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Customer Protections and Smart Meters

Background Paper

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Tables, graphs and boxes

Tables

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Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure
ATA	Alternative Technology Association
COAG	Council of Australian Governments
CPI	Consumer Price Index
CPP	Critical Peak Pricing
CPRS	Carbon Pollution Reduction Scheme
CSO	Community Service Obligation
CUAC	Consumer Utilities Advocacy Centre
DLC	Direct Load Control
DLC	Direct Line Carrier
DRET	Department of Resources, Energy and Tourism
HAN	Home Area Network
IHD	In-home display
IMRO	Interval Meter Roll out
KWh	Kilo Watt hour
LV	Low volume
MCE	Ministerial Council on Energy
MWh	Mega Watt hour
NECF	National Energy Customer Framework
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NPV	Net Positive Value
NSMP	National Smart Meter Project
NSSC	National Stakeholder Steering Committee
NSW	New South Wales
NT	Northern Territory
OIC	Order in Council
PLC	Power Line Carrier
QLD	Queensland
RIS	Regulatory Impact Statement
SA	South Australia
SCO	Standing Committee of Officials
SMI	Smart Meter Infrastructure
SVDP	St Vincent de Paul
TAS	Tasmania
TOU	Time of Use
VIC	Victoria
WA	Western Australia

1. Background and introduction

The purpose of this Background Paper for the 'Consumer Protections in Light of Smart Meters' project is to provide readers with an overview of the National Cost-benefit Study and smart meter related consumer issues, as raised in the associated consultation processes. This Background Paper should be regarded as an attachment to all of the four jurisdictional 'Consumer Protections and Smart Meters' reports (Victoria, New South Wales, Queensland and South Australia) to be produced by this project. All of the jurisdictional reports make reference to issues outlined in this Background Paper.

1.1 Smart meter programs in Australia

The National Smart Metering Program (NSMP)

In April 2007, the Council of Australian Governments (COAG) committed to a national mandated rollout where benefits outweigh costs. This commitment was followed by a two-phased cost benefit analysis conducted by a consortium of consultants, with NERA Economics being the lead agency and coordinator.

Extensive consultations were undertaken for both the phase 1 and the phase 2 studies and further stakeholder input was sought to the Ministerial Council on Energy (MCE) Standing Committee of Officials' (SCO) Regulatory Impact Statement (RIS).

In June 2008, the MCE agreed to continue with the NSMP by undertaking coordinated pilots and business specific business case studies in most jurisdictions. The reason for this decision being that the initial cost benefit analysis showed that there is a potential for significant net benefits at the upper range of the scale, but that risk associated with the costs remains an issue in some jurisdictions.[1]

The MCE established the National Stakeholder Steering Committee (NSSC) to develop the NSMP. The NSSC's mandate is to develop a national framework for rolling out Smart Meter Infrastructure (SMI). This framework will encompass technical and operational requirements as well as changes to the regulatory rules and procedures in the NEM, Western Australia and the Northern Territory. The NSSC comprises nine voting members, four retail representatives, four network representatives and one consumer representative, as well as three non-voting members representing the AEMO, MCE SCO and the Western Australian Independent Market Operator.

The aim is to ensure that the NSMP work will result in the finalisation of jurisdictional smart meter business cases (except for Victoria) by 2012.

The Victorian Advanced Metering Infrastructure (AMI) program

In early 2006, upon the completion of the Victorian Cost Benefit analysis, the Victorian Government endorsed the deployment of Advanced Metering Infrastructure

[1] Ministerial Council on Energy, Smart Meter Decision Paper,13 June 2008, p 3.

(smart meters) to all Victorian electricity consumers using less than 160 MWh per annum.[2] The Victorian rollout will commence in 2009 and be completed by 2013.

1.2 Drivers and Objectives

Overseas smart meter programs have typically been promoted as a tool to achieve demand response (North America) or to improve customer service and meter reading/billing practices (Europe). In Australia, both the MCE and the Victorian Government have presented a range of objectives they believe SMI can deliver to consumers and the energy market more broadly.

The initial driver behind COAG's decision to explore the costs and benefits of smart meters was to reduce peak demand. However, a number of other objectives were added to the list as the debate about smart meters and direct load control proceeded. The objectives considered in the Regulatory Impact Statement released by the Standing Committee of Officials (SCO) of the MCE were:[3]

1. Reducing demand for peak power, with consequential infrastructure savings (e.g. network augmentation and generation)
2. Driving efficiency and innovation in electricity business operations, including improving price signals for efficient investment and contracting
3. Promoting the long term interests of electricity consumers with regard to the price, quality, security and reliability of electricity
4. Promoting competition in electricity retail markets
5. Enabling consumers (including residential, business, low- and high-volume users) to make informed choices and better manage their energy use and greenhouse gas emissions
6. Manage distributional price impacts for vulnerable consumers
7. Promoting energy efficiency and greenhouse benefits
8. Providing a potential platform for other demand side response measures and avoiding discrimination against technologies, including alternative energy technologies

In its June 2008 Decision Paper the MCE noted that the cost-benefit analysis largely supported these objectives (albeit with major jurisdictional differences) and that smart meters would have significant impact on:

- Efficiency and innovation in electricity business operations;
- Promoting the long-term interest of electricity consumers; and
- Enabling consumers to better manage energy use and greenhouse gas emissions.

The Decision Paper also stated that smart meters are expected to:

- Reduce peak demand;
- Promote retail competition;
- Promote energy efficiency and greenhouse benefits; and
- Provide a platform for other demand side response measures.

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[2] This decision was expanding on the Essential Services Commission decision in 2004 to mandate a rollout – called the IMRO program, adding features such as remote two-ways communications.

[3] Ministerial Council on Energy Standing Committee of Officials, *Cost-benefit analysis of Options for a National Smart Meter Roll-Out* (Phase Two – Regional and Detailed Analyses), Consultation, Regulatory Impact Statement, April 2008, p 29.

1.3 Distributor-led rollout

The Terms of Reference for the National Cost-benefit analysis included an investigation of four separate rollout scenarios (a distributor-led rollout, a retailer-led rollout, a non smart meter Direct Load control rollout and a retailer-led rollout with centralised communications) to determine which rollout scenario would deliver the highest net benefits. The National Cost-benefit analysis found that a distributor-led rollout would deliver the highest benefits. This finding was consistent with the Victorian AMI Program that already had sought to make the distributors the party responsible for the rollout.[4]

1.4 Cost to electricity consumers

Although the cost-benefit study found that a smart meter rollout would deliver net benefits, rolling out smart meters and the associated communications infrastructure to households is an expensive exercise. By making the distributors the responsible party for a rollout, electricity consumers will pay for this infrastructure through an increase in their tariff. The National Cost-benefit analysis found that a national rollout would cost consumers between $2.7 billion to $4.3 billion (in NPV terms over a 20 year period).[5] According to the budget proposals submitted to the Australian Energy Regulator (AER) by the Victorian distribution businesses, the cost to households is approximately $80 per annum over a 10 year period (depending on which distribution area they live in). The regulatory cost recovery process and the allocation of these costs to households are discussed in more detail in Section 5.4.

1.5 Why assessing consumer protections in light of smart meters is important

Electricity is an essential service and SMI has the ability to drastically change how industry allocates the cost to various households. Smart meters enable the user pays principle as well as time varying prices for electricity. Subsequently, the cross subsidies inherent in today’s market will reduce, price volatility will increase and new groups of winners and losers will emerge.

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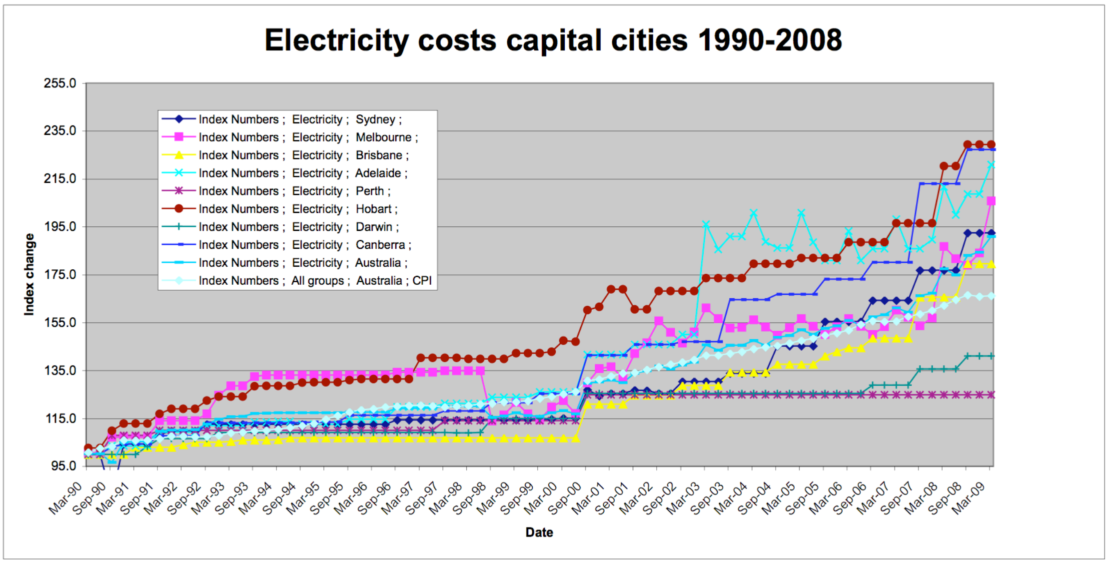
[5] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 22.

Graph 1[6]
Cost of electricity compared to CPI in capital cities from 1990-2008



Increases in electricity costs and bill volatility are not 'just' issues facing low income and disadvantaged households, or households in long term financial hardship. It affects all households as they move in and out of hardship and price volatility can exacerbate the risk of temporary hardship.

Historically, managing the price of electricity has been the main tool to ensure that electricity is affordable and that households have access to supply. Retail offers subject to regulation are available to all households in Australia except in Victoria, which deregulated its energy retail prices on 1 January 2009. There is currently a major push from the retailers across Australia to continue, and accelerate, this deregulation process. A key argument being that cost pressures such as the Carbon Pollution Reduction Scheme (CPRS) will become a major risk to the viability of the industry if retailers operate with regulated prices or price caps. The rollout of smart meters is another reason presented by retailers for price deregulation: retail price regulation is seen as a barrier to introducing time of use (TOU) tariffs and more cost reflective pricing.

A challenge for governments and regulators in relation to rolling out smart meters to domestic consumers is therefore to ensure that electricity remains affordable whilst allowing for cost reflectivity, TOU pricing and increased price volatility.

Consumer protections, delivered through regulation, community service obligations (CSOs) and legislation will be instrumental to ensure energy affordability in such an environment. The National Energy Customer Framework (NECF), which is currently being developed, must therefore be a robust regulatory framework as this is the opportunity to ensure that effective and universal protections are put in place. The role of the NECF can be described as the new shock absorber, replacing government set price caps as the main consumer protection measure.

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6 Graph based on ABS, 6401.0 Consumer Price Index, Australia, Table 13, March 2009.

