Review of Victorian Distribution Network Service Provider's 2017 Advanced Metering Infrastructure Transition Applications

Prepared for the
Australian Energy Regulator

September 2016

1 Executive Summary

On 31 May 2016, Jemena (JEM), United Energy Distribution (UED) and AusNet Services (ANS), formerly SP AusNet, lodged 2017 Advanced Metering Infrastructure (AMI) Transition Charge Applications totalling $112.0 million in excess capital expenditure and $31.1 million in excess operational expenditure for 2014 and 2015 combined.[1] CitiPower and Powercor's applications were within approved budgets.

The Australian Energy Regulator (AER) engaged Energeia Pty Ltd (Energeia) to undertake a review of the Victorian Distribution Network Service Provider's (DNSPs) Transition Charge Applications against the criteria specified in the 30 June 2015 Order in Council (the OIC).

Regulatory Context

Section 5I.7 of the OIC, referred to by sections 5L.4(a)(iii) and 5L.4(a)(iv), allows the AER to refuse to allow the expenditure excess if the DNSP has not satisfied the AER that it is prudent. Section 5I.7A defines prudent as being where the expenditure excess reasonably reflects the efficient costs of a business providing the Regulated Services *over the entirety of the period*.[2] Section 5I.7AA adds that the DNSP's expenditure, *not just the excess*, must be efficient over the entirety of the period for the excess to be efficient.

Section 5I.7B details a range of criteria that the AER *may* (not must) take into account for the purpose of being satisfied under Section 5I.7. However, section 5I8A requires that the AER must take into account the expenditure of a benchmark efficiency entity[3] over the entirety *or* any part of the initial regulatory period. When determining a benchmark efficient entity, section 5I.8B sets out criteria that AER may (not must) have regard to, e.g. benchmarking methods, adjustment factors, and capitalisation and cost allocation policies.

Review Scope

The scope of Energeia's review was the $143.0 million in total excess expenditure claimed by the three Victorian DNSPs in their 2017 Transition Charges Applications. The AER required the review to focus on identifying any WiMax related expenditure by AusNet and to include an assessment of benchmarking options consistent with section 5I.8A and 5I.8B of the OIC.

Review Approach

Energeia's review approach has been tailored to address the requirements of the OIC as of 30 June 2015, which differs from the OIC when the original budgets were determined, or the OIC dated 22 December 2011 in force during Energeia's review of DNSP's excess expenditure in 2013.[4] It is consistent with the approach we developed to assess the 2013 excess expenditure, adjusted to reflect key changes in the OIC.

We first developed an expenditure estimate of a benchmark efficient entity, based on our analysis of the most appropriate benchmarking methods and inputs in light of OIC clauses 5I.7B, 5I.8A and 5I.8B and the AER's benchmarking guideline[5]. We then adjust the benchmark for a given situation based on factors including those specified in clauses 5I.7B and 5I.8B.

Benchmark efficient expenditure levels and adjustment factors relevant to DNSP's 2014 and 2015 (2014-15) excess expenditure have already been considered as part of the 2015 Charges Revision application process,

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[1] Unless otherwise stated, all reported figures are in 2018 dollar terms ($real 2018).

[2] Emphasis added

[3] Energeia notes that a 'benchmark efficient entity' is not defined in the OIC

[4] *Review of Victorian Distribution Network Service Provider's Advanced Metering Infrastructure 2015 Charges Revision Application*, Energeia, December 2014.

[5] *Better Regulation, Expenditure Forecast Assessment Guideline for Electricity Distribution*, AER, November 2013

where the prudency and efficiency of DNSP's 2013 excess expenditure was assessed. Where this analysis remains valid under the 30 June 2015 OIC, it has been updated for the purpose of this review.

Energeia's review methodology involved the following key steps to meet the AER's review requirements as described in their Request for Proposal (RFP):

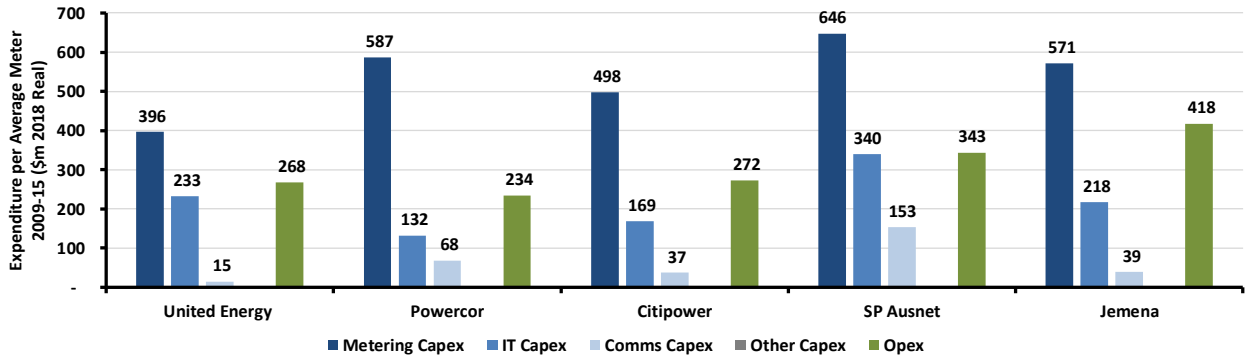
- review each DNSP's Transition Charges Application and supporting materials;
- develop questions to help clarify or supplement information provided by the DNSPs;
- undertake independent research, analysis and modelling as required;
- develop an independent estimate of the benchmark efficient level of expenditure for each expenditure category and DNSP based on key contextual factors set out in the OIC;
- determine efficient levels of excess expenditure where it was less than our estimate of benchmark efficiency levels, adjusted for key contextual differences.

In addition to the guidance set out in the OIC and the AER's Benchmarking Guideline, efficient costs were estimated based on the experience of our personnel rolling out meters.

Benchmarking Results

Following an in-depth review and assessment of the various benchmarking inputs, methods and specification options against the OIC and the AER's guidelines, including those put forward by UED and JEN, Energeia developed an independent, top-down estimate of the benchmark efficient entity for each capex category and overall opex, based on the comparative benchmarking analysis presented in Figure A.

Figure A – DNSP's Adjusted Expenditure per Average Meter by Category (2009-2015)



Source: AER, AusNet, Jemena and UED

Based on the above analysis, supported by OIC clause 5I.8B(c) and reasons detailed in the report, Energeia identified Powercor as the benchmark efficient entity for ANS except for IT capex, where Powercor and CitiPower were combined to take a more conservative position. For UED and JEN, UED was the benchmark efficient entity for each capex and opex category, except for IT, where Jemena set the efficient benchmark.

In addition to the category level benchmarking results above, Energeia also developed specific sub-category benchmark estimates on a case-by-case basis, which included meter installation, rollout completion timeframes, and several opex sub-categories.

Efficient Excess Expenditure

The result of our review and assessment of in-scope expenditure against each of the OIC tests is shown in Table A. Overall, Energeia has concluded that $59.8 out of $112.0 million of claimed excess capex and $22.5 out of $31.1 million of claimed excess opex meets the OIC standard.

Table A – Excess Expenditure Assessment Summary

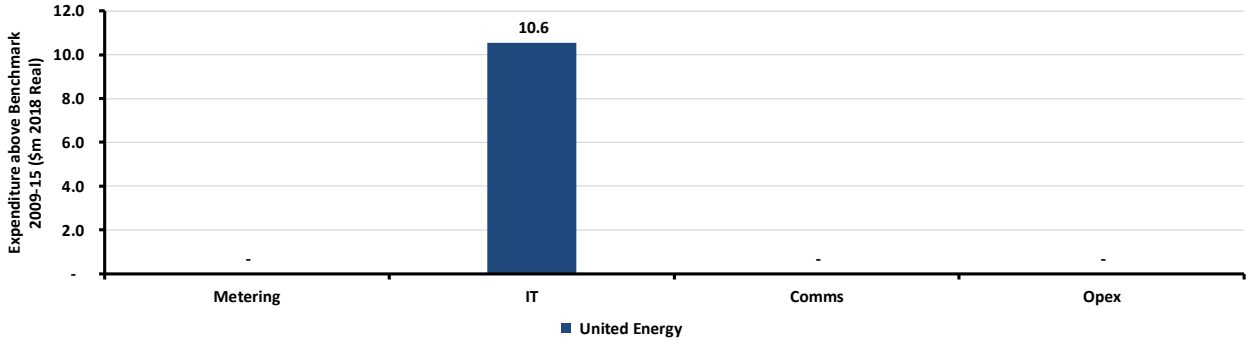
Real 2018 Dollars	Applications			Energeia			Difference		
Category	UED	JEN	ANS	UED	JEN	ANS	UED	JEN	ANS
Capex	$ 25.3	$ 12.3	$ 74.4	$ 25.3	$ 7.6	$ 26.9	$ -	-$ 4.7	-$ 47.5
Meter Supply	$ 7.0	$ 1.6	$ 25.6	$ 7.0	$ 1.6	$ 13.9	$ -	$ -	-$ 11.7
Meter Installation	$ 17.9	$ 8.2	$ 15.5	$ 17.9	$ 4.8	$ 7.4	$ -	-$ 3.4	-$ 8.2
Communications Infrastructure	$ 0.3	$ -	$ -	$ 0.3	$ -	$ -	$ -	$ -	$ -
IT	$ -	$ -	$ 33.3	$ -	$ -	$ 5.7	$ -	$ -	-$ 27.6
Other	$ -	$ 2.4	$ -	$ -	$ 1.2	$ -	$ -	-$ 1.3	$ -
Opex	$ -	$ 2.5	$ 28.6	$ -	$ 0.3	$ 22.2	$ -	-$ 2.1	-$ 6.4
Total	$ 25.3	$ 14.8	$ 103.0	$ 25.3	$ 7.9	$ 49.1	$ -	-$ 6.8	-$ 53.9

Source: Energeia

Most of the excess expenditure we found to be efficient under the OIC was due to it representing a timing rather than pricing variation. Where a pricing variation occurred, we generally tested it against the aggregated category results to determine whether it reflected the benchmark efficient entity, as well as against the inflation adjusted unit prices determined in the 2015 review, which adjusted the original 2013 budget allowances based on uncontrollable and unforeseeable changes in DNSP's operating environment.

