responsible for providing the metering installation unless it agreed to give this responsibility to the LNSP. Under the current arrangements the LNSP cannot seek AER approval for

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[7] Clause 7.2.1 of the NER defines the role of the Responsible Person.

[8] Under the proposed approach any accredited entity can be a metering services provider. This would be achieved by allowing these entities to be the Responsible Person under chapter 7 of the NER. The purpose of this proposal would be to increase the competition for the provision of metering services.
We also considered removing the Responsible Person role from the NER entirely. This could be achieved by:

- requiring the retailer assume this role, with the retailer either providing the metering services or contracting this role on behalf of the consumer; or
- requiring the Metering Data Provider defined in the NER to assume this role.

Removing the Responsible Person by reassigning it to the retailer or Metering Data Provider may further increase competition for the provision of metering services. However, given that we are proposing a range of metering changes in the Electric Vehicle review and the Power of Choice Review, we consider that the Responsible Person role should be retained. This decision could be revisited when the metering arrangements.

[9] Clause 7.2.3(b) and (c) allows the retailer to request the LNSP to act as the Responsible Person for remotely read interval metering installations.

expenditure on a remotely read interval meter (type 4 metering installation) as these meters are a contestable service.

In addition, the metering costs have been unbundled from the distribution use of system (DUOS) charges in two states - Victoria and South Australia ($25 pa). In contrast New South Wales[10] and Queensland LNSPs bundle all their charges into a single charge that includes the regulated metering costs. If a consumer in these jurisdictions seeks to use an alternative metering provider then it will end up paying twice for metering.[11] This would be a significant disincentive on AMI investment.

Also, when a consumer switches from a LNSP owned manually read metering installation (type 5 or 6) to a type 4 metering installation, the retailer is required to negotiate with the LNSP in good faith to ensure that the LNSP is reasonably compensated for the stranding of its metering investment.[12] This requirement is intended to prevent the inefficient churn of meters. We consider that this clause can be unworkable in practice as it very difficult to negotiate with the LNSP on the value of its lost profit stream from a stranded regulated metering investment.

In South Australia there is a standard exit fee set at $267. However some retailers and metering providers have told us that they consider this amount to be too high and hence it prevents meter upgrading and competition.

Another consequence of the retailer being responsible for meter provision is the risk of meter churn. That is, if the consumer changes retailer at the end of its retail contract that the new retailer takes over this responsibility. This results in a potential stranding of the first retailer's metering investment. This means that the retailer must either:

- recover the full cost of the AMI over the length of its retail contract with the consumer, which would add to its costs and make it appear unattractive to the consumer; or
- run the risk that its investment would be stranded should the consumer change retailer, which adds to its long term costs.

In addition, under the current NER a retailer can request the LNSP to provide an interval meter for a consumer. Retailers seem to be reluctant to do this given the lack of commercial accountability and a civil penalty regime for LNSP. Currently LNSPs are largely bound by only a best endeavours obligation. Retailers raised this concern in their submissions to the power of choice directions paper. Finally, limiting the ability of third party metering providers to offer services directly to consumers may limit the choices available to consumers.

2.2 Uncertainty in relation to government policy

At present there is some uncertainty relating to government policy on metering and the associated services. This has the potential to discourage investment in AMI and, hence,

[10] On page 30 of its document "Preliminary positions- Framework and approach paper – Ausgrid, Endeavour Energy and Essential Energy – Regulatory control period commencing 1 July 2014", published June 2012, the AER indicated that metering costs should be unbundled from other costs.

[11] That is, the consumer would be paying the LNSP a charge that includes metering as well as the cost of the replacement metering installation.

[12] This requirement is specified in clause 7.3A(g) of the NER.

reduces the opportunity to facilitate consumer choices, which could lead to potential benefits.

The NEL allows the Minister of a participating jurisdiction to require the LNSPs to conduct a smart meter trial or assessment[13], or to roll out smart meters across all or part of its network.[14] Such a mandated roll out of AMI represents a significant risk to any retailer or metering service provider that is considering providing metering services. This risk arises because a mandated roll out would strand any other AMI investment in the affected network.

Similarly, the consumer protections for small consumers, including with respect to the framework for time varying prices, are still being developed. These consumer protections affect the regulatory treatment of the services associated with smart meters.

Another important consideration is the treatment of non-metering functions available in AMI. These additional functions are not currently regulated. That is, it is unclear which entity controls these functions. Thus it is potentially possible for a retailer or LNSP to fit AMI only to find it cannot use some of these non-metering functions or that another entity can also operate these functions. For example, AMI include a remote energisation/de-energisation function that may potentially be valuable to both a LNSP (for emergency load control) and a retailer (to manage credit risk and consumer moving between premises).

Therefore, some investors may delay their decisions to invest until the regulatory treatment of smart meters services is developed.

2.3 Misalignments between the parties that pay for the meter installation and those that benefit

The benefits of AMI may be gained by consumers, retailers and the LNSP, but these benefits may not be able to be captured by any single entity. That is, in some instances the total benefits to the market may exceed the cost of providing AMI but these costs may exceed the benefits accruing to any individual entity. This means that there is likely to be under investment in AMI unless there is a mechanism to capture the majority of potential benefits by a single entity.

In relation to retailers, another disincentive is that they may find it difficult to identify which consumers would potentially benefit from time varying pricing and hence which consumers to fit with AMI. This lack of information will mean that a targeted roll out by the retailer would be less likely to occur.

There are also alignment issues for the roll out of AMI by the LNSPs. In order to roll out AMI to a group of consumers the LNSP needs to put forward a case to the AER showing a net positive benefit. This may be difficult as there is more certainty regarding the costs of a metering roll out than the benefits and the network business is not necessarily well placed to assess the benefits to consumers and retailers.

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[13] This power of the Minister is in Section 118B of the National Electricity Law.

[14] This power of the Minister is in Section 118D of the National Electricity Law

3 Objectives and key decisions for metering arrangements

The National Electricity Objective (NEO) is founded on the concept of economic efficiency with emphasis on the long term interests of consumers. This encompasses not only the price in which services are provided, but also the quality, reliability, safety, and security of the market. This section, set outs the objectives which we have developed based upon the NEO to guide our assessment of these issues.

3.1 Key objectives and principles for AMI roll out

We have considered how the metering arrangements in the NEM should operate in order to facilitate:

- a greater uptake of AMI metering in the absence of a Government mandated roll out;
- an efficient level of demand side participation; and
- a greater level of consumer choice in the metering services.

We consider that the appropriate metering arrangements should be consistent with the national electricity objective (NEO); that is, the metering arrangements should efficiently and deliver benefits to consumers in the long term.

Based on the NEO, we consider that the key principles for the metering arrangements should be:

- **Consumer choice** – the metering arrangements should be as simple and practicable as possible from the consumer's perspective. This would mean that consumers would be more likely to be engaged and be attracted to time varying pricing incentives that require interval metering. We also consider that the consumer's choice of metering should not necessarily be tied to a specific retailer, rather the choice should provide consumers with the services they require to make informed decisions regarding their consumption.
- **Competition is promoted** – the metering arrangements should, where appropriate be contestable to give consumers more choice of services. There is a concern that the provision of metering services by a regulated entity is likely to provide less choice and ongoing innovation with a lower level of preformance.
- **Maximising overall market efficiency** – the metering arrangements need to consider the overall efficiency of the market, including the impacts on retailers, LNSPs and consumers, rather than being efficient for their own sake.
- **Alignment of costs and benefits** – if the metering arrangements align benefits and costs then an efficient level of investment in AMI is likely to occur.
- **Minimise risks to market participants** – the metering arrangements should consider the potential risks to market participants and consumers and allow the market to develop mechanisms to mitigate these risks.
- **Be robust in the long-term** – as well as operating efficiently now, the metering arrangements need to promote certainty for investors in the long term.

3.2 Key decisions in relation to the roll out of AMI

Minimum functionality specification of AMI

An absolute minimum functionality specification for the AMI necessary to facilitate the benefits described in the power of choice review is an interval meter that is remotely read.[15] This is the minimum functionality specification required to provide compatibility with the wholesale market and allow the maximum flexibility for time varying pricing.

In addition, there are smart meters available to the market that offer many non-metering functions in addition to a basic remotely read interval meter. These additional functions can include additional power quality data, direct load control, remote energisation/de-energisation etc. While these functions are not directly related to the metering requirements in the NER they can provide benefits to the retailer, LNSP and/or the consumer.

These additional functions come at a cost and including these functions in an AMI roll out could act as a disincentive to their adoption, specifically if the benefits accrue to an entity other than the one that paid for the installation. Therefore, the composition of the minimum functionality specification is an important factor for the roll out of AMI.

The advantages of remotely read meters which can be read on an interval basis include:

- being more cost effective, in most instances;
- providing the consumer with real-time (or near real-time) consumption data to facilitate better management of its energy usage; and
- the ability to use current data in the settlement systems, rather than relying on estimated and infrequently read meter data.

Therefore, the minimum AMI functional specification includes the ability for the meter to be remotely read. This is discussed in more detail in Appendix B.

Managing complexity for consumers

While it is important for consumers to have a high degree of choice so that they can get the metering installation that best suit their needs, it is also important that there are simple options available to consumers.

The metering arrangements in the NEM are naturally complex due to the different arrangements that apply for different sized loads, different jurisdictions, whether the meter is provided by the LNSP or a retailer, and also due to increasing number of additional non-metering functions available in smart meters. In contrast, the majority of consumers are likely to have little interest or need in becoming more familiar with metering details. Consumers are more likely to be interested in overall package of products offered by the retailer (or other service providers).

The metering arrangements should also ideally provide consumers with additional metering choices for that smaller number of consumers that actively want to choose their meter and associated functions. This needs to be supported by having appropriate, simple default arrangements for when the consumer does not want to get

[15] Except in some limited scenarios where it is more cost efficient to manually read the meter.

actively involved in metering services. Therefore, if there is going to be a high penetration of AMI, especially a roll out driven by retailers and consumer choice, then the metering arrangements need to be:

- simple, if not transparent, to consumers; while
- retaining the ability to offer choice to end consumers that are interested in engaging in the process of choosing to upgrade their metering.

Capturing retail and network benefits

The potential benefits that AMI can facilitate from both savings in energy costs as well as network benefits. Therefore, a roll out of AMI that is only driven from a retail perspective or from a network operational perspective may not capture all these benefits.

For example, if the roll out of AMI is only driven by savings in the energy market then:

- there could be an inefficiently low level of investment as retailers and consumers will not take into account network benefits of upgraded meters; and
- retailers and consumers would tend to install meters that do not include the functionality required to deliver network benefits, such as a higher communications bandwidth and speed plus many of the non-metering functions.

Similarly, if the roll out of AMI is only driven by the LNSPs and their potential benefits, then:

- the NSPs may not roll out AMI meters in certain areas when the network benefits in that location are low but there still may be substantial benefits in terms of energy market savings; and
- the AMI meters rolled out are likely to be a higher cost because LNSPs would be likely to install more sophisticated meters that include additional control functions.

We also note that the AMI meters rolled out to deliver benefits to the LNSP are likely to be suitable for delivering energy market benefits as both would require interval consumption.

Recovering the LNSPs' stranded metering costs

The majority of residential and small commercial and industrial consumers use accumulation meters. These accumulation meters are owned by the associated LNSP who receives a regulated return on this investment.

A roll out of AMI will require the replacement of these accumulation meters and in many cases the existing accumulation meters will not be near the end of their useful lives. This represents a stranding risk to the LNSPs as they may not have recovered the full cost of the metering installation before it is replaced.

There are a number of ways that this risk to the LNSPs can be managed. These include allowing the LNSPs to recover their unrecovered metering costs from:

- all customers via DUOS charges. This option may result in an inefficient overinvestment in new AMI installations as those seeking to replace the meters would not be facing the full costs of their decisions; or

- the individual consumer or retailer seeking to replace the metering installation. This option is theoretically correct as the entity making the investment decision faces the full costs of it investment decision. Unfortunately, this option may not always be practicable as the LNSPs may not always have sufficient records to accurately determine unrecovered costs of specific installed meters.

A reasonably efficient and practical compromise would be to allow the LNSPs to charge a nominal cost of say 30% of a replacement meter, as determined by the AER. For example, if the replacement cost was estimated to be $100 then an exit fee of $30 would be charged, with any residual recovered via DUOS from all consumers (practical). The value of 30% is somewhat arbitrary but is based on a typical meter being at approximately two thirds of its useful life.[16] However we are open for the industry to propose alternative amounts. What is important is that there is a standard fee and no requirement for the parties to negotiate on a case by case basis. Such negotiation is costly and may not conclude.

One issue with this compromise approach is that the replacement cost of the existing accumulation meter may not be available as these meters are not generally manufactured any longer, with new meters being electronic interval meters.