In addition to the NECF, jurisdictional CSOs and legislation will be crucial to ensure that other specific protections and assistance measures are in place, and continue to involve state and territory governments in ensuring that their constituencies have access to affordable electricity. The involvement of jurisdictional governments is made even more important by the fact that the various energy markets are at very different stages in relation to market reform (ownership structures, retail competition and price regulation).

2. The National Cost-benefit analysis

2.1 Split benefits and government mandated programs

Both the National Smart Meter Program and the Victorian AMI program are government initiated programs producing mandated rollouts because no single stakeholder has the business case to rollout smart meters themselves.

First of all, the supply chain in most jurisdictions is vertically disaggregated. This means that distribution businesses and retailers are separate entities with separate ownership. This structure is different to many overseas markets where the distribution and retail arm of the supply chain is vertically integrated (e.g California) and it is therefore easier for a business to capture benefits associated with many energy market initiatives, including smart meters.[7]

While the majority of the benefits associated with a smart meter rollout will be accrued by the distribution businesses, due to operational savings from the ability to remotely read and connect/disconnect meters and avoided meter costs, the distribution benefits alone are not enough to produce a positive business case for rolling out smart meters. The National Cost-benefit analysis therefore examined distribution benefits, retail benefits and consumer benefits, as well as broader market and environmental benefits. Combined, these benefits resulted in a net positive societal business case.

This situation of positive net benefits split between several stakeholders, justifies governments decision to mandate a rollout. The risk of a government mandated program is, of course, that the businesses' incentive to deliver the program at least cost is heavily jeopardised.

2.2 Jurisdictional differences

It is not only the market and ownership structures that vary from jurisdiction to jurisdiction. There are significant jurisdictional differences in terms of connection numbers, consumption, fuel mix, appliance penetration and network constraints. All these factors impact on the costs and benefits of rolling out smart meters for residential customers within each jurisdiction.

Table 1 below illustrates some key differences in relation to consumption and appliance use.

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[7] There are currently several different models in terms of ownership structures and vertically integrated businesses applied in the various NEM jurisdictions. An outline of these structures is provided in the jurisdictional analyses.

Table 1[8]
Jurisdictional differences - consumption

	VIC	NSW	QLD	SA	WA	TAS	ACT	NT
Number of Residential Connections	2.1mill	2.7mill	1.6mill	679,000	860,000	217,000	n/a	61,500
Average residential consumption (annum)	5990 kWh	7501 kWh	7767 kWh	6185 kWh	5758 kWh	9283 kWh	8194 kWh	8597 kWh
Residential consumption as proportion of total electricity consumption	26%	39%	27%	39%	20%	22%	n/a	14%
Summer or winter peak demand.	Summer	Summer & winter	Summer	Summer	Summer	Winter	Winter	None
Residential AC penetration	69.5%	58.3%	64.6%	85%	80%	35.5%	62.3%	92.9%
Use mains gas for heating purposes	66.5%	17.2%	1%	26.6%	35.1%	1.3%	57.3%	1.3%
Use electric heating	18.5%	43.1%	36.1%	46.5%	30%	63.5%	35.3%	4.8%
Gas water heating	65.7%	25.5%	11.7%	46.2%	58.4%	4.2%	36.4%	5.9%
Peak electricity water heating	6.3%	10.9%	10.6%	3.6%	17.7%	46.8%	21.8%	34.3%

2.3 National Cost-benefit analysis – Net benefits

The cost-benefit analysis produced net values (calculated over a 20 year period) for each jurisdiction along four rollout scenarios, applying both high and low value estimates.[9] The reason for the high and low value approach is the significant uncertainties attached to many of the values used in the analysis. There are considerable uncertainties attached to both the cost figures used and the estimated benefits a meter rollout can deliver. These uncertainties highlight the need for further trials and pilots on a jurisdictional level before commitment to a rollout.

Total quantified potential benefits ranged from $4.8 billion to $7.5 billion nationally. However, the analysis demonstrated significant differences between jurisdictions.[10]

Table 2 illustrates the considerable jurisdictional differences in potential net benefits from a distributor-led smart meter rollout.

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[8] Sources: NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2, Stream 4), February 2008 for: Number of residential connections in Vic, Qld, SA, Tas and NT, Average residential consumption (all jurisdictions), residential consumption as proportion of total consumption (all jurisdictions) and summer versus winter peaks (all jurisdictions).
Independent Pricing and Regulatory Tribunal, *Electricity retail businesses' performance against service indicators in NSW*, Electricity – Information Paper, March 2009 for: Number of residential connections in NSW (using disconnection numbers to calculate total number of domestic connections).
Economic Regulation Authority of Western Australia, *2007/08 Annual Performance Report, Electricity Retailers*, March 2009 for: Number of residential connections in WA.
Energy Market Consulting Associates (EMCa) report to the Ministerial Council on Energy Standing Committee of Officials, *Smart Meter Consumer Impact: Initial Analysis*, Consultation Draft, February 2009 for AC penetration, use of gas and electricity for heating and gas and electric hot water systems (all jurisdictions).

[9] The four rollout scenarios investigated were a distributor-led rollout, a retailer-led rollout, a non-smart meter Direct Load control rollout and a retailer-led rollout with centralised communications.

[10] All values presented in this section are taken from NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008.

Table 2
Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout across all jurisdictions

Net position	Low	High
VIC	(101)	690
NSW[11]	212/248	1,378/1,447
QLD	112	980
SA	(74)	200
WA	93	553
TAS	(48)	54
ACT	(12)	25
NT	(3)	23

2.3.1 Victoria

The National Cost-benefit analysis found that the vast majority of the business efficiency benefits are driven by the distribution network efficiencies (which was the case for all of the jurisdictions). In the case of Victoria, these network benefits comprise 92 to 99% of the total business efficiency benefits.

The key components of the network efficiency benefits are the expected reduction in the cost of special reads, the avoided cost of routine reading and the avoided cost of manual disconnections and reconnections (the size of this benefit reflects the high frequency of connections and disconnections in Victoria compared with many other jurisdictions). Combined, these three categories account for between 58 and 64% of the total network business efficiency benefits estimated for Victoria.

The demand response benefits estimated for Victoria were relatively modest.

Table 3
Victoria, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

VIC	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(1,090)	375	584	31	**(101)**
Maximum Net Benefits	(673)	492	760	111	**690**

2.3.2 New South Wales

The National Cost-benefit analysis examined both a summer and winter peak scenario to estimate demand response benefits for NSW. Although NSW is expected to move towards a summer peaking load profile, the base year (2007) used for the analysis showed a winter peak and both scenarios were thus included.

The business case for rolling out SMI in NSW can be justified solely by the avoided metering costs and resulting business efficiencies that are expected to accrue to distribution businesses. The two key components of the network efficiency benefits calculated for NSW are the expected reduction in the cost of special reads and the

[11] NSW Net position includes winter peak/summer peak.

avoided cost of routine reading. Combined, they account for between 52 and 60% of the total network business efficiency benefits estimated for NSW.

The avoided cost of connections and reconnections is estimated to be another major component of the NSW business efficiency benefits. The demand response benefits (both for summer and winter peak) are significantly lower than the business efficiency benefits.

Table 4
NSW, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

NSW	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand Response (winter peak)	Demand Response (summer peak)	Net Position (winter peak)	Net Position (summer peak)
Minimum Net Benefits	(1,274)	552	807	128	163	**212**	**248**
Maximum Net Benefits	(841)	882	1,055	283	352	**1,378**	**1,447**

2.3.3 Queensland

As in NSW, the business case for rolling out SMI in Queensland can be justified solely by the avoided metering costs and resulting business efficiencies that are expected to accrue to distribution businesses. The key components of the network efficiency benefits calculated for Queensland are the expected reduction in the cost of special reads and the avoided cost of routine reading. Combined, they account for between 42 and 51% of the total network business efficiency benefits estimated for Queensland.

Another major business efficiency benefit calculated for Queensland is the avoided cost from a reduction of calls to faults and emergency lines due to improved outage detection. Queensland currently has a high number of calls compared to other jurisdictions and operators handle a greater proportion of these calls.

The demand response benefits are significantly lower than business efficiency benefits.

Table 5
Queensland, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

QLD	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(894)	365	592	49	**112**
Maximum Net Benefits	(534)	566	778	170	**980**

2.3.4 South Australia

The key components of the network efficiency benefits are the avoided cost of routine reading, the avoided cost of manual disconnections/reconnections and the expected reduction in the cost of special reads. However, the estimated benefits from avoided special reads in South Australia are the lowest of any jurisdiction, due to lower reading costs and less property churn. Combined, these three categories account for between 42 and 47% of the total network business efficiency benefits.

The estimated demand response benefits for South Australia are modest.

Table 6
South Australia, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

SA	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(307)	83	134	17	**(74)**
Maximum Net Benefits	(188)	134	166	88	**200**

Reducing the summer peak demand is an important issue for South Australia and ETSA Utilities had already commenced trials of Direct Load Control (DLC) programs before the National Cost-benefit study was undertaken.

The analysis of a non-smart meter DLC rollout scenario found that to the extent that a DLC rollout may be more effective in reducing peak demand, rolling out DLC alone could be a more appropriate and cost effective strategy for South Australia.

Table 7
South Australia, Net Positive Values (NPV) of Costs and Benefits ($m) for a non-smart meter DLC rollout

SA	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(41)	NA	NA	41	**0**
Maximum Net Benefits	(14)	NA	NA	81	**66**

2.3.5 Western Australia

Western Power is experiencing accuracy problems with their current meters and are therefore planning to replace almost a third of meter stock. Thus a significant benefit estimated for Western Australia is the avoided cost of replacement meters.

The key components of the network efficiency benefits calculated for Western Australia are the expected reduction in the cost of special reads and the avoided cost of routine reading. Combined, they account for between 46 and 56% of the total network business efficiency benefits estimated for Western Australia.

As in Queensland, a significant business efficiency benefit occurs in relation to the avoided cost from a reduction of calls to faults and emergency lines due to improved outage detection.

Table 8
Western Australia, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

WA	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(532)	297	299	28	**93**
Maximum Net Benefits	(336)	394	411	84	**553**

2.3.6 Tasmania

The key components of the network efficiency benefits are the expected reduction in the cost of special reads, the avoided cost of routine reading and the avoided cost of manual disconnections and reconnections. Combined, these three categories account for between 50 and 67% of the total network business efficiency benefits estimated for Tasmania.

The overall demand response benefits for Tasmania are estimated to be negative. This means that customers would face higher tariffs at peak times but without being able to shift or reduce their load in response to the price signal.

Table 9
Tasmania, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

TAS	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(152)	58	49	(2)	**(48)**
Maximum Net Benefits	(86)	97	75	(1)	**84**

2.3.7 Australian Capital Territory

As in the other jurisdictions, the vast majority of the business efficiency benefits are driven by the distribution network efficiencies.

As the ACT does not have a distinct NEM region, the consultants were unable to estimate market benefits. However, considering the other jurisdictional results the consultants did not find any reason to believe that the market benefits would be of such significance that it would alter the outcomes of the analysis.

The key components of the network efficiency benefits calculated for the ACT are the expected reduction in the cost of special reads and the avoided cost of routine reading. Combined, they account for between 63 and 68% of the total network business efficiency benefits estimated for ACT.

As the electricity network in the ACT was built to serve a lot more people than it currently does, as well as being designed to meet a peak winter heating load (which is now served by gas) the ACT is unlikely to see any network deferral benefits from rolling out SMI.