All of UED's excess expenditure was found to be efficient under the OIC, mainly due to our finding that they represent the efficient benchmark entity overall, and in the metering and communications capex sub-categories, which were also their excess expenditure sub-categories. UED's IT capex levels were estimated to be $10.6 million higher than JEN's, the efficient benchmark entity for UED's IT capex (see Figure B), however UED did not incur excess expenditure in this category

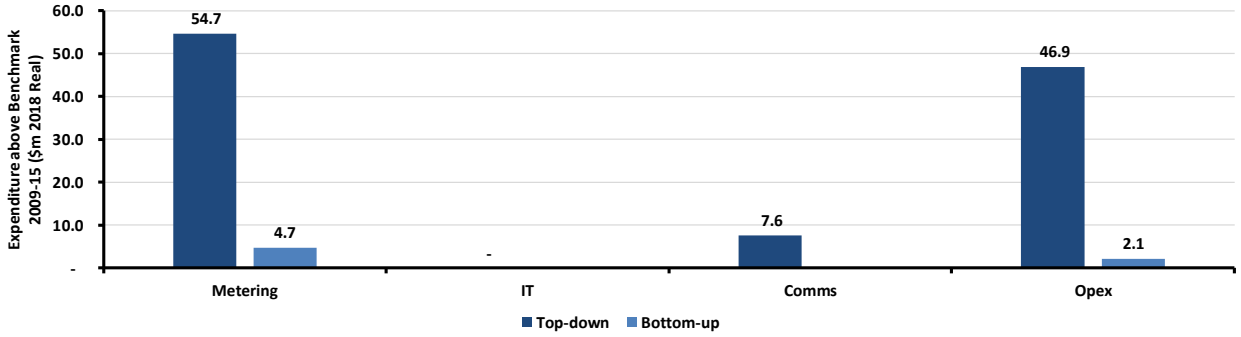
Figure B – UED's Expenditure above the Benchmark Efficient Entity 2009-15 by Category



Source: AER, UED, Jemena and Energeia

Energeia concluded that $7.9 million out of JEN's $14.8 million excess expenditure claim was efficient under the requirements of the OIC. We concluded that $3.4 million in meter installation capex and $1.3 million in Other capex did not meet the OIC on the basis that JEN spent $54.7 million more than the benchmark efficient entity, UED, on its metering capex, and $4.7 million more than the AER's 2012-15 allowance after adjusting for changes in conditions. Energeia's review concluded that $2.1 million of JEN's excess opex was due to delays in its rollout, which we deemed to be inefficient based on the on-time performance of Powercor, and UED's $46.9 million lower overall opex category efficient benchmark (see Figure C).

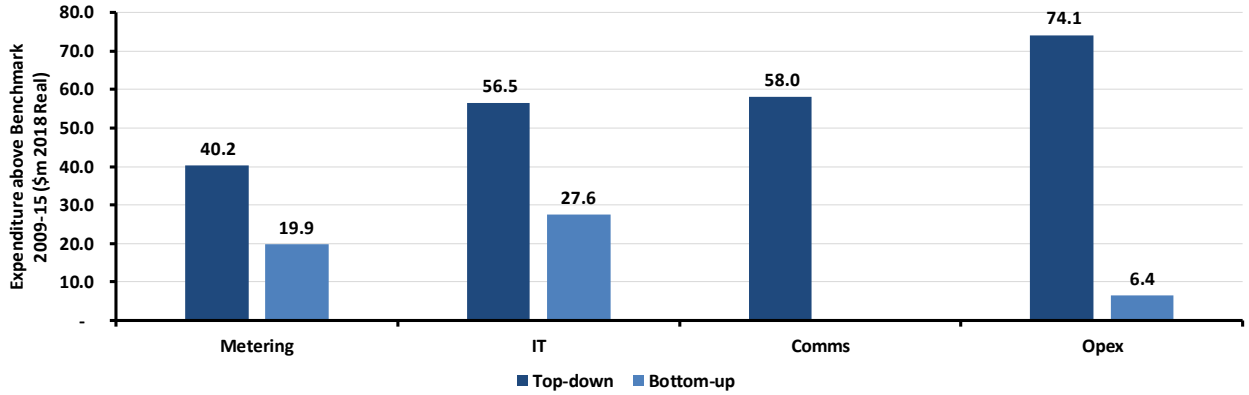
Figure C – JEN's Expenditure above the Benchmark Efficient Entity 2009-15 by Category



Source: Energeia, Jemena

Energeia concluded that $49.1 million of ANS's excess expenditure was efficient under the OIC. Most of the $19.9 million metering supply and installation capex determined to be not efficient under the OIC was due to our conclusion that it was incurred as a result of its WiMax decision. We also could not justify more than $5.7 million of ANS's IT capex excess expenditure due to ANS's category benchmarking, which showed that it has spent $56.5 million more than the benchmark efficient entity, being Powercor and CitiPower combined.

Figure D – ANS's Expenditure above the Benchmark Efficient Entity 2009-15 by Category



Source: Energeia, AusNet

Energeia largely accepted ANS' excess opex on the basis that it was consistent with the AER's determination of efficient levels. $6.4 million in excess meter reading, customer service and project management opex was found to not meet the OIC to the extent it was due to delays in completing the rollout. Despite being $74.1 million above the efficient opex category benchmark of Powercor, as shown in Figure D, we did accept $1.1 million in customer service and project management excess opex on the basis that it was due to a variation in timing, and not a variation in volume or pricing.

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Disclaimer

While all due care has been taken in the preparation of this report, in reaching its conclusions Energeia has relied upon regulatory guidance from the Australian Energy Regulator (AER) and information provided by the Distribution Network Service Providers (DNSPs), including third party consultants. To the extent these reliances have been made, Energeia does not guarantee nor warrant the accuracy of this report. Furthermore, neither Energeia nor its Directors or employees will accept liability for any losses related to this report arising from these reliances. While this report may be made available to the public, no third party should use or rely on the report for any purpose.

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2 Review Scope and Approach

Energeia's review approach has been tailored to address the requirements of the OIC as of 30 June 2015, which differs from the OIC when the original budgets were determined, or the OIC dated 22 December 2011 in force during Energeia's review of DNSP's excess expenditure in 2013.[6] It is consistent with the approach we developed to assess the 2013 excess expenditure, adjusted to reflect key changes in the OIC.

We first developed an expenditure estimate of a benchmark efficient entity, based on our analysis of the most appropriate benchmarking methods and inputs in light of OIC clauses 5I.7B, 5I.8A and 5I.8B and the AER's benchmarking guideline[7]. We then adjust the benchmark for a given situation based on factors including those specified in clauses 5I.7B and 5I.8B.

Benchmark efficient expenditure levels and adjustment factors relevant to DNSP's 2014-15 excess expenditure have already been considered as part of the 2015 Charges Revision application process, where the prudency and efficiency of DNSP's 2013 excess expenditure was assessed. Where this analysis remains valid under the 30 June 2015 OIC, it has been updated for the purpose of this review.

Energeia's review methodology involved the following key steps to meet the AER's review requirements as described in their Request for Proposal (RFP):

- review each DNSP's Transition Charges Application and supporting materials;
- develop questions to help clarify or supplement information provided by the DNSPs;
- undertake independent research, analysis and modelling as required;
- develop an independent estimate of the benchmark efficient level of expenditure for each expenditure category and DNSP based on key contextual factors set out in the OIC;
- determine efficient levels of excess expenditure where it was less than our estimate of benchmark efficiency levels, adjusted for key contextual differences.

In addition to the guidance set out in the OIC and the AER's benchmarking guideline, efficient costs were estimated based on the experience of our personnel rolling out meters.

The following sections detail Energeia's approach to reviewing and testing the 2017 Transition Charges Applications, including resolving any issues.

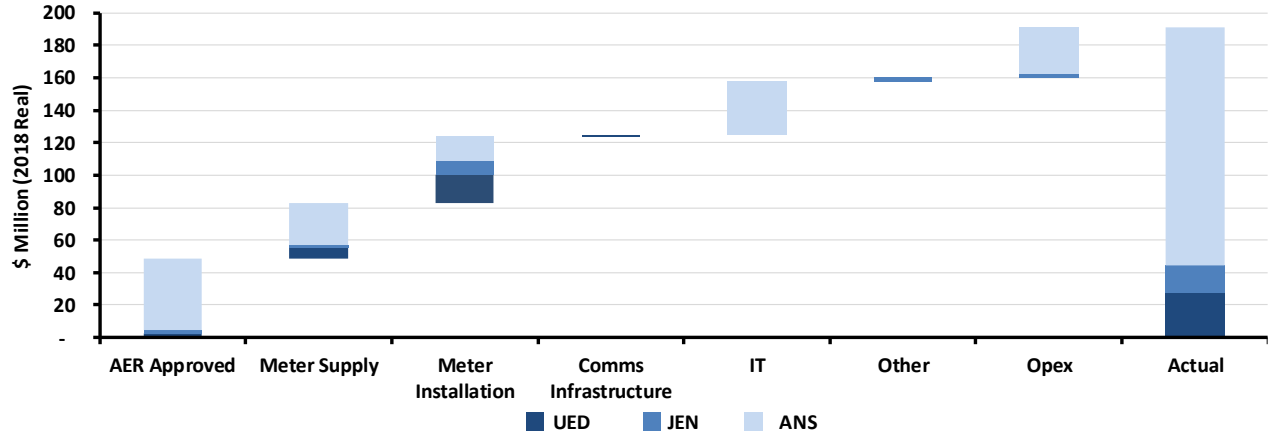
2.1 DNSP's Excess Expenditure

Total excess expenditure by DNSP and excess expenditure category is presented in Figure 1. The figure only shows AER approved expenditure for expenditure categories where DNSPs have submitted applications to recover excess expenditure, and not all AER approved expenditure in 2014-15.

[6] *Review of Victorian Distribution Network Service Provider's Advanced Metering Infrastructure 2015 Charges Revision Application*, Energeia, December 2014.