<u>The speed of the roll-out</u>

The speed of the roll out of AMI would be affected by a number of factors, including whether:

- the benefits of the roll out are well aligned with who bears the cost;
- the roll out is contestable, and driven purely by retailers and consumers or whether there is a form of monopoly roll out;
- new developments, upgraded and meter replacements are required to have AMI meters, which would obviously accelerate a roll out;
- the minimum functionality specification include non-metering functions, which would add to the cost of the meters and dampen consumers (and hence retailers) demand to upgrade their meter, unless the consumer was able to capture the network benefits;
- an interval meter is required for a site or premises that have the capability to export (eg with a solar PV or an electric vehicle with vehicle to grid capability); and
- a decision is made to require industrial and commercial and/or residential consumers above a given threshold to require a remotely read interval meter.

<u>Competition in non-metrology services</u>

As discussed above, in addition to being a remotely read interval meter, AMI meters include the capability of providing non-metering functions including:

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[16] For in-service induction accumulation meters, it is assumed that many meters would be close to their end-of-life book value, some meters would have been recently installed, and the remaining meters would have a spectrum of book lives between these two end points. It is also assumed that the average book life for this type of meter is skewed towards the end of the spectrum. It is assumed, for the purpose of this paper (an in the light of no definitive data) that the average book life for these meters in 30%.

- load management through the use of a remotely controlled contactor to switch a load contractor;
- the provision of a home area network and the associated display unit;
- facilities to limit the load during periods of high system or network loading; and
- the ability for the remote re-energisation /de-energisation of the premises.

These functions do not necessarily need to be provided in the AMI meter by the meter provider. The interval meter, and its associated installation and communications facilities, must be provided by entities that are accredited by AEMO.[17] The other functions could be provided by other entities or as part of other systems. For example, the home area network may be provided by a company that is primarily an IT or software vendor. Therefore, there is more scope for making these non-metering functions contestable, although this would not preclude the functions being included in a smart meter. We consider that making the provision of these non-metering services contestable would increase the competition in these services and would be expected to give consumers better choice at more efficient prices. This needs to be supported by appropriate interoperability arrangements.

Conditions for market efficiency

Ideally an efficient roll out of AMI would be characterised by:

- the ability for the investor to be able to consider all the benefits and costs associated with an AMI investment;
- the provision of a large amount of choice for consumers so that there is competition between suppliers;
- interoperability to facilitate consumer choice and competition amongst service providers;
- the ability for LNSPs to capture the benefits of AMI non-metering functions, where it is efficient to do so; and
- meters consistent a minimum functionality specification.

[17] This is undertaken by the Responsible Person under clause 7.2.1 of the NER.

4 Comparison of contestable and monopoly smart metering roll-out

The purpose of this section is to consider the two dominant models that exist to facilitate the introduction of interval metering (AMI) in the NEM, namely:

- a contestable roll-out; and
- a monopoly roll-out.

The analysis in this section applies the principles outlined earlier to identify how effective each approach might be in achieving the objective of increased AMI penetration, and any issues that might need to be resolved before either approach is implemented. It is important to be clear, however, that a fundamental tenet of either approach is that consumer choice remains a centrepiece. Therefore, the choices available to a consumer should not be unduly restricted by choosing either approach.

The approaches identified here are effectively a choice between whether a market will be effective in providing consumers with an efficient price and service offering, or whether the conditions of the service suggest that a single provider might be more efficient. Therefore, before addressing the matters of detail associated with each approach we will first consider how the economic characteristics of a service might influence the choice between the two options.

Consumer choice in meter provision

Both the contestable and the monopoly AMI roll out models retain a high degree of consumer choice. Under both models consumers would be able to:

- accept a retailer offer that includes time varying tariffs, and hence require an interval meter; and
- choose metering installations (from the selection being offered).

Neither of the models being proposed are a mandated roll out by a specified entity. That is, the consumers would always have the option to choose not to have an AMI, with some exceptions to be discussed below.

Economic costs and benefits of a contestable or regulated roll out

It is commonly assumed that efficient price and service offerings for a product or good will emerge under conditions of a competitive market. This is because in an effectively competitive market, competition between businesses will provide them with an incentive to price at marginal cost and to deliver a level of service desired by consumers. When a market is effectively competitive there is no need for the regulation of price and service offerings. Regulation imposes costs and these costs would not deliver better outcomes than could be achieved in the competitive market. As such, a competitive market should always be the starting point.

A competitive market may not, however, always be the most efficient market structure. For instance, competitive markets are typically not preferred where natural monopolies exist. Natural monopoly conditions might arise due to the nature of the assets or services involved. Natural monopolies are typically considered to exist in circumstances where investment in assets is irreversible or where there are substantial economies of scale or scope. These conditions create barriers to entry for other providers. In addition, it can mean it is more efficient for one firm, rather than two or more, to produce a good or service.

Similarly, a competitive market may also not be appropriate where a market failure has been demonstrated or is likely to occur. For example, a market failure could potentially arise if there was a large amount of competition for meters but there was a monopoly communications supplier or a single entity able to install the meters.

The remainder of this section considers what matters are relevant when considering whether a competitive market or a monopoly might be the preferred market structure for the provision of metering and related services. It is important to note that we have not undertaken a detailed analysis of whether competition would be effective in the market for metering services. The intention here is only to outline those matters that will be relevant when such an assessment is undertaken.

Does meter provision exhibit natural monopoly features?

In the first instance, it is important to note that contestable provision of interval meters already exists for large consumers. While we have not undertaken an assessment of the effectiveness of competition for these services it is noteworthy that we have not received any submissions to suggest that this market is not delivering acceptable outcomes for consumers. However, the small consumer market presents different challenges than the market for industrial and commercial consumers. This might mean that the competitive market that exists for larger consumers is not suitable for small consumer groups.

The small consumer group includes many more consumers than the larger consumer group. There are many millions of residential and small business consumers that might be supplied with a AMI. In addition, these consumers are unlikely to have the resources or the familiarity that commercial and industrial consumers have to negotiate with a meter service provider. The implication of these characteristics is that individual negotiation may be costly and absent an effectively competitive market there is unlikely to be sufficient countervailing buyer power for efficient price and service offerings to be maintained. The factors relevant to whether an effectively competitive market for metering services might emerge for small consumers is discussed in the following section.

At the outset, it is relevant to note that the actual installation of the meter may not represent significant economies of scale under a monopoly approach. This is because the installation of a meter would remain driven by consumer choice. Therefore, it would not be the case that a distributor could install meters in every household a street at a time. These scale economies would eventuate, however, in a circumstance where there is a roll-out of meters at a particular location, based on a positive cost benefit analysis. There are, however, a number of areas where meter provision may exhibit the characteristics of natural monopoly, the most notable of these are:

- meter procurement
- meter maintenance and replacement
- communications and data management infrastructure, and
- complementarities with network functions.

Meter procurement

A LNSP is responsible for all consumers with in its geographic area. This means that it is able to deal with considerable volumes when purchasing equipment, including meters. The volumes that a distributor has might mean that it is able to procure the metering installation at lower cost than some other providers in a contestable market. The extent that this is an advantage is dependent, however, on how much choice the LNSP has over the meter type it purchases. As a LNSP is required to procure more meter types the volume benefits diminish. In addition, there would be greater regulatory complexity if the LNSP is required to provide a large variety of meter types.

Meter maintenance and replacement

Meter maintenance and replacement are services that occur at the location of the meter. This means they are geographically focused services. The geographic nature of the service might mean that it is more efficient for a single, or limited number of providers, to service particular locations. For instance, under monopoly provision there would only need to be a single team and single service centre for each location. A contestable approach would mean that there would be multiple meter service providers in a geographic region. Therefore, each contestable provider would need to make separate arrangements to maintain and replace meters they own, although a local contractor could be engaged by more than one meter provider to provide maintenance and service.

Having each of the contestable providers create separate teams and service centres for their meters on a geographic basis would reduce the chances for scale efficiencies materialising. This does not imply that it is not possible to achieve these scale efficiencies under a contestable model. Instead, a number of contestable providers might look to contract with firms that provide maintenance and meter replacement services at particular geographic locations.

Communications and data management infrastructure

Communications and data management infrastructure are essential for facilitating the communication of information from meters to retailers, distributors or other parties and back to the consumer. We understand that there are a number of alternative approaches that can be taken with respect to communications and data management infrastructure.[18] The issue of how material the economies of scale are for telecommunications and data management infrastructure in the context of meter provision will depend strongly on how much, if any, dedicated infrastructure is required and how much reliance can be placed on existing (or prospective) infrastructure.

There is already significant telecommunications infrastructure available for meter providers to draw on. This includes the mobile networks of companies such as Telstra, Optus and Vodaphone and potentially the infrastructure associated with the National Broadband Network (NBN). In addition, we understand that there are a number of firms that specialise in data management solutions. Where meter providers are able to draw upon this existing infrastructure it would enable them to contract for the amount of bandwidth or data storage they require. Obtaining services in this way would

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[18] Appendix 3 discusses the costs of the metering and communications systems.

facilitate a competitive market and mean that barriers to entry are reasonably low. However, in Victoria AMI has been rolled out with dedicated communications infrastructure. We understand this largely due to security issues and the bandwidth necessary to meet minimum functionality requirements.

It is also relevant to note that in the United Kingdom the government is tendering for a single company to provide communications infrastructure to support remote data acquisition and two-way communications to electricity and gas meters. This is being undertaken in a circumstance where meter provision will be a contestable service.

Complementarities with network functions

AMI can facilitate network businesses undertaking their functions more efficiently. This can be due to smart grid technologies such as improved fault response or better peak network management. Where there are strong complementarities between metering provision and network services it may be more efficient to place the services within a single entity. This would allow the full benefit of the complementarities to be captured without the transaction costs that would be imposed if the roles were undertaken separately.

Will competition to be sufficiently effective to deliver for consumers?

Even where a market does not possess strong natural monopoly conditions, it may nevertheless be the case that competition is not an effective tool in protecting consumers from inefficient price and service offerings. This can be the case where there are insufficient market participants, or insufficient rivalry, to put pressure on firms to price at marginal cost and to provide acceptable service quality.

Meters have not, to date at least, been a product that consumers have taken a strong interest in. Most small consumers would not know what type of meter they have nor its functionality; even those that have AMI. While this may change as electricity costs take up more of consumer's budgets, it means that consumers might not be sufficiently engaged to seek out different meter types, understand the costs and benefits of different meter functions, and to identify the lowest cost meter provider. If there are insufficient consumers seeking low priced and innovative products this might have consequences for the intensity of competition. This is because it is difficult and costly to engage consumers sufficient to choose your product. It may also mean that incumbent firms, such as a consumer's retailer, may be able to charge above efficient costs because the consumer is unlikely to make the effort to search for a better offer.

Where there are concerns about the effectiveness of competition in a market, the next relevant question is what, if any, oversight or regulation is needed so that consumers are provided with services at efficient prices. This might extend to the full regulation of a monopoly though to oversight on prices in a competitive market. We note that price cap regulation is applied in the retail electricity market in most jurisdictions as a means of protecting consumers while also seeking to facilitate a competitive market.

Introducing regulation into a market where competition is being promoted should, however, be undertaken with caution. This is because regulation itself can lead to distortions from efficient outcomes. As an example, if regulated price caps existed for meter provision, where these did not accommodate for differences in the locational costs of installing a meter, cross-subsidies might be created. These cross-subsidies, which would not exist absent regulation, may influence the incentives for contestable providers to offer metering services to some consumers, or the choice of meter provider by consumers.

4.1 Contestable metering roll out

Introduction

Under a fully contestable roll out model no entity has the exclusive right to be the person to provide metering services under the NER. The potential advantages of this type of model include:

- a large range of innovative DSP services, enable by metering technology, could potentially be offered to consumers;
- a reduced need to churn the meters when a consumer changes retailer;
- no need for the AER to regulate the return on metering services; and
- an incentive for metering services providers to be continuously innovating metering services that they provide.

The contestable model is driven by consumer choice. Investment in an AMI installation would occur when:

- a consumer accepts a package from a retailer that has time varying pricing and includes the provision of an interval (or smart) meter;
- a consumer accepts an offer to be part of a DSP related service, such as electric vehicle charging or direct load control of an air-conditioner, and that service requires a remotely read interval meter; or
- a consumer accepts an offer from another entity to provide metering services that include an interval (or smart) meter.

We expect that under the contestable model most investment in AMI would occur when a consumer accepts an offer from a retailer or to be part of a DSP related service. A few consumers who are sufficiently engaged may negotiate directly with a metering services provider.

Key design factors to be considered for a contestable roll-out

The key design factors for a contestable model for AMI roll out are:

How can inefficient meter churn be avoided under meter contestability?

As discussed above, as the retailers would need to undertake a contestable roll out of AMI under the current arrangements in the NER, there is a risk of meter churn whenever the consumer changes retailer. As a consequence of this risk the retailers would need to recover their metering costs over the length of the retail contract or run the risk of not fully recovering these metering costs.

This risk already exists in the NEM for large consumers that change retailers but in these instances the cost of metering is usually relatively small compared to the annual cost of energy. This is in contrast to small consumers where the metering costs could be a larger portion of the energy costs, thus making the potential inefficiencies from unnecessary meter churn more important.

Therefore, a contestable metering model needs to find a method of mitigating this risk, that is, to allow a consumer to change its retailer without automatically needing to have the metering installation replaced.

