Attachment 2:
Cost Benefit Analysis – Type 5 Meter Rollout Scenarios

1 Background

At the recent ACCC Pre-Determination Conference held in Sydney on 14 January 2005, the ACCC specifically requested that EnergyAustralia Network provide indicative costs and benefits associated with a large and small scale Type 5 meter rollout and a Type 5 meter/Automated Meter Reading (AMR) rollout. Such a study would serve to quantify the economies of scale arising from a mass Type 5 rollout, as well as highlighting the additional benefits arising from incorporating AMR technology in the rollout.

The request was spurred by staunch resistance to the ACCC's draft decision to exclude remotely read Type 5 meters for customers with annual consumption less than 100MWh from the NSW Metering Derogations. The ACCC's draft decision has been overwhelmingly opposed by DNSPs, retailers, consumer representatives and metering businesses alike.[1]

This cost-benefit analysis sheds some light on the following issues that the ACCC must grapple with in assessing the impact of its preliminary decision:

- Can DNSPs generate greater economies of scale from a mass rollout of an innovative metering solution compared to a smaller scale rollout (the latter case would arise if a retailer were able to elect to be the Responsible Person for Type 5 meters with communication devices)?
- If DNSPs were unable to introduce AMR technology in conjunction with a Type 5 meter rollout (principally due to the stranded asset risk stemming from the ACCC's preliminary decision), would there be a material loss of additional benefits compared to those resulting from a standard Type 5 meter rollout?
- In order to assess relative incentives to introduce innovative new metering technology, how are the benefits from an advanced metering solution apportioned across the various segments of the energy value chain (ie. retailers, networks)?
- What is the likely magnitude of the opportunity costs to businesses and consumers stemming from the ACCC's decision?

EnergyAustralia Network conducted its analysis in conjunction with information provided by the relevant metering businesses. The cost information included is based on the most reliable and up to date estimates available.

2 Project Overview

2.1 Scope

This cost-benefit analysis of various Type 5 meter rollout options represents an economic cost benefit from the perspective of a combined network and retail business. To the extent that the market price does not represent the long run marginal cost of generation, here may be additional upstream impacts that are not fully captured in this analysis. Retail energy costs have been assumed to align with historical energy market purchases in NSW.

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[1] However, stakeholder views do differ on the specific reasons for opposing the ACCC's decision, as well as the preferred solutions.

2.2 Scenarios

EnergyAustralia examined the relative costs and benefits under five different scenarios:

Scenario 1: Rollout of Type 5 meters to 40-160 MWh customers together with application of Time of Use (ToU) and seasonal pricing.

This project is currently being undertaken by EnergyAustralia.

Scenario 2: Rollout of Type 5 meters to 15-40 MWh customers.

EnergyAustralia is intending to proceed with this phase of the rollout following Scenario 2.

Scenario 3: Mass rollout of type 5 meters to all customers.

Scenario 4A: Mass rollout of type 5 meters with communications to all customers, based on information provided by manufacturer A.

In this case, two-way communication has been assumed, which enables several advanced facilities to be developed, in addition to remote meter reading.

Scenario 4B: As above, but based on cost information provided by manufacturer B.

Presenting different cost estimates from two different suppliers with extended communications capability has enabled EnergyAustralia to conduct sensitivity analysis and present a range of possible net benefits from an AMR solution. In this case the communications option would offer the possibility of direct load control of appliances like air conditioners and pool pumps, the additional benefit of which has been estimated.

2.3 Basic Assumptions

The assessment of the costs and benefits was based on the following key assumptions.

- Real rate of return 7.0 percent.
- Period of analysis 15 years.
- Network long run marginal cost (LRMC) 80 percent of average cost, allocated to top 70 percent of loading periods. It is assumed that permanent deferral of the capex program would result from reduced peak consumption, reflecting the average effect of changed behaviour of small customers.
- Network and Retail base prices as per EnergyAustralia's FY05 published prices.
- Proposed ToU, seasonal and critical peak prices fully cost reflective.
- Elasticity assumptions as per National Institute of Economic and Industry Research (NIEIR), rates independent of the level of price excursion. Long term price elasticity achieved over 5 years, as follows:

Year	1	2	3	4	5	6
Elasticity	-0.12	-0.17	-0.22	-0.27	-0.32	-0.37

- Elasticity applies to individual rates, ie. the effect on peak energy consumption is the elasticity from the table above times the price differential above the former flat rate.
- Elasticity of price reductions is assumed to be 80 percent of above.
- Distribution losses are calculated for price periods and are higher during peak periods.