[7] *Better Regulation, Expenditure Forecast Assessment Guideline for Electricity Distribution,* AER, November 2013

Figure 1 – Excess Expenditure by DNSP and Category



Source: Jemena, AusNet and UED

UED is claiming efficient excess expenditure in meter supply ($7.0 million), meter installation ($17.9 million), and comms infrastructure capex ($0.3 million). JEN is claiming efficient excess expenditure in meter supply ($1.6 million) and meter installation ($8.2 million), as well as $2.4 million in other capex and $2.5 million in opex. ANS has submitted the largest claim of efficient excess expenditure, being $25.6 million for meter supply capex, $15.5 million for meter installation capex, $33.3 million for IT capex and $28.6 for opex. Powercor and CitiPower have not claimed excess expenditure.

2.2 Regulatory Tests

The regulatory arrangements relating to the rollout were originally set out in an August 2007 Order in Council made under sections 15A and 46D of the Electricity Industry Act 2000, and an amending order made on 25 November 2008. The Order in Council was revised a number of times, with 30 June 2015 being the most up to date, relevant OIC, and this is the version referenced throughout the remainder of this report as the 'OIC'. [8]

The OIC sets out the regulator's role and is the primary regulatory instrument which guides the determination of revenue and prices for metering services. The following sections detail the key regulatory tests under the OIC and Energeia's approach to interpreting and/or applying them, where appropriate.

2.2.1 Scope

Energeia first assessed the excess expenditure under review against the within scope activities criteria under 5I.2(a)(ii) of the OIC.

Energeia notes that according to clause 5I.2(a)(i) of the OIC, auditor reports prepared under clause 5H.2 are not conclusive as to whether the expenditure is for in scope activities.

Energeia's assessment of whether excess expenditure met the criteria was based on the experience of its personnel deploying advanced metering infrastructure and their technical knowledge of the relevant regulatory obligations, metering services and advanced metering infrastructure related technologies.

2.2.2 Prudency and Efficiency

Energeia then reviewed DNSP's in scope excess expenditure against the following OIC criteria:

> 5I.7 Where t-1 is any other year in the initial regulatory period, the Commission may refuse to include in the building blocks an expenditure excess if the distributor has not satisfied the Commission that the expenditure excess is prudent.

[8] *Victoria Government Gazette, No. S 186*, Victorian Government Printer, 31 June 2015.

5I.7A Subject to clause 5I.7AA, for the purposes of clause 5I.7, the expenditure excess is prudent where that expenditure excess reasonably reflects the efficient costs of a business providing the Regulated Services.

5I.7AA For the purposes of clause 5I.7, and in *any* case where an application pursuant clause to 5L is made, the expenditure excess is prudent where the expenditure of the distributor *over the entirety of the initial regulatory period* reasonably reflects the efficient costs of a business providing the Regulated Services over the entirety of that period.[9]

In order to apply the prudency test, Energeia developed an independent estimate (benchmark) of the reasonably efficient level of expenditure for each of the targeted expenditure categories and DNSP contexts based on the following OIC criteria:

5I.7B For the purposes of the Commission being satisfied that an expenditure excess reasonably reflects the efficient costs:

(a) of a business providing the Regulated Services; or

(b) of a business providing the Regulated Services over the entirety of the initial regulatory period, the Commission may [not must] take into account:

(c) where the expenditure excess is a contract cost, whether the contract was let in accordance with a competitive tender process; and

(d) the matters set out in clause 5I.8.

5I.8 The matters that the Commission may [but not must] take into account include the following:

(e) the information available to the distributor at the relevant time;

(f) the nature of the provision, installation, maintenance and operation of advanced metering infrastructure and associated services and systems;

(g) the nature of the rollout obligation;

(h) Note: See clause 14 and Schedule 1.

(i) the state of the technology relevant to the provision, installation, maintenance and operation of advanced metering infrastructure and associated services and systems;

(j) the risks inherent in a project of the type involving the provision, installation, maintenance and operation of advanced metering infrastructure and associated services and systems;

(k) the market conditions relevant to the provision, installation, maintenance and operation of advanced metering infrastructure and associated services and systems;

(l) any metering regulatory obligation or requirement; and

(m) any other relevant matter.

In light of the AER's pre-existing Determination of efficient costs for 2013, and our subsequent estimate of efficient 2013 excess expenditure, Energeia first assessed whether the same factors applied to 2014-15 excess expenditure, and if so, applied the same adjustment approach. Efficient 2013 benchmarks were then typically adjusted for wage inflation or CPI, as appropriate.

[9] Energeia notes that 5I.7AA was added since Energeia's 2015 Charges Revision Application review.

Energeia's approach to assessing the efficiency of excess expenditure in 2013 first sought to identify and quantify the changes in conditions that drove the excess expenditure, and then sought to identify a benchmark efficient response to the change in conditions that would deliver a reasonably efficient outcome.

Efficient costs are the product of management processes designed to ensure that sustainably least cost options are systematically chosen and effectively implemented from a reasonable range of feasible alternatives. Energeia therefore sought to identify the unforeseeable or uncontrollable change and the range of feasible response options in order to determine the benchmark efficient option.

Given the significant uncertainty and risk associated with the AIM rollout programs, it was particularly important to take the information available to a benchmark efficient entity at the time into account when considering the efficiency of any decision to incur excess expenditure. In considering any alternative courses of action that may have been taken, Energeia strove to demonstrate that necessary information would have been available. This often required additional, independent research on our part.

2.2.3 Benchmark Efficient Entity

One of the key changes to the OIC since the 2015 Charges Revision Application review was the requirement for the AER to take into account the expenditure of a benchmark efficient entity:

> 5I.8A In any case where an application pursuant to clause 5L is made, the matters the Commission *must* [not may] also take into account include the expenditure of a benchmark entity over the entirety of, or any part of, the initial regulatory period.
>
> 5I.8B For the purpose of clause 5I.8A.
>
> (a) Benchmark efficient entity:
>
> In determining what may be or is a benchmark efficient entity the Commission may have regard to (but is not limited to):
>
> (i) meter density; and
>
> (ii) number of meters subject to regulation in this Order.

As detailed in Section 3.1.1.2, Energeia specifically considered customer density, meters per customer, percentage of business customers, as well as a range of other contextual factors including those listed in 5I.8 when considering what may be or is an appropriate benchmark entity under the OIC.

> (b) Benchmarking methods:
>
> (i) the Commission may make use of either or both category level benchmarking and aggregated category benchmarking;
>
> Note: See section 2.4.1 of the AER's Expenditure Forecast Assessment Guideline for Electricity Distribution, November 2013
>
> (ii) the Commission may have regard to (but is not limited to), both for the benchmark efficient entity and the distributor:
>
> (A) capitalisation policies; and
>
> (B) any allocation of costs between distribution services that are metering services and distribution services that are not metering services

As detailed in Section 3.1.1, Energeia analysed category and aggregated category level benchmarking methods given the OIC, the AER's benchmarking guidelines, and the Tribunal's recent decision regarding appropriate benchmarking methods and inputs. Based on that analysis, Energeia determined category level benchmarking to be the most appropriate method in the circumstances to apply the OIC tests.

Energeia's also estimated a benchmark efficient entity based on total expenditure (totex) over the period, to normalise for any differences between the businesses' capitalisation policies. Differences in each DNSP's cost allocation policies between metering and non-metering services was not able to be analysed in depth, however, Energeia does not believe it to be a material factor in the circumstances.

(c) Benchmarking:

(iii) That a distributor is the only distributor that incurs particular expenditure or engages in a particular activity is not a matter, and is not to be taken as a matter, that prevents or limited the use of benchmarking;

(iv) That a benchmark efficient entity might not have incurred particular expenditure or engaged in a particular activity is not a matter, and is not to be taken as a matter, that prevents or limits benchmarking of that entity against a distributor and vice versa;

(v) The Commission is not bound to proceed on the basis that the starting point for benchmarking is what a distributor has in fact done but may instead proceed from the starting point of what a hypothetical benchmark efficient entity would have done;

(vi) Without limiting clause 5I.2B(c)(iii), the Commission may proceed on the basis that a benchmark efficient entity's remotely read interval meters become logically converted remotely read interval metres at either or both different rates and different times from the rates and times at which the distributor's remotely read interval meters become logically converted remotely read interval meters; and

(vii) The Commission may disregard (in whole or in part):

(A) expenditure with respect to Distribution IT Systems where such systems are required for all customers of a distributor and not just for the distribution services that are metering services; and

(B) expenditure with respect to Distribution IT Systems where that expenditure has been or is sought to be brought into account as expenditure for the purposes of standard control services

For Distribution IT Systems, see also the scope of the distributor.

(viii) Clauses 5I.B(c)(i)-(v) do not limit matters that the Commission may have regard to when benchmarking.

Energeia's interpretation of clauses 5I.B(c)(i)-(v) is that they have been designed to ensure that the Commission is afforded a wide range of discretion regarding the determination of a benchmark efficient entity, including the use of hypothetical benchmark entity, or the use of benchmarks that do not align with the actual actions or inactions of a given DNSP.

2.2.4 Contract Cost

In determining whether excess expenditure is reasonably efficient, clause 5I.7B(b) states that the AER may (not must) take into account whether or not the excess expenditure is a contract cost and whether or not the contract was let in accordance with a competitive tender process.

Sections 5I.9 and 5I.10 detail the criteria that the AER must (not may) consider when determining whether the contract was let in accordance with a competitive tender process, and the definition of a contract cost:

> 5I.9 When taking into account whether a contract was let in accordance with a competitive tender process, the Commission must [not may] have regard to:
>
> (a) the tender process for that contract;
>
> (b) whether there has been compliance with that process; and
>
> (c) whether the request for tender unreasonably imposed conditions or requirements that prevented or discouraged the submission of any tender that was consistent with the selection criteria.

Energeia notes that the OIC has been changed since our review of the 2015 Charges Revision Applications to allow the AER discretion as to how it treats competitively-let, contract costs in its assessment of efficient costs. Where it does take them into account, Energeia's interpretation of the OIC is that it must have regard to the criteria set out in clause 5I.9(a)-(c).