Table 10
Australian Capital Territory, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

ACT	SMI Costs	Avoided meter Costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(58)	23	24	NA	**(12)**
Maximum Net Benefits	(36)	33	28	NA	**25**

2.3.8 Northern Territory

The key components of the network efficiency benefits calculated for the Northern Territory are the avoided cost of manual disconnections/reconnections and the expected reduction in the cost of special reads. Combined, they account for just over 50% of the total network business efficiency benefits estimated for the Northern Territory.

For the Northern Territory, the avoided cost of routine readings and demand response benefits are both very low.

Table 11
Northern Territory, Net Positive Values (NPV) of Costs and Benefits ($m) for a distributor-led rollout

NT	SMI Costs	Avoided meter costs	Business efficiencies and other benefits	Demand response	Net position
Minimum Net Benefits	(35)	5	27	(0)	**(3)**
Maximum Net Benefits	(22)	8	33	4	**23**

Box 1 Summary of jurisdictional cost benefit analysis[12]

Queensland, New South Wales and Western Australia
For these jurisdictions a smart meter rollout would have a positive net benefit on the basis of avoided metering costs and distribution business efficiencies alone. The net benefit of a smart meter rollout remains positive even if costs are at the upper end of the estimated range and business efficiency benefits at the lower end of the range. Any demand response benefits arising in these jurisdictions would represent additional benefits.

Victoria and South Australia
Whether a rollout of smart meters results in a positive net benefit in these jurisdictions is crucially dependent on being able to achieve a cost towards the low end of the range estimated and business efficiency benefits at the upper end of the range estimated. In these jurisdictions demand response benefits would need to be more aggressively pursued (through the introduction of TOU tariffs and/or CPP, or direct load control programs) in order to make-up any shortfall between benefits and costs on business efficiency grounds only.

Given the uncertainties associated with the likely demand response, the consultants team recommends that for South Australia a decision about a smart metering rollout be further informed through undertaking specific jurisdictional trials of CPP/TOU and DLC. This will assist with informing whether the demand response benefits they have estimated are realistic in the individual jurisdictional circumstances. In the case of Victoria, which is committed to a smart meter rollout, they suggest that similar trials are undertaken in order to maximise the potential scope for demand-side response benefits.

Australian Capital Territory, Tasmania and the Northern Territory
For the Australian Capital Territory, Tasmania and the Northern Territory the analysis indicates again that the justification for a smart meter rollout is highly dependent on whether the bottom range of the cost estimates can be achieved, together with the upper end of the business efficiency benefits. However in these jurisdictions the consultants do not consider that there are likely to be significant demand response benefits. As a result there is not the same scope for potential 'upside' through demand response as there is in Victoria and South Australia.

2.4 Benefits – assumptions and estimates

The four main categories for benefits quantified and therefore accounted for in the National Cost-benefit analysis are:

1 *Business efficiencies* which accounted for 67 to 74% of the total annual distribution benefits and include the avoided cost of:
   - Manual meter readings and special reads (e.g. when a customer moves)
   - Manual connections and disconnections
   - Customer calls to faults and emergency lines (due to fewer calls)
   - Customer complaints regarding voltage and quality of supply

2 *Service quality improvements* include reductions in unserved energy (resulting from the ability to more quickly detect of outages and shorter). Service quality improvements also result in a number of retail efficiencies due to:
   - Fewer high bill enquiries to the call-centers
   - A reduction in bad debt and working capital requirements
   - A reduction in hedging costs due to improved forecasting

[12] The jurisdictional differences outlined in Box 1 is based on the NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 196-197.

3 *Avoided metering costs* is a significant benefit, accounting for between 39% and 44% of the total benefits estimated in the analysis. The benefits from avoided metering costs incur as the analysis consider the difference in meter and installation cost between rolling out smart meters and the counterfactual. It takes into account the costs the distribution businesses otherwise would have incurred from replacing and installing meters as usual over the assessment period.

4 *Demand response impacts* were found to be of a much lower net benefit than the various business efficiencies. Demand response impacts derive from the possibility of:
- o Deferred need for peak network augmentation
- o Reduced hedging costs for retailers due to lower peak wholesale prices
- o Deferred need for peak generation capacity and reduced levels of unserved energy
- o Reduced generation operating costs and carbon emissions due to demand response patterns that can impact on the pattern of electricity market dispatch.

The estimated benefits in relation to the avoided cost of manual meter readings and manual connections/disconnections are based on regulated charges for these services and are therefore the benefit estimates with the highest level of certainty. The retail efficiencies stemming from service quality improvements, on the other hand, are estimates with a high degree of uncertainty. These calculations are based on information provided by the retailers.

Benefits deriving from demand response impacts are the benefits associated with the most uncertainty. Basically, the analysis has assumed that SMI provide the mechanisms to influence customers' demand by introducing time varying pricing and/or through the direct load control of certain appliances at specific periods of high demand.

However, the ability and willingness of consumers to respond to price signals (time varying prices) is a highly debated area. The elasticity of demand for household electricity consumption is relatively low and whilst some customers may be able to shift some of their consumption to other times, the likelihood of a significant overall reduction in demand due to price signals is more questionable. This issue, and some of the assumptions used for the National Cost-benefit analysis, will be explored in more detail in Section 5.2 below.

Table 12
Demand response estimates the in National Cost-benefit Study[13]

		Vic	NSW/ACT		QLD	SA	WA	TAS	NT
			Base	Summer peaking					
Peak times	**Summer**								
	CPP day	-16.7%	-17.3%	-19.6%	-18.6%	-14.5%	-21.5%	n/a	-10.6%
	Peak day (non-CPP)	-4.5%	-5.2%	-5.2%	-4.6%	-2.8%	-5.8%	-1.4%	-1.0%
	Winter								
	CPP day	n/a	-7.8%	-5.7%	-4.3%	n/a	-4.4%	-6.0%	-3.4%
	Peak day (non-CPP)	-1.7%	-1.9%	-1.9%	-1.2%	-0.7%	-1.4%	-1.1%	-0.2%
Daily average	**Summer**								
	CPP day	-7.3%	-5.4%	-6.5%	-7.8%	-7.2%	-6.6%	n/a	-5.4%
	Peak day (non-CPP)	-0.1%	0.0%	0.0%	-0.1%	0.4%	0.2%	0.1%	0.2%
	Winter								
	CPP day	n/a	-3.2%	-1.5%	-1.6%	n/a	-1.3%	-3.0%	-2.2%
	Peak day (non-CPP)	0.0%	0.0%	0.0%	0.0%	0.2%	-0.2%	0.0%	0.1%

This table shows the demand response rates for Critical Peak Pricing (CPP) and time of use (TOU) tariffs estimated in the National-cost benefit study. It presents demand response estimates for those customers on a TOU/CCP tariff *only* – it is not the demand response estimates for each jurisdiction simply as a result of rolling out smart meters.

The top half of the table (peak times) presents the estimates of change in maximum demand. The bottom half of the table (daily average) presents the estimates for the overall change in demand (for those customers who are on a TOU/CPP tariff).

Focusing on the top half of the table (peak times), it shows that the National Cost-benefit analysis estimated that the summer demand response rate for Western Australian customers on a CPP tariff will be as high as a 21.5% reduction in peak load. This is a substantially higher reduction than that estimated for South Australia (14.5%). It also shows that the reduction in winter peak demand is modest for customers on a TOU (but non-CPP) tariff. New South Wales' customers on TOU tariffs have been estimated to have the highest winter peak reduction (1.9%).

There are significant regulatory and policy challenges attached to ensuring that the benefits (stemming from business efficiencies, service improvements and demand response) are realised. The estimated benefits will not be automatically met by rolling out SMI and it is therefore crucial that the regulatory framework incorporates the right incentives for industry, and that government is willing to utilise policy incentives to ensure that the societal benefits are realised.

[13] This table is based on the figures presented in NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control,* Consultation Report for the Ministerial Council on Energy Smart Meter Working Group, *Work Stream 4: Consumer Impacts* (Phase 2) February 2008, Table 5.2, p 42.

A key challenge for regulators and policy makers is to address the relationship between networks and retailers. This issue is discussed in more detail in Section 5, however it should be noted that the National Cost-benefit study made the following assessment in relation to those jurisdictions where SMI is justified on the basis of demand response benefits:

> The underlying incentives for network businesses to implement TOU or CPP to achieve these demand response benefits as well as the most appropriate approach to ensure that retailers pass through the resultant pricing structure to customers should be considered. According to the study, options range from an approach where benefits associated with the cost savings are shared between networks and retailers to a regulatory requirement on retailers to directly pass through network tariffs to customers.[14]

2.5 Costs – assumptions and estimates

The National Cost-benefit analysis stressed that there are considerable limitations to the cost information used in the study. There has never been a rollout of smart meters with the functionalities included in the analysis. This may mean that the actual SMI costs could be significantly different from the costs included in the study. The analysis was conducted prior to the commencement of the Victorian AMI Program cost recovery process and therefore unable to take the distributors budget submissions to the AER into account.

On 30 July 2009, the AER released its draft determination on the initial charges (2010-2011) for the Victorian AMI program. The charges proposed by the draft determination will produce average increases in metering charges of $53 in 2010 and $77 in 2011 (compared to 2009 charges). However, the charges vary significantly between the distribution networks, ranging from $68 to $105 in 2010 and from $92 to $130 in 2011.[15]

These figures include the cost of the actual rollout (i.e. installation cost, labor force) but both the meters themselves and the communications technology required are significant cost components and these costs increase in line with the functionalities (that is, the actual capabilities) of the meters installed. The more functionality included, the more expensive the meters and communications technology required will be.

3. The functionalities of the smart meters – what they can do

'Smart meters' is a generic term that may just mean that the meter can record consumption on a regular (and frequent) basis and have the ability to transfer this data via remote communications technology. Meter functionalities have significant cost implications and any business or government deciding to rollout smart meters must

[14] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 201.

[15] These charges relate to a single phase, single element meter. AER, Draft Determination, *Victorian advanced metering infrastructure review, 2009–11 AMI budget and charges applications*, July 2009, p 7.

carefully consider the cost and benefits of including functionalities beyond the core capabilities that actually defines a smart meter. The National Cost-benefit study defined smart meters as: interval meters with secure two-way communications and remote reading capabilities that provide the base for more advanced functionality.

It was the MCE's decision to proceed with a national minimum functionality for smart meters. The reason for a national specification is to avoid a divergence of minimum functionality and performance levels of smart meters that can result in a number of market, operational and regulatory inefficiencies. These inefficiencies will increase costs for retailers, meter manufacturers, meter purchasers and AEMO (NEMMCO), costs that are ultimately paid for by consumers.