- Greenhouse benefit is calculated at the rate of $15/tonne of CO_2 combined with an average conversion rate of 1 MWh per tonne of CO_2. This calculation corresponds to the licence condition for NSW retailers.
- Retail energy costs are based on the pool price, averaged for the years FY00 to FY04.
- Meter and installation costs are based on current averages and projections. Advice on costs was confirmed with metering manufacturers.
- Guaranteed Customer Service Standard (GCSS) payments are based on the current IPART proposals.
- Other costs and benefits associated with an AMR rollout are estimated from the cost of current processes.
- Scale economics would be associated with a Type 5 rollout over a period of, say, 3 years.

3 Cost Estimation Methodology

For scenarios 1-3, EnergyAustralia assessed the following costs for a Type 5 meter rollout:

Cost Category	Description
Capital Costs	• Purchase of Type 5 meters • Meter installation
Operating Costs	• Manual meter reading (less existing manually read Type 6 meters) • MDA - validation and processing • Meter Data Management • Back office registration per NMI (one-off costs)

Scenarios 4A and 4B, incorporating AMR technology in the mass Type 5 meter rollout, called for the inclusion of the following costs in addition to those outlined in the above table:

Cost Category	Description
Capital Costs	• Communications
Operating Costs	• No manual meter reading costs included • Remote reading • Software license costs per annum

4 Benefit Estimation Methodology

Quantifying the benefits arising from the five scenarios, as well as allocating benefits to a particular segment of the value chain, is less straightforward than identifying costs. Fortunately, EnergyAustralia is able to draw from its existing models and previous domestic and international empirical evidence to derive robust estimates.

For scenarios 1-3, the following benefits were estimated.

Benefit	Description
Network tariff	• Capex deferral from ToU tariff and/or; • Capex deferral from Seasonal Tariff
Retail tariff	• Lower wholesale prices due to peak deferral from tariffs
Greenhouse benefits	• Lower greenhouse abatement costs based on reduction of overall consumption

The benefits flowing from the introduction of Type 5 meters predominantly relate to the deferred consumption driven by the ability to introduce cost-reflective ToU tariff products. For scenarios 1 and 2, it is assumed that all of these customers will be moved to a new seasonal-based ToU tariff. Scenario 3 includes smaller customers that will not be suited to a seasonal tariff. Therefore, it is assumed that only 50 percent of customers will be transferred to a new seasonal tariff, with the balance allocated to a standard ToU tariff.

The network ToU tariffs that underpin all the new tariff structures are based on a three-rate structure:

- Peak – between 2pm-8pm on working weekdays;
- Shoulder – between 7am-2pm and 8pm-10pm working weekdays; and
- Off peak – between 10pm and 7am working weekday plus weekends plus public holidays.

A seasonal tariff extends this concept by magnifying the peak-off peak differentials during the peak summer and winter periods, and reducing it during the remaining months.

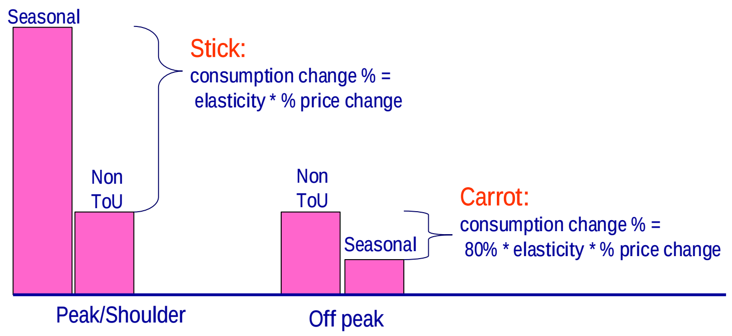
4.1 Estimating Peak Deferral and Reduced Energy Consumption

Due to the higher peak prices, customers will shift consumption away from costly peak times according to the relative peak demand elasticity (or the elasticity of substitution). As noted, EnergyAustralia has based its estimates on demand elasticities estimated by NIEIR, which gradually rise from –0.12 percent in year one to -0.37 percent in year 6. Standard theory dictates that the elasticity will increase in the longer-term as customers adjust their behaviour patterns and invest in energy efficient appliances.