Energeia's assessment of whether excess expenditure met the above criteria was based on the experience of its personnel procuring advanced metering infrastructure and their technical knowledge of DNSP tendering processes and the market for advanced metering infrastructure related technologies and services.

2.2.5 Out of Scope

Other regulatory tests have been agreed with the AER to be out of scope for our review.

2.3 Resolving Issues

Where DNSP's 2017 Transition Charges Applications did not contain sufficient information for Energeia to form a view as to whether they met the particular regulatory test, Energeia developed questions to address its specific areas of concern.

DNSPs were each sent questions to address these issues, with a request to respond within five business days due to tight timeframes. Energeia considered each DNSP's response, and met with them via telephone to address any remaining questions. Follow-up materials were also reviewed and considered.

Energeia acknowledges the pressure these requests put on each DNSP, and would like to thank their regulatory managers in particular for their understanding, support and cooperation.

2.4 Out of Scope

Anything not specified as being in scope for Energeia's limited review of DNSP's 2017 Transition Charges Applications is out of scope, including:

- Assessment of 2012 or 2013 excess expenditure
- Assessment of whether DNSP's met the best efforts criteria
- Benchmarking methods other than those methods set out in clauses 5I.8B(a)(i) of the OIC

3 Review Outcomes

The result of our review and assessment of in-scope expenditure against each of the in-scope OIC tests is shown in Table 1. Overall, Energeia has concluded that $59.8 out of $112.0 million of DNSP's claimed excess capex and $22.5 out of $31.1 million of DNSP's claimed excess opex meets the OIC standard.

Table *1*– Excess Expenditure Assessment Summary

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Communications Infrastructure	$ 0.3	$ -	$ -	$ 0.3	$ -	$ -	$ -	$ -	$ -
IT	$ -	$ -	$ 33.3	$ -	$ -	$ 5.7	$ -	$ -	-$ 27.6
Other	$ -	$ 2.4	$ -	$ -	$ 1.2	$ -	$ -	-$ 1.3	$ -
Opex	$ -	$ 2.5	$ 28.6	$ -	$ 0.3	$ 22.2	$ -	-$ 2.1	-$ 6.4
Total	$ 25.3	$ 14.8	$ 103.0	$ 25.3	$ 7.9	$ 49.1	$ -	-$ 6.8	-$ 53.9

Source: Energeia

Most of the excess expenditure we found to be efficient under the OIC was due to it representing a timing rather than pricing or volume variation. Where a pricing variation occurred, we generally tested it against the category results to determine whether it reflected the benchmark efficient entity, as well as against the inflation adjusted unit prices determined in the 2015 review, which adjusted the original 2013 budget allowances based on uncontrollable and unforeseeable changes in DNSP's operating environment.

Energeia's assessment of benchmarking inputs, methods, and adjustment factors, as well its assessment of each DNSP's in-scope expenditure against the relevant regulatory tests under the OIC, are detailed in the following sections.

3.1 Benchmarking

The OIC for the 2017 Transition Charges Application review is unique in that it for the first time in a budget or charges review *requires* that the AER take account of the expenditure of a benchmark efficient entity over the entirety, or any part of, the initial [2009-15] regulatory period.

The nature of the benchmarking that the AER is required to take into account is informed by clauses 5I.8B(a)-(c). Energeia notes that the OIC uses the term may, not must, implying that while specified benchmarking methods may be suggested, alternative benchmarking methods and approaches may also be used. It is also worth noting that the OIC is silent on the data to be used for benchmarking purposes, a potential issue which is addressed in the following sections.

3.1.1 Benchmarking Methods and Inputs

As set out in the OIC clauses 5I.8B(a)-(c), there are a number of key decisions about benchmarking methods, inputs and adjustments that must be made in the course of developing an appropriate estimate of a benchmark efficient entity for the purpose of taking its expenditure into account under the OIC.

As already mentioned, the OIC is silent on the inputs to be used for benchmarking purposes, what adjustments to the input data may be appropriate, and/or how the data should be limited, for example to a specific set of years.

3.1.1.1 Input Data

The main input options available for consideration are the DNSP's audited actual expenditure, as reported in the charges applications themselves, or data included in the Regulatory Information Notices (RINs), which includes data on metering related quantities and expenditure items by metering type.

Although it does not provide an explanation for its decision, UED's benchmarking analysis in its 2017 Transitional Charges Application appears to rely on reported actual expenditure data gleaned from published charges applications. Jemena's submitted benchmarking, carried out by its consultants, uses RIN data, also without providing a basis for its chosen benchmarking inputs. Energeia could not identify why Jemena's consultant did not use the publicly available AMI actual expenditure data provided as part of the OIC process, particularly given the consultant's own conclusion that the RIN data is inconsistent and non-standardised.[10]

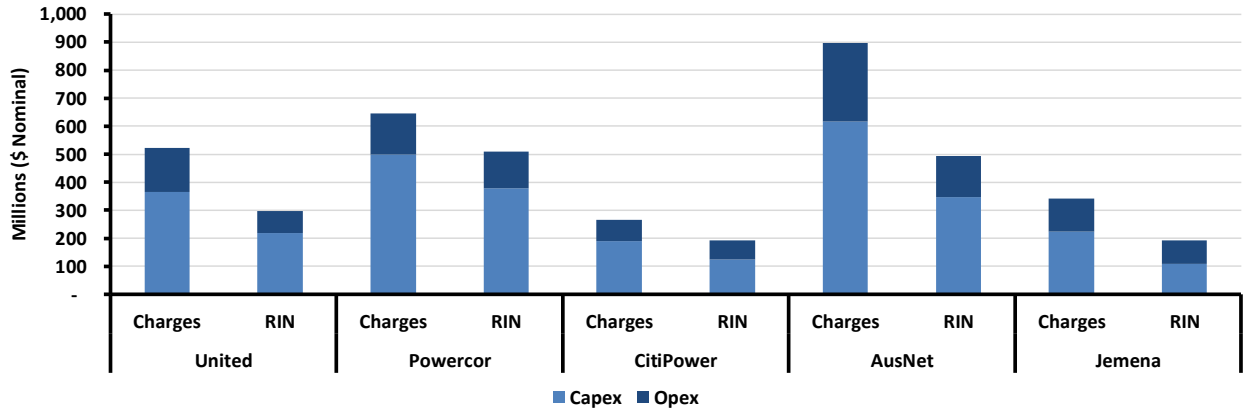
Energeia's review of the OIC and analysis of the two main input options has found that on balance, the RIN data has more deficiencies than the charges applications data, including that:

- the RIN reported expenditure is not as well standardised as the charges data for the purposes of benchmarking efficiency under the OIC;
- the RIN reported expenditure may also include costs unrelated to the OIC due to estimated data and type-4 metering being used by non-AMI sites, and
- the RIN reported expenditure is consistently lower than charges reported expenditure, suggesting there may be a reporting lag or estimation errors in the RIN data.

Expenditure under the OIC is relatively consistently categorised and limited to AMI costs only due to the inclusion of specific scoping language, e.g. Schedule 2, to ensure that costs are indeed related to the AMI program. RIN data, on the other hand, is specified according to each DNSP's basis of preparation, with AMI expenditure generally being included as part of type-4 metering, which is also the categorisation used for remotely read meters used by some business customers. This means it might include non-AMI costs.

Finally, Energeia's analysis presented in Figure 2 shows that the RIN reported expenditure over the 2009-15 period is significantly lower than the charges reported expenditure for the same period. Perhaps more significant is that the analysis shows how the use of one dataset over another could impact on benchmarking results. Assuming that the charges data is the more accurate dataset, Figure 3 shows how using the RIN data tends to make Jemena relatively more efficient, especially for capex, which is 52% lower.

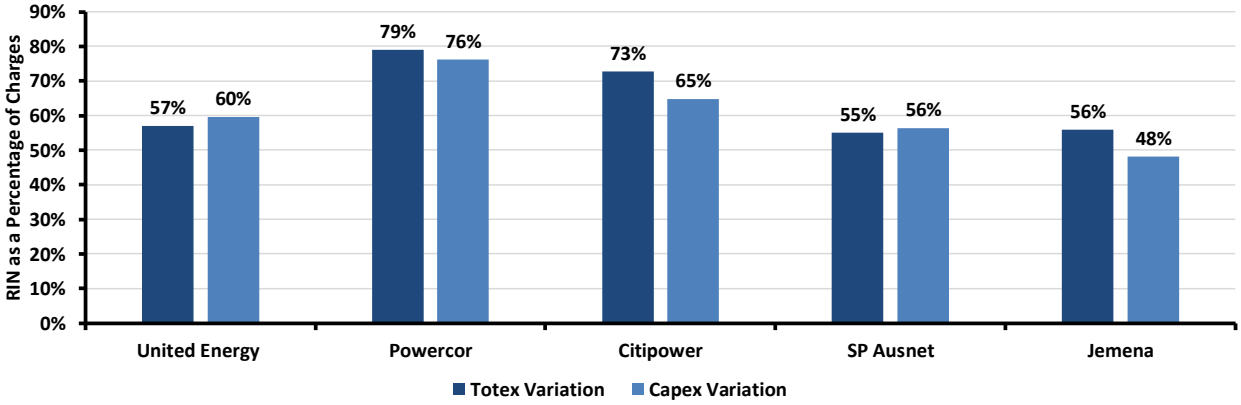
Figure 2 – Comparing Capex and Opex between Charges and RIN Datasets



Source: UED, Jemena

[10] *Advanced Metering Infrastructure, AMI Transition Application, Attachment 2 – Advanced Metering Infrastructure Expenditure – Benchmarking Victorian metering expenditure from 2009 to 2015*, Huegin, 31 May 2016, pg 6

Figure 3 – RIN Expenditure as a Percentage of Charges Expenditure



Source: UED, Jemena

Energeia notes that the RIN data does have some advantages over charges data. For example, metering opex is separated into a number of sub-categories in the RIN, potentially enabling aggregated category or more fine grained benchmarking. There is also a comparability issue when using Jemena's and UED's data due to their inclusion of significant expenditure in the 'Other' category, which may require reallocation as part of the benchmarking process. However, on balance, Energeia is of the view that the charges data is the superior dataset to use for benchmarking as required under the OIC.