Eight functionalities are regarded as 'core' for a national smart meter specification.[16]

Table 13
National Core Functionalities for Smart Meters

Functionality #	Functionality	Description
1	Half-hourly consumption measurement and recording	Meters must record active energy in 30 minutes interval
2	Remote reading – weekly	Data is collected from the meters on a weekly basis
3	Local reading – hand-held device	Meters are also capable of being read on-site by a meter reader using a special meter reading device (as a back up in case there is a communications failure)
4	Local reading – visual display on meter	Meters are also capable of being read on-site by the customer using a visual display (as a back up in case there is a communications failure)
5	Communications and data security	All data from the meter is securely transmitted
6	Tamper detection	The meter system would support detection of attempts to tamper with the meter and would communicate any such attempts remotely
7	Remote time clock synchronization	Remote setting of the clock in the meter and maintenance of clock accuracy, in order to ensure that half-hourly data reads correspond to actual time of use.
8	Load management at meters through a dedicated controlled circuit	Continued support for current arrangements for load management at dedicated control circuits, ie, hot-water control systems. Allows broadcast of turn-on/turn-off commands to dedicated circuits, with the action performed at 99% of meters within 1 hour.

The benefits of the following additional functionalities were assessed by the National Cost-benefit analysis to outweigh the costs and thus recommended to be included in the minimum national meter specification.[17]

[16] Ministerial Council on Energy Standing Committee of Officials, Cost-Benefit Analysis of Options for a National Smart meter Roll-Out, Regulatory Impact Statement, April 2008, p 14.
[17] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 1 Overview Report), September 2007, p 13 - 23.

Table 14
Additional functionalities recommended by the National Cost-benefit analysis

Functionality #	Functionality	Description
Energy measurement functionalities		To provide more frequent information on a customer's energy usage or enhanced measurement of energy usage
9	Daily remote reading	Daily remote collection of the previous trading day's 30 minute interval energy data (rather than on a weekly basis, which is assumed in the 'core' functionality)
10	Power factor measurement (three phase meters only)	Half-hourly reactive energy measurement
11	Import/export metering	Records active energy flows both into a premise and out of a premise, where the customer has installed local generation (eg, solar cells).
Switching and load management		The ability to control supply and selected loads at customer premises.
12	Remote connect/disconnect	Customers can be connected and disconnected remotely.
13	Supply capacity control	Provides the ability to limit power to individual households.
Facilitation of Customer Interaction		
16	Interface with a Home Area Network	Provides the *capability* for both direct load control via the home area network (HAN) and the provision of an In-Home Display (IHD).
Supply and service monitoring		Recording quality of supply and other events would provide a benefit for distribution businesses in being able to better monitor the quality of supply performance, and to detect and react to non-compliance with service standards more quickly.
19	Quality of supply and other event recording	Enables meters to record information in relation to quality of supply events or other events (eg: outage, undervoltage, disconnection, meter loss of supply, change of settings). The event log could then be read remotely.
20	Meter loss of supply and detection	Regular communication with the meters at customer premises would enable a loss of supply to a meter to be detected within one hour (for 90% of meters). The metering systems would also enable system outages to be detected, either at meters or at distribution transformers. Where a loss of supply or an outage was detected, an alarm would be sent.
Upgradeability and configurability		Alternative installation options for the meters and the ability to upgrade or reconfigure the meter settings remotely in future.
25	Remote configuration	Enables meter settings to be remotely changed. Settings would include, for example: ▪ times for controlled load switching; ▪ thresholds for quality of supply events; and ▪ supply capacity control settings.
26	Remote software upgrades	The software in the meter can be upgraded remotely by the responsible person over the communications link, without the need for a site visit or action from the customer.
29	Plug and play device commissioning	Allows meters to be activated and registered on the system remotely once installed, rather than manually.

Other functionalities have been subject to much discussion, as the benefits do not clearly outweigh the costs. However these functionalities are closely linked to some of the objectives envisaged to be achieved by a smart meter rollout.[18]

Table 15
Functionalities *not* recommended by the National Cost-benefit analysis

Functionality #	Functionality	Description
Switching and load management		The ability to control supply and selected loads at customer premises
14	Load management at meters through a dedicated controlled circuit	Allows more flexible use of existing load control for hot water.
15	Interface for other load control devices	Allows electric devices in the home to be cycled at peak times (ie, turned on and off remotely at short intervals), such as air-conditioners and pool pumps.
Facilitation of Customer Interaction		
17	Provision of an in-home display	An in-home display is provided as part of the smart meter rollout.
18	Interface for communications with gas and water meters	Gas and water meters would also be able to be read remotely, via communications installed for the electricity meter.
Supply and service monitoring		Recording quality of supply and other events would provide a benefit for distribution businesses in being able to better monitor the quality of supply performance, and to detect and react to non-compliance with service standards more quickly
21	Customer supply monitoring	The meter would send an alarm if it detected: ▪ reverse polarity at a customer's connection; ▪ degradation of the customer's neutral; and ▪ degradation of the customer's earth connection (from switchboard to earth).
22	Real-time service checking	The meter can be accessed remotely in real time in order to check the presence of supply to a meter.
Standards and interoperability		The extent to which commands and responses between the different hardware components forming part of the overall smart metering system can be facilitated by a single network management system.
23	Interoperability for meters/ devices at the application layer	Allows requests and messages to be sent to the system by parties other than the party primarily responsible for the meter, using a standard interface.
24	Hardware component interoperability	Hardware components which can operate with components from different manufacturers – for example communications modules and meters.
Upgradeability and configurability		Alternative installation options for the meters and the ability to upgrade or reconfigure the meter settings remotely in future.
27	Separate standard base plate	The provision of a base plate into which the meter can be plugged. It may be possible for the communications unit to be plugged into the base plate as well. Future upgrades to the meter or communications unit could then be undertaken by plugging in the new units, rather than replacing the whole installation.

[18] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 1 Overview Report), September 2007, p 13 - 23.

28	Non meter board installation	Instead of the meter mounted on the wall of the premises it is mounted elsewhere (eg, on the power pole supplying the premises).

The NSSC and its associated work streams are currently developing advice on detailed national minimum functionality for smart meters in order to maximise benefits across all stakeholders. This work will include advice on technical definitions, performance and service level requirements for the national minimum functionality specification.

3.1 National minimum functionality specification

Prior to assessing where the benefits of rolling out smart meters would outweigh the cost, the National cost-benefit analysis assessed the functionalities to be included in an Australian smart meter specification. This was done in order to produce a recommendation to the MCE about the benefits and costs of including specific functionalities in the specification.

A national minimum specification means that every household in jurisdictions where meters are rolled out must receive a meter capable of delivering the functionalities included in the specifications. When distribution businesses are made the responsible party for a rollout, this also means that the distribution businesses will get full cost recovery for purchasing meters and communications technology as required to deliver the specification. If a distribution business should wish to include any functionality outside the specification, the business would need to produce its own business case for doing so.

It is also important to note that the specification is just a *minimum* specification and allows distribution businesses, retailers and consumers to add some functionalities. This is especially relevant for in-home displays. In-home displays (IHDs) are fairly costly devices (the National Cost-benefit estimated a cost of $80-100 per IHD) and if IHDs were to be included in the minimum specification it would add significant cost to a rollout, and ultimately consumers. However, by including a Home Area Network (HAN) in the specification, IHDs can be installed post a rollout and target households most likely to benefit. As such, the cost of IHDs would not be socialised across all households, but rather the business and or the customer wishing to utilise this functionality would pay. As a result, and importantly, the cost would be much lower as not all households would automatically receive an IHD with the smart meter. That said, some uncertainty prevails in relation to the technology used to create a HAN and the NSSC has been requested by the MCE to provide advice on the HAN standard to be adopted.

3.2 Different stakeholder interests

Distribution businesses, retailers, environment and consumer groups often want different and various functionalities included in the minimum specification. For example, distribution businesses want outage detection while retailers want daily reads allowing them to settle customer accounts over the phone. Environment groups have pushed for information provision such as in-home displays, as they believe increased information will result in reduced consumption. Consumer groups have been concerned about the cost of a rollout and the impact it will have on low-income households in particular. Due to the various stakeholder interests and the multiple government objectives for rolling out smart meters, both the national minimum functionality specification (and the Victorian minimum functionality specification) are currently encompassing more functionalities than other smart meter specifications produced to date internationally.

4. Communications technology

For the meters to operate as smart meters, defined by a secure two-way communication and remote reading capabilities, significant investment in communications technology is required.

One of the key challenges for rolling out SMI is the ability of certain communication technologies to deliver the minimum functionality specification and the minimum service specifications as set out in regulation. Furthermore, in order to produce jurisdiction-wide rollouts, the communications technology must be able to deliver the same functionalities in rural areas as in an urban setting. There are both significant cost and technology implications for delivering SMI to rural households.

There have been several technology trials undertaken in Victoria to ascertain which communication technologies have the ability to deliver on the meter specifications as well as the network service specifications.

The trials measured the performance of SMI communications systems under realistic conditions, testing particular issues such as:

- Reliability of communications
- Bandwidth
- Speed and accuracy
- Response time
- Interference to other communication systems or power system devices

Furthermore, the trials tested the performance on various distribution network configurations, including:

- Low and high voltages
- Long and short feeders
- Residential and industrial areas
- Overhead and underground reticulation

Possible communication technologies include power line carrier, direct line carrier and radio mesh.

Some of the key finding in Victoria when comparing these three communication technologies against the minimum functionality specification and the service standards were:

- Power Line Carrier (PLC)
  - Will support minimum functionality specification
  - Can read meters wherever the electricity network reaches
  - Particular challenges: limited bandwidth (which may limit messages to individual meters as well as tariff or load control changes to individual meters), radio noise, load current swamping signal and customer voltage flicker
  - Minimal potential for application growth

- Direct Line Carrier (DLC)
  - Will support minimum functionality specification
  - Particular challenges: limited bandwidth, limited noise immunity and customer equipment interference
  - Some systems capable of multiple concentrators on a single low-volume (LV) network
  - Limited potential for application growth
- Mesh Radio
  - Will support minimum functionality specification
  - Particular challenges: external antennas or extra repeaters required and lower reliability in fringe areas
  - Potential for application growth

5. Issues for consumers

The issues discussed in this section have been raised by stakeholders in submissions to various smart meter stakeholder consultations or identified by the National Cost-benefit study.

5.1 New capabilities

Although it has not yet been agreed exactly what functionalities and service levels the national smart meter specification will adhere to, a rollout of SMI will introduce new functionalities and their capabilities will impact on the electricity market and shape new interactions between consumers and industry participants.

5.1.1 Remote connection/disconnection

An important benefit of rolling out smart meters in Australia is the avoided cost in physical connections/disconnections. However, connecting and disconnecting a property remotely raises some important consumer protection and safety concerns.

Under the current arrangements, a person has to physically visit the property in order to connect/energise or disconnect/de-energise. This means that direct human interaction occurs if someone is at home at the property. This interaction is important, as the person sent out to do the job will notice if there is someone elderly or ill living at a property which the retailer has requested to be disconnected. Some customers have life support equipment dependent on electricity supply, and while customers on with such equipments at home are supposed to be registered and it is illegal to disconnect these households, the home visits do provide an additional safety-net in case people have not registered or human error occurs.

Furthermore, disconnections are sometimes avoided as people ring their retailer to discuss payment arrangements upon being visited by the person sent out to undertake a disconnection. Remote disconnection means that this direct human contact will not occur in the future and that new procedures for phone contact may be warranted.

Consumer representatives are also concerned about the increased expediency with which disconnections can occur when undertaken remotely. Although the regulatory framework will continue to stipulate the necessary steps a retailer must take prior to disconnecting a customer for non-payment, there is a risk that retailers will become more unreserved in disconnecting customers due to lower costs as well as the ability to more rapidly reconnect in the same name upon receiving payment.