The change in consumption arising from a customer transferring from a standard non-ToU tariff to a seasonal ToU tariff can therefore by calculated as the product of the price differential for each component multiplied by the elasticity. Compared to the non-ToU rate, the consumer will face a price increase for the peak and shoulder components (a "stick" incentive) and a price decrease for the off-peak component (a "carrot" incentive). Discussion in the literature suggests that the "stick" incentive is more effective than the "carrot" incentive. In order to reflect this in the analysis, the elasticity applied to the price reductions was assumed to be only 80% of that applied for price increases.

The use of elasticities to evaluate changes in peak and off-peak consumption resulting from ToU-based tariffs is depicted in Figure 1 below.

Figure 1: Use of Elasticities to Measure Change in Consumption

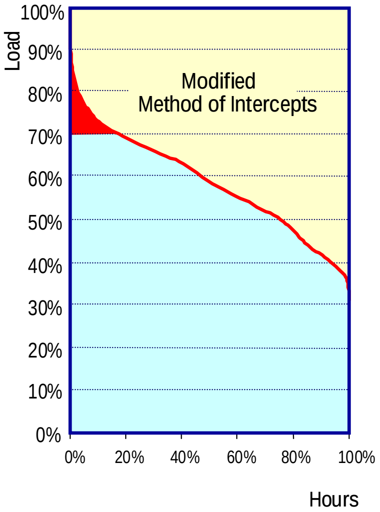


Thus, peak and shoulder consumption will be reduced and off-peak consumption will increase. The net effect of this change in consumption gives the overall reduction in total consumption produced by the new tariff structures, which is actually minimal in aggregate.

4.2 Network Tariff Benefits

Once the changes in peak, shoulder, off-peak and total consumption are estimated, the network benefits are evaluated using the method of intercepts and LRMC estimates based on EnergyAustralia's approved forward capital plan. Essentially, the network benefit is the avoided capital expenditure resulting from the peak demand reduction. Recall from Attachment 1 that EnergyAustralia applies the modified method of intercepts to allocate the vast majority of network costs to a very small period of time where the system is at or near full capacity. The red shading in Figure 2 represents this cost loading.

Figure 2: EnergyAustralia Modified Method of Intercepts



4.3 Retail Tariff Benefits

The changes in peak, shoulder and off-peak consumption can be combined with average wholesale pool prices and loss factors for the three time bands in order to estimate the benefits accruing to the retail business. Retail energy costs are based on the pool price averaged for the years FY00 to FY04.

4.4 Greenhouse Benefits

The greenhouse gas benefits arise from the reduced greenhouse gas abatement costs associated with the aggregate reduction in energy usage generated by the ToU pricing structures. EnergyAustralia calculates the greenhouse benefit at the rate of \$15/tonne of CO_2 combined with an average conversion rate of 1 MWh per tonne of CO_2. This calculation corresponds to the license condition for NSW retailers.

The greenhouse benefits are expected a priori to be dwarfed by the benefits flowing from capex reductions. This is a function of both the lower cost of greenhouse gas emissions on a MWh basis and the fact that ToU tariffs do not cause a substantial reduction in total consumption.

4.5 Addition Benefits for Scenarios 4A and 4B

Attachment 1 describes the significant additional cost-saving benefits that can result from introducing AMR technology in addition to a standard Type 5 meter rollout.

These additional benefits were also noted by the Essential Services Commission (ESC) in its final decision on the Interval Meter Rollout in Victoria:

> *"The Commission's position paper and draft decision paper noted that two-way communication is likely to provide further benefits when installed. Worldwide, there are many cases of the implementation of automatic meter reading (AMR) being implemented and one key case where two-way communication and load control are being implemented for all customers: the Italian utility, ENEL, is installing two-way communication and load control for all its 30 million customers and*

around 15 million meters have now been installed. ENEL lists demand-side management among the benefits of this system which also includes many other benefits. …

…Meter communication can provide a number of benefits, which include meter reading (including avoiding the extra costs of reading hard-to-reach meters), load control, outtage detection and notification and power quality monitoring. It can also provide other benefits in the market, such as, the capability to read the meter for transfers and "move-ins"; and even to allow remote connection and disconnection."[2]