3.1.1.2 Input Data Adjustments

Whether or not to adjust input data to account for key differences between DNSP's treatment of the data is an important benchmarking decision, which the Tribunal has referenced in its recent judgement.[11] The key questions, then, are what adjustments may be necessary, and how best to implement them.

UED has adjusted the charges data to account for previous AER decisions to reduce actual expenditure. No adjustments are made to take into account the impact of having 4% of their total actual capex allocated to the 'Other' category, which may tend to overstate their relative efficiency across the remaining categories.

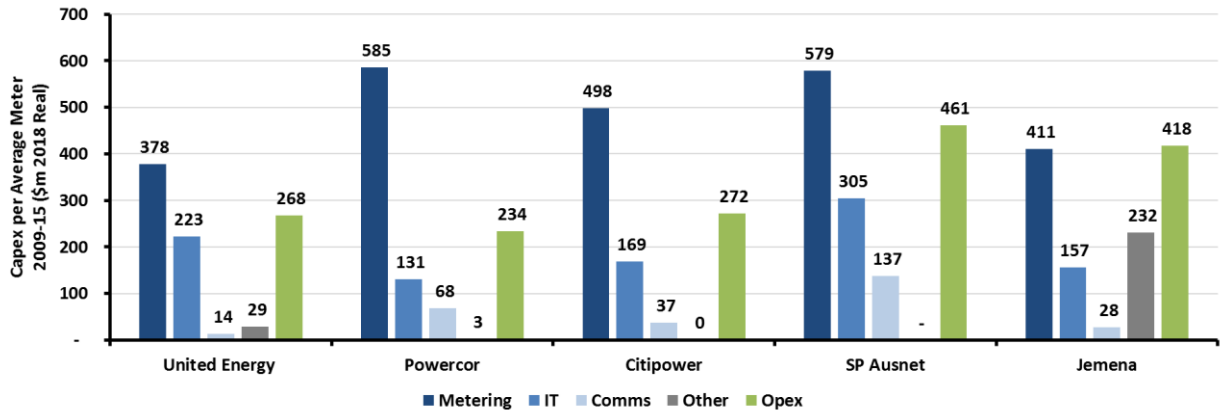
Jemena's consultant does not appear to adjust the inputs other than to use the number of meters in 2015 as the normalisation factor for their category analysis.[12] UED uses the average number of meters over the period as the normalisation factor for their benchmarking.

Energeia's review and analysis of input data issues found that the Jemena and UED's unique allocation to the Other category was potentially substantial, as shown in Figure 4. For UED, the allocation was significant in terms of its potential impact on comms and IT capex per meter. For Jemena, the expenditure appears to be relevant to all capex categories given its size, which is second only to metering capex.

[11] *Applications by Public Interest Advocacy Centre Ltd and Ausgrid* [2016] ACompT 1, Review from Australian Energy Regulator, 26 February 2016, p 179-180

[12] The consultant's do adjust the model specification, but these are dealt with in a separate section.

Figure 4 – Raw Expenditure per Average Meter by Capex Category



Source: UED, Jemena

The key question then is how best to allocate the Other category across the metering, IT and comms categories in order to enable a reasonable benchmarking analysis. Ideally, the specific cost categories included in Other capex by Jemena could be matched to the categories used by the other DNSPs and adjusted accordingly. Unfortunately, this is not feasible due to the lack of more detailed reporting.

Based on the expected material impact of the Other capex categorisation on the other capex categories, Energeia concludes that the Other capex should be allocated to the metering, IT and comms categories so that JEN's and UED's benchmarks are not artificially low. Based on the lack of the quality dataset needed to appropriately reallocate 'Other' capex to the other primary capex categories, Energeia concludes that a pro-rata allocation is a reasonable approach in the circumstances. In our view, it is a conservative approach for the purpose of this review given the categories inclusion of meter rollout related expenditure, which is expected to be more likely to be categorised as meter capex than IT or communications capex.

The other key input data adjustment that Energeia has made is to allocate a portion of ANS's opex to its capex categories on a pro-rata basis. This is to adjust for differences in capitalisation policies between ANS and the other DNSPs, who have capitalised their project management, while ANS has chosen to expense it. We used the breakdown of opex sub-categories from our 2015 review to re-allocate $118 million of ANS's $461 million in opex to capex on a pro-rata basis, increasing each capex category proportionally.

3.1.1.3 Methods and Implementation

When it comes to the method of benchmarking, there are a wide range of possibilities, including Total or Partial Factor Productivity Analysis, which was applied in the recent EDPRs, or Data Envelope Analysis (DEA) and Stochastic Frontier Analysis (SFA), referred to by the AER[13]. However, the OIC is clear that the preferred benchmarking methods for the AER to use are Category or Aggregated Category methods, or both, as defined in the AER's guideline.[14]

[13] *Better Regulation, Expenditure Forecast Assessment Guideline for Electricity Distribution*, AER, November 2013, pg 13

[14] Ibid.

The AER's guideline describes its approach to category and aggregated category benchmarking as follows:

> **Category level benchmarking**
>
> We will benchmark across DNSPs by expenditure categories on a number of levels including:
>
> - total capex and total opex
> - high level categories (drivers) of expenditure (for example customer driven capex or maintenance opex)
> - subcategories of expenditure.
>
> We may benchmark further at the following low levels:
>
> - unit costs associated with given works (for example, the direct labour and material cost required to replace a pole)
> - unit volumes associated with given works (for example, kilometres of conductor replaced per year).
>
> **Aggregated category benchmarking**
>
> In addition to detailed category benchmarks we are likely to use aggregated category benchmarks, which capture information such as how much a DNSP spends per kilometre of line length or the amount of energy it delivers. We intend to improve these benchmarks by capturing the effects of scale and density on DNSP expenditures.

The following sections review and assess each DNSP's benchmarking approach before determining the approach that Energeia determines to be the most appropriate under the OIC.

UED's Methodology

UED's benchmarking approach, while not described explicitly, seems to adopt aggregated category and category methods. UED takes actual capex and opex[15], also known as totex, and divides it by the average number of meters over the period.[16] It also looks at capex per meter separately[17], but not opex per meter. There is no justification as to why average meters is used, and not some other metric or normalising factor.

Energeia agrees with UED's approach to using the average number of meters over the period, although we would be comfortable with using the number of meters at the end of the expenditure period in 2015 as well. While we agree with the totex based approach to assessing DNSP's overall efficiency, we believe that category and sub-category based benchmarking are appropriate under the OIC when considering specific categories and sub-categories of excess expenditure.

Jemena's Methodology

Jemena's consultant used three methods it refers to as aggregate category analysis, activity based category analysis and Total Factor Productivity (TFP).[18] The category analysis focused on adjustments to IT and

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[15] UED's numbers have been reduced by the AER's efficiency adjustments.

[16] *United Energy's 2017 AMI Transition Charge Application*, United Energy, 31 May 2016, pg 21

[17] Ibid. pg 5

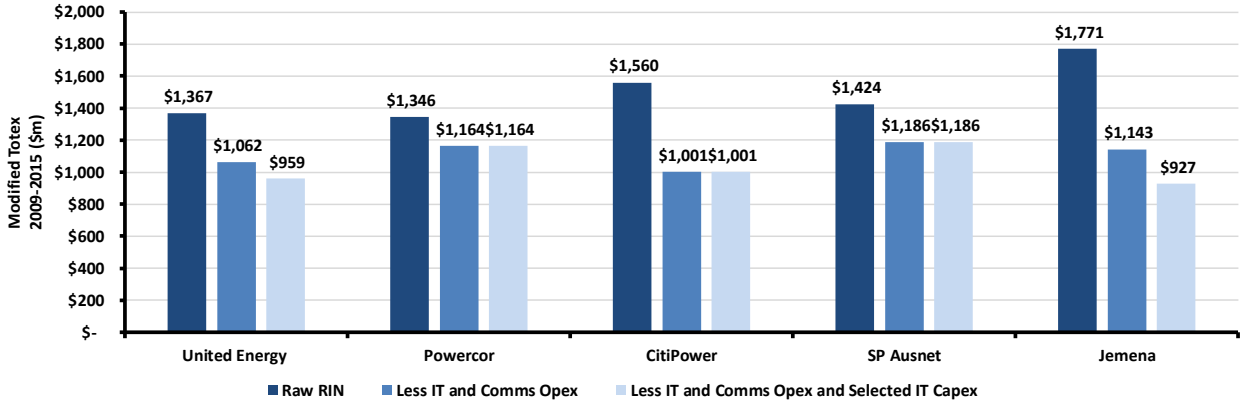
[18] *Advanced Metering Infrastructure Expenditure – Benchmarking Victorian metering expenditure from 2009 to 2015*, Huegin, 31 May 2016, pgs 9-10

communications opex to account for fixed cost factors, the activity based approach focused on a number of activities, and the TFP used a subset of the activities as outputs with totex as the input.

Energeia's analysis of the materials provided has found that the methods applied by Jemena's consultant do not appear to fit the OIC benchmarking methods precisely. The consultant develops its own definition of aggregate category analysis, which appears to be a mix of category and aggregated category benchmarking as defined by the AER, due to the inclusion of a category that has no volume divisor.[19] They also use activity based category analysis and total factor productivity, neither of which are specifically referred to by the OIC. Finally, there is no justification as to why these are superior methods to those specified by the OIC.

The consultant's category analysis focused on adjusting the benchmarking model to account for key differences in fixed costs. The consultant concludes that IT and communications opex are fixed on the basis that each company spent $40-50 million on it over the 7-year period, once CitiPower and Powercor's (CP/PAL) costs were grouped together.[20] They also refer to CP/PAL's sub-categorisation of this category into IT maintenance, support and data analysis as evidence that these costs are fixed. The result of each of the above adjustments to the modified totex per meter performance of DNSPs is displayed in Figure 5.