There are also safety concerns in regards to energising properties remotely. Doing it remotely means that crucial safety checks in terms of wiring and other matters will not be undertaken. It is also a risk that someone within the property is in contact with the electrical system at the time of connection.

5.1.2 Remote meter reads

Remote meter reads are regarded as a key customer service benefit from rolling out smart meters. Currently the practice of estimated bills causes major problems for customers who either receive severely over-estimated bills, or receive underestimated bills and therefore a large adjustment bill when a meter read is finally undertaken.

As the distribution businesses own the meters, customers are obliged to provide access to their meters for the purpose of reading them. However, some meters are placed on the back of the house or behind gates and the resident is reluctant to provide keys for access. In those situations, the customer is obliged to be at home when the company representative comes to read the meter. However, no exact appointment time will usually be provided and the customer may be required to spend a whole day at home in order to have the meter read. Clearly, remote reads will improve the service for many of these customers.

After finding that approximately 21% of all Victorian electricity customers received at least one estimated bill in 2006-07, the Victorian Essential Services Commission initiated a special investigation into the use of estimated reads concluding that:

> The most significant cause identified by retailers for the increased prevalence of estimated accounts appears to be meter access issues, a fact which is supported by the data provided by distributors in relation to Reason/Trouble codes. Legitimate consumer concerns regarding security and personal safety have resulted in access to meters not being assured. The increase in apartments and multi dwelling buildings, and their increased security measures may also have had an impact. Customers must therefore compare the benefits gained from the security of their properties against the need for a more accurate energy bill based on an actual reading.[19]

The same report also noted that:

> The Victorian Government's decision to roll out advanced meter infrastructure, or 'smart meters' should also minimise the need for estimated accounts as household energy consumption data will be remotely read and automatically transferred to distributors, thereby minimising the need for actual reads and obviating the ongoing meter access issues.[20]

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[19] Essential Services Commission, *Special Report – Use of estimated accounts by Energy Retailers*, December 2008, p 20.
[20] Essential Services Commission, *Special Report – Use of estimated accounts by Energy Retailers*, December 2008, p 21.

It is not just the routine reads that can be undertaken remotely. The current functionality specification also ensures that retailers can order special reads. This means that retailers will have the ability to request final payment of account over the phone and it is therefore important that the regulatory framework does not allow retailers to prevent customers from initiating a change of retailer without settling their accounts on the spot. The technical ability to undertake instant meter reads must not erode the practice of allowing consumers a reasonable amount of time to pay their bills. Electricity is a significant household expenditure item and it is crucial to ensure that the billing arrangements reflect the fortnightly pay cycle most people are on.

5.1.3 Prepayment capabilities

Smart meters will have the capability to operate as prepayment meters. The use of prepayment for electricity supply is a much debated and contested issue. There are major jurisdictional differences when it comes to the use of prepayment meters. In Tasmania, Aurora Electricity promotes and utilises prepayment contracts extensively, while in Victoria prepayment meters are currently banned.

To date, prepayment has meant that a special meter has to be installed in households in order to utilise this method of payment. With the rollout of smart meters, there is no technical barrier in place for a retailer to demand that the customer prepay for their electricity consumption. It is therefore crucial that other barriers are in place to ensure that a smart meter rollout does not result in customers being simply transferred to prepayment contracts.

From a consumer protection point of view, prepayment removes many of the current safety-net provisions in place to ensure that households can afford, and have continuous access to, electricity supply. A prepayment arrangement removes key responsibilities of the retailers in relation to the supply an essential service and places the onus to stay connected to supply on the households themselves.

Furthermore, a mass transfer of customers to prepayment arrangements following a rollout of smart meters would reduce, and in some cases remove, some of the perceived benefits of a smart meter rollout. Price signals and demand response benefits would be difficult in a setting where the customers pay for their consumption in advance.

5.1.4 Direct load control functionality

> Direct load control has the potential to reduce peak demand, thereby avoiding network augmentation and peak generation. A reduction in peak demand would also have wider market impacts in relation to generation fuel costs and greenhouse gas emissions.[21]

The functionality of direct load control (DLC) of appliances via the Home Area Network (HAN) can result in product offerings where the customer agrees to cycle or reduce usage of certain appliances at times of peak demand. Both distribution businesses and retailers may have an interest in utilising this functionality:

[21] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 1 Overview Report), September 2007, p 17.

distribution businesses to avoid the need for network augmentation and retailers to reduce electricity consumption at expensive peak generation times. In exchange for entering into such contracts, customers may be rewarded through lower electricity rates. The greenhouse benefits from reducing peak demand are more complex however. In some jurisdictions, like Victoria, where peak electricity is cleaner than the brown coal fired base load, shifting demand from peak to off-peak times may actually increase greenhouse gas emissions.

DLC of appliances has the potential to be an incentive based product offering where customers agree to nominate certain appliances such as air conditioning units and pool pumps for load control in exchange for cheaper electricity rates. Still, the NECF needs to specify the framework within which DLC may operate. To ensure that DLC product offerings will eventuate into incentive based contracts (instead of punitive arrangements), the customer framework should stipulate maximum thresholds for duration, frequency and number of appliances. DLC should be a tool to reduce peak demand, not a tool for retailers to limit overall supply to households.

As the benefits of DLC to the supply side are split, there should also be arrangements in place to ensure that DLC can reduce both network constraints and peak generation.

5.1.5 Home areas networks and in-home displays

The National Cost-benefit analysis did not recommend the inclusion of in-home displays (IHDs) in the minimum functionality specification. It did however recommend the inclusion of a home area network (HAN) that can support an IHD.

The analysis estimated that the cost of IHDs would be approximately $100 per customer and would therefore have a significant cost impact, while the benefit case is questionable. As the report noted "there is considerable uncertainty surrounding the impact on demand that may result from the provision of IHDs to consumers and the results from trials both in Australia and internationally are mixed."[22] By ensuring that the HAN supports the inclusion of IHDs, customers interested in a display may install one after a rollout, or retailers may choose to offer IHDs to customers in conjunction with specific retail products.

Not all stakeholders supported this recommendation. The Total Environment Centre, for example, argued:[23]

> In-home displays are essential to convey information to consumers and to maximise greenhouse benefits. Without IHDs the meters are for the benefit of electricity business efficiency, not for direct consumer benefit, and will only result in small greenhouse emissions reductions. An IHD has been the only genuine vehicle proposed for consumers to receive information on their usage and impacts, and the higher-range greenhouse benefits modelled in the CBA all depend on the existence of IHDs. Without these, for consumer information and greenhouse benefits a smart meter is no better than an interval meter. It is

[22] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 164.

[23] Total Environment Centre, *Submission to MCE SCO Regulatory Impact Statement on the Cost Benefit Analysis of options for a national smart meter roll-out*, May 2008, p 11.

> suggested that retailers may offer them to customers, or consumers may be able to buy them, but there is absolutely no guarantee and limited incentive for these possibilities to eventuate.

However, not all households would be interested in an IHD and there are other (and less expensive) ways to provide customers with information about their energy consumption, such as websites.

5.1.6 Supply capacity control

From a customer perspective, supply capacity control is the functionality that imposes the greatest risk to the provision of energy services in the future. The broader benefits of including the supply capacity control functionality in the meter are positive, as it allows distribution businesses to limit power to individual consumers following a network outage. Basically, it allows networks to provide affected customers with a limited supply of electricity rather than having a whole area blacked out until fully restored. The risk, however, is attached to retailers accessing supply capacity control. Retailers do not have a role in system management, so their use of the functionality would relate to developing contractual arrangements with customers where customers agree to use electricity below a maximum threshold. Presumably, customers agreeing to such a contract would be rewarded with cheaper electricity rates, however, not all customers have the same bargaining powers when it comes to dealing with their energy retailers.

The National Cost-benefit study noted that:[24]

> Retailers could potentially also choose to offer supply capacity products to assist low income customers manage their expenditure, or could adopt supply capacity limits as an alternative to disconnection for defaulting customers.

The notion that supply capacity products could be tools to assist low-income households is to step back to the dark-ages of consumer protections in relation to essential services. There are numerous arrangements in place to assist low income households paying their energy bills, ranging from payment plans to energy efficiency improvements to concessions and relief grants.

Allowing retailers to limit the supply capacity (which is effectively placing a choker on a household's electricity supply) would set a dangerous precedent and undermine the principle of universal access to essential services. At what point is a supply capacity limit effectively a disconnection? How much electricity does a household need? Is it acceptable to request low-income households to watch television in the dark or chose between running the fridge or the heater?

The principle that disconnection of supply is the last resort, and that no-one should be disconnected due to an inability to pay, must be upheld and it is thus crucial that the NECF stipulates how the supply capacity control functionality can be utilised and by whom.

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[24] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 1 Overview Report), September 2007, p 16.

5.2 Demand response

The assumptions behind and the calculations of demand response rates in the cost-benefit analysis are important consumer issues for three main reasons. First, this is one of the benefits that directly involve and depend on consumers. Consumers can expect to be financially disadvantaged if unable or unwilling to respond to price signals. It is therefore crucial that the limitations to households' demand response to price signals are properly understood. Second, the cost-benefit analysis demonstrates that some of the jurisdictions will be dependent on achieving demand response benefits in order to have a net benefit case for rolling out smart meters. Third, and in response to the second point, it is therefore important that governments monitor the demand response outcomes and express commitment to increase the response by introducing complementary programs and policies if the smart meters do not elicit the response forecasted.

5.2.1 Demand elasticity

The economic concept of measuring price elasticity of demand is used to assess consumer response to price changes through an increase or a decrease in demand.[25]

As electricity is an essential service, this places a significant constraint on the ability of households to reduce demand in response to price increases. However, there are numerous factors influencing a household's willingness and ability to respond to price signals for electricity, including:[26]

- The value households place upon electricity access and usage
  - This will depend on a number of factors that influence what a household regards as necessary, or non-discretionary, usage. Such factors are both climatic and demographic.
- Electricity expenditure as a proportion of income
  - Low-income households are more price responsive as electricity makes up a greater proportion of total household expenditure.
- Substitutability of electricity
  - Households able to substitute electricity for other fuel sources will have higher demand elasticity.
- Appliance holdings
  - As electricity demand is derived from the flow of services provided by households' durable electric appliances, the electricity demand is not as price sensitive as the demand it is derived from. The appliance factor makes a significant impact on the differences detected in short run elasticity and long run elasticity.
- The magnitude of the price change
  - The elasticity rates will vary according to the magnitude of the price change – the rates are unlikely to be linear.

All these factors will impact on an individual households' ability to respond to price signals, as well as influencing the overall benefits and market efficiencies smart meter enabled dynamic pricing can deliver.

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[25] This is calculated by dividing the percentage change in demand by the percentage change in price.
[26] This list is based on the analysis presented in the report *Domestic electricity demand elasticities – Issues for the Victorian Energy Market* by Langmore and Dufty, June 2004.