For scenarios 4A and 4B, the following addition benefits were included in addition to those described for scenarios 1-3:

Benefit	Description
Network tariff	• Capex deferral from Critical Peak Pricing
Retail tariff	• Lower wholesale prices due to peak deferral from Critical Peak Pricing
Other	• Non technical loss reduction • Vacant sites • Replacement of CLC • Reduced GCSS • Reduced GCSS verification • Supply fault/theft investigations • Disconnection/reconnection • New load control of pool pumps and air conditioning • Billing cash flow

The additional AMR benefits included in the "other" category accrue to both network and retail businesses.

The tariff mix assumed for the two Scenario 4 options reflects the availability of enhanced communications provided. The assumed tariff mix was as follows:

	Scenarios 4A & 4B
ToU	45%
Seasonal	45%
Critical peak	10%

4.5.1 Critical Peak Pricing Tariff Benefits

AMR technology enables the introduction of critical peak pricing structures, as customers can be contacted via remote technology and informed of critical peak events. The tariff works in the same way as ToU and seasonal ToU tariffs, except that there is a substantial larger peak/off-peak differential for a small number of critical peak days.

[2] Essential Services Commission (2004), "Mandatory Rollout of Interval Meters for Electricity Customers: Final Decision", ESC, Melbourne, p 40.

The critical peak tariff structure used by EnergyAustralia in the analysis is based on 30 critical peak events per annum. These 30 days are split 50/50 between the network and retail businesses – that is, the network and retail businesses can each nominate their top 15 peak cost days per year.

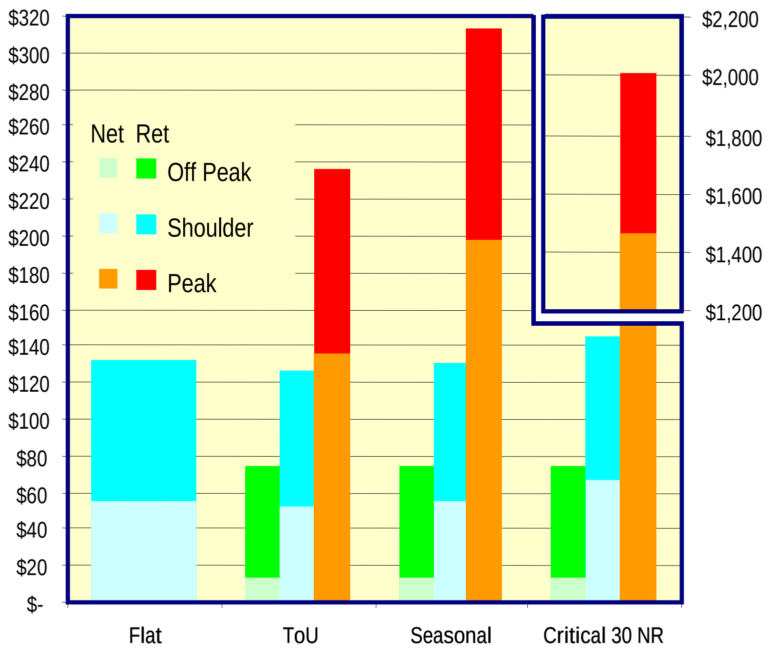
It is important to note that the elasticities used to assess the change in peak consumption are identical to those used for the ToU and seasonal tariffs. However, it is quite unlikely that the elasticity would be constant over the entire range of the demand curve - overseas research has not found a constant elasticity of demand for electricity. A customer's response to a price signal will be a function of income, information and the relative proportion of electricity consumption compared to total expenditure. Customers are expected to be far more responsive to a given change in critical peak price signal, given the substantial cost differential. The econometric analysis undertaken by the Charles River Associates as part of the Statewide Pricing Pilot in California also showed that elasticities increased on critical peak days.

Therefore, the benefits estimates by EnergyAustralia are likely to be extremely conservative. In some respects there is a "chicken and egg" problem tied to EnergyAustralia's planned pricing experiment – accurate elasticity measures are needed to demonstrate the full benefits of critical peak pricing to support a trial, and the full benefits cannot be properly estimated until the pricing experiment has been completed.

4.6 Specific Tariff Structures Considered

The tariff structures used in the analysis are summarised in Figure 3 below.

