
**Common Principles for the
Assessment of Interval Meters:
Overview paper**

**Report to the Ministerial Council on Energy Standing
Committee of Officials**

User Participation Working Group

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INTRODUCTION

A particular concern for electricity market regulators is that peak demand is increasing and approaching supply capacity. One option to address this is to construct generating plant and augment networks for peak supply.

An alternative approach is to implement demand management mechanisms to shift loads away from the peak period. Time of day pricing is one incentive for consumers to participate in load shifting. For this to be effective price signals need to be provided to the consumer. Interval metering is a means of achieving this and would provide other benefits to networks, retailers and consumers.¹

Interval meters offer the potential to increase retail pricing efficiency, provide better incentives for demand side participation in the National Electricity Market, increased network efficiency, reduced meter reading costs, greater equity among electricity consumers and increased NEM settlement accuracy.

While the potential benefits are significant, the costs of implementation are material and, large-scale precedent is limited. It is therefore appropriate that a robust and transparent evaluation process be implemented in all jurisdictions to identify whether interval meters warrant mandating for each of the various types of electricity customers and, if so, over what timeframe implementation should take place.

The Ministerial Council on Energy's Standing Committee of Officials issued a User Participation Policy Framework in August 2004 that called for the development of common principles for cost-benefit analysis to be used across jurisdictions for future assessments of interval meter roll outs.

In developing a set of common principles, this overview document draws on a number of documents and studies including the Council of Australian Governments (COAG) guidelines for cost benefit analysis, the assessment framework established in the Joint Jurisdictional Review of Metrology Procedures for considering metering issues, NSW discussion paper on Metering and Settlement Strategies for Full Retail Competition, and the precedent set by the inquiry of the Essential Services Commission (Victoria) into interval metering.

The principles described in this overview document set out a common starting point for all jurisdictions but are intended to allow the flexibility needed to suit local circumstances.

¹ Interval metering here refers to a meters that record consumption of electricity each half hour rather than on a simple accumulation basis. However, these principles also apply to more advanced meters such as 'smart' meters incorporating two-way communication.

1. BACKGROUND

In December 2002, the final report of the Council of Australian Governments' Independent Review of Energy Market Directions recommended that "Installation of interval meters should be mandated for all consumers with the installation program to be achieved over the next 5 to 10 years."²

The Ministerial Council on Energy (MCE) in its 11 December 2003 Report to the Council of Australian Governments – *Reform of Energy Markets*, recommended that "The MCE to examine options for a demand-side response pool in the NEM, and consider the costs and benefits of introducing interval metering."³

In August 2004, the MCE's Standing Committee of Officials issued a User Participation Policy Framework drawing on the Committee's *Improving User Participation in the Australian Energy Market* discussion paper and subsequent stakeholder consultation in March/April 2004. This policy framework re-iterated the MCE's endorsement of "...a future role for interval meters to facilitate greater user participation in a competitive national electricity market and will investigate issues relating to interval meter rollouts..."⁴. The framework laid out two specific actions that the MCE agreed to with respect to interval meters:

"3.1 *Common Principles for the Assessment of Interval Meters*. Develop common principles for cost-benefit analysis to be used across jurisdictions for future assessments of interval meter roll outs including new meter stock investments and other technological and social aspects.

3.2 *Jurisdictional Reviews of Interval Meters*. All NEM jurisdictions which have not done so should review the use of interval meters and assess the relative benefits of an interval meter rollout by 2007."⁵

This overview document is designed to meet the requirements of the first action item.

2. PREVIOUS WORK

There is strong guidance and precedent both for the development of cost benefit analysis (CBA) generally and as applied to interval metering in particular. This section briefly summarises that previous work.

2.1. *General Principles for Cost Benefit Analysis*

In a November 1997 communiqué, the Council of Australian Governments published principles and guidelines for CBA relevant to regulatory action.⁶ Figure 1 is based on these principles and indicates the main steps for undertaking a CBA. The COAG principles have been underscored and further elaborated on by some jurisdictions to provide additional guidance.⁷

² Final report of COAG Independent Review of Energy Market Directions, *Towards a Truly National and Efficient National Energy Market*, December 2002, p183, recommendation 6.2

³ Ministerial Council on Energy, Report to the Council of Australian Governments, *Reform of Energy Markets*, 11 December 2003, p6