Figure 5 – Capex per Average Meter by Capex Category ($ Nominal)



Source: Jemena

The main deficiencies Energeia sees with the above analysis is the reliance on RIN data that does not appear to include all actual expenditure, a reliance on an assumption that Jemena and UED implemented specific IT functionality for the OIC that others did not, which is not demonstrated, and a reliance on an assumption that IT and communications opex is a fixed cost and cannot be shared which is demonstrably false given Jemena and UED undertook such an arrangement (notwithstanding performance issues ended it). We also note that reallocation of costs such as in Section 3.1.1.2 leads to different expenditure amounts.

The consultant's activity based category analysis, which appears to Energeia to fit well under the AER's category analysis lexicon as a unit cost benchmark includes meter purchases (supply) capex, meter reading opex, meters installed and replaced capex, and meter investigations, maintenance and testing opex.

Given Jemena's excess expenditure unrelated to timing is mainly meter installation related, we focused our analysis on this particularly activity. Using Jemena's consultant's own analysis, it shows that Jemena's benchmarked installation costs at $163 per meter are $46 per meter or 29% higher than the most 'efficient' DNSP by this benchmarking approach, AusNet Services. Energeia's own analysis of the benchmark efficient meter installation unit costs for JEN is presented in Section 3.3.2.

[19] *Ibid.* pg 9

[20] It's important to bear in mind here the degree to which RIN costs reflect estimates, reporting delays, etc.

The main deficiencies Energeia sees with the above analysis includes that it does not address the $72.5 million in 2009-15 'Other' capex that is likely to reduce JEN's benchmark efficiency with respect to meter installation costs. It also relies on RIN data, which is demonstrably incomplete relative to actual audited costs reported by the DNSPs as part of the OIC regulatory process and JEN's basis of preparation report describing the quality of the metering data within the RIN.[21]

The last benchmarking method applied by JEN's consultants is Total Factor Productivity, which is included on the basis that the AER has applied it as part of its statutory benchmarking activities. The consultant uses meters installed or replaced, maintained or inspected and read as the output factors, which are weighted using a complex methodology that is not explained or justified in the report. The results initially show Jemena as being in the middle of DNSPs, but once adjusted by removing IT and comms opex, it shows Jemena as being the most efficient DNSP in Victoria using the consultant's TFP implementation.

The main deficiencies Energeia sees with the above analysis include:

- its lack of explanation;
- the selected inputs and outputs and their weightings, which have not been justified;
- the inconsistency in using meter reading weighted by comms opex as a major output metric but removing it from the input metric;
- the reliance on incomplete RIN data, which tends to make CitiPower and Powercor look relatively more expensive; and
- the removal of IT and communications opex on the basis that it is a fixed cost and cannot be shared, for reasons given above.

Interestingly, there is no discussion of what the benchmark efficient entity is with respect to each of JEN's excess expenditure categories based on the benchmarking analysis as required under the OIC. JEN appears to be being put forward as the benchmark efficient entity in a number of assessments, but PC, ANS, UED and CP are each also indicated as the most efficient in some categories.

In summary, for the reasons set out above, Energeia does not find the benchmarking methods or implementations applied by JEN's consultants to be sound or appropriate based on our interpretation of the OIC. We believe that JEN's consultant's approach is also deficient because it did not consider meter density, which is specifically referred to in the OIC, and which may be relevant to JEN's network given its size. Our preferred benchmarking methods and implementation is described in the following section.

Energeia's Methodology

Based on our review and analysis of the OIC, the OIC's referenced sections of the AER's guideline and the associated section in the companion explanatory statement, the approaches of UED and Jemena, and the Tribunal's judgement, Energeia has concluded that the most appropriate benchmarking approach for this review would consider a number of benchmarking methods including at a minimum those specified in the OIC, and adjust them for relevant factors, for example those listed in OIC clauses 5I.7B and 5I.8.

One key issue related to the interpretation of the OIC is whether DNSP's requested excess expenditure should be broken down into its constituent parts, or whether it should be considered together a whole. Energeia notes that the OIC refers to AER benchmarking techniques that are themselves broken into categories, although they do include totex (total opex and total capex) as one of the options. Had the OIC

[21] *JEN response to Category Analysis Regulatory Information Notice for the 2015 regulatory year - Basis of preparation*, Jemena, 29 April 2016.

meant to focus on total excess expenditure only, and a benchmark efficient entity with respect to totex only, we believe that the language would have been more explicit in this regard.

Another key issue to be settled is the most appropriate adjustment factors to be applied when comparing expenditure between DNSPs. Meters, and meters per square kilometre (density) are both referenced in the OIC, and meters has been used by both Jemena and UED in their preferred benchmarks. Based on our own experience and expertise, Energeia also considered percentage of business customers (a metric for difficult to install) and meters per customer (a metric for efficiency of install) as potential normalising factors.

The results of our technical analysis of the relationship (regression) between the above potentially appropriate normalising factors and totex over the 2009-15 period is presented in Table 2. The analysis found that none of the tested normalising factors other than meter volumes could be shown to exhibit a statistically meaningful impact on the capex or totex result, as each did not either pass the t-stat test and/or had the wrong sign. The r-squared of meter volumes was 0.85, suggesting only 15% of the variation in totex between DNSPs was due to other factors, most likely factors other than those reported in Table 2.

Table 2 – Technical Assessment of Quantitative Benchmarking Adjustment Factors

Adjustment Factor	Capex		Totex	
	Correct Sign	t Stat > 2	Correct Sign	t Stat > 2
Average Meters	✓	✓	✓	✓
Meters per Customer	✓	×	✓	×
Businesses	×	✓	✓	×
Density	✓	×	✓	×

Source: AER, AusNet, Jemena and UED

Recognising the very limited dataset that we are working with, Energeia nonetheless concluded that average meters over the period was the most appropriate normalising factor to implement for our review. The technical analysis suggested that including any of the alternative factors could not be demonstrated to be a key driver of expenditure. In other words, where including these other factors resulted in a different benchmarking result to the meter normalised result, they could not be statistically demonstrated to be robust.

Following our analysis of key expenditure adjustment factors, Energeia implemented the following benchmarking methods as part of our review:

- Category level benchmarking methods
    - Capex sub-category unit costs (bottom up)
    - Opex sub-category unit costs (bottom up)
- Aggregated category benchmarking methods
    - Totex per meter (top down)
    - Capex and opex category per meter (top down)

The key implementation changes we made included the use of charges input data and the adjustment of Other capex and project management opex to metering, IT and communications on a pro-rata basis. Other specific modelling adjustments are described alongside the related results in the next section.

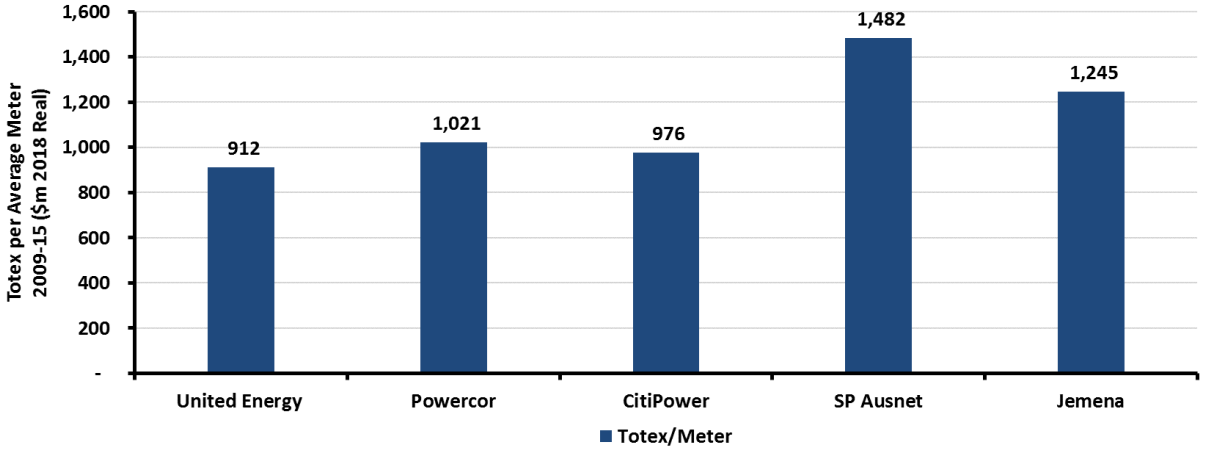
3.1.2 Benchmark Efficient Entities

The following sections present and discuss the findings and conclusions from Energeia's assessment of benchmark efficient entities using three OIC referenced benchmarking approaches representing both top-down and bottom up methodologies, but relying exclusively on the charges dataset and a per meter adjustment factor to enable relatively like-for-like efficiency comparisons.

3.1.2.1 Totex per Meter

The results of Energeia's application of totex per meter benchmarking is presented in Figure 6. The analysis shows ANS to have the highest cost per meter at $1,482, and UED the lowest cost at $912 per meter. Interestingly, three of the DNSPs all have a similar cost per meter of around $950, with ANS and JEN being outliers at $1,482 and $1,245, respectively.

Figure 6 – Totex per Average Meter by DNSP (2009-2015)



Source: AER, UED, AusNet, Jemena and UED

It is also interesting to note that UED, PC and CP represent relatively different networks in terms of customer numbers, customer mix and terrain, which is presented in Table 3. UED is often compared to JEN for having a similar, mostly suburban network, while PC is often compared to AusNet services for having a similar, mostly rural network. What is not shown is that CP and PC share a common owner, and have worked to integrate their management, systems and operations as much as possible.

Table 3 – Key Operating Environment Factors

DNSP	Totex	Meters	Meters per Customer	Business Customers	Density
UED	594,875,120	669,745	1.03	8.4%	89.5
JEN	389,922,889	323,790	1.03	7.9%	71.7
CP	302,082,343	321,901	0.99	15.8%	102.4
PAL	736,855,846	762,898	0.99	12.7%	11.5
ANS	1,010,654,976	695,361	1.00	9.9%	18.3

Source: AER, AusNet, Jemena and UED

While customer density and customer scale can all be reasonably expected to represent uncontrollable cost factors, and therefore lead to acceptable variations in costs of equally efficient businesses, Energeia's analysis suggests that the magnitude of these factors cannot be robustly demonstrated. Nevertheless, there may be other, untested factors at play, Energeia therefore selected the most similar, least cost DNSP on a per meter basis as the benchmark efficient entity, consistent with OIC clause 5I.8B:

- UED, JEN and CP are most similar in terms of meter density and customer mix
- PC and ANS are most similar in terms of meter scale and density, and customer mix

The above totex based analyses and conclusions in isolation of other benchmarking approaches would lead to a determination that UED's excess expenditure is efficient as the benchmark efficient entity, but that JEN's and ANS's excess expenditures are not efficient, being $70 and $314 million higher than their respective benchmark entities, respectively, calculated by multiplying $/meter variations by average meter numbers.