Figure 3: Tariff Structures Used in the Analysis



5 Results of Cost Benefit Analysis

5.1 Costs and Benefits Per Customer

A summary of the overall costs and benefits on a per customer basis is displayed in Table 1 below.

This clearly shows that the net benefits of the rollout for customers above 15 MWh are greater than for a mass market rollout. This provides justification for the structure of EnergyAustralia's rollout program, where stage one and two of the program equate to scenarios 1 and 2 respectively. However, the economies of scale are visible on the cost side, as reflected by the reduction in capital costs per installation for scenarios 3, 4A and 4B.

Scenario 3, a mass rollout for all customers without the additional benefits of an AMR solution, still produces a net benefit. However, this net benefit per customer may not be sufficiently large to ensure that such a project would proceed on a commercial basis.

As expected, the net benefits under scenario 4A and 4B are significantly larger than under scenario 3. This difference in net benefits represents the additional benefits possible under an AMR solution. This quantifies the potential additional AMR benefits highlighted by the ESC in its final decision on the Victorian interval meter rollout.

Scenario 4A was based on higher communications cost figures (provided by manufacturer A) compared to scenario 4B, hence the net benefits are larger for scenario 4B.

Table 1: Costs and Benefits Per Customer

	Scenario 1 40 - 160 MWh Seasonal	Scenario 2 15 - 40 MWh Seasonal	Scenario 3 Type 5 mass	Scenario 4A Type 5 AMR mass Manufacturer 1	Scenario 4B Type 5 AMR mass Manufacturer 2
Average consumption MWh	60	20	7	7.1	7.1
Annual retail bill	$ 7,947	$ 2,649	$ 935	$ 935	$ 935
Total metering investment $M	-$20.0	-$66.3	-$276.2	-$457.5	-$370.4
Costs and benefits per installation					
Capital costs					
Meters	-$301	-$280	-$91	-$91	-$88
Meter installation	-$500	-$500	-$100	-$100	-$100
Communications	$0	$0	$0	-$125	-$67
Operating costs					
Manual meter reading	$0	-$38	-$38	$0	$0
… Less existing manual read Type 6	$38	$38	$38	$38	$38
Special/Final (Offcycle) Meter Reads	$0	$0	$0	$23	$23
Remote meter reading	$0	$0	$0	-$13	-$13
MDA - validation/processing	-$162	-$162	-$162	-$162	-$162
Meter Data Management	-$26	-$4	-$4	-$9	-$9
Software Licence / NMI / annum	$0	$0	$0	$0	$0
Back office registration per NMI (one	-$15	-$15	-$15	-$15	-$15
Benefits					
Network tariff	$4,146	$1,493	$454	$623	$623
Retail tariff	$604	$207	$64	$103	$103
Greenhouse	$80	$28	$9	$9	$9
Non technical loss reduction	$0	$0	$0	$18	$18
Vacant sites	$0	$0	$0	$0	$0
Replacement of CLC	$0	$0	$0	$0	$6
Reduced GCSS	$0	$0	$0	$7	$7
Reduced GCSS verification	$0	$0	$0	$1	$1
Meter Fault Testing	$0	$0	$0	$7	$7
Supply fault / theft investigations	$0	$0	$0	$14	$14
Disconnections / Reconnections	$0	$0	$0	$6	$6
New pool pump, A/C load control	$0	$0	$0	$108	$108
Billing cash flow	$638	$0	$0	$0	$0
	$0	$0	$0	$0	$0
Total	$4,502	$767	$156	$442	$509
Percentage of NPV retail bill	6.0%	3.1%	1.8%	5.0%	5.8%

In practice, the supplier would be determined via a competitive tender process, in which case EnergyAustralia would be inclined to adopt the solution offered by manufacturer B. Option 4A has been included in order to display a range of possible outcomes, depending on the choice of supplier.