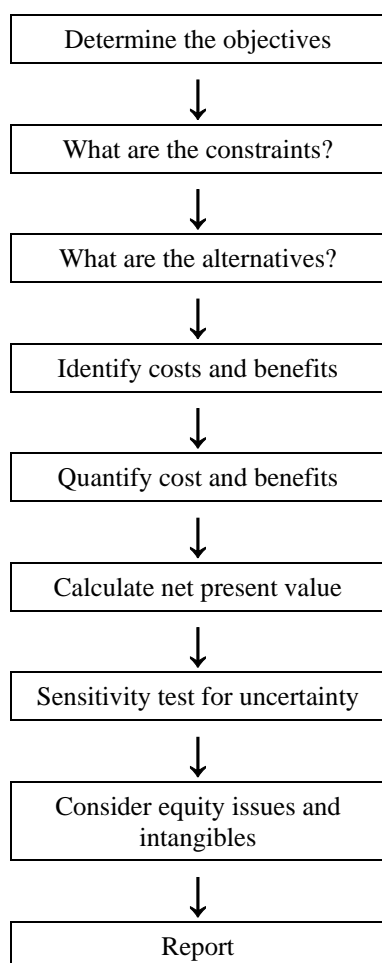
⁴ Ministerial Council on Energy – Standing Committee of Officials, *User Participation Policy Framework*, August 2004, p2

⁵ *ibid* p5

⁶ COAG Communiqué - November 1997 – "Principles and Guidelines for National Standard Setting and Regulatory Action" available at: http://www.premiers.qld.gov.au/policy/intergovt/coagmincncl/Communiqués/COAG/pre-2000/November_1997_-_National_Standard_Setting_and_Regulatory_Action/#top

⁷ eg NSW Treasury "Guidelines for Economic Appraisal" TP 97-2, 1997; and "Economic Appraisal Principles and Procedures Simplified" TP 99-1, March 1999.

Figure 1: CBA Principles & Procedures



This overview document adopts the COAG principles as an appropriate basis for performing CBA of interval meters. Accordingly, the document interprets and applies the main steps in developing the principles for interval meter rollouts.

2.2. Previous CBA of Interval Meters

There is some useful precedent for CBA of interval meters. In particular, between 2002 and 2004, the Essential Services Commission (Victoria) conducted an inquiry into the rollout of interval meters for electricity customers.⁸ The ESC performed a detailed draft and final CBA, and conducted extensive public consultation on both the CBAs and the interval meter policy more broadly. The experience and information collected during that process provides useful precedent for development of future CBA work on interval meters.

The NSW Treasury also issued a discussion paper in August 2000 entitled ‘Metering and Settlement Strategies for Full Retail Competition’. This overview paper contains a useful review of metering and load profiling options and some cost benefit analysis that again, serves as a useful precedent.

The Joint Jurisdictional Review of Metrology Procedures recommended an assessment framework for consideration of metering issues.⁹ The guidance is high level, but is consistent with the COAG principles. The Joint Jurisdictional Review also laid out a series of deployment and technology options relevant to interval meters.¹⁰

This overview document also draws on the information provided from the Essential Services Commission (ESC) and Joint Jurisdictional Review processes to help ensure that the general principles described by COAG are interpreted in an appropriate manner in developing principles for future CBA of interval meters. It is recommended that these and other relevant studies be analysed with particular reference to the key lessons learnt, key assumptions, deficiencies and problems encountered.

3. COMMON PRINCIPLES FOR INTERVAL METER COST BENEFIT ANALYSIS

Step 1. Determine the Objectives

Guiding principle: the overall objective is to indicate the wider benefits, both to the market and society, and the specific objectives of the task are to be well defined.

Each jurisdiction will need to adopt its own specific objectives, but a possible common initial definition is as follows:

⁸ Essential Services Commission “Mandatory Rollout of Interval Meters for Electricity Customers” July 2004.

⁹ Joint Jurisdictional Review of the Metrology Procedures Final Report, October 2004, Section 2.1.

¹⁰ Ibid, Chapter 8.

OBJECTIVES

The overall objective is to further improve the efficiency of the electricity market, the retail sector in particular, for the long term benefit of consumers. The ability of the retail market to deliver a variety of price arrangements allows customers to choose how they consume power to gain maximum benefit for themselves and the electricity market as a whole.

Step 2. Identify the Constraints on Government Action

Guiding principle: identify constraints with any significant impact on the objective specific to the jurisdiction so that they can be addressed during policy implementation.

The second step in CBA is to identify the constraints on government action that may limit the ability to implement the proposed interval metering rollout. This step needs to also identify constraints that limit the ability to implement alternative methods of achieving the required benefits.