The cost benefit analysis assumed that the mere installation of smart meters would elicit an automatic 3% demand reduction, and that every household with a smart meter as well as an in-home display would automatically reduce demand by 7%. These are optimistic assumptions and many consumer groups pointed to a 'fudge factor' being applied in order to get a positive business case in their submissions to the consultation process.[27]

As pointed out in the SVDP/CUAC submission, studies from the US have indicated that the demand response from IHD can vary widely depending upon appliance mix (as low as 1.2% to as high as 16%).[28]

Variability in demand response has been highlighted through the research findings of the American Council for an Energy Efficient Economy.

> The results from roughly 20 studies on energy use feedback over the past 35 years indicate energy savings from energy use feedback devices falls somewhere between 4% and 15%. … Results may vary significantly depending on the type of marketing, instruction, and/or goal-setting that accompanies the device. Other factors such as the presence of children or previous exposure to government conservation campaigns are also likely to affect savings. A 2004–2005 controlled pilot study by Hydro One in Canada found that, without any energy savings guidance on the part of the utility, participants achieved aggregate savings of 5% in base-load electricity that persisted over the 18-month test period.[29]

The cost-benefit study did reflect upon these uncertainties and as such policy makers should be cautious in accepting the demand response figures assumed in the analysis without further evidence.

5.2.2 Product take-up rates

For the purpose of achieving enough demand response to justify a rollout of smart meters, it is not just the response households have to TOU and CPP pricing that is important. As governments envisage consumers will voluntary sign up to these tariffs, assumptions about take up rates are critical to the business case.

As discussed in Section 2.4 above, the demand response estimates presented in the National Cost-benefit study measured the response rate of customers assumed to have signed on to TOU or CPP contracts.

The SVDP/CUAC submissions to the cost-benefit analysis consultation process raised some concerns about the take up rates assumed in the study. One particular assumption that caused concern was in regards to the take up rates of the TOU/DLC and TOU/CPP options in relation to the inclusion of a Home Area Network (HAN) in the minimum functionality specification. In the high demand scenario the analysis

[27] SVDP/CUAC, *Submission to the Cost Benefit Analysis of Smart Metering and Direct Load Control: Phase 2 Reports for the Ministerial Council on Energy's Smart Meter Working Group*, April 2008.
[28] See for example, cost benefit analysis for interval metering and time based pricing: http://publicservice.vermont.gov/planning/vermontdpsworkshopcompressed.pdf
[29] The American Council for Energy Efficient Technologies, *Emerging Technologies Report*, June 2007, p 3.

assumed that 30% of the population would be on a TOU with an additional 15% on a TOU/CPP, and a further 15% on a TOU/DLC.

However, it is reasonable to suggest that only households with air conditioners would take up CPP and DLC programs and according to figures presented in the cost-benefit study, only about 60% of Australian households have air conditioners.[30] By applying the 30% take up rates to the population (those on TOU/CPP and those on TOU/DLC) on the whole, the modelling implies that approximately 50% of all households with air conditioners will sign up for CPP or DLC tariff options. This was arguably an overly optimistic take up rate for these products.

5.3 Time varying pricing

A key objective for rolling out smart meters is of course to enable distribution and retail businesses to introduce time varying pricing. Time varying, or dynamic, pricing will allow the market to produce more cost reflective electricity prices according to when the electricity is consumed and hence provide consumers with price signals. Currently most electricity tariffs are static types (such as single rate) and controlled off-peak tariffs, but smart meters will allow the industry to charge according to demand and time. This will of course result in new winners and losers, depending on factors such as consumption pattern, total consumption and ability to shift load.

5.3.1 Product complexity

Dynamic pricing will increase the complexity of consumers' electricity offers. Dynamic pricing products for electricity are commonly compared to the type of contracts we use for mobile phones. There are, however, several differences between electricity and mobile phone services which warrant careful consideration. Electricity is an essential service that every household needs to purchase. As such, increased complexity may disproportionately impact on vulnerable and disadvantaged classes of consumers. Furthermore, consumers' knowledge and understanding of their electricity consumption and patterns are limited. The accumulation meters used to date have not required consumers to understand when they consume electricity or how much specific appliances use. Even if we accept the argument that consumers need to become more aware of their consumption as a response to the climate change challenge, consumers are not going to obtain this knowledge overnight and regulatory arrangements will be required to ensure that consumers can obtain information and compare electricity offers. This is not only vital to consumers as individuals, it is also important for the effective working of a competitive retail market.

An important matter for the NECF to resolve is how to ensure that the Standard Retail Contracts are basic, comparable retail offers in a SMI environment. Currently the meter types to a large extent dictate the tariff shape available to domestic consumers, but with the rollout of smart meters, networks are likely to place all customers on a TOU network tariff. In such an environment it would be unreasonable to expect retailers to offer flat tariffs and there is hence nothing that constrains the shape of the tariff offered on Standard Retail Contracts. To use an extreme example, the Standard Retail Contract tariff may be a ten part seasonal TOU tariff if the NECF does not address the issue of Standard Retail Contracts and tariff shape.

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[30] The 60% figure is a rough estimate based on the air conditioning penetration rates listed by NERA in the Phase 2 Consumers Impact Report. These were approximately: SA 85%, Vic 60%, NSW 54%,Qld 58%, Tas 20%, WA 70% and NT 90%.

The ability to match a household's consumption pattern to the most suitable tariff offer will be of great importance in a dynamic pricing environment. However, typical life cycle changes have significant impact on the total load used and at what time of the day electricity is consumed. A couple going from being a double income household with both residents in daytime jobs will have a very different consumption load and pattern if they were to have a child and therefore be at home during the day. In order to avoid bill shocks and an increase in hardship cases, it is crucial that consumers understand the impact of change in consumption pattern, know how to search for a more suitable tariff offer and can easily switch between offers without being locked in or facing exit fees.

5.3.2 Bill volatility

Dynamic pricing is likely to result in increased bill volatility for households. Bill volatility (especially combined with increased electricity prices) will cause affordability issues for many households, especially those on fixed and/or low incomes. Seasonal bill volatility will result in an increased demand for bill smoothing products. An important issue for the NECF to address is therefore to ensure that access to payment plans is a consumer right delivered through regulation.

5.3.3 Dual fuel households and low off-peak demand

Some Australian metropolitan areas have a high penetration of reticulated gas (most notably Melbourne and Canberra). As dual fuel households already use very little off-peak electricity, dynamic pricing (simply meaning that prices are high at peak times and lower at off-peak times) will basically result in a direct price increase for dual fuel households as they have a limited opportunity to use electricity at times of low demand and hence lower price.

Dual fuel households are likely to have different demand elasticity compared to all-electric households due to differences in electricity demand (theirs is lower) and usage patterns. This also means that the financial impact on these households is likely to differ from all-electric households.

Furthermore, this may have a significant demand response impact in the long run. If a dual fuel household is allocated a TOU tariff, the household will have limited opportunity to maximise the benefits available from an off-peak pricing component, as a high proportion of the household's energy consumption at off-peak times is likely to be gas usage (gas space heating and gas hot water systems). Subsequently, these households are likely to prefer the installation of electrical appliances when the issue of replacement arises. This will not only result in an overall increase in demand for electricity but also a potential increase in greenhouse gas emissions.

5.3.4 Off-peak electricity (controlled load)

A customer impact issue pertaining to non-metropolitan households in particular is that of two element meters vs. TOU pricing. Concern has been expressed about the impact a smart meter rollout may have on households with dedicated off-peak circuits (which are particularly prevalent in Victoria).[31] There may be major price increases

[31] It has been estimated that price increases due to TOU replacing dedicated off-peak circuits will potentially affect as many as 500,000 Victorian households, mostly confined to regional centres and rural towns. See CUAC/SVDP/ATA *Submission to the Cost Benefit Analysis of Smart Metering and*

for households currently using dedicated off-peak circuits (with and without boost options) if they are transferred to a TOU pricing arrangement. This is a particular concern for households currently taking power through a two-element or a separate meter, which may not be available as a result of a smart meter rollout.

Customers currently on two-rate electricity have particular appliances that are hard-wired to receive off-peak consumption at a specific rate and all other consumption at a general domestic or general residential rate. With the installation of a single-element smart meter these customers may be allocated to a new – TOU – network tariff.

A discussion paper on metering for electric off-peak heating issues by the Victorian Department of Primary Industries rightly noted that:

"A single element meter cannot distinguish between *types* of use within the defined period. As a consequence, the same network tariff would be applied to all uses in any given period, whether the consumption is for electric off-peak water heating or other uses."[32]

Subsequently, customers with electric hot water and slab heating may be significantly disadvantaged by a smart meter rollout if unable to separately hard-wire these appliances.

Hot water services and slab heating are major appliance investment items and customers are unlikely to change these appliances in the short to medium term. Moreover, as the majority of these consumers live in non-metropolitan areas without access to reticulated gas, they will have limited options in terms of converting appliances and/or fuel substitution.

Many of the 6 and 8 hours off-peak electric hot water and space heating units have boost functions incorporated into the appliance design. However, these appliances boost during peak periods (electric slab heating typically boost for three hours between 2-5pm) but because they are hard-wired into the meter the boosting load is currently assigned to off-peak tariffs although the usage occurs during peak times.

Without a second element in the new smart meter, this boost function will attract a time of use peak charge rather than an off-peak charge. The magnitude of the impact on households would depend on a few factors, but consumers with electric slab heating as well as large electric hot water tanks who have household members home during the day (which means that the water service will boost more regularly) are clearly going to be among the most financially disadvantaged.

The individual distribution businesses *may* have a business case to roll out two-element meters to these customers, but the magnitude of the possible disadvantage clearly warrants a thorough investigation into the impact of single element meters

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Direct Load Control: Phase 1 Reports for the Ministerial Council on Energy's Smart Meter Working Group, November 2007.

[32] Department of Primary Industries, Discussion Paper, *Metering for electric off-peak heating*, December 2006, p 5.

(both in terms of numbers of customers affected and price increases) as well as an assessment of possible mechanisms that can mitigate these impacts.

5.3.5 Relationship between network and retail tariffs

As the energy industry is vertically disaggregated there are significant challenges in regards to the relationship between the network businesses and the retailers. The first challenge is in regards to TOU pricing. Distributors and retailers do not have the same reasons for introducing TOU pricing. A distributor would use TOU pricing to shift load from peak times (when the network is under stress) to other times of the day. If a distributor can achieve a high level of certainty around this load shifting it enables them to defer spending on network upgrades. This makes business sense as distributors are financially penalised by the regulatory arrangements if their networks under-perform. However, a distributor would need certainty around the demand response as it would not make business sense if they only occasionally achieved the demand reduction they aimed for and thus would need to augment their networks or pay penalties nonetheless.

Retailers on the other hand, would want to use TOU price signals to reduce the risk they are exposed to in the wholesale market. Although high prices in the wholesale market often correlate with high demand on the networks, this relationship is not perfectly aligned. Furthermore, the retailers may seek to maximise their profits by ensuring that a significant proportion of a household’s consumption does not attract off-peak rates. One approach the retailers could utilise is to extend the peak times (or shoulder period if a three rate tariff is applied) beyond the network and wholesale market peak. By pushing the peak/shoulder tariff to last as late as possible (say 9pm) households’ ability and willingness to shift load would be reduced and significant consumption deriving from washing machines, dryers, dishwashers and television sets would attract a higher rate. The theory is of course that consumers would be aware of these arrangements and seek a different offer, however this theory places a lot of faith in the competitiveness of the market and the well-informed consumer.