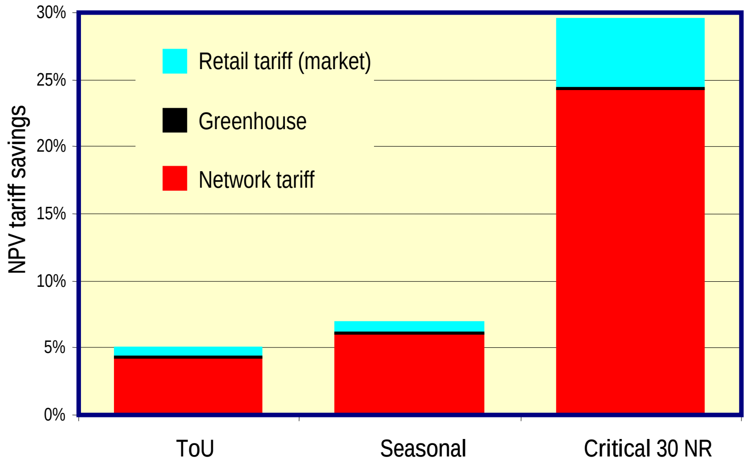
It is important to be aware that if an AMR solution were to be rolled out along with Scenarios 1 or 2, the benefits would increase by an even larger percentage. Estimates of these benefits were not included as alternative scenarios because the NIEIR elasticity measures used for the rest of the study would be unreliable for estimating the critical peak pricing benefits accruing to these two groups of customers. EnergyAustralia can only make these estimations with any certainty upon completion of its pricing experiment.

5.2 Distribution of Tariff Benefits

In addition to identifying the total quantum of net benefits for the various options, it is also necessary to allocate these benefits across the various segments of the energy value chain. The analysis considers the benefits accruing to networks and retailers, in addition to the greenhouse benefits.

The allocation of tariff benefits in scenarios 4A and 4B is shown below in Figure 3.

Figure 4: Allocation of Tariff Benefits



The analysis clearly demonstrates that the network is the major beneficiary of the ToU, seasonal and critical peak pricing structures that can be introduced as a result of a Type 5 meter rollout with AMR technology. It should be restated that the capex deferral benefits accruing to the network are based on conservative elasticity assumptions.

5.3 Costs and benefits

A comparison of the costs and benefits for each scenario can be plainly displayed using a waterfall chart, which depicts the net present value (NPV) of the costs and benefits as a percentage of the NPV of the total average retail bill for an average customer. In Scenario 1 and 2 the relative effect of implementation of ToU and seasonal prices is illustrated.

The “CAPEX” and “OPEX” bars shown in Figures 5-9 depict the rollout costs for each scenario, while the remaining bars display the benefits and the relevant segments of the energy value they accrue to.