Each jurisdiction will need to develop its own identification of constraints. At a minimum, this should address the following:

CONSTRAINTS

- *Customer Equity* – Retail and network prices that better reflect costs in the NEM may result in a more efficient market. Considerably higher prices during constrained periods may result in disproportionately higher overall costs for certain groups of customers (eg heavy peak users). However, more reflective pricing structures may also reduce costs for other users, such as off-peak users. The extent of the impact will depend on the retailer's ability to manage financial risk (eg. to hedge costs) and/or dependence on the extent to which network and retail costs might continue to be regulated or capped. To what extent will it be appropriate to impose higher peak period costs on consumers? To what extent might future retail price regulation or Government Community Service Obligations be effected?
- *Stranded Asset Equity* – Mandatory installation of interval meters over an accelerated timeframe (eg 5 or 10 years) will result in the removal of existing meters before they reach the end of their average life of 45 years or more. To what extent should DNSPs be compensated for these stranded assets and through what regulatory mechanism, and to what extent should consumers pay for this compensation?
- *Consistency with NEC consumer choice policy* – A core objective of the National Electricity Code (NEC) is to facilitate consumer choice (NEC Section 1.3 (b) (2)). While some customers may desire time-varying pricing structures that would be enabled by interval metering, others prefer simplicity. What is an appropriate balancing of these interests?
- *Consistency with Metrology Procedures regarding metering services and ownership* – DNSPs currently have exclusive responsibility for metering services and meter ownership for certain types of customers (e.g., currently all first tier customers and type 5, 6, and 7 metering installations), and the Jurisdictional Regulators have recommended maintaining exclusivity in a modified form, with additional consideration given to customer size. (*Joint Jurisdictional Review of Metrology Procedures: Final Report October 2004, Chapters 4 and 5*). In any case, the proposed interval metering policy will have to be consistent with the NEC metrology procedure.
- *Consistency with light handed regulation* - Another objective of the NEC is to apply light handed regulation to the extent possible (NEC Section 1.4 (b) (1)). However, achieving the benefits identified in Step 1 will require considerably more than merely mandating deployment of interval metering. It will, for example, also require that retailers and DNSPs develop and implement new cost-reflective price structures. Ensuring that such pricing is developed may require new regulatory impositions. However to be consistent with a light

handed approach the alternative is to remove regulatory constraints that inhibit cost-reflective pricing, allowing market forces to drive the introduction of new pricing structures.

- *Adequacy of regulatory resources* – The regulator will need to assess whether it has adequate resources to: a) monitor and ensure that new price structures are appropriate, adequate, and effective; b) assess the full costs of implementation in the development of effective interval metering (e.g., IT costs, customer education costs and stranded asset costs) and ensure they are appropriately included in network price determinations; and c) identify and assess the full range of benefits, and ensure that they are appropriately taken into account in retail and network pricing mechanisms.

Step 3. Identify Alternative Actions

Guiding principle: all reasonable alternative approaches to achieving the objective are to be addressed to avoid missing opportunities and these should be compared with a base case.

The third step in the CBA is to identify a meaningful array of alternatives to the proposed action that may address the objective identified. These alternatives should be clearly defined and while not necessarily exhaustive, must span an array of reasonable alternatives that are "...sufficient to provide the decision-makers with real scope for exercising choice."¹¹ A base case and/or business as usual scenario should be included in order to be able to assess the benefit of the various options.

As a common starting point for the interval metering CBA, eight broad alternatives grouped in two categories should be considered.

ALTERNATIVE ACTIONS

Non-interval metering alternatives:

1. **Take no regulatory action.** Under this alternative, some additional interval meters would still be deployed where market participants and customers found them to be of benefit.
2. **New network and retail pricing policies using accumulation meters.** In particular, specific consideration could be given to such pricing measures as seasonal and inverted block pricing, with a requirement that DNSPs and/or retailers develop and market such offerings. Additional consideration could also be given to revised load profiling. These may provide some of the benefits achievable with interval metering, and do so at lower cost.

Alternative interval metering actions:

For the following voluntary and mandatory options, interval meter roll-out could be for selected classes of consumer or for those with consumption above a certain level (although this is not necessarily representative of demand during peak periods), and implemented on a new or replacement basis.

3. **Voluntary roll-out of manually read interval meters**
4. **Voluntary roll-out of advanced interval meters**
5. **Voluntary roll-out of interval meters with additional network and/or retail pricing policies**
6. **Mandatory roll-out of manually read interval meters**
7. **Mandatory roll-out of advanced interval meters** (eg with 1 or 2-way communication capability, appliance control capability, display allowing for feedback to customers, support

¹¹ COAG Communique November 1997.

for multiple elements or other utility services and/or other features).