A possible means of mitigating this risk is to separate the role of meter provision (or from the retail energy contract. That is, the entity that is responsible for the metering installation need not be the current retailer that is financially responsible for the consumer.

This approach would rely on incoming retailers assuming the metering service contracts entered into by the outgoing retailer or directly by the consumer. To makes this work, would it be sensible for there to be a standing/default contract to govern the relationship between any retailer and any metering service provider, possible supported by NER obligations. This avoids the need for the contract to be renegotiated once the consumer switches retailer.

What should be the Responsible Person role?

Under the contestable model, the retailer could carry out the role of the responsible person, although the responsibilities may be slightly adapted compared to the existing role. Effectively the retailer would be responsible for ensuring that there is adequate metering and data services at each consumer's site consistent with the provisions of the NER. However there would be competition in who could provide both the meter provision service and metering data management service to that consumer site.

We note that, while the role is purely technical, the Responsible Person would require liability insurance as an error in the metering could result in a large financial liability for the retailer or the remainder of the market (depending on the nature of the error).

What should be the arrangements for existing meters where the LNSP is the responsible person?

As explained above, the LNSP acts the responsible person for accumulation meters (type 6) and manually read interval meters (type 5). Hence the LNSP provides the metering services and the data management services for the majority of residential consumers.

If a contestable approach is introduced, the question emerges regarding the treatment of LNSP's on-going metering services for the types of meters. Either the LNSP remains responsible for those services until the consumer (or retailer) decides to upgrade the meter (i.e. its role is grandfathered into the new provision). An alternative to be explored is whether the services for these existing meters are also opened up under the contestable approach. In this alternative, the regulated LNSP retain ownership of the meter but would be passive in how the metering services are provided to the consumer.

Possible model for a contestable AMI roll out

In this section we describe a possible contestable model for the roll out of AMI. It addresses the issues above and retains the ability of the consumer or its agent (the retailer) to choose when to upgrade its metering, who should provide the metering and what functions it should include. In the case where a consumer is required to have AMI (eg. their consumption is above a threshold) then the consumer or its agent would still be able to choose who provides the meter and the functions included.

Under this possible contestable arrangement:

- All new and upgraded metering installations would be classified as type 1 -4, that is remotely read interval meters consistent with the proposed minimum functionality specification.
- Metering services would be contracted for separately from the retailer's energy charges. It could happen either:
  - o when the retailer offers the consumer a package that includes time varying tariffs and metering services, but the metering services portion of the contact would be over a longer period so that the retailer can recover the metering costs over this longer period; or
  - o when the consumer accepts an offer directly from a metering services provider (we anticipated that this would not happen often as this implies a high level of engagement by the consumer), with the consumer accepting a separate energy offer from the retailer.
- If the consumer changes retailer then the new retailer would be required to:
  - o ensure that there was a suitable meter and data service at the consumer's premises, which would mean honouring any existing meter arrangements the consumer has entered into or installing a new meter (including paying any exit fees if there is an existing metering installation); and
  - o to reimburse the meter service provider and data service provider for the costs of the metering services, recovering these costs from the consumer.
- When an existing meter that is owned by the LNSP is being replaced, then there would be an exit fee. The objective of the exit fee is to assist the LNSP to recover of the stranded costs of the meters being replaced and to encourage a more efficient investment in AMI. As discussed above we are proposing that a flat regulated exit fee of 30% of an equivalent new accumulation meter.
- The consumer and the retailer with the consumer's consent can arrange for the metering to be replaced at any time (giving an agreed amount of notice). The consumer or retailer would need to pay any exit fees under the existing contract and establish a new metering service contract with a new provider. If the change is driven by the consumer then it must keep the retailer informed as it is responsible for ensuring that there is an appropriate metering installation at the premises.
- The metering services provider can transfer its metering responsibilities to another accredited provider if it no longer wishes to provide such services. Subject to the metering services contract, this transfer should be at no cost to the consumer and the consumer should be provided with a service that is equivalent or better than the service it is currently getting.
- AEMO would be required to prepare a procedure for accrediting metering service providers, in addition to the procedures for accrediting metering providers[19] and

[19] Metering Providers are responsible for installing metering equipment, as defined in clause 7.4.2 and schedule 7.4 of the NER.

metering data providers. [20] The procedure should include the requirements of the Responsible Person role in the NER and for the resolution of any inaccuracy found in a metering installation provided by an accredited provider.

Duration of the metering services contract

The metering services contract with the consumer would be over a period that is independent of the retail energy contract so that the metering services provider can recover its costs over a longer period. This longer period could be as long as the life of the metering equipment, which we believe is typically about 15 years.

We are proposing that the duration of the metering services contract should be left to a commercial decision by the provider. There is a natural trade-off between:

- a longer contract period - that spreads the costs over a longer time, making the annual charge smaller and making the service look more attractive, and provides the consumers with greater certainty in terms of their metering costs; and
- a shorter contract period – that allows the consumer greater flexibility in the future to upgrade its metering should more attractive technology becomes available at lower costs.

This is very similar to situation that exists with mobile phones were contracts are for one or two years, although we expect metering services contracts to be more likely to be five to ten years in duration, subject to competition and commercial pressure. Therefore, it is likely that some consumers would be wary of metering services providers that want to lock them into contracts over many years given that metering costs are likely to become lower as more AMI is rolled out both in Australia and overseas. It may also become common for metering services contracts to include an option for the consumer to extend the contract once the initial contract period is over (this may even be the default).

An alternative approach to leaving the form of the metering services contracts to commercial pressure could be to include standard contract conditions, such as minimum and maximum contract durations, in the NER. While this may restrict the possible commercial outcomes that could emerge it could re-enforce consumer protections.

Capturing network benefits – network payment or DUOS discount

The contestable AMI roll out model as it is described above would be likely to lead to an underinvestment in AMI both in terms of:

- the number of AMI installations being used; and
- the functionality of the AMI installed.

This underinvestment is likely because, as described above, the model does not include a mechanism for capturing the potential network operation benefits available from AMI. Note that the functionality could be addressed by including the functions

[20] Metering Data Providers are responsible for the collection, processing, storage and delivery of metering data and the management of relevant standing data, as defined in clause 7.4.2A and schedule 7.6 of the NER.

required to deliver these network operation benefits but this would add to the cost and hence be likely to lead to a smaller roll out.

A potential approach to improving the quality and quantity of the AMI rolled out could be to include a network payment (or DUOS discount) in the contestable model. This could operate where:

- the LNSPs can offer consumers in an area a payment (or DUOS discount) for installing an AMI meter with the appropriate functions;
- the size of the payment or discount would be determined through the planning undertaken by the LNSP and regulated by the AER; and
- consumers (via their metering service provider) would receive this payment or DUOS discount if they install the appropriate AMI and allow the LNSP to control the associated network operational functions.

Another benefit of including a regulated network payment or DUOS discount in a contestable model is that the LNSP is not required to estimate the benefits to consumers and retailers. Rather the consumer assesses the total benefits, including the network payment or DUOS discount, when determining its AMI investment.

We expected that allowing the LNSPs to compensate consumers for installing AMI meters would encourage a greater roll out of AMI, as well as increase the functionality of the AMI that is rolled out. When a consumer receives, via a retailer or metering services provider, an offer for compensation from the LNSP then this could:

- raise the consumer's awareness of the benefits of an AMI meter and from using a time varying tariff, ie to encourage the consumer to consider the benefits of exercising its choice or tariff and associated metering; and
- augment the overall net benefits to a consumer of installing an AMI meter, thus increasing the likelihood the consumer will agree to replace its metering installation with an AMI meter.

Also, consumers are more likely to make an efficient level in AMI investment if there is a mechanism that can potentially allow them to capture the value of network benefits in addition to the potential benefits of a time varying tariff.

Consumer choice

The contestable AMI roll out model is likely to give consumers a high degree of choice provided:

- sufficient metering service providers make offers to consumers;
- retailers engage with potential metering service providers to form retail packages that include time varying tariffs that are enabled by AMI;
- the LNSPs are able to identify the benefits from AMI in their networks and make attractive offers to install AMI through a payment or DUOS discount.

Consumers also have the choice under a contestable model not to use an AMI meter, although this choice may be removed from consumers if policy makers made time varying tariffs or network peak pricing mandatory for some classes of consumers.

One possible problem with a contestable model that is able to capture network benefits is that the model needs to be relatively complex. The majority of consumers would need to be sheltered from this complexity if it is expected that they will be able to make metering choices. Therefore, the retailers will need to actively offer consumers packages that include AMI meters if there is going to a high AMI penetration.

Promote competition where appropriate

The original NEM design principles are that the provision of all metering services would be contestable.[21] This principle currently applies only for large consumers in the NEM where type 1 - 4 metering installations are used and the Responsible Person for this installation is the retailer unless it accepts an offer from the LNSP. In practice the retailers can subcontract the metering services to an accredited third party provider (metering provider and metering data provider).

Currently most residential and small commercial and industrial consumers have a type 5 or 6 metering installation which is not contestable. This occurred as a transitional measure to ensure consumers had effective metering services for the commencement of the NEM. However, it may be an appropriate time for the original design principle to be applied in order to promote more consumer choice.

An important consideration when considering whether the provision of metering services should be contestable is whether there are sufficient potential metering service providers to make for meaningful competition. We consider that there are a large number of potential providers including:

- all the existing distribution businesses currently provide metering services within their geographic area and would be able to offer these services in other areas (distribution businesses would need to develop ring fenced commercial operations to provide contestable metering services);
- the existing Metering Data Providers and Metering Providers that are accredited with AEMO; and
- entities that currently offer metering services in other electricity markets worldwide.

Given the large pool of possible metering service providers it is likely that the provision of metering services could have sufficient competition to be contestable.

Maximise overall market efficiency

A contestable model that is operating effectively and able to capture network operation benefits would be expected to facilitate an efficient overall market. This is because the benefits of time varying prices and network peak charges can only be realised with interval meters. Therefore, consumers need to have access to such meters at an efficient price to be able to maximise the total market benefits.

Efficient pricing for AMI services

A contestable model would be expected to deliver efficient pricing if there is sufficient competition for the provision of metering services. Where each consumer has the

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[21] We engaged Phacelift to document the original design principles for the NEM metering arrangements. This document was circulated to the attendees at our metering workshop in Melbourne on 16th May 2012 and is published as Appendix A to this document.

choice of an assortment of equivalent metering services options from a range of providers we would expect prices to be efficient in the long term.

There is a risk that metering service prices could be inefficient if there is a market failure of some sought. In such a case consumers would have limited choices which could lead to higher prices and a slower roll out of AMI.

Minimise risk to market participants

The contestable model described in this section aims to minimise the risks faced market participants and consumers. In particular, separating the provisions of metering service from retail energy tariffs means that consumers can change retailers without a risk of the metering service provider not recovering their investment.

The risks to LNSPs are also minimal. They can recover the cost of any existing metering through an unbundled metering charge if the meter is not replaced, or through an exit fee and DUOS if the consumer chooses to install an AMI meter. It is also anticipated that the concept of a network fee, or DUOS discount, would introduce a material risk to the LNSPs as this would be regulated by the AER.

The main risks of the contestable model are:

- if there is a lack of competition leading to inefficient metering services costs;
- metering services providers are exposed to normal competitive pressures and, therefore, may risk having stranded assets if a competitor develops a product that is substantially cheaper than its assets (this is a normal risk in a competitive market); and
- that a natural monopoly exists for all or part of the provision of metering services.

Promote innovation and robust long-term solution

A successful contestable model for the provision of metering services would be competitive. This competition places a commercial pressure on the metering services providers to improve the metering services that they offer.

It is more difficult to impose an equivalent commercial pressure on a monopoly metering services provider.

4.2 Monopoly metering roll out

The overarching difference between the monopoly approach and the contestable approach is that network businesses would be the exclusive Responsible Person for metering installations and metering data services for small consumers. This does not mean that the roll-out of meters is mandated. Instead, whether a consumer has AMI or not will depend on arrangements for when meters are upgraded.

The absence of competition as a driver for efficiency means the price of a meter would need to be regulated by the AER. Given there would be a number of alternative metering types and configurations the AER would need to approve a list of prices.

Monopoly provision would also mean that there may need to be regulations for service performance. These must be in the form of obligations, such as strict timetables for installing a meter, or incentive arrangements that provide a distributor with either a financial reward or penalty for either achieving or failing to achieve certain performance parameters (i.e. meter reading and data provisions).

With respect to the monopoly roll-out of AMI by network businesses, we note:

- The simplicity of the monopoly approach could likely drive the quickest penetration of AMI
- Where could be economies of scale under the monopoly approach
- A challenge of a monopoly approach is ensuring that the efficiency benefits of a single provider are passed onto consumers. It might be hard for the regulator to set the efficient price for metering services.
- There are potential complementarities between meters and network functions. A monopoly roll-out through the NSP is likely to be the most efficient approach to capturing the network operational benefits.
- Innovation in metering capability and services might be slower under a monopoly approach. However is might be facilitated by giving consumer agents, such as retailers and other third parties, a direct role in selecting meter types.
- Regulation of performance and service quality may be an issue.