Figure 5: Costs and benefits, Scenario 1

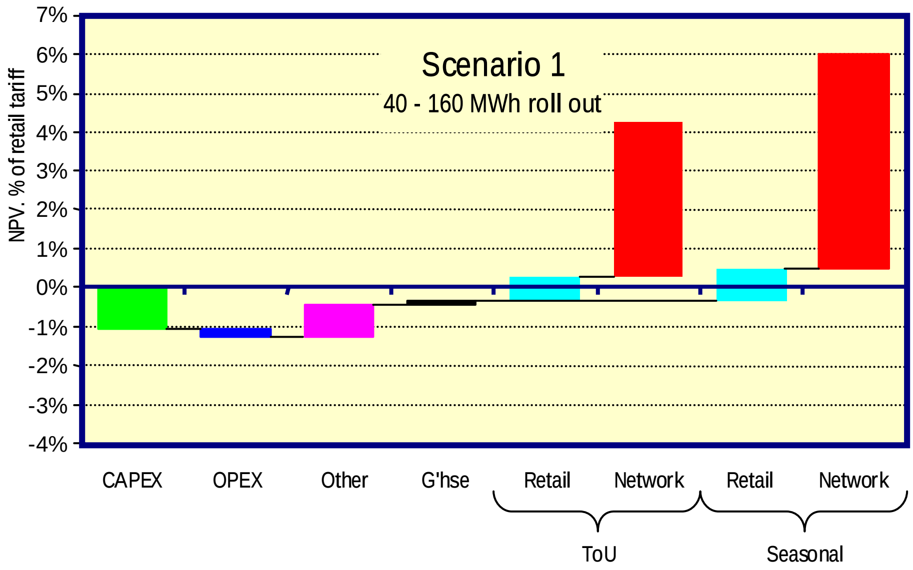


Figure 6: Costs and benefits, Scenario 2

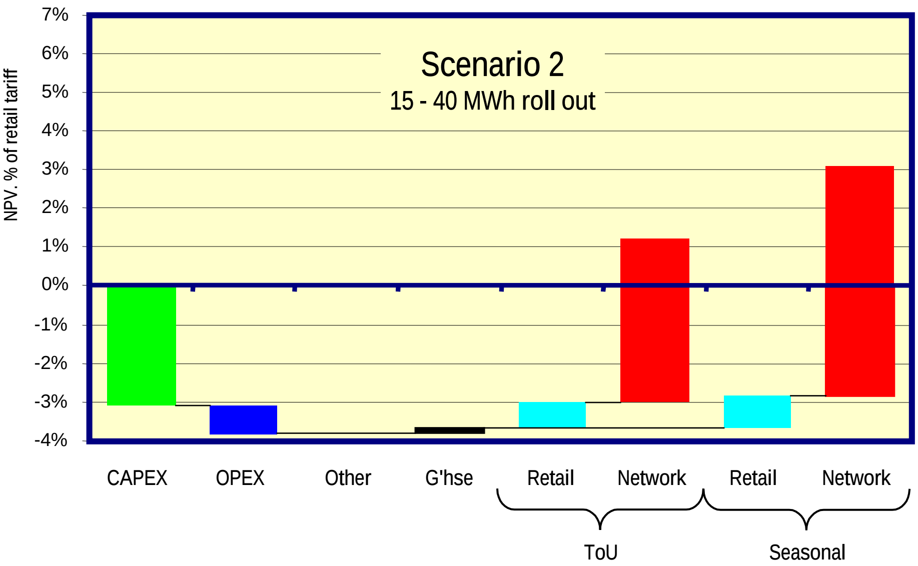


Figure 7: Costs and benefits, Scenario 3

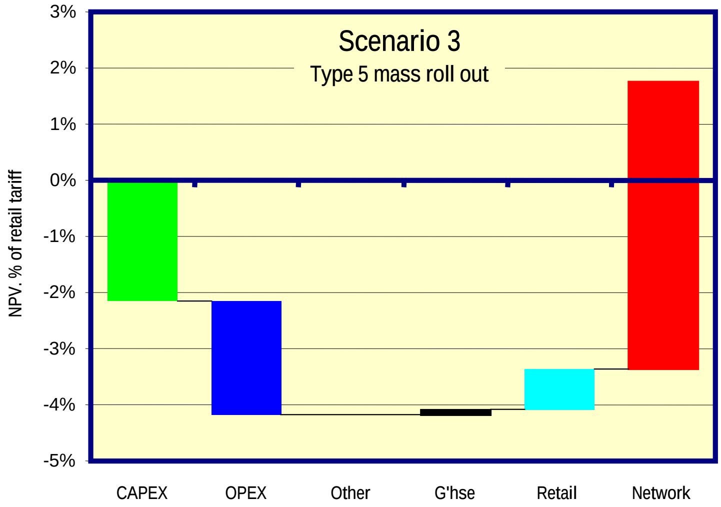


Figure 8: Costs and benefits, Scenario 4A

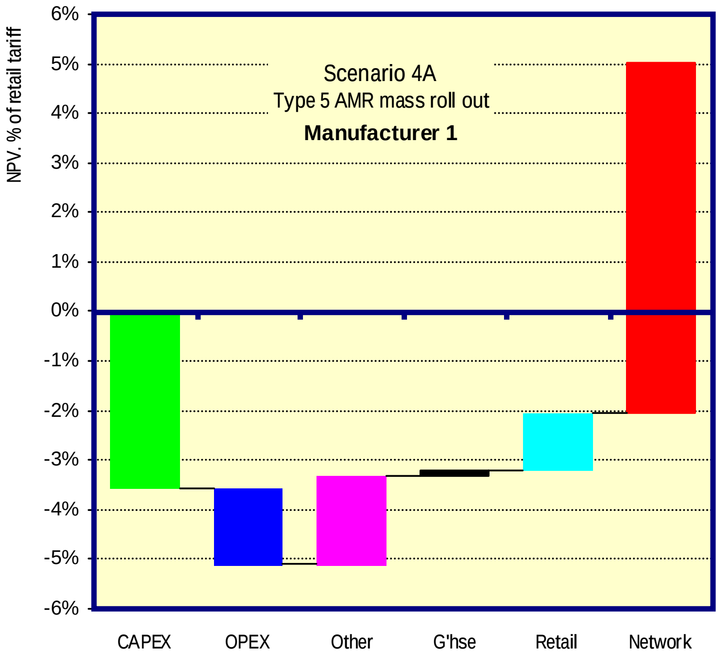
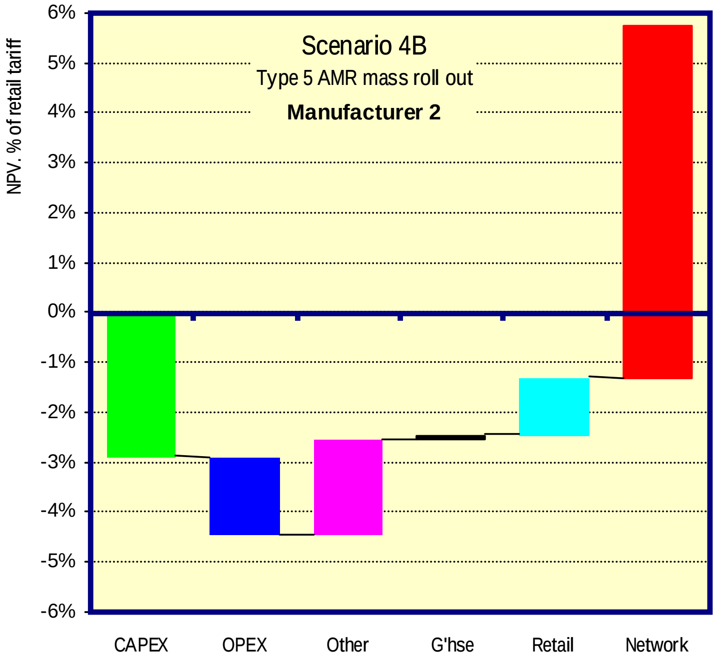


Figure 9: Costs and benefits, Scenario 4B



6 Conclusions

The ACCC's draft decision to exclude remotely read Type 5 meters for customer with less than 100MWh consumption pa. from the derogation appears to have been made in the absence of a quantitative study of the potential costs of the decision on networks, retailers and the wider community. The ACCC's Draft Determination states that sub-section 90(6) of the Trade Practices Act 1974 (the Act) specifically requires these costs to be fully considered. To this end, EnergyAustralia trusts that that this cost-benefit study will provide important information to assist the ACCC in deliberating over its decision.

The key results emerging from EnergyAustralia's analysis highlight the appropriateness of its current strategies in relation to its Type 5 meter and ToU rollout to larger customers, as well as its desire to investigate through a pricing experiment the advanced metering solution before a mass rollout.

The main points of the study are as follows:

- material economies of scale can be generated from a mass rollout, shown by the lower capital costs per installation under Scenarios 3, 4A and 4B;
- the benefits from a Type 5 meter rollout are in excess of costs for customers with annual consumption in excess of 15MWh per annum, particularly if a seasonal tariff is employed;