- 8. Mandatory roll-out of interval metering with additional network and/or retail pricing policies.** Achieving the benefits identified in Step 1 will require development of new network and retail pricing structures. It is unclear, however, the extent to which those structures would be developed on a voluntary basis by networks and retailers and whether these would be allowed by current regulation. Removing constraints that currently inhibit new pricing structures to allow market forces to drive the introduction of new structures would need to be considered. Accordingly, it may be worth specifically examining an alternative that encompasses this broader regulatory issue.

A decision on the implementation period for mandatory roll-out will need to be made eg. new or replacement (about 2-4% per year) or over 10 years (about 10% per year) or over 5 years (20% per year). For purposes of the analysis, it is suggested that customer/installation types be disaggregated as per the ESC Interval Meter Rollout – Final Decision 2004.

Step 4. Identify the Benefits and Costs

Guiding principle: outcomes from achieving the objective are to be specified to provide a broad perspective on benefits and costs.

The fourth step of the CBA is to identify the societal benefits and costs anticipated from the proposal and the alternatives. These benefits and costs should be described with adequate detail to demonstrate that they specifically result from the proposed actions. Consideration should be given to the change in consumer behaviour in response to price signals and assessment of innovation and service provision improvement if alternatives such as competitive services were explored. A transparent and consultative approach should be undertaken to achieve full recognition of all benefits and costs. Note that this step should not identify transfer payments between different parties (e.g., payment from customers to DNSPs for stranded assets) as those are not additional societal costs or benefits. Rather, transfer payments should be addressed in Steps 2 and 8.

Several categories of benefits and costs of interval meters have been identified (from the ESC investigation, EPRI report ‘Business Case Assessment for Energy Service Portal’ March 2004, and the report to NEMMCO ‘Development of a Conceptual Metering and Settlement Design for Full Retail Competition in the National Electricity Market December 1998). However, the following list of benefits and costs is not exhaustive and should be expanded to include others that have an impact on the CBA. Consideration of costs and benefits should also take into account differences that may exist between specific customer segments.

BENEFITS:

The main potential benefits that have been identified would result from demand management should customers modify their consumption behaviour in relation to more cost-reflective prices. Some additional benefits not resulting from demand management may also result and should be considered as well.

- Avoided capital costs of new generation and network capacity;
- Avoided variable costs of energy generation;
- Avoided manual meter reading costs;
- Improved operational network management including near real-time measurement of network losses,
- Reduced greenhouse gas emissions from a reduction in peak demand (where there is not a shift in consumption to more emission intensive generation at another time of day);
- Increased settlement accuracy,

- Pricing flexibility and accuracy,
- Fraud detection,
- Opportunity to integrate electricity metering with gas and water,
- Remote connection and disconnection capability, and
- Premise outage detection and event record and communication.

COSTS:

Costs include the deployment and operation of the meters themselves, as well as the additional costs of developing and implementing more cost reflective pricing, and enabling customer response.

- Meter hardware (incremental cost only when replacing an accumulation meter with an interval meter);
- Installation;
- Maintenance;
- Metering data communication infrastructure costs,
- Meter data and coordination costs resulting from new and larger data streams, including IT costs of network service providers, retailers and NEMMCO;
- Costs to implement new cost reflective network tariffs (e.g., IT, product development);
- Costs to develop and implement new retail products (e.g., IT, product development, marketing); and
- Costs to facilitate customer response (e.g., education campaigns; and enabling equipment such as in-house price displays, and smart appliances).

For each of the above items, cost variance with the scale of the roll-out will need to be considered. In particular, implementation on a new/replacement basis will offer limited economies of scale given the limited installation volumes (about 2-4% per year of total metering population) and the dispersed nature of the installations. Alternatively, large scale implementation over 5 or 10 years should offer significant economies in equipment purchasing, installation and other costs, and support the implementation of advanced data communication infrastructure (whereas a partial roll-out may not).

Step 5. Quantify the costs and benefits

Guiding principle: outcomes from achieving the objective are to be assigned a value in order to undertake an appropriate economic evaluation.

Dollar values must be assigned to as many of the costs and benefits as possible, where those values are likely to be material. To the extent possible, this should rely on actual market information and relevant precedent, and all assumptions should be clearly laid out with justification. Potential costs and benefits that have not been quantified or that are transfers (such as removal of cross subsidies between customers) need to be clearly discussed and considered in contributing to the overall result.