The remainder of this section considers the monopoly approach against the principles outlined earlier.

Consumer choice

The monopoly model would still focus on maintaining consumer choice regarding the timing of installation and type of meter installed. However, unlike the contestable model competition would not put pressure on the distributor to provide a variety of meter types with different functionality. Having consumer agents, such as retailers or other 3rd parties, choose a list of suitable meter types on a period basis may facilitate consumer choice, meter innovation, and minimise the costs of regulation. The option of having consumer agents choose the list of metering types is discussed further under the innovation section.

A monopoly meter provider would likely have the incentive to choose only one meter type and roll this out to all consumers. This would allow it to purchase meters at scale and reduce any costs associated with parts or meter maintenance. The minimum functionality specification for metering would ensure that consumers are at least provided with a meter that delivers key functions such as time of use measurement and remote reading. While this outcome might be efficient from the perspective of the monopoly business, it does not promote the full range of choice for consumers, which is a fundamental objective of this review. This means that some form of regulation is required so that consumers are provided with a meter of their choosing.

In Appendix B we discuss the minimum functional specification for an AMI roll out. We are proposing that there be a minimum functionality specification that includes the functionality necessary to meet the NER metering requirements. We also discuss including additional non-metering functions (such as remote energisation/de-energisation and direct load control). Having a minimum functionality specification that only includes metering functions would enable the widest scope of consumer choice but this approach may increase the overall costs of rolling out meters and the costs of regulation.

- The cost of rolling out meters might increase because a distributor would not be able to make use of the scale economies available to it. That is, it would not be able to have an inventory of a limited number of meter types that it could purchase at scale. Purchasing the meters at scale implies that they can be procured at lower cost than purchasing individual units.
- The costs of regulation might increase because the AER would need to either make a price determination for each meter type chosen, or estimate an average cost for certain categories of meters. Determining a cost for each meter would impose an obvious administrative cost. Determining an average cost might mean that consumers do not receive an accurate price signal and it also increases the scope for cross-subsidies between consumers to exist.

A pre-determined list would accommodate a distributor taking advantage of scale purchases of meters. In doing so, however, it would also limit consumer choice to some extent. We note, however, that even where a list approach to meter provision costs is chosen, consumers may still be provided the opportunity to divert from the list in specific circumstances. It is not obvious, however, what these circumstances might be or why the consumer would need to divert from the list of options.

Promote competition where appropriate

Choosing the monopoly option implies that a finding has been reached that it is more efficient for a single firm, rather than two or more, to roll-out AMI. This does not mean that competition does not still have a role. Under a monopoly provision model it may be possible that the distribution businesses would issue tenders for 3rd parties to undertake some roles, although it may difficult to require this in practice. In addition, the presence of an advanced meter and its associated data will likely facilitate new innovative services for consumers that can be provided by a competitive market.

While a distributor would have a monopoly over providing a meter it might be expected that they would nevertheless contract with third parties for keys parts of the service. Obviously this would include the manufacture and supply of the meter. However, it might also extend to the installation of the meter as well. Indeed, it is common practice for network businesses to issue tenders for the construction of network assets. A distributor would undertake this practice where there are incentives within the regulatory framework to minimise cost. It is relevant to note that even though a monopoly has responsibility for meter provision, where it subjects part of this service to competitive tender, the efficient costs of providing the service will be revealed.

The installation of AMI would allow for data to be developed that is useful for other applications. These applications might include direct load control, real time in-home information or smart appliances. While obtaining the full benefit of these services might rely on AMI being available, they do not need to be provided through the meter itself. As such, even though a distributor might have a monopoly over meter provision, retailers and third parties would be able to continue to offer innovative technology and product solutions to consumers.

Efficient pricing for AMI services

A key concern with monopoly provision is that that the lack of competition provides the opportunity for a firm to price above cost and let service performance deteriorate without fear of consumers switching to an alternative provider. As indicated above, this provides the case for price and service regulation.

An advantage of price regulation is that it allows a regulator to ensure prices are set to achieve certain objectives. An important principle is that those that cause costs pay, while those that create broader benefits are compensated. That is, for consumers to be able to make an efficient decision about whether to install AMI or not they need to face the true cost of the investment and also be able to realise any associated benefits they create. There are a number of challenges in achieving this for AMI.

Costs of installing AMI

The first challenge for developing a regulated charge for AMI is to identify what are the incremental costs of the change of meter. The incremental costs in this instance are the costs associated with the new meter, an attribution of common costs for AMI and any unrecovered costs associated with at consumer's existing meter.

There is a risk under a monopoly approach is that the actual costs of AMI are not easily identifiable and efficient prices are not set. Under a monopoly approach the AER will need to make an assessment of whether a business' pricing proposal is efficient. However, as with all regulated businesses there is an asymmetry of information between the regulated and the regulated business. This means that a regulator may set a price that is either too high or too low. Both of these outcomes could have efficiency consequences.

The fact that a regulator does not have all the necessary information to set an efficient price for AMI adds weight to the use of incentives to encourage cost efficiency. Financial rewards and penalties associated with AMI expenditure would work to encourage businesses to be efficient and in the process reveal the efficient costs of providing the service.

Benefits of installing AMI

Ensuring consumers are rewarded for any benefits they create is considerably harder than allocating costs. Costs are typically incurred up-front and are therefore more certain. The benefits of AMI will accrue over time and some of the benefits will only accrue when there is sufficient penetration of AMI. In addition, it is sometimes more difficult to identify which parties directly cause benefits.

We note that a similar issue exists with embedded generators. The Rules recognise that while there are costs associated with the connection of an embedded generator, and their proponents should incur these costs, their installation can also create benefits. The benefits in this case are potential avoided transmission costs. As such, the NER allow embedded generators to receive a benefit equal to the size of any benefit they create, which is considered to be equal to the locational component of transmission use of system charges.

The approach to compensating embedded generators for the benefits they are perceived to create is not perfect. In particular, it requires a forecast of whether the embedded generator is expected to be generating at times of peak demand. In this case, however, we have previously taken the view that an imperfect subsidy was likely to be more efficient that providing no subsidy at all. This is because the subsidy might be expected to encourage embedded generators to locate in areas where they avoided the most transmission costs.

Minimise risk to market participants

The risk to market participants from a monopoly roll-out will be directly related to the regulatory framework that exists. That is, the regulatory framework can either confer more or less risk on network businesses. In some instances more risk might be desirable, for instance through incentive schemes to encourage efficient behaviour. Some risks, however, may want to be minimised, such as the risk of cost recovery.

Promote innovation

A concern that has often been expressed against a monopoly approach to metering provision is that it might not promote innovation in meter type. As indicated above, it might be expected that much of the innovation that could occur would be around the metering installation, rather than the meter itself. Therefore, the extent that meter innovation is an issue is not necessarily clear. Nevertheless, it would still be important to encourage innovation in meter types where this would deliver benefits to consumers. Having consumers' agents, such as retailers and other third parties select meter types on a periodic basis might be expected to overcome any concerns about innovation in meter type.

The key reason innovation is not expected under a monopoly model is that competition would not provide any pressure for the network business to introduce new products that might be desirable by consumers. In addition, it is difficult for regulation to encourage innovation. This is particularly the case with a technology such as metering where the costs are certain but the benefits are particularly uncertain given the depend on the behaviour of consumers.

One way to encourage innovation might be through the more direct role of consumer agents in choosing the metering options that are available. As identified above, retailers, or other third parties, might be asked to assist the network business, and the AER, in the development of the menu of meters available for consumers. These participants could be asked on a periodic basis if any meters should be either added or removed from the list. Facilitating this involvement from retailers or third parties will be important given they are the ones that will market the meters to consumers.

Robust long-term solution

A regulated solution could be expected to be robust over the long-term. As identified above, the risk associated with a regulated solution is mostly dependent on the regulatory framework that exists. On that basis, improved certainty on matters such as cost recovery will enable a robust outcome over time.

One issue that may arise over the longer term is whether the distributor's role as a meter provider means it is able to encroach on future competitive services. Having responsibility for the meter and its data may mean that a distributor is able to foreclose on alternative providers offering services to consumers. For this reason, a framework that allows appropriate access to the meter, its data, and consumers will be necessary.

5 Recommendations and possible model

More analysis and stakeholder analysis is necessary to determine which model is more efficient. Therefore, the purpose of this section is to summarise a set of recommendations which should be made irrespective of the roll out model and to set out a possible approach for stakeholder comments.

5.1 Recommended changes irrespective of roll out model

While it is difficult to develop a firm recommendation of model of AMI roll out, we are making the following recommendations that should apply irrespective of which AMI model is adopted.

Unbundling metering costs from DUOS

We recommend that metering costs should be unbundled from DUOS for existing LNSP owned metering installations. This will allow AMI to be installed without the consumer being required to pay for both the existing meters and the new AMI installation. Currently unbundling occurs in ACT, Victoria and South Australia. The AER is proposing that unbundling be introduced for the New South Wales distribution businesses with metering becoming an alternative control service under their next revenue determination. Unbundling of metering costs from DUOS

Under any model it is important that the metering charges for existing meters owned by the LNSP to be unbundled from DUOS. This allows consumers to:

- install AMI knowing that, subject to any exit fee, they will only be charged for the new metering installation; and
- consider the costs of AMI compared to their existing metering charges, thus to better assess the potential benefits of moving to a time varying tariff.

Transparent exit fee

There should be transparent, standard exit fees for those consumers that wish to replace an existing metering installation with AMI. These fees should approximately reflect typical unrecovered metering costs of the LNSP.

Making smart meter functions contestable

The functions of smart meters that are in addition to meter provision and data management should be contestable as there is a variety of potential third party vendors for these services (eg IT and telecommunication companies). This needs to be supported by appropriate interoperability provisions.

Remove the possibility of a government mandated roll-out

We recommend removing the provisions of the NEL that allow a government mandated roll out of AMI. The threat of such a possible mandate is a disincentive for a commercial roll out. Any investment in AMI would possibly become stranded should the associated government mandate a roll out by a specific entity.

Remove distinction between metering types based on LNSP exclusivity

We recommend that exclusivity of the provision of metering installation should not be based on the type of the meter. In particular we recommend that all meters should be remotely read except when it clearly impractical to remotely read the meter.

Currently LNSPs install manually read interval meters in preference to remotely read ones because the provision of remotely read metering installations is contestable. We consider that choice between remote and manual meter reading should be made on the basis of costs and the advantages to consumers and retailers of the faster access to metering data provided by remotely read meters. The method for reading the meters should be independent of the regime for who is responsible for meter provision.

5.2 Proposed model for discussion

To promote discussion on the potential arrangements necessary to encourage the roll out of AMI, we are putting forward a model for consultation. Under this model the provision of metering services would be contestable. One possible exemption to this could to allow a network business to roll out AMI in its geographic area, as part of its DSP programs. We recognise that further analysis and consultation is required.

Our proposed model would work as follows:

- small consumers have the right to upgrade their metering installation;
- small consumers have the right to contract with any accredited provider for the provision of metering services;
- in most cases we envisage that the consumer will not actively exercise these options, but in such circumstances the retailer is responsible for ensuring the metering installation reflects the consumer's needs;
- if the consumer changes retailer for the supply of electricity it would not be required to change its meter;
- the current retailer at the consumer's premises would be responsible for the costs of metering and managing metering services providers on behalf of consumers;
- in the situations where we advise that an interval meter should be installed (ie consumers above a threshold) the current retailer is also responsible for ensuring that such meters are installed in a timely manner;
- the consumer will be liable for the costs of the metering and associated services over the life of the metering contract;
- the network businesses can offer a discount on DUOS or one-off payment to those consumers who also install meters with additional functionality which delivers network operational benefits;
- any non-metering services relating to the meter (ie energy management services) will be contestable and can be provided by any third party provider. Our proposals regarding metering data access, as set out in chapter 2 of the draft report, will support this; and
- the local distribution network business has the option to do a roll-out of smart meters as part of its DSP programs to defer network augmentation. In this situation the network business is responsible for providing metering services (ie the metering

installation and data services) to the consumer and would face performance obligations. The retailer would still be responsible for managing the services on behalf of the consumer.

We favour a contestable approach because meter provision does not have the characteristics of a monopoly service and we consider it will drive innovation and metering services at a lower cost. This is more likely to deliver an outcome consistent with the NEO. A number of third parties have indicated to us their keenness to enter this market and provide efficient solutions to consumers.

Work is needed on the detail and practicalities of this approach. There is also an issue whether a contestable roll out is simple for the consumer to understand and participate with. We are keen to work with all stakeholders to develop these issues further.

APPENDIX A Original design principles used in developing the metering arrangements (chapter 7) of the National Electricity Rules

This Appendix was prepared by Phacelift Consulting Services.

1. Background

In 1994 the National Grid Management Council established a project to develop the rules for the proposed (and imminent) wholesale National Electricity Market ("NEM"). The project was generally resourced from teams of Power Company representatives, with each team given a topic around which rules were required to be developed.