The significant gains a retailer can achieve by modifying network charges to maximise profit was illustrated in a report analysing issues arising from Energy Australia’s pricing study in NSW. Using Energy Australia’s tariffs as an example, it found that retailers could achieve a percentage gain of just over 20% by offering a two-part tariff (peak/off-peak) rather than reflecting the network’s three-part tariff (peak/shoulder/off-peak).

Table 16
TOU Adjusted Vs. unadjusted retail tariffs[33]

	Peak	**Shoulder**	**Off-peak**	**Total**
Network tariff (three part)				
Rate	0.275	0.099	0.055	
Hours per week	30	75	63	
Consumption (kW per hour)	2	2	2	
Unadjusted retail tariff (three part)				
Total	$16.5	$14.85	$6.93	**$38.28 per week**
Adjusted retail tariff (two part)				
Rate	0.187*	N/A	0.055	
Hours per week	105	N/A	63	
Consumption (kW per hour)	2	N/A	2	
Total	$39.27		$6.93	**$46.2 per week**
Difference				**20.69%**

* 0.187 is the average price of peak and shoulder rates

Some retailers may want to take a completely different approach by absorbing the TOU price signals sent by the networks and offering customers a flat (or flatter) tariff shape. The assumption behind such an approach being that consumers do not want TOU products and that a retailer can increase its market share by offering flat rate products. This approach may present more risk for the retailer, but a retailer with good hedging contracts, a sizeable customer base and a varied consumption profile may find that washing out any TOU price signals sent by the network business is a profitable approach. However, such a pricing strategy could have negative impact on the networks. A distributor needs to 'bank' the demand response and the assumed load shifting and/or load reduction in order to avoid or defer network augmentation. Furthermore, a distributor may be severely financially penalised if outages occur due to capacity constraints, and it could end up being too risky for networks to rely on price signals as a tool to control demand if the retail contracts do not reflect their tariff shapes.

This issue was also raised by the SVDP report on Energy Australia's trial of TOU and CPP network pricing in NSW where only about 50% of the retail offers actually passed through the full network tariff shape to the customers. The study report noted:[34]

> In a situation where some or all retailers fail to pass on the network tariff shape, this will not only reduce the overall demand response across the network customer base but it also produces the uncertainty for the relevant distribution network. This uncertainly occurs as customers churn from one retail offer to another or retailers themselves seek to develop tariff options that diverge from

[33] Applies the three part network tariff trialed by Energy Australia to demonstrate the difference in weekly consumption charge between a retailer that reflects the network tariff (unadjusted) and a retailer that applies a two part tariff instead (adjusted). Based on tables 3, 4 and 5 in Dufty G, St Vincent de Paul Society Victoria, *Lessons learnt from Energy Australia's Pricing Trials and issues for Victorian Consumers*, October 2008, p 7.
[34] Gavin Dufty, St Vincent de Paul Society Victoria, *Lessons learnt from Energy Australia's Pricing Trials and issues for Victorian Consumers*, October 2008, p 6.

the network tariff shape. In both cases, it results in muffling or distorting the ultimate price signal (and hence demand response) that the networks seek. This limits the effectiveness of network based demand management pricing strategies, ultimately resulting in higher network charges and reducing the benefits of the interval meter rollout.

A second challenge pertains to the use of CPP. As with TOU pricing, the distribution businesses and the retailers may have different reasons for offering CPP to customers. As customers must be notified of a CPP event and distribution businesses do not have a direct relationship with their customers, it is difficult to see how a distributor would be able to call a CPP event under the current regulatory framework. The National Cost-benefit analysis, however, assumed that the distributors would call 50% of CPP days and retailers the other 50%.

Even if only retailers were able to call CPP events there is a good chance that some of these events (driven by high demand and high generation cost) would correlate with days the network was under stress. But, as retailers operate across networks and distributors would need significant demand reduction on specific feeders, it is difficult to see how a retailer called CPP event can create network benefits without new regulatory arrangements in place.

5.3.6 Tariff reassignment

Distribution businesses do not have a direct contractual relationship with their customers, rather the retailers act as the customer interface on behalf of both the distribution businesses and themselves. Consequently an issue arises in relation to informing customers about a network tariff reassignment to a TOU tariff as a result of interval data. As discussed above, the retailer may or may not choose to pass through the tariff shape in the retail tariff, and retailers argue that they should not be required to inform customers about changes to the network tariff which they may or may not pass through to customers. The AER issued a decision on interval meter reassignment requirements for Victoria in May 2009, which simply places an obligation on distribution businesses to write to their customers 20 days before a smart meter is installed at the premises (and again 4 days before) to say they may be reassigned to a time of use tariff in the future.

The actual wording of the notification to customers being:[35]

> The rollout of AMI meters may result in your network tariff being changed in future to a time of use network tariff. If this change has any implications for your retail costs and charges then your retailer will inform you of this. You do not need to act now; your retailer will notify you of any changes.

This approach seeks to solve the information requirement problems between distribution businesses and retailers, but it does nothing to ensure that the customer is informed in a timely manner. The retailers will receive information about tariff reallocations from the distribution businesses 45 days prior to taking effect but the customer may receive a notification from the retailer after the new tariff has taken

[35] Australian Energy Regulator, *Interval Meter Reassignment Requirements*, Final Decision, May 2009, p 21.

effect (on the first bill after the retailer decides to change the customer's tariff). As the AER decision failed to take customer interests into account, it is now crucial that the NECF stipulates requirements, in terms of both content and timelines, for the information retailers must provide to customers where retailers choose to pass through the amended tariff shape.

5.3.7 Potential bill impacts of TOU and CPP

Some customers will financially benefit while others will be penalised by TOU/CPP tariffs. As electricity is most expensive during the day from Monday to Friday, households comprising of people that are at work during the day are most likely to benefit. On the other hand, households with young children at home, the unemployed and aged pensioners (those at home during the day) are most likely to be financially worse off.

The consumer focus groups conducted as part of the national cost benefit study described the reaction to the two rates TOU offers (adjusted according to jurisdictional price differences) as:[36]

> There was a general lack of willingness to change electricity usage behaviour on a day to day basis due to the reality of the impact on lifestyle and household needs, therefore the core appeal for TOU was very much among consumers who are not at home during peak period, ensuring minimal impact on household habits but opportunities to make savings during off peak times on a much lower tariff than the current standard tariff.
>
> The TOU offer was particularly appealing to high income singles/couples who are working during the day and some low and medium income earners who were willing to change some electricity usage habits to save money but again mainly those who are not home during the day.

The National Cost-benefit analysis included various price impact case studies examining the households' bills prior to the introduction of new product offerings and under each of the product offerings assessed as part of the cost-benefit analysis. These were a TOU tariff, TOU in combination with a CPP tariff, and a TOU tariff in combination with participation in a direct load control (DLC) program.

Three of the case studies presented in the cost benefit analysis were Jill an unemployed single mother from regional Victoria, Sharon a working mother of two from Queensland and the Harris', a retired couple from South Australia. The tables below show the National Cost-benefit analysis' assessment of the impact on these three households' electricity bills (in relation to the TOU and CPP treatments) – highlighting the difference between no demand response and the assumed demand response rate.

[36] Red Jelly for NERA Economic Consulting on behalf of the Department of Resources, Energy and Tourism, *Qualitative Assessment of Consumer Responses to the National Electricity Smart Meter Rollout Program*, Final report (Phase 2) January 2008, p 52.

Case study 1: Jill[37]

Jill rents a house in regional Victoria with her two young children. She is currently not working and relies on her support payments from the children's father and mother's allowance which combined is less than $28,000 per annum. As neither child is of a school age the family spends a lot of time in the home during the day (peak hours). Jill owns and uses a washing machine, clothes dryer, air conditioner, electric stove and is currently on an electric off-peak hot water tariff. Her annual consumption is 9695 kWh.

Table 17
Case study 1 – impact on bill

Jill - unemployed, single mother in regional Victoria				
Scenarios	Consumption (kWh per annum)	Change (%)	Estimated bill ($ per annum)	Change (%)
Estimated bill with no change in demand				
Current	9695	-	$1,442	-
TOU	9695	-	$1,526	5.9%
CPP + TOU	9695	-	$1,549	7.4%
Estimated bill with demand response				
Current	9695	-	$1,455	-
TOU	9657	-0.4%	$1,442	-0.9%
CPP + TOU	9647	-0.5%	$1,455	-0.1%

<u>Issues:</u>

As Jill's household needs to use a significant proportion of their total electricity consumption during weekdays she would face price increases if reallocated to a TOU or TOU/CPP tariff. However, these calculations do not take into account that Jill's hot water system currently uses a controlled off-peak rate that will not be available to Victorian's post a SMI rollout. Her bill could therefore increase significantly under the TOU scenario when she is reallocated from a two-rate tariff (peak and off-peak) to a TOU tariff. The NERA analysis discusses this issue, but it assumes that customers like Jill will voluntarily sign-up to a TOU tariff. This assumption is not necessarily right, as the network will reallocate Jill to a TOU tariff and the retailer merely has the opportunity to reflect the new tariff shape or take the risk of smoothing the underlying tariff shape. Either way, Jill is unlikely to continue to enjoy the low off-peak rate her hot water system currently is allocated to and she may also end up paying a peak rate for every time her hot water system boosts during the day.[38]

[37] Assumptions and bill impact analysis as presented in NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control,* Consultation Report for the Ministerial Council on Energy Smart Meter Working Group, *Work Stream 4: Consumer Impacts* (Phase 2) February 2008 , p 108.

[38] See Section 4 of *Customer Protections and Smart Meters – Issues for Victoria*, for more detailed discussion on the impact of reallocating customers from a controlled off-peak load to TOU tariffs.

Case study 2: Sharon[39]

Sharon is a single mother who lives with her two children in south eastern Queensland. They live in a small three bedroom home that Sharon rents. Both of her children are school aged with one old enough to mind the other when they usually arrive home from school mid afternoon. Sharon is therefore able to work a full time job without requiring childcare for the younger child. She earns $31,000 per annum. Their house has access to mains gas, which is used for cooking and hot water heating. Given the warm climate Sharon owns an air conditioner as well as a washing machine and dryer. The analysis assumed that the dryer is not often used. Their average annual consumption is 7980 kWh.

Table 18
Case study 2 – impact on bill

Sharon - employed, single mother in South East Queensland				
Scenarios	Consumption (kWh per annum)	Change (%)	Estimated bill ($ per annum)	Change (%)
Estimated bill with no change in demand				
Current	7980	-	$1,182	-
TOU	7980	-	$1,155	-2.3%
CPP + TOU	7980	-	$1,149	-2.8%
Estimated bill with demand response				
Current	7980	-	$1,182	-
TOU	7958	-0.3%	$1,135	-4.0%
CPP + TOU	7969	-0.1%	$1,101	-6.9%

<u>Issues:</u>

Compared to Jill, Sharon may be better off without having to do much in terms of changing her behaviour/consumption pattern. This is mainly because Sharon is employed and her children are of school age. The difference between Jill and Sharon's bill impact highlights the effect TOU pricing may have on customers having their peak electricity consumption paid for by their work place versus those who are left to face peak electricity costs on their household bills. As found in a MCE commissioned Smart Meter Consumer Impact Analysis: "Where there are more people at home during weekdays, both annual consumption and underlying per unit cost are slightly higher".[40] It is this combination of higher unit cost and higher daytime consumption that makes customers in Jill's situation face higher price increases due to TOU tariffs than customers in Sharon's situation.