Specifically with respect to interval metering, it must be noted that there is very limited information on the main driver of efficiency gains, specifically, consumer response to the types of cost-reflective pricing structures that may be developed. There is some limited international precedent with interval metering that allows development of price elasticity estimates (eg -0.1 price elasticity for household customers and -0.025 for business customers was used in Victorian

ESC's Final Determination which cited US precedent¹²). However, care must be taken to ensure that the characteristics of that precedent are properly recognised and adapted to the CBA quantification (e.g., that the structure and level of prices upon which the price elasticity estimates are based are similar to those anticipated under the proposal). Accordingly, estimates will require analysis and interpretation of the limited but growing body of domestic and international data currently available. Also, the determination of the elasticity must be robust and transparent with all assumptions made in determining the elasticity clearly defined.¹³

The CBA will need to consider specific market sectors, based on customer size and meter type. In addition the term of the CBA will need to consider both the life of an accumulation meter and the alternative interval meter.

QUANTIFICATION OF COSTS & BENEFITS

- **Detailed Analysis of Consumer Price Elasticity Essential.** In quantifying the costs and benefits, one of the primary areas of uncertainty requiring attention is the price elasticity of consumer demand. An understanding of how particular sectors of the market targeted for interval meter roll-out contribute to peak demand would be required. Firstly, in developing the CBA, each jurisdiction could consider conducting a study of consumer price response to interval metering data and interval pricing in order to estimate the potential reduction in peak demand. This could then be used as an independent starting point for the estimation of benefits in the CBA being performed. Secondly, sensitivity analysis around this key area of uncertainty is an essential component of the quantification of benefits and subsequent assessment of value. The determination of elasticity must be robust and transparent with all assumptions made in determining elasticity clearly specified.
- **Analysis of the benefits to networks and retailers.**
 - An assessment should be undertaken of the benefits gained by networks in having the ability to improve network management and for both networks and retailers being able to implement flexible tariff structures in their business processes and systems.
 - An assessment should also be undertaken of the benefits from the ability of networks and retailers to cooperate on demand response initiatives that require benefits to be delivered jointly.
- **Consultation.** Given the uncertain nature of many costs and benefits in this relatively new area, public consultation about the array of cost and benefit assumptions is essential. This consultation should be undertaken based on a draft CBA report (ie, as in Step 8) to facilitate meaningful input. Consultations with separate parties should be held prior to finalising recommendations.

Step 6. Calculate the Net Present Value

Guiding principle: realistic parameters are to be defined for analysing the value of the method to achieve the objective. The aim is to enable an informed decision to be made on the whether the objective should be pursued.

Calculation of Net Present Value (NPV) involves discounting future costs and benefits to the current year using an appropriate discount rate and term for the analysis. The present value of costs and benefits are summed to determine the extent to which benefits exceed costs. It is a well understood and widely applied process, and the CBA for interval meters should not raise particular challenges in this regard.

¹² Essential Services Commission "Mandatory Rollout of Interval Meters for Electricity Customers" July 2004, p48.

¹³ When considering the impact of elasticity on likely demand changes, consideration should be given to the constraints such as the willingness of governments to introduce consumer price shocks (as outlined on page 5) that might be necessary to produce the behaviour changes required.

Two common principles for the CBA of interval meters could be as follows:

NPV CALCULATION

- *Choice of Discount Rate* – The discount rate used should be chosen having regard to the weighted average cost of capital, the investment practices of market participants and customers, and the discount rates used in other regulatory activities
- *Choice of Term* – The term of the CBA should be chosen having regard to the useful life of accumulation meters that are currently deployed. This is typically in the order of 45 years.

A number of scenarios may be considered and these would need to be described in detail (market sector, meter type, manual or remote reading, new or replacement meter, etc).

Step 7. Address Uncertainty

Guiding principle: the impact of parameter variability on the value of the outcomes is to be evaluated as a means of defining the risk of pursuing the objective.

Sensitivity analysis is required to test the extent to which the NPV, which represents the ‘most likely estimate,’ may be incorrect, and the overall robustness of the proposal.

As a common principle, sensitivity analysis should be performed on all of the major cost and benefit variables as well as on the choice of discount rate. This should be used to identify: 1) whether the proposals are robust under a reasonable range of scenarios; and 2) which variables are most significant and may require further analysis.

As noted above, there is significant uncertainty regarding both the change in price structures and the consumer response that may eventuate with interval metering. Accordingly, it would be expected that extensive sensitivity analysis be performed of the assumed consumer response and underlying assumptions.

Step 8. Report on the Analysis

Guiding principle: analysis of the results is to be clearly presented to enable easy evaluation by the target audience.

The final step is to document the analysis, addressing all of the above steps.

In addition to providing a written document, it would facilitate communication and consultation with interested parties to provide a spreadsheet model of the costs and benefits detailing the calculations, and consistent with the written report.

As noted in Step 5 above, an open consultation process including solicitation of submissions on a draft CBA report (including spreadsheet model) would be expected to significantly inform the valuation of costs and benefits of a final CBA and should be undertaken.