Chapter 7 of the NER was developed during the 1994 and 1995 period by a team of cross jurisdictional representatives with metering knowledge spread across transmission, distribution and large customers ("the Chapter 7 design team").

The objective of the Chapter 7 design team was to develop a set of rules that enabled revenue standard metering to be applied to the NEM for jurisdictional customer tranches 1, 2 and 3. The lower limit of tranche 3 was 750 MWh, and this was adopted by the Chapter 7 design team. This limit was subsequently extended to zero MWh in Chapter 7 as part of the ACCC approval process.

The new rules needed to be mindful of the role of the National Measurements Act (Commonwealth legislation) and the various Weights and Measures Acts (jurisdictional legislation) that were in place to govern the use of electricity meters for revenue purpose - and the bodies that administered these Acts. As a consequence, it became clear that Chapter 7 was not going to be a stand-alone instrument, but rather would exist in concert with those other instruments. The role of Chapter 7 was to provide detail specific to electricity measurement (consistent with the relevant measurement legislation) so as to avoid duplication of instruments, including processes for accrediting meter installers and metering installations.

Physical infrastructure:

In 1994 and 1995, power companies in the pending NEM jurisdictions were either vertically integrated (fully), vertically integrated (partially with commercial interfaces between transmission and distribution) or in the process of being unbundled into unique commercial entities.

In each of these infrastructure arrangements, there were many points of supply (both at the generator/transmission interface and the transmission/distribution interface) where metering was installed, either not to revenue standard, or if to revenue standard, not suitable for settlements of the wholesale market.

Consequently, Chapter 7 was required to accommodate:

(a) A transition of supply point metering technology to revenue standard and NEM specification;
(b) The application of new supply point revenue metering technology to NEM specification;
(c) Certainty that revenue metering technology to NEM specification would be rolled out as quickly as possible without unreasonable delay.

Point (c) was particularly important as the new revenue metering technology for tranches 1, 2 and 3 were required to have their metering data collected daily and settled by the Market Operator on a weekly cycle. This part of the NEM specification dictated the use of remote electronic communication systems, which in-turn required assistance from public telecommunication companies. The possibility of a delay in the roll out of NEM compliance revenue metering technology was considered a material risk to the commencement of the wholesale market.

Resources to roll out NEM revenue metering technology:

The team identified 3 resource options in deciding how the NEM revenue metering technology would be rolled out:

(i) Centrally controlled roll out by the Market Operator;
(ii) Commercially controlled roll out by NEM participants;
(iii) Commercially controlled roll out by independent third parties.

The choice between these options was guided by the following principles:

- The principle of economies of scale – this principle offered the benefits of lower cost through higher volume purchasing and administration efficiencies, but uncertainties around slower rollout due to management of stranded assets.
- The principle of innovation – this principle offered the benefits of fast roll out due to flexible purchasing decisions based on winning customers, but higher cost due to the impact of new technology prices.
- The principle of resource congestion – this principle recognised that risk trade-offs existed between using resources that were concentrated in a single entity versus using resources that were distributed across multiple entities.

The choice between options (i), (ii) and (iii) was also guided by one overarching market design requirement, which was to limit the concentration of resources in the pending new Market Operator to ensure that this entity was not deflected away from its primary purpose, which was to manage the commencement and on-going development of the wholesale market.

Adoption of the 'metering installation' concept:

To satisfy the National Measurement Act, Chapter 7 had to establish integrity in the process that transferred the measurement from the power conductor to the value recorded on the customer's bill (being the Market Participant for the NEM). This was achieved by separating the process into two steps. The first step was to measure the electricity flow in the power conductor and make this measurement data available for collection using remote electronic communication systems. The second step was to collect the measurement data using that communication system and process the data to ensure its integrity on route to the Market Operator's settlement system.

The interface between these two steps was chosen as the point where the measurement data first met the public telecommunications network ("the public telecommunications boundary") on route to the settlement system. During the first step, the data was termed 'energy data' and during the second step the data was termed 'metering data'.

The term used to describe the first step was 'metering installation'. The term used to describe the second step was 'data collection system'.

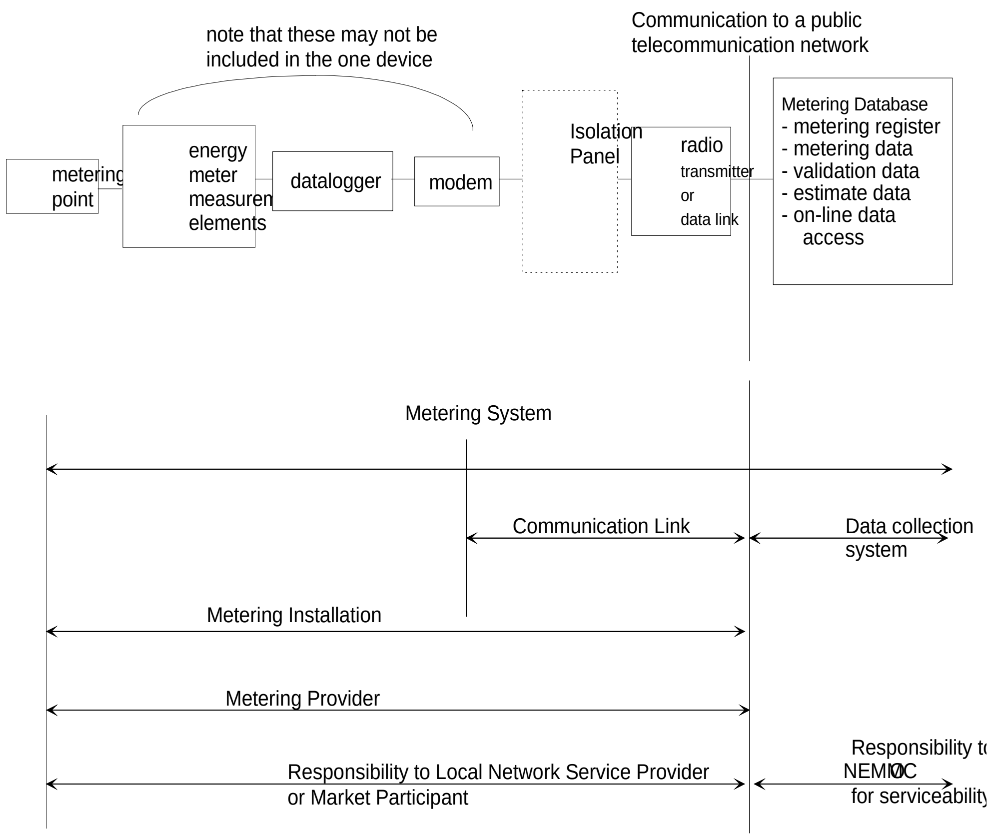
In the first step, the metering installation included several different components, such as a Voltage Transformers, Current Transformers, wiring, one or more measurement elements, one or more data loggers (recording devices), a communication modem and an isolation transformer. Note that the term meter was separated into its two physical characteristics (measurement and recording) – this provided maximum flexibility for innovation rather than the use of the term 'meter'.

Within the metering installation, the components of communication modem and isolation transformer were given the title of communications link. The communications link could also include a private communications system for transferring energy data from a site to a remote location and the storing of that data in a remote database, where access to that data could be given via the public telecommunications network. This intent was clearly recorded in the Schedule 1 diagram in Chapter 7 and the definition of communications link, which was:

> "All communications equipment and arrangements that lie between the *meter / data logger,* and the public telecommunications network"

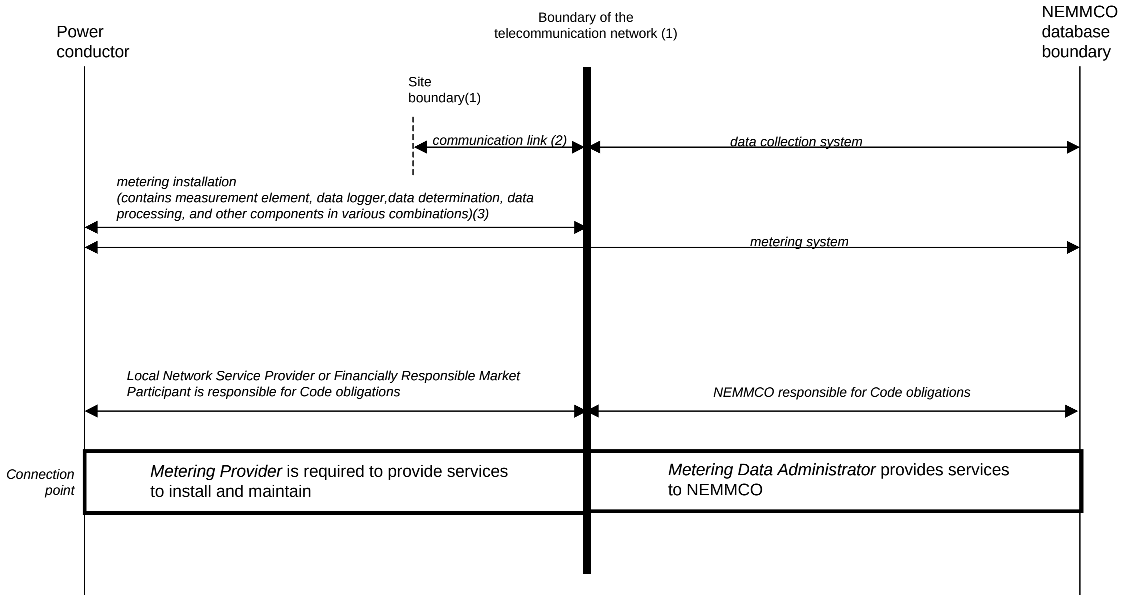
The diagram is reproduced twice below for ease of reference. The first diagram was included in the original ACCC approved version of the Code, as released in 2000. The second diagram appears in a 2005 version of the Code (after changes were made for the commencement of FRC). Whilst there was some tidying up of the diagram during the FRC rule changes, the definition of metering installation and communications link didn't change. Both versions indicate that the communications link can include a radio transmitter or some other form of communication (data link).

2000 version:



2005 version (note that the explanation of the communications link appears in a footnote to the diagram):

Schedule 7.1 - Responsibility for Metering



Note (1): the site boundary and the boundary of the telecommunications network may be the same point
Note (2): indicative position only. The communications link may contain a transmitter and receiver, isolation panel, modem, database, other suitable technology, data processing and/or data transfer process(s). There may be more than one communication link within a metering installation.
Note (3): the data logger may be local or remote to the site on the power conductor. It may be internal or external to the device containing the measurement element.

In summary, the term 'metering installation' was coined to represent one part of the process in getting measurement data from a power conductor to a customer's bill. This term closely replicated the requirement in the National Measurement Act to demonstrate that there was integrity in the measurement data as it undertook its journey. Devices within the metering installation could then be transparently regulated via Chapter 7.

Concept of responsibility for the 'metering system':

During the 1994 & 1995 period, the intent of the Chapter 7 design team was to have one person responsible for the integrity of the process that commenced at the power conductor and finished at the Market Operator's metering database (the combined metering installation and Data Collection System processes). The combined process was named the 'metering system', as shown in the above diagrams. It was agreed elsewhere that the Market Operator would be responsible for integrity of the process from the metering database to the customer's bill - the settlements process.

The concept of a single person being responsible for the metering system was challenged by the different risk profiles allocated to the metering installation responsibility and the Data Collection System responsibility. The Data Collection System was considered to be closely aligned to the settlements process and it was agreed to be of a higher risk to market failure and consequently should be the responsibility (initially) of the Market Operator. Conversely, the metering installation responsibility was considered a lower risk that was mostly associated with inaccurate measurement devices, or data logging failures. It was agreed that a Market Participant should accept responsibility for this risk. Hence, the concept of the 'responsible person' was introduced into the design of Chapter 7.

It is noted that in the 2010 Rules changes to Chapter 7, it was agreed to adopt the single person responsibility concept for the combined metering installation and the Data Collection System. This change was based on market experience where it was considered that the risk to the settlements process had been addressed by industry maturity and improvements made to data collection systems by the Market Operator.

Metering changes to accommodate Full Retail Competition:

Once the NEM had commenced in Dec 1998, attention moved to the rollout of Full Retail Competition (FRC) in all NEM participating jurisdictions. In the period 2000 and 2001 modifications were made to Chapter 7 (via the Code change process) to accommodate metering to consumers with loads <160MWh (or similar) per annum. These modifications were developed in workshop consultation with jurisdictional representatives.

All jurisdictional representatives wanted their historical practices retained at the commencement of FRC, which meant incorporating the existing accumulation meter stock into the rules, as well as the emerging interval meter that was manually read.

The common compromise reached with all jurisdictional representatives was to recognise:

- the manually read interval meter as a ‘type 5’ volume for purposes of metering installation component accuracy;
- the manually read accumulation meter as a ‘type 6’ volume for purposes of metering installation component accuracy;
- those special situations at connection points where no meters were installed as a ‘type 7’ volume, but subject to specific conditions, including that the load for a type 7 metering installation would be miniscule, subject to Ministerial approval, and not encouraged to be propagated as a viable option for future metering installations (these conditions were included in Chapter 7, along with examples or miniscule loads).