Among the key limitations of the totex per meter approach is that while it internalises DNSP capitalisation policies, a significant amount of the expenditure being compared is not directly related to the excess expenditure submitted by the DNSPs. To the degree that the OIC calls for category level benchmarking, and in Section 3.1.1.3 Energeia argues that in our view it does, then a totex based benchmarking approach would not be the most appropriate benchmarking approach to adopt, at least not in isolation.

3.1.2.2 Expenditure Category per Meter

Category level totex per meter benchmarking would address the key limitation of the totex based approach by focusing on specific areas of expenditure to improve their comparability. However, due to the lack of granularity in opex reporting in the charges dataset, it is not possible to implement a category level benchmark that includes capex and opex.

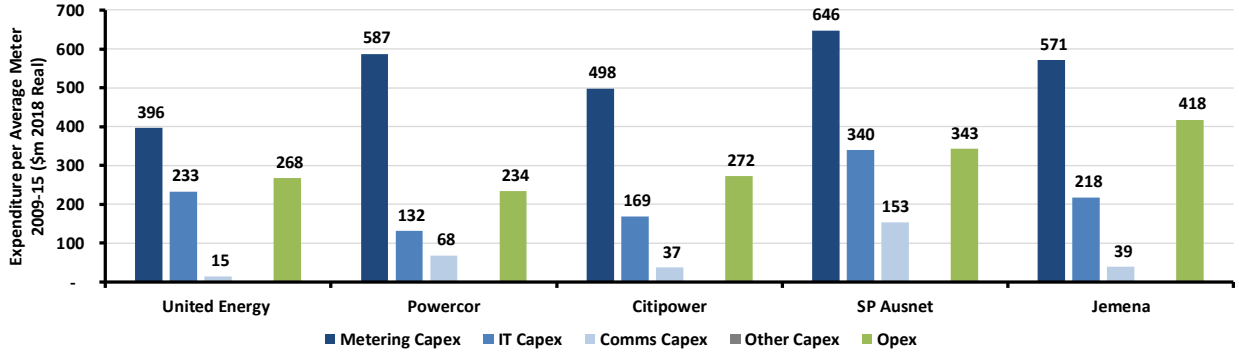
Instead, Energeia has implemented a category based benchmarking model. We have considered but rejected pro-rata allocation of opex, as it would result in the same outcome as capex only. We also considered allocating opex from the RIN, which can be allocated to metering, IT and comms, and adjusted based on estimated reporting gaps, but rejected that as not fit for purpose given the discreet, capex and opex based excess expenditure categorisation by the DNSPs.

The results of our analysis of category level benchmarking is presented in Figure 7.[22] As was the case for our totex per customer based benchmarking, and for the same reasons, Energeia selected the most similar, least cost DNSP on a per meter basis as the benchmark efficient entity for a given capex or opex category, consistent with OIC clause 5I.8B:

- UED, JEN and CP are most similar in terms of meter density and customer mix
- PC and ANS are most similar in terms of meter scale and density, and customer mix

UED is the clear benchmark efficient entity overall for metering capex at $396 per meter. IT capex, which might arguably be the most fixed in nature, shows a wide variation that does not appear to be related to scale with two out of the three largest DNSPs (ANS and UED) having the two highest IT capex costs per meter. UED is the benchmark efficient entity for comms capex, being less than half that of second placed CP. PC is the benchmark efficient entity for opex, which may be driven by cost sharing arrangements with PC.

Figure 7 – DNSP's Adjusted Expenditure per Average Meter by Category (2009-2015)



Source: AER, UED, AusNet, Jemena and UED

Based on the above analysis in isolation, Energeia concludes that UED's excess expenditure in metering and communications are efficient under the OIC criteria being equal to the efficient benchmark. Jemena's $12.3 million excess capex expenditure, which Energeia believes is appropriate to allocate to the metering category

[22] The main adjustments are the reallocation of JEN and UED's Other capex and ANS's project management opex on a pro-rata basis to the other capex categories.

given nature of capex listed as Other, would not be determined to be efficient, as it is higher than the benchmark efficient entity UED by almost $175 per meter, or $54.7 million. JEN's $2.5 million excess opex would also not be efficient, as part of the $46.9 million higher opex than UED's efficient entity benchmark. AusNet's $41.1 million metering expenditure excess would not be found to be efficient, being $59 per meter or $40.2 million higher than Powercor's. ANS's $61.8 million IT and opex excesses would also be judged to be inefficient at more than double PC's respective benchmark costs.

While limited in that cost allocation policies are not taken explicitly into account, Energeia is of the view that the above approach is on balance more appropriate under the OIC than the totex based approach as the former better aligns the benchmark to the excess expenditure. Also, the opex levels of JEN suggest additional differences in capitalisation could be having a substantial effect on its respective capex benchmarks, and that the latter should therefore be treated with caution. Another potential limitation with the above category based analysis is that it does not account for key factors raised by the DNSPs including the cost impact of unforeseeable and uncontrollable conditions, e.g. no access.

3.1.2.3 Sub-Category Unit Pricing

Among the key limitations of category and sub-category level benchmarking is that it may not be able to account for key differences in DNSP's operating environment factors. Another limitation is that it not be granular enough, for example where the excess expenditure is a sub-set of the category or sub-category benchmark, for example meter reading opex within the overall opex benchmarking category.

Energeia has therefore assessed selected excess expenditure below the sub-category level using a range of bottom-up benchmarks as indicated. In all cases, the sub-category unit pricing approaches resulted in more conservative benchmarks than totex, category or sub-category benchmarking approaches, which we believe highlights the value in adopting the more granular, bottom-up approach in these cases.

Meter Installation Unit Costs

Jemena, UED and ANS's meter installation unit costs were compared against their respective benchmarks in our 2015 review, which was UED for JEN and ANS for ANS. UED's was determined to be the benchmark efficient entity for 2014-15, and the percentage increase in their unit cost from 2013 was applied to JEN's efficient 2013 benchmark along with wage inflation to form JEN's 2014-15 benchmarks. ANS's 2013 efficient benchmark price was increased by labour inflation for its 2014 and 2015 benchmarks.

Network Interface Card Unit Costs

ANS's mesh and 3G NIC unit costs were taken from our November 2012 review of efficient communications expenditure. They were not adjusted to reflect current NIC prices as the hypothetical efficient entity was determined to have already deployed them in 2011.

PMO and Customer Service Unit Costs

ANS and JEN's project management and customer service unit costs were taken from the efficient unit costs determined by the AER in the 2012-15 budget review. Both unit prices were increased by the respective impact of no access sites determined in our 2015 review, and both were increase by labour inflation for 2014 and 2015, but only JEN's was increased by UED's end of rollout increase as ANS's category level benchmarks suggested their opex expenditure was the least efficient.

Manual Metering Reading Unit Costs

Manual meter reading costs were taken from the AER's 2015 Charges Revision Application Final Determination, except for ANS, where the EPDR unit cost was used.

3.2 United Energy Distribution

United Energy Distribution's (UED's) 2017 Transitional Charges Application included $25.3 million in excess capital expenditure, of which $7.0 million was for meter supply capex, $17.9 million was for metering installation capex and $0.3 million was for communications infrastructure capex, as detailed in Table 4.

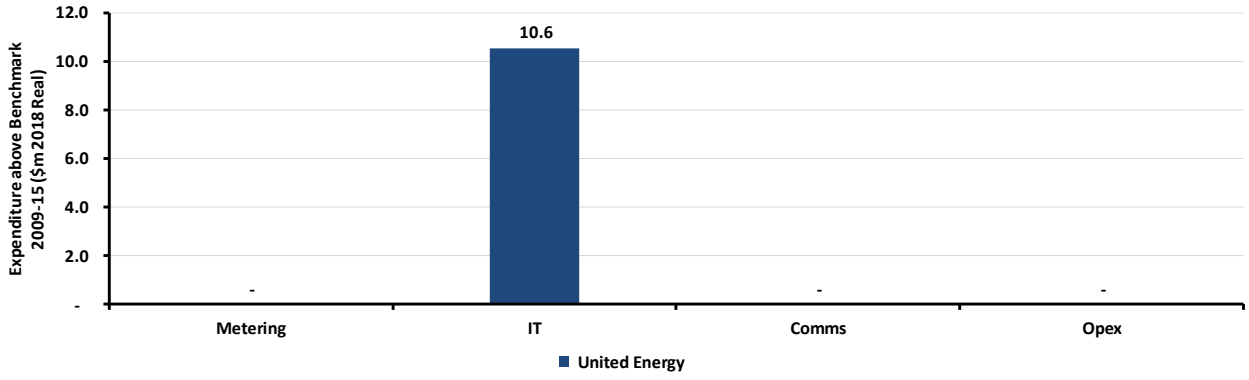
Table 4 – UED's Excess 2014-15 Expenditure by Category

Real 2018 Dollars		Actual		Approved Budget		Requested Excess		Allowance		Difference	
Category	Type	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Capex		$ 27.5	$ -	$ 2.3	$ -	$ 25.3	$ -	$ 25.3	$ -	$ -	$ -
Meter Supply	**Capex**	**$ 8.4**	**$ -**	**$ 1.4**	**$ -**	**$ 7.0**	**$ -**	**$ 7.0**	**$ -**	**$ -**	**$ -**
Total Meters	Numbers	40,461	-	8,462	-	31,999	-	31,999	-	-	0
Total Meters	Capex	$ 8.40	$ -	$ 1.4	$ -	$ 7.0	$ -	$ 7.0	$ -	$ -	$ -
Meter Installation	**Capex**	**$ 17.9**	**$ -**	**$ -**	**$ -**	**$ 17.9**	**$ -**	**$ 17.9**	**$ -**	**$ -**	**$ -**
Rollout - Meter Installation	Numbers	111,701	-	0	0	111,701	-	111,701	-	$ -	0
Rollout - Meter Installation	Capex	$ 17.9	$ -	$ -	$ -	$ 17.9	$ -	$ 17.9	$ -	$ -	$ -
Comms Infrastructure	**Capex**	**$ 1.2**	**$ -**	**$ 0.8**	**$ -**	**$ 0.3**	**$ -**	**$ 0.3**	**$ -**	**$ -**	**$ -**
IT	**Capex**	**$ -**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other	**Capex**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Opex		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total		$ 27.5	$ -	$ 2.3	$ -	$ 25.3	$ -	$ 25.3	$ -	$ -	$ -

Source: UED, Energeia

In summary, Energeia has concluded that all of UED's 2014 and 2015 excess expenditure is efficient under the requirements of the OIC, due largely to UED being the benchmark efficient entity in all the categories of excess expenditure being claimed. This is despite some of the unit prices being higher than the benchmark efficient levels we determined in our 2015 review, for the reasons set out in the sections below.