[39] Assumptions and bill impact analysis as presented in NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control,* Consultation Report for the Ministerial Council on Energy Smart Meter Working Group, *Work Stream 4: Consumer Impacts* (Phase 2) February 2008, p 101.

[40] Energy Market Consulting Associates (EMCa) report to the Ministerial Council on Energy Standing Committee of Officials, *Smart Meter Consumer Impact: Initial Analysis*, Consultation Draft, February 2009, p 100.

Case study 3: The Harris'[41]

Mr and Mrs Harris are retirees living in South Australia. Their combined pension is $25,000 per annum and as pensioners they hold a concession card for their energy bills which entitles them to receive a $120 rebate that covers both electricity and natural gas ($60 has been allocated to this electricity bill). They own their house, which is located in a metropolitan area, and have access to gas, which they use for cooking and hot water. Since Mr and Mrs Harris are retired they are usually home during business hours, especially if it is hot, in which case they will use their air conditioner. They also use a washing machine and infrequently a clothes dryer. Their average annual consumption is 5810 kWh, which is below the state average of 6,185 kWh.

Table 19
Case study 3 – impact on bill

The Harris' - retired couple, South Australia				
Scenarios	Consumption (kWh per annum)	Change (%)	Estimated bill ($ per annum)	Change (%)
Estimated bill with no change in demand				
Current	5810	-	$1,052	-
TOU	5810	-	$1,052	0.0%
CPP + TOU	5810	-	$1,068	1.5%
Estimated bill with demand response				
Current	5810	-	$1,052	-
TOU	5790	-0.4%	$1,052	-0.1%
CPP + TOU	5801	-0.2%	$1,022	-2.9%

<u>Issues:</u>

The Harris' is a case of low consumption and low demand response. Their bills may increase slightly if they are on a TOU + CPP tariff or they may experience a slight decrease if a minimum level of demand response is applied. Nonetheless, the Harris' would pay for SMI under a mandated rollout and this case study highlights how many low income and low consumption households will face the cost of a rollout without having much of an opportunity to directly benefit from the new meters and their associated functionalities. Based on the cost of the rollout in Victoria, the Harris' would experience an automatic 8-10% increase to their annual bill just to cover the cost of the rollout itself.

5.3.8 Consecutive days of CPP

There are also potential customer impacts when CPPs are applied to customers over consecutive days. The application of sequential CPP pricing may result in customer fatigue, especially if the CPP event coincides with a heat wave. On the first day of the CPP event there may be significant demand response but it would be reasonable to expect the demand response to decrease relative to the number of consecutive CPP days called.

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[41] Assumptions and bill impact analysis as presented in NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control,* Consultation Report for the Ministerial Council on Energy Smart Meter Working Group, *Work Stream 4: Consumer Impacts* (Phase 2) February 2008, p 103.

This raises the question of whether networks and retailers should have the ability to call sequential CPP events for the same group of customers. From a network management perspective it would be important to avoid customer fatigue (as it reduces demand response) and hence exposes these companies to possible penalty payments. Distribution businesses will seek to guarantee supply as they can be exposed to Guaranteed Service Level and S-factor payments if the required demand response was not achieved due to demand fatigue. In the case of retailers, on the other hand, there are no such explicit punitive regulatory arrangements in place and they may seek to exploit demand fatigue to maximise profit.[42]

The consumer focus group research undertaken in relation to the National Cost-benefit analysis noted the following overwhelmingly negative reaction to the CPP/TOU offer presented to them:[43]

> Consumers overall immediately concluded there was absolutely no benefit or incentive for the consumer at all in taking up this option, with the incentive of a 5% discount seen to be insignificant and certainly not enough to outweigh the perceived inconvenience of taking up a critical peak offer, or the risk of a few days of critical peak in a row.
>
> The reaction was to believe it was just another way for the electricity companies to make more money and could manipulate it to suit themselves, as they control when critical peak periods happen.

5.3.9 Opportunistic retail tariff structures

The price setting of the CPP raises a number of challenging regulatory and policy issues. For example, the Energy Australia trials in NSW are seeking to explore the elasticity thresholds of two trial groups; one group that is exposed to a medium CPP ($1 per kWh) and another group that is exposed to a high CPP ($2 per kWh). However, it is quite possible that a similar demand response could be achieved at a lower price level than what we have seen tested in major trials to date.

Although the CPP can assist retailers in managing the risk associated with demand volatility, this also means that retailers may have an incentive to inflate the CPP rates purely to maximise profits. This could occur where retailers' price aggressively with little or no change to consumer demand, or conversely price at a level that is greater than the benefits obtained by the reduction in demand as this would result in increased revenue for the retailers.

In theory, the competitive forces of a deregulated retail market should ensure that retailers would not benefit from taking such an approach to CPP tariffs, however as there continues to be low levels of understanding of the demand response to various

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[42] For a more detailed discussion of this issue, see Dufty G, St Vincent de Paul Society Victoria, *Lessons learnt from Energy Australia's Pricing Trials and issues for Victorian Consumers*, October 2008, p 4-5.

[43] Red Jelly for NERA Economic Consulting on behalf of the Department of Resources, Energy and Tourism, *Qualitative Assessment of Consumer Responses to the National Electricity Smart Meter Rollout Program*, Final report (Phase 2) January 2008, p 61.

levels of CPP pricing, a regulatory approval process for the setting of CPP price thresholds may be warranted.[44]

5.4 Cost allocation and customer charges

As discussed in section 2.3, a decision to mandate the rollout of smart meters will come at a significant cost to households. Based on the assumption that the distribution businesses will be made the responsible party for rolling out meters in every jurisdiction that decide to do so, the Australian Energy Regulator (AER) will be responsible for reviewing and determining the cost recovery process. The National Cost-benefit analysis highlighted the difficulty in accurately estimating the costs, and demonstrated that some jurisdictions (Victoria and South Australia) would need to keep costs to the lower range estimates and get business efficiencies to the upper range in order to justify a rollout.[45] It is therefore important that the distribution businesses are given appropriate incentives to minimise cost.

The approach utilised for the Victorian rollout does not include any incentives for the distribution businesses to outperform forecasted expenditure. The Victorian Government issued an Order In Council (OIC) in November 2008 stipulating the regulatory framework for the Victorian price setting. Basically, the approach stipulated in the Victorian OIC requires the distribution businesses to provide an initial budget to the AER which the AER must approve unless it can establish that the expenditure is for activities that are out of scope or is not prudent.[46] Prices to be charged to customers are set on the basis of the budgets approved by the AER, and will be adjusted on an annual basis (based on actual expenditure incurred).[47]

An incentive based approach to determine costs and charges may have the ability to put downward pressure on the costs, and the Victorian approach should therefore not set a precedent for the regulatory approach used for other jurisdictions.

5.4.1 Allocation of costs to households

Customers may experience two types of cost increases as a result of a smart meter rollout: the initial costs associated with the rollout of the smart meters and possible bill increases due to tariff reallocations. In both cases this will increase the cost of energy disproportionately for low-volume energy consumers.

In addition to price increases, low-volume energy consumers will also have the least ability to respond to price signals (due to low discretionary consumption), to allow them to offset these costs.

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[44] For a more detailed discussion of this issue, see Dufty G, St Vincent de Paul Society Victoria, *Lessons learnt from Energy Australia's Pricing Trials and issues for Victorian Consumers*, October 2008, p 3-4.

[45] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 196.

[46] Expenditure is taken to be prudent unless: (1) the AER establishes the contract was not let in accordance with a competitive tender process (in the case where expenditure is a contract cost) and (2) for other expenditure, where the AER establishes it is more likely than not that the expenditure will not be incurred or that incurring the expenditure involves a substantial departure from the commercial standard that a reasonable business would exercise in the circumstances.

[47] For more detail on the Victorian OIC and the regulatory framework, see for example: Essential Services Commission, *Advanced Metering Infrastructure Review: Consultation Paper: Revised Framework and Approach*, December 2008.

In effect low-volume households will cross subsidise high volume households. This is of particular concern as low-income households represent a large proportion of low-volume consumption households. This raises important impact and equity issues which can be addressed through the regulatory arrangements.

One approach to address these equity issues is to apply pricing principles that allocate the cost of the smart meter rollout (or a higher proportion thereof) to higher consumption households. This can be achieved by only allowing the pass through of these costs once a certain consumption threshold has been reached and hence ensure that costs are more equitably allocated.[48]

Cost allocation issues also pertain to the transparency of smart meter costs met by consumers. For example, if the retailers are allowed to incorporate the smart meter component of a customer's bill into the fixed charge component, it would be reasonable to demand this charge be itemised on the customer's bill. Although the fixed charge does not usually itemise the various costs it is made up of, a government mandated rollout is a major infrastructure project and consumers should be made aware of the additional costs added to their bills for three reasons. Firstly, because a rollout of smart meters is a specific project with set timelines and consumers should expect the additional cost to be removed/reduced upon completion. Secondly, because a key objective behind rolling out smart meters is to improve price signals and elicit demand response, 'hiding' further costs under the fixed charge component would seem to contradict this goal. Thirdly, it is important that consumers become aware of the rollout to increase interest and understanding about what smart meter technology will mean for their consumption patterns and bills. Electricity bills itemising the smart meter cost to consumers may be one of the most effective ways in ensuring the effectiveness of a public education campaign.

5.4.2 Pass-through of benefits to consumers

The majority of the cost of rolling out smart meters will occur in the initial stagers of the rollout. The National Cost-benefit analysis stated that while the impacts are likely to be net positive over a 20 year period, the expectation is also that "average prices would rise initially to pay for the initial rollout with benefits accruing over the remaining period as the business efficiency benefits are realised and passed through to customers".[49] This arrangement imposes two main risks to consumers in relation to the pass-through of benefits.

First, if not all the estimated benefits are accrued it will result in less avoided costs than first assumed and hence less savings to be passed through to consumers who have already paid for the infrastructure. To mitigate this risk, it is important the governments and regulators monitor the benefits as they accrue (i.e. on an annual basis) and seek to actively ensure that the benefits are achieved.

[48] See Dufty G, *Electricity pricing – delivering social justice and environmental equity,* in CUAC Expert Forum on Electricity Pricing, Forum Papers, August 2007.
[49] NERA Economic Consulting, *Cost Benefit Analysis of Smart Metering and Direct Load Control*, Report for the Ministerial Council on Energy Smart Meter Working Group (Phase 2 Overview Report), February 2008, p 204.

Second, there is a risk that benefits are not accurately and/or timely passed through to consumers. The distribution businesses may have an incentive to game the regulatory framework and will seek to underestimate the benefits accrued from a smart meter rollout in order to retain as much of the savings as possible (arguing that it is a result of business efficiencies rather than the smart meter roll out). To mitigate this risk, the regulatory framework can be restructured to ensure that operational benefits are accounted for and passed through on an annual basis. The typical 5 year regulatory period would not deliver satisfactory outcomes and most likely allow the network businesses to gather windfall gains.

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