The lower boundary value for the volume to be applied to the type 5 metering installation was unanimously chosen as zero. However, a common view on the upper boundary value was not able to be reached as a unique number. Instead, it was agreed that the maximum upper boundary would be 750 MWh (which was the upper boundary for the type 4 metering installation) and that the actual value would be flexible for each jurisdiction.

To incorporate this flexibility into the rules, the ‘x’ factor was adopted. Likewise, for the type 6 metering installation, a ‘y’ factor was adopted with the maximum upper boundary set at 750 MWh and the lower boundary set a zero.

To regulate the ‘x’ and ‘y’ factors, the use of a documented procedure was adopted (this procedure became known as the ‘metrology procedure’, with each jurisdiction having responsibility for producing their own metrology procedure (and hence the ‘x’ and ‘y’ factors) at the commencement of FRC.

In producing their metrology procedures, each jurisdiction chose an ‘x’ and ‘y’ factor to equal their current FRC tranche value, nominally 160 MWh.

In agreeing to the ‘x’ and ‘y’ factors, the jurisdictional representatives recognised the following key points:

- The ‘x’ and ‘y’ factor flexibility permitted the jurisdictions to progressively lower these factor values over time so as to eliminate the use of manual meter reading in favour of the type 4 metering installation which had remote reading capability. The move to remote reading was to provide retailers with the opportunity to reduce their working capital that arises with a weekly NEM settlement payment and a quarterly (in arrears) recovery from consumers. A reduction in working capital represents an industry efficiency improvement. This efficiency improvement would be in the long term interest of consumers, as the efficiency should be passed on through lower prices.
- The type 5 and type 6 metering installation practices would be eliminated as soon as possible. To this extent, the *Rules* [*Code*] carried the following paragraphs:

  7.13(f): the *Jurisdictional Regulators* must, by 31 December 2003, jointly conduct and complete a review of *metering installations* types 5 and 6 and the *metrology procedures* that have been implemented in the *participating jurisdictions*.

  7.13(g): The review conducted in accordance with clause 7.13(f) must:

  (1) in relation to *metering installations* types 5 and 6:

  (i) consider whether barriers exist to consumers adopting economically efficient *metering* solutions or other economically efficient technology and examine whether *meter* ownership acts as a barrier to end users switching retailers;

  (ii) if it is determined, in accordance with clause 7.13(g)(1)(i), that barriers exist, the review must make recommendations in relation to reducing those barriers, in order to promote the adoption of economically efficient solutions for example, recommendations regarding the accelerated replacement of type 6 *meters* with type 5 *meters* and/or the sun setting of load profiling;

  (iii) include in the economic analysis the cost to consumers of any stranded assets;

  (iv) take into account any jurisdictional requirements in place at the time of the review in relation to new and replacement *meters*; and

  (v) consider the effect of implementing a *metering* solution on consumption decisions made at the wholesale level and how this filters through to retail pricing;

  (2) consider options for developing a single nationally consistent *metrology procedure* for each of *metering installation* types 5, 6 and 7;

  (3) propose to *NECA* any changes to the *Code* that are necessary to implement the recommendations made by the review; and

  (4) specify a date for a further review to be conducted.
- The DNSPs had responsibility for these historical practices. To manage a smooth transition, it was decided to provide the DNSPs with continued responsibility for type 5, 6 and 7 metering installations (as the exclusive Responsible Person) but

only on a temporary basis. This was achieved by placing their exclusivity as a jurisdictional derogation in the *Rules* [*Code*].

The intent of the decisions for FRC metering can be brought into focus by examining clause 7.13(g)(1)(ii) above. It states in part: "…in order to promote the adoption of economically efficient solutions for example, recommendations regarding the accelerated replacement of type 6 *meters* with type 5 *meters* and/or the sun setting of load profiling…". When the Jurisdictional Regulators subsequently undertook their review, their recommendations (in 2004) substantially changed the emphasis of this latter paragraph, replacing both 7.13(f) and 7.13(g) with the current clauses 7.13(g) and 7.13(h), which state:

7.13(g): The *Ministers of participating jurisdictions* must, by 30 June 2009, conduct and complete a review of type 5 and 6 *metering installations* and the *metrology procedure*.

7.13(h): In undertaking the review referred to in paragraph (g), the *Ministers of the participating jurisdictions* may:

(1) review the outcomes from the Joint Jurisdictional Review of Metrology Procedures: Final Report of October 2004 ('**the JJR report**') and identify any outstanding issues from the JJR report;

(2) make recommendations to resolve any outstanding issues from the JJR report;

(3) identify any additional barriers to the adoption of efficient solutions and make recommendations to reduce those barriers; and

(4) have regard to the need to maintain the regulatory certainty, in recognition that regulatory uncertainty is itself a major barrier to the adoption of efficient solutions.

The 2004 review recommendations also requested that the temporary jurisdictional derogations for DNSP be made permanent by transferring the jurisdictional derogations from Chapter 9 into Chapter 7, making this provision a permanent arrangement.

Whilst it is noted that the Jurisdictional Review in 2009 has not yet taken place, the National Smart Meter program undertaken by the MCE can be considered a suitable replacement, as it will remove the need for both the type 5 and type 6 metering installations.

2. Design principles

In consideration of the above background, the Chapter 7 design team identified the following set of principles to be applied in the design of the revenue metering rules. Each principle was endorsed by the NGMC Project Steering Committee, either individually or in groups, depending on the significance of the principle:

Economically related principles:

(a) The principle of innovation was chose to guide the choice of option. It was determined that the focus on achieving a roll out as quickly as possible was more beneficial to all parties due to the increase in certainty of a successful market commencement and early development.

(b) The option of NEM Participant (Market Participants or registered Network Service Providers) involvement in revenue metering technology roll out was chosen for the sole purpose of managing the detrimental financial impact on all NEM participants that might occur at a point of supply if the revenue metering technology was incorrectly installed. This decision provided the market with one party who was responsible for the accuracy of the metering data in a pool based settlements methodology where inaccurate data at one location impacted all participants. The party who adopted this responsibility was known as the Responsible Person. This decision was supported by the following supplementary principles:

(1) The principle that each Local Network Service Provider would have responsibility for the provision of metering installations to Market Participants in its local area and the installation and maintenance of those metering installations unless otherwise elected by the Market Participant, was adopted. This was known as the default position, and was introduced to remove the risk of a small Market Participant not being able to obtain a metering installation.

(2) The principle that each Market Participant could elect for a registered Metering Provider other than the Local Network Service Provider to provide, install and maintain its metering installation, was adopted. This meant that a Retailer could control the timing of the roll out of the metering installation in accordance with its customer's requirements if it so chose. If the Market Participant made this election, it became the Responsible Person. If it chose not to take on this responsibility, the default responsibility position would then need to be adopted in which case the relevant Network Service Provider became the Responsible Person.

(c) The principle that a third party be involved in revenue metering technology roll out was adopted for the purpose of maximising resource distribution and hence increased certainty that metering technology could be installed in multiple supply points in multiple jurisdictions as quickly as possible. This decision was supported by the following supplementary principles:

(1) The principle that metering installations must be installed and maintained by Metering Providers was adopted. This principle also required Metering Providers to be:

- Engaged by the Responsible Person; and
- Accredited by and registered with the Market Operator.

(2) The principle that the Market Operator be responsible for the collection and processing of metering data for use by the NEM settlements process was adopted. This principle was a complement to the metering installation responsibility principle (except that one party had exclusive responsibility) and was adopted to manage a perceived risk of a NEM settlement delay due to the inability for the Market Operator to obtain metering data.

This principle was tightly coupled to the principle that the Market Operator could engage agents (subsequently know as Metering Data Agents, MDA) to perform the metering data collection and processing role. The Market Operator established contractual arrangements with MDAs to perform data collection and processing duties in accordance with standards established with the Market Operator but under commercial contracts with financially responsible Market Participants.

(d) The principle that metering data would not be owned by any party was adopted. Instead, access rights would be provided to parties in accordance with their role in the NEM. In particular:

(1) Market Participants were entitled access to the metering data in respect of their own production or consumption of energy for which they were responsible;

(2) Each Network Service Provider was entitled to access metering data in respect of metering points on their network;

(3) Consumers could obtain access to their metering data, but only through a request to their financially responsible Market Participant.

(e) The principle that historical practices would be grandfathered was adopted, but with the intent to unwind these practices as soon as possible. To this extent, jurisdictional Ministers (in regard to the x and y factors) and Jurisdictional Regulators (in regard to type 6 practices) were transparently engaged in the rules to lead this transition.

Regulatory related principles:

(f) Elsewhere in the developing rules, the NEM relevant supply points were termed 'Connection Points'. These are points of supply established between *Network Service Provider*(s) and another *Registered Participant (Retailer or registered NSP), Non-Registered Customer* or *franchise customer.* Based on this definition, the principle that each Connection Point must have a metering installation was adopted to address the requirements of the National Measurements Act.

One matter requires clarification in applying this principle:

- Where a point of supply exists at the interface of a Network Service Provider (that is not registered) and a franchise customer or non-registered Customer, that point of supply can't be defined as a Connection Point. Consequently, at this supply point, the provisions of chapter 7 are not enforceable.
- Consequently Chapter 7 is silent on how Chapter 7 is to be applied to these supply points and will only apply if there is industry agreement that adopts the Chapter 7 provisions at these points of supply.
- Subsequently to the commencement of the NEM and FRC, the Market Operator obtained industry agreement for guidelines to be applied to these non-registered Network Service Providers (known as exempt embedded networks). As an aside, the strengthening of the guidelines

by bringing them into Chapter 7 would be beneficial in the future use of this type of network.

Technically related principles:

(g) The principle that the type of *metering installation* at each *metering point* was to be determined in accordance with the annual amount of *active energy* passing through that *metering point* was adopted. This principle underpinned the formation of metering installation types 1, 2 3 and 4.

(h) The principle that costs associated with a *metering installation* was to be borne by the *Market Participant* was adopted.

(i) The principle that metering installations must be registered with the Market Operator was adopted. This principle was underpinned the formation of the Metering Register.

(j) The principle that energy data must be collated in trading intervals was adopted.

(k) The principle that energy data be based on units of watthours (active energy) and where necessary varhours (reactive energy) was adopted.

(l) The principle that the electronic accessibility of each metering installation must be co-ordinated by the responsible person to prevent congestion was adopted.

(m) The principle that check meters, in specified circumstances, be used to provide metering data when revenue meters fail was adopted.

(n) The principle that historical data be maintained in the metering database:

(1) for 13 months in accessible format; and

(2) for 6 years in archive,

was adopted.

(o) The principle that the Market Operator be responsible for auditing revenue metering installations and check metering installations be adopted.

(p) The principle that the Market Operator establish a registration process to facilitate the application of this Chapter 7 to Market Participants and Network Service Providers in respect of:

(1) new *metering installations*;

(2) modifications to existing *metering installations*; and

(3) decommissioning of *metering installations*, including the provision of information on matters such as application process, timing, relevant parties, fees and *metering installation* details was adopted.

This principle underpinned the development of the Metering Administration System (MAS) and its subsequent replacement (MSATS).

Appendix B Minimum Functionality Specification for metering in the NEM

This Appendix was prepared with the assistance Phacelift Consulting Services.

Introduction

The National Electricity Rules (*Rules)* currently contains a minimum functionality specification for electricity meters used for revenue purpose. The minimum functionality specification is contained in Chapter 7 of the *Rules*. For electricity volumes greater than 1,000 GWh per annum down to zero MWh per annum, the following functionality applies:

Chapter 7 minimum functionality specification**:**

(a) A visible display with at least accumulated active energy able to be read in the display;
(b) A least one measurement element which is accurate within specified limits;
(c) A communications interface;
(d) Electronic / remote data transfer facilities (for nominated types of meters);
(e) Specified security arrangements;
(f) Bi-directional energy measurement;
(g) A measurement element for active energy is mandatory. A measurement element for reactive energy is discretional.
(h) Storage of measurement data in the meter, with a minimum of 35 days.

This minimum functionality specification was established to meet the national electricity market settlements requirements (for example, pricing period and credit risk) and was deemed adequate to meet the billing requirements of small consumers. The added benefit of this standard is (1) the improved speed of delivery of the measurement data to authorised parties, and (2) the improved detail of the consumption for any nominated time during a day. These added benefits have merit for application to residential consumers, in addition to all other consumers.

It is noted that the *Rules* also recognised that historical meter technology needed to be accommodated for a period until this type of technology was withdrawn from service. The key features that distinguish this historical technology are:

(a) Manual extraction of measurement data, rather than remote electronic data extraction;
(b) Electro-mechanical induction measurement mechanism, rather than an electronic mechanism;
(c) Electronic mechanism that can't be programmed to 30 minute interval packets, or sub-multiples of 30 minutes.

The *Rules* grandfather this technology but limit its application to very low electricity volumes – however, those volumes are sufficiently high to cover all residential consumers.