- the network tariff benefits resulting from a Type 5 meter rollout eclipse those accruing to other parts of the value chain, suggesting that DNSPs have the strongest incentives to introduce innovative new metering solutions. In addition, the network benefits accrue solely to the one entity, EnergyAustralia Network, whereas the retail benefits are dispersed among all active retailers in the network area;
- a rollout of AMR technology in conjunction with a Type 5 meter roll-out has the potential to provide significant additional benefits beyond those arising from a standard Type 5 meter rollout; and
- if the stranded asset risk introduced by the ACCC's decision were to impede EnergyAustralia's planned Type 5 meter/AMR rollout, as well as the new ToU tariff produces enabled by this technology, there would be a

detrimental impact on DNSPs (principally), retailers and greenhouse costs. These costs imposed across the energy value chain are substantial and quantifiable; and

- although the potential costs of the ACCC's decision can be inferred from this analysis, no quantitative evidence of the potential benefits of the ACCC's decision (if any) has been publicly presented to date.

As a final consideration, this analysis did not specifically evaluate the increased tariff costs to consumers that would arise if the tariff measures considered under the five scenarios could not be introduced. Such tariff rises, necessary to fund the additional capital augmentation and wholesale energy costs required in the absence of peak demand shifting, represent a further important potential impact of the decision.