Consumers who have this historical meter technology lack the opportunity to receive increased speed of data delivery and improved detail of their consumption across the billing period. For example, to enable residential consumers to have access to time-of-use pricing and peak demand pricing product offers, their measurement technology needs to be upgraded to meet the Chapter 7 minimum functionality specification identified in (a) to (h) above. That is, the historical meter technology needs to be removed from service and replaced by measurement technology that meets the Chapter 7 minimum functionality specification.

SMI Minimum Functionality Specification

The NSSC[22] Smart Metering Infrastructure Minimum Functionality Specification (SMIMFS) was developed over the period 2009 to 2011. It was developed at the request of the MCE[23] and endorsed by the SCER[24] in December 2011. The SMI Minimum Functionality Specification is available to jurisdictional Ministers should they wish to evoke a mandatory rollout of smart meters, as provided by the National Electricity (South Australia) (Smart Meters) Amendment Act 2009. This specification calls for the functionality listed in Table B.1 to be available in, or associated with, a meter.

Table B.1: Summary of the SMI Minimum Functionality Specification

Ref#	Title of function	Metrology or non-metrology orientation	Match(1)
1	Measurement And Recording	Metrology	Yes
2	Remote Acquisition	Metrology	Yes
3	Local Acquisition	Metrology	Yes(2)
4	Visible Display On Meter	Metrology	Yes
5	Meter Clock Synchronization	Metrology	Yes(3)
6	Load Management: Through a controlled load contactor or relay. Via the HAN	Non-metrology	No
7	Supply Contactor Operation	Non-metrology	No
8	Supply Capacity Control	Non-metrology	No
9	HAN Using Open Standard	Non-metrology	No
10	Quality Of Supply & Other Event Recording	Non-metrology	No
11	Meter Loss Of Supply Detection	Non-metrology	No
12	Remote Meter Service Checking	Non-metrology	No
13	Meter Settings Reconfiguration	Non-metrology	No
14	Software Upgrades	Non-metrology	No
15	Plug and Play Device Commissioning	Non-metrology	No
16	Communications and Data Security	Non-metrology	No
17	Tamper Detection	Metrology	Yes(4)
18	Interoperability for Meters/Devices at Application Layer	Non-metrology	No
19	Hardware Component Interoperability	Non-metrology	No
20	Meter Communications: Issuing Messages and Commands	Non-metrology	No
21	Customer Supply (Safety) Monitoring	Non-metrology	No

Notes:

(1) 'match' means a comparison with the Chapter 7 minimum functionality specification – Yes (green highlight) means there is a match.

22 National Stakeholders Steering Committee, a forum of retailer and distributor representatives, and consumer advocates.

23 Ministerial Council on Energy.

24 The Standing Committee for Energy and Resources, the body that ceded the MCE.

(2) 'local acquisition' is not explicitly included in the Chapter 7 minimum functionality specification because this is an inherent feature of all electronic meters.
(3) 'meter clock synchronisation' is not explicitly included in the Chapter 7 minimum functionality specification because this is an inherent feature of all electronic meters. The use of this functionality is called up by Chapter 7.
(4) Tamper detection is foreshadowed by the 'security arrangements' in Chapter7, but is more advanced than Chapter 7.

The green highlight on the right hand side of the Table indicates a one-for-one match of the metrology functions with the functions specified in Chapter 7.

From Table B.1, it can be seen that the SMI Minimum Functional Specification contains a few functions relating to measuring consumption (metrology functions) and many non-metrology related functions. These non-metrology functions capture the businesses operational savings possible with a smart meter and facilitate the increased ability for the consumer to manage its consumption.

Victorian Advanced Metering Infrastructure Specification

The Victorian Government chose to mandate a rollout of advanced metering infrastructure ('Victorian AMI'). The rollout commended prior to the development of the NSSC SMI Minimum Functionality Specification – rather, it was based on a purpose built specification produced by the Victorian Government in 2008. The Victorian AMI specification contains the functionality shown in Table B.2:

Table B.2: Summary of the Victorian Government's AMI Specification

Ref#	Title of function	Metrology or non-metrology orientation	Match[(1)]
1	bi-directional	Metrology	Yes
2	interval measurement data	Metrology	Yes
3	active energy only (1 phase)	Metrology	Yes
4	active + reactive energy (3 phase)	Metrology	Yes
5	record total accumulated energy	Metrology	Yes
6	data storage of 35 days minimum	Metrology	Yes
7	remote & local access to data	Metrology	Yes
8	accuracy of Type 4	Metrology	Yes
9	Time clock synchronisation	Metrology	Yes
10	remote & local configuration of 'import interval energy data'	Metrology	No
11	remote & local configuration of 'reactive energy data'	Metrology	No
12	Remote & local other data readings: • Settings; • Time; • Date; • Status indicators; • Event logs	Metrology	No
13	Supply disconnect & reconnect	Non-metrology (similar to Supply Contactor Operation in Table 1)	No
14	Load Control	Non-metrology (similar to Load Management in Table 1)	No
15	Meter Loss of Supply detection and outage	Non-metrology	No

	detection	(similar to Meter Loss of Supply Detection in Table 1)	
16	Quality of Supply and other event recording	Non-metrology (similar in Table 1)	No
17	Supply Capacity Control	Non-metrology (similar in Table 1)	No
18	Interface to HAN	Non-metrology (similar to HAN Using Open Standard in Table 1)	No
19	Tamper detection	Metrology (similar in Table 1)	Yes
20	Communications and data security	Non-metrology (similar in Table 1)	No
21	Remote firmware upgrades	Non-metrology (similar to Software Upgrades in Table 1)	No
22	Self-registration of meters	Non-metrology (similar to Plug & Play Device Commissioning in Table 1)	No

Notes:

(1) 'match' means a comparison with the Chapter 7 minimum functionality specification – Yes (green highlight) means there is a match.

Whilst there are many functions in the Victorian AMI Specification that appear similar to the SMI Minimum Functional Specification, there is considerable difference at the detailed level of functionality. For example, the VIC specification doesn't require single phase meters to measure reactive energy, which is required by the SMI specification.

Consequently the meters rolled out in Victoria don't meet the SMI Minimum Functional Specification. If no upgrade in functionality was required for the Victorian AMI meters in the near future, it means that the SMI Minimum Functional Specification will not be the minimum functionality specification for the NEM. Rather, a minimum standard with less functionality will emerge for the NEM.

Proposed Minimum Functionality Specification for the NEM

It is assumed that the single purpose for metering in Australian electricity markets is measuring electricity for revenue collection, both in the wholesale and retail sectors of the markets.

A Proposed Minimum functionality specification for revenue metering in the NEM could be developed using the following criteria:

- Consistent with the National Measurements Act;
- Suitability for NEM wholesale settlements;
- Suitability for Retailer and Distributor consumer billing;
- Other features.

These criteria were applied to Table 1 "SMI Minimum Functionality Specification' with the outcome shown in Table B.3 "Functions required…" and Table B.4 "Functions not required…" .

Table B.3: Functions required for revenue metering in the NEM (1)

Ref#	Title of function in SMIMFS	Comparison with Chapter 7	Criteria
1	Measurement and Recording	• A least one measurement element which is accurate within specified limits; • Bi-directional energy measurement; • A measurement element for active energy is mandatory. A measurement element for reactive energy is discretional; • Storage of measurement data in the meter, with a minimum of 35 days.	• National Measurements Act consistency • NEM settlements • Consumer billing
2	Remote Acquisition	• A communications interface; • Electronic / remote data transfer facilities (for nominated types of meters)	• NEM settlements • Consumer billing
3	Local Acquisition	• Not explicitly stated in Ch7, but implied	• NEM settlements • Consumer billing
4	Visible Display On Meter	• A visible display with at least accumulated active energy available in the display.	• NEM settlements • Consumer billing
5	Meter Clock Synchronization	• Not explicitly stated in Ch7, but implied.	• NEM settlements • Consumer billing
17	Tamper Detection	• Specified security arrangements	• NEM settlements • Consumer billing

Notes:

(1) This Table represents the Proposed Minimum Functionality Specification required for a revenue meter used in the NEM. The Proposed Minimum Functionality Specification can be enhanced by minimal cost features from Table 4.

Table B.4: Functions not required for revenue metering in the NEM (2)

Ref#	Title of function in SMIMFS	Comparison with Chapter 7	Criteria
6	Load Management: Through a controlled load contactor or relay. Via the HAN	• Available as enhanced discretional feature	• Other
7	Supply Contactor Operation	• Available as enhanced discretional feature	• Other
8	Supply Capacity Control	• Available as enhanced discretional feature	• Other
9	HAN Using Open Standard	• Available as enhanced discretional feature	• Other
10	Quality Of Supply & Other Event	• Voltage and current are automatically available in electronic designed meters and could be used as a starting point for QOS information.	• Other
11	Meter Loss Of Supply Detection	• Available as enhanced discretional feature	• Other
12	Remote Meter Service Checking	• Available as enhanced discretional feature	• Other
13	Meter Settings Reconfiguration	• Available as enhanced discretional feature	• Other
14	Software Upgrades	• Available as enhanced discretional feature	• Other
15	Plug and Play Device Commissioning	• Available as enhanced discretional feature	• Other
16	Communications and Data Security	• Available as enhanced discretional feature	• Other
18	Interoperability for Meters / Devices at Application	• Available as enhanced discretional feature	• Other

	Layer		
19	Hardware Component Interoperability	• Available as enhanced discretional feature	• Other
20	Meter Communications: Issuing Messages and Commands	• Available as enhanced discretional feature	• Other
21	Customer Supply (Safety) Monitoring	• Available as enhanced discretional feature	• Other

Notes:

(1) The red highlight in this Table indicates functions (or parts of a function) that may be available at minimal cost. Other functions may become available over time at minimal cost. These minimal cost functions will be added to TableB.3 to complete the Proposed Minimum Functionality Specification to be adopted by Chapter 7 of the *Rules*.

Other features that electronic meters may progressively contain as part of a manufacturer's standard design package could be:

- Remote software upgrade facility;
- Plug and Play device commissioning.

However, the mandating of these in the Proposed Minimum Functionality Specification would not be consistent with a minimum cost outcome, as minimal cost will be dependent on each manufacturer's offer.

Rational for possible reduced functionality – metering only

There are several reasons for adopting the reduced functionality in Table B.3 rather than the full SMI Minimum Functional Specification. These are:

(a) All meter manufacturers will automatically include the Table B.3 functions in their minimum basic electronic design. If the design meets the pattern approval and meter verification requirements of the National Measurements Act, it will be able to be used in the NEM. This will enable Metering Providers to access the cheapest meters from global manufacturers. Any additional features that manufacturers include on top of the minimum functionality specification would be because of a global demand which will ensure the lowest cost and would be a bonus to participants in the NEM. Thus the Proposed Minimum Functionality Specification will not drive up manufacturing costs but instead will add to the global demand for basic functionality in electronic meters. Hence, the Proposed Minimum Functionality Specification will bring cost savings to consumers.

(b) By adopting the Table B.3 and nominated Table B.4 functions, the only significant change to Chapter 7 *Rules* will be the increased emphasis on removing manually read meters from metering installations. In particular, the emphasis on removing electro-magnetic inductions accumulation meters will be strengthened. Whilst this will introduce discussions on stranded costs of existing electro-magnetic inductions meters (both in-service meters and held in stock by Metering Providers). In the supplementary paper we have put forward a way to remove this risk of stranded costs. For the in-service manually read interval meters, it is expected that these meters all have remote access capability. That is, they can be readily adapted to meet the minimum functionality specification without any stranded cost.

(c) Consumers, Retailers, Energy Supply Companies (ESCO) and Local network service providers (LNSP) can add the functionality contained in Table B. 4 to the connection point / supply point in one of two ways:

- By adding a separate device(s)[25] that contain some or all of this functionality, according to the needs of the parties and the design innovation of manufacturers;
- By replacing the minimum functionality specification meter with a meter that has the additional functionality required by the parties.

The flexibility available from separating the minimum functionality specification from additional functionality ensues that all consumers (1) receive the minimum cost solution at any one time, and (2) are, or have the ability to be engaged in the enhancement process, if they so wish.

(d) The continued emphasis on point-to-point communication, utilised effectively in the NEM from 1998 until now, will continue to play a significant role in providing a communications network solution into the foreseeable future. The proposed minimum functionality specification permits point-to-point communications to be the fundamental functionality for each meter. Other types of communication networks can also be used, but their use must maintain the integrity of the point-to-point access capability. This feature maximises interoperability for meters.

Local Network Service Provider -the beneficiary for the additional functionality

By adopting the Table B.3 functions as the Proposed Minimum Functionality Specification for inclusion into the Rules for new metering installation, the LNSP is free to seek increased functionality for targeted consumers that optimise the network benefits for both parties.

The LNSP has an interest in a range of information that could emanate from end points in their network. Such information might include:

- Absolute voltage levels;
- Feeder and circuit loads;
- Locating circuit faults;
- Safety status of the connection point.

In addition, the LNSP (and the retailer) has an interest in actions at the end point, including:

- Dis-connection and re-connection of individual connection points, either for consumer credit purpose or for power system security purpose;
- Dis-connection and re-connection of individual consumer appliances for congestion control on its network.

Some of these measures are best performed in near real time. This means that electronic communications to the connection point would be essential, as well as a remote transmitting / receiving device that would perform the desired action. The business case of the LNSP to install the communications path and the remote device should be developed in conjunction with the consumer who may need to be aware of the influence the LNSP will have on its availability of electricity supply and what actions it needs to take when the LNSP makes use of its installed functionality.

The Proposed Minimum Functionality Specification may embrace any of the functions listed in TableB.4 that impose no additional cost on the provision of the functions specified in Table B.3. In theory, LNSPs (as a collective) have an opportunity in the first instance to nominate any of the Table B.4 functions that should be added to the Proposed Minimum Functionality Specification at no cost. However, in practice, this

[25] In this arrangement, separate devices may include the use of the internet, as an example.

opportunity may be difficult to exercise, in which case the consumer should not be disadvantaged, cost wise. To ensure that no disadvantage flows to the consumer, and to ensure that maximum awareness is available to the consumer from an educational perspective, the consumer must be engaged (to some meaningful degree) in the LNSP's decision making process.

Discussion between the LNSP and the consumer (or the Retailer on behalf of the consumer) will be optimised if the Proposed Minimum Functionality Specification is removed from the discussion (because it is the underpinning platform on which the LNSP will base its business case). In this way, the LNSP has more versatility in establishing a business case that will empower the consumer to adopt the LNSP's functional requirements. For example, the LNSP's business case might adopt the proposition that a consumer is 'paid'[26] for LNSP's right to add additional functionality to connection point (inside a meter or separate to a meter).

In this way, the LNSP becomes a beneficiary from the adoption of the Proposed Minimum Functionality Specification. It also better enables other market participants to develop DSP related products which require additional funcitionality.

Proposal

It is recommended that Chapter 7 of the Rules be modified to the extent necessary to ensure that the following Minimum Standard for revenue metering in the NEM is adopted:

(a) Measurement and recording functions (S7.1) [27];
(b) Remote acquisition (S7.2), where point-to-point communication is an essential feature[28];
(c) Local acquisition (S7.3);
(d) Visible display on meter (S7.4);
(e) Meter clock synchronisation (S7.5);
(f) Tamper detection (S7.17);
(g) Quality of Supply and Other Events (S7.10) – voltage & current only.

This Minimum Functionality Specification has been established primarily to meet the requirements of NEM settlements. All new meters installed for residential and small businesses consumers should be required to meet this minimum standards.

[26] Payment here could be in the form of a discount from the LNSP network charges, where the network changes and associated discount were transparent on the consumer's bill.
[27] The functions listed are a direct reference to Section 7 of the approved SMI Minimum Functionality Specification.
[28] The requirement to ensure that point-to-point communication is supported by each metering installation is not specifically identified in the SMI minimum functional specification, but is a feature of the Minimum Functionality Specification. There is no rule preventing the metering installation from supporting other additional forms of communication access, for example mesh radio or Distribution Line Carrier.

Appendix C Minimum Functionality Specification with additional functionality

This Appendix was prepared with the assistance Phacelift Consulting Services.

Appendix B discusses the rationale for selecting a Minimum Functionality Specification for metering in the NEM. It recommends that the minimum functionality be chosen to primarily satisfy the requirements of NEM settlements.

The Minimum Functional Specification forms the basis for adding additional metering related functions to a supply point. This Appendix builds on Appendix B by identifying three sets of additional functionality that could be added to the Minimum Functionality Specification and explains their relationship to the SMI Minimum Functional Specification.

Diagrammatic representation of advanced functionality

The three examples of advanced functionality identified in this explanation involve Smart Grid business functions, Energy Management Systems and device servicing. These examples are shown diagrammatically in Figure C.1 alongside the 'measurement and recording' function and the remote communications, which represents our proposed Minimum Functionality Specification.

Figure C.1: Additional functionality alongside the Minimum Standard

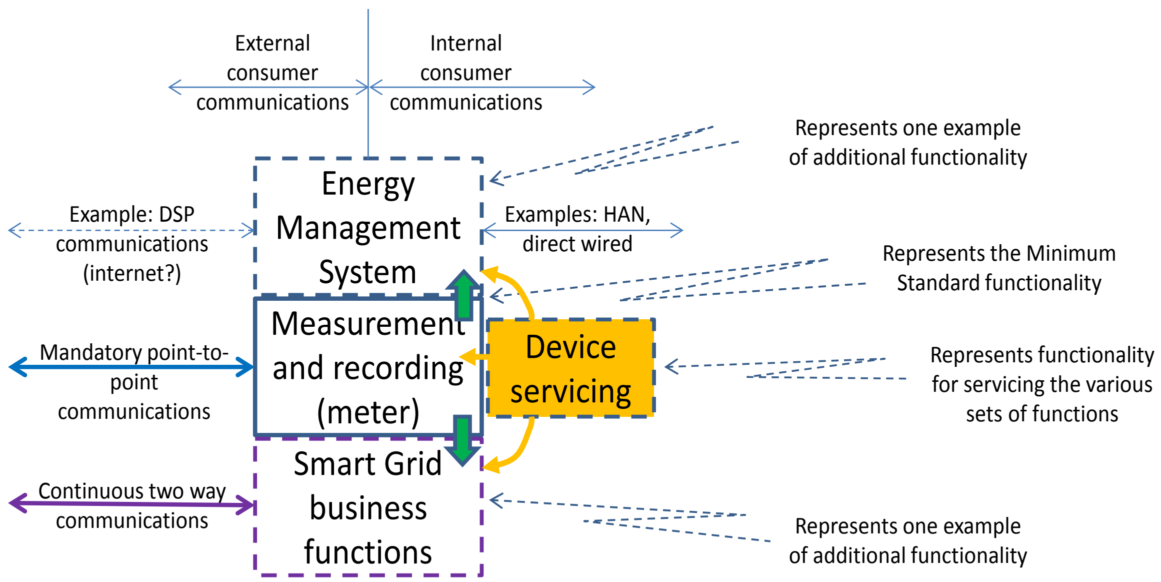


Figure C.1 consists of a stack of three sets of functions that have some involvement in the measurement of electricity, with a fourth set of functions off to the side.

The first set of functions 'Energy Management System' (shown at the top of the stack) provides outgoing load control and messaging functions to the consumer. The following functions might be included:

- Load Management: through a controlled load contactor or relay; via the HAN (S7.6) [29];
- Home Area Network using Open Standard (S7.9).

[29] The functions listed are a direct reference to Section 7 of the approved SMI Minimum Functionality Specification.

The second set of functions 'Measurement and recording (meter)' (shown in the middle of the stack) is the source of the metrology for the nominated point of supply. It consists of the Minimum Functionality Specification functions recommended in Appendix B.

The third set of functions 'Smart Grid business functions' (shown at the bottom LHS of the stack) provides incoming load control, Quality of Supply, and alarm functions to the LNSP. Some or all of the following functions might be included:

- Supply Contactor Operation (S7.7);
- Supply Capacity Control (S7.8);
- Quality Of Supply & Other Event (S7.10);
- Meter Loss Of Supply Detection (S7.11);
- Remote Meter Service Checking (S7.12);
- Customer Supply (Safety) Monitoring (S7.21).

The fourth set of functions 'Device servicing' (shown at the RHS side of the meter and shaded orange) provides the ability to remotely configure settings, to remotely upgrade software, to remotely commission a meter when it is installed without manual intervention, rules around communication security and the rules around the remote issuing of messages and commands for use by the Responsible Person / Metering Provider. Some or all of the following functions might be included:

- Meter Settings Reconfiguration (S7.13);
- Software Upgrades (7.14);
- Plug and Play Device Commissioning (S7.15);
- Communications and Data Security (S7.16);
- Meter Communications: Issuing Messages and Commands (S7.20).

The stack conceptualises the relationship of the additional functions to the Minimum Standard in the following way:

(a) The first set of functions is shown in dashed outline. This is to symbolise that the functions are additional to the Minimum Standard, and may be external or internal to the meter.
(b) The second set of functions is shown in solid blue outline. This is to symbolise that the functions are the Minimum Standard, and would be included within or directly associated with the device known as a 'meter'.
(c) The third set of functions is shown in dashed purple outline. This is to symbolise that the functions are additional to the Minimum Standard, and may be external or internal to the meter.
(d) The fourth set of functions is shaded orange and shown in dashed outline. This is to symbolise that the functions are additional to the Minimum Standard, may be internal to the meter and (some or all) may also be internal to the 'Energy Management System' and the 'Smart Grid business functions'.
(e) The green arrows represent the possible transfer of raw measurement data to the advanced functions for purpose of information only.
(f) The orange arrows indicate that the nominated set of functions may be used in any one or in all of the other sets of functions.

Key features of the Minimum Functionality Specification and the additional functionality

There are several key features that are observed from Figure C.1. These are:

(e) The Left hand side of figure C.1 shows communications that are external to the consumer's site.

- In the case of the ‘Energy Management System’ functions, the communication connection is shown as a dashed line. This symbolises that external communication is optional and at the discretion of the Service Provider (Retailer or ESCO). For example, one option may not include any external communication for energy management system functions, whilst another option may use the internet to provide communication to this set of functions.
- In the case of the ‘Measurement and recording’ functions, the communication connection is shown as a solid blue line. This symbolises that external communication is mandatory and must support point-to-point communication arrangements. This feature (a) ensures interoperability is achieved between communication networks and meters, and (b) maximises the provision of cyber security.
- In the case of the ‘Smart Grid business functions’, the communication connection is shown as a solid purple line. This symbolises that external communication will always be required by the LNSP, but the type of communication technology is subject to the requirements of the LNSP. For example, it is likely that the LNSP will require continuous two way communication and will choose technology that best meets provides this functionality.

(f) The right hand side of figure C.1 shows communications that are internal to the consumer’s site.

- In the case of the ‘Energy Management System’ functions, the communication is shown as a solid line. This symbolises that some form of internal communication will always be required with this functionality. For example, one option may utilise a wireless network to the consumer’s appliances (including an in-home display) and another option may utilise direct wired circuits to these appliances. A combination of these communication arrangements may be deployed.
- In the case of the ‘measurement and recording’ functions, the ‘Smart Grid business functions’ and the ‘Device servicing’ functions, no internal communications is shown. This is to symbolise that the only communications to consumers would be via the ‘energy management system’ functions.

(g) The sets of functions may be combined in the one device, or be provided as separate ‘add-on’ devices, depending purely on the decision of the party requesting the additional features. For example:

- If a Minimum Functionality Specification meter is being utilised and a consumer wishes to have the benefit of the ‘Energy Management System’ functions, the consumer (or the Retailer on behalf of the consumer) can decide to replace the existing meter with a new meter that contains the additional features (as well as the Minimum Functionality Specification), or retain the existing meter and install an additional device that separately contains the additional features and interfaces with the existing meter.
- If a Minimum Functionality Specification meter is being utilised and a LNSP wishes to have additional functionality installed at the consumer’s site for purpose of supporting its Smart Grid requirements, the LNSP may seek approval from the consumer to change the Minimum Functionality Specification meter for an advanced functionality meter, or retain the Minimum Functionality Specification meter and add a separate device to the site that contains only the additional functionality. In this latter case, a

suitable interface would be used to connect the additional functionality to the Minimum Functionality Specification meter.

Consumer choice for advanced functionality that is added to the Minimum Functionality Specification

In the power of choice review, emphasis has been given to the involvement of the consumer in decisions relating to demand side participation. One of these decisions relates to the provision of electricity measurement technology and the features that this technology may contain.

In summary, the proposed approach would be for the consumer to be given the ability influence the characteristics of this technology above a Minimum Functionality Specification. This could ensure that the consumer receives meter technology:

- that best meets its ability to participate in DSP to the maximum extent possible;
- at the lowest cost;
- that is not churned without approval of the consumer;
- is backed up by Service Provider support (whether Retailer, ESCO, DNSP, Responsible Person)
- that is supported by reasonable Information on the usefulness of that technology.

The consumer is that party that pays for the meter technology that meets the Minimum Functionality Specification. This payment is either direct to the Responsible Person or indirect via a Retailer’s bill.

When additional functionality is to be installed, in addition to the above payment choices, the Service Provider offering the additional functionality may determine that there are benefits accruing to that Service Provider (and often only recognisable by that Service Provider) that allow that party to offer a discount to the consumer.

For example, it may be advantageous to a Retailer, or a LNSP or a Responsible Person to offer a consumer a package of Minimum Functionality Specification and added functionality that together doesn’t exceed the cost of the Minimum Functionality Specification. Note that this example is only provided to explain that the:

- separation of Minimum Standard functionality from additional functionality has the potential to be economically advantageous to the consumer, and
- consumer is more often than not, will be faced with the lowest cost option for participation in DSP when meter technology is deemed to be a barrier to DSP uptake.

This proposed approach demonstrates how the range of functionality that was developed and approved by the SCER can be deployed in the NEM whilst maintaining minimum cost impact on consumers.