Figure 8 – UED's Excess 2014-15 Expenditure by Category



Source: Energeia, Jemena

The following sections detail Energeia's assessment of UED's excess expenditure against the OIC criteria using the methodology outlined in Section 2 and the benchmarking results in Section 3.

3.2.1 Meter Supply Capex

UED's justifications for the efficiency of its $7.0 million in meter supply excess expenditure included that it reflects a timing rather than cost variation, and that its overall expenditure per meter is the lowest.[23]

Energeia's review of UED's meter supply capex found that it primarily reflects a timing difference. Our analysis found UED's 2014 unit cost was $35 ($ nominal) per meter higher than the labour inflation adjusted

[23] *United Energy's 2017 AMI Transmission Charge Application*, United Energy, 31 May 2016, pg 4

unit cost of $158 ($ nominal) per meter from our 2015 review[24], most likely due to it reflecting relatively more, higher cost sites, which are typically left to the end. Finally, we found that UED's overall metering capex, which includes meter supply and meter installation capex sub-categories, to be the benchmark efficient entity for metering capex.

Based on the above findings and the OIC criteria, Energeia has concluded that UED's excess expenditure related to its meter supply capex is efficient.

3.2.2 Meter Installation Capex

UED's justifications for the efficiency of its $17.9 million in meter supply excess expenditure included that it mainly reflects a timing variation, is only ~10% higher than the 2013 unit prices approved in the 2015 review, after adjusting for labour cost inflation, and that its overall expenditure per meter is the lowest.[25]

Energeia's review of UED's metering installation capex found that is also primarily reflected a timing difference due to delays in UED completing the rollout relative to the timeline assumed in the AER approved budget. We also found unit prices were significantly higher in 2014 at $150 ($ nominal) per meter than the wage inflation adjusted installation unit prices of $130 ($ nominal) per meter we determined in the 2015 review. However, as mentioned in the above section, we also found UED's overall metering capital expenditure to be the efficient benchmark.

Based on the above findings and the OIC criteria, Energeia has concluded that UED's excess expenditure related to its meter installation capex is efficient under the OIC.

3.2.3 Communications Infrastructure Capex

UED's justifications for the efficiency of its $0.3 million in communications infrastructure excess expenditure included that it reflects a timing variation, and that its overall expenditure per meter is the lowest.[26]

Given our finding that UED is the benchmark efficient entity for communications infrastructure capex, less than half the cost if the nearest other DNSP, CitiPower, Energeia is reasonably satisfied that its excess expenditure of $0.3 million is efficient under the OIC criteria.

3.3 Jemena

Jemena's (JEN's) 2017 Transitional Charges Application included $12.3 million and $2.5 million in net excess capital and operational expenditure, respectively. $1.6 million net was for meter supply capex, $8.2 million was for metering installation capex and $2.4 million was for 'other' capex, as detailed in Table 5. [27]

[24] *Review of Victorian Distribution Network Service Provider's Advanced Metering Infrastructure 2015 Charges Revision Application*, Energeia, December 2014, pg 28

[25] *United Energy's 2017 AMI Transmission Charge Application*, United Energy. 31 May 2016, pg 5

[26] *Ibid.* pg 19

[27] Minor discrepancies in Meter Supply and Meter Installation figures with Table 5 are due to rounding in the table.

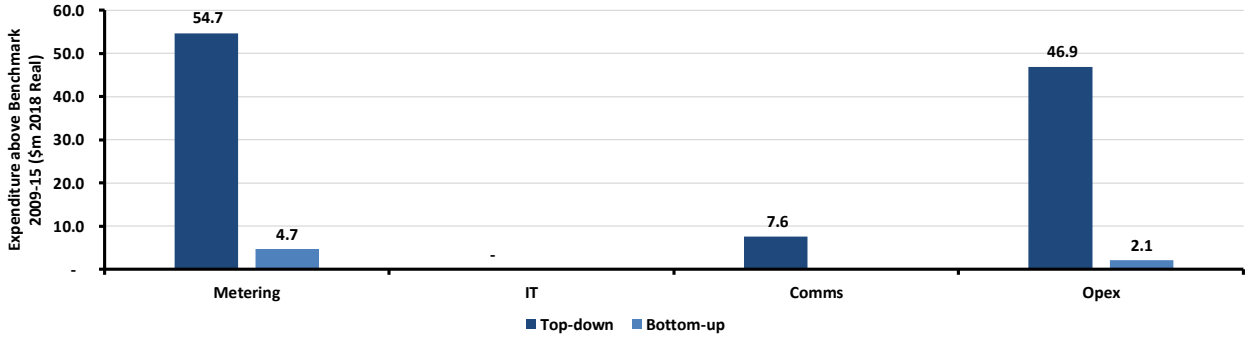
Table 5 – Jemena's Excess 2014-15 Expenditure by Category

Real 2018 Dollars		Actual		Approved Budget		Requested Excess		Allowance		Difference	
Category	Type	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Capex		**$ 14.3**	**$ 0.3**	**$ 1.1**	**$ 1.2**	**$ 13.2**	**-$ 0.9**	**$ 8.5**	**-$ 0.9**	**-$ 4.7**	**$ -**
Meter Supply	**Capex**	**$ 3.9**	**$ 0.0**	**$ 1.1**	**$ 1.2**	**$ 2.8**	**-$ 1.1**	**$ 2.8**	**-$ 1.1**	**$ -**	**$ -**
Meter Installation	**Capex**	**$ 8.0**	**$ 0.3**	**$ -**	**$ -**	**$ 8.0**	**$ 0.3**	**$ 4.5**	**$ 0.3**	**-$ 3.4**	**$ -**
Rollout - Meter Installation	Numbers	26,782	1,103	-	-	26,782	1,103	26,782	1,103	$ -	-
Rollout - Meter Installation	Capex	$ 8.0	$ 0.3	$ -	$ -	$ 8.0	$ 0.3	$ 4.5	$ 0.3	-$ 3.4	$ -
Comms Infrastructure	**Capex**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
IT	**Capex**	$ -	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Other	**Capex**	**$ 2.4**	**$ -**	**$ -**	**$ -**	**$ 2.4**	**$ -**	**$ 1.2**	**$ -**	**-$ 1.3**	**$ -**
MRO Backoffice	Capex	$ 2.4	$ -	$ -	$ -	$ 2.4	$ -	$ 1.2	$ -	-$ 1.3	**$ -**
Opex		**$ 1.6**	**$ 0.8**	**$ -**	**$ -**	**$ 1.6**	**$ 0.8**	**$ 0.3**	**$ 0.1**	**-$ 1.4**	**-$ 0.8**
Meter Data Collection	Opex	$ 1.6	0.844617	$ -	$ -	$ 1.6	$ 0.8	$ 0.3	$ 0.1	-$ 1.4	-$ 0.8
Total		**$ 16.0**	**$ 1.1**	**$ 1.1**	**$ 1.2**	**$ 14.8**	**-$ 0.0**	**$ 8.8**	**-$ 0.8**	**-$ 6.1**	**-$ 0.8**

Source: Energeia, Jemena

In summary, Energeia has concluded that $7.9 million of JEN's requested $14.8 million excess expenditure is efficient under the requirements of the OIC. Our conclusions regarding inefficient expenditure under the OIC are based on our findings that JEN's costs are above the benchmark entity at the totex per meter, category opex and capex per meter, as well as sub-category (bottom up) level, which is presented in Figure 9.

Figure 9 – Jemena's Expenditure Above Bottom-up and Top-down Benchmark Estimates



Source: Energeia, Jemena

The following sections detail Energeia's assessment of JEN's excess expenditure against the OIC criteria using the methodology outlined in Section 2 and the benchmarking results in Section 3.

3.3.1 Meter Supply Capex

JEN's justifications for the efficiency of its $1.6 million in net meter supply excess expenditure included that it was within 1% of its approved 2009-12 budget, and that it reflected market testing, and the outcomes of a competitive tendering process, which the AER appears to agree with in its 2016-2020 Final Determination.[28]

Energeia's review of JEN's meter supply capex found that it was within $500 thousand of their AER approved budget over the 2009-15 period. However, we also found that Jemena's metering capex, which included their meter installation and pro-rata other capex, to be $46.9 million above UED's efficient benchmark.

We did not receive information regarding the number of meters that were purchased, so it was not possible to determine unit pricing and undertake benchmarking at the sub-category level. That being said, we would expect to see unit prices being higher than average due to the nature of sites at the end of a program, which tend to be higher cost due to industry practice of leaving more relatively complex sites to the end.

[28] AER, *Final Decision, Jemena Distribution Determination 2016 to 2020, Attachment 16 – Alternative Control Services*, May 2016, section 16.3.4.2

Based largely on Jemena's 2009-15 capex being reasonably close to the AER's approved 2009-15 budgets, which included the lowest cost metering supply unit price of $148 compared to UED's allowance of $150[29] ($ real 2013), Energeia concludes that Jemena's metering supply capex reflects the reasonably efficient costs of a benchmark efficient entity, being that of Jemena's 2014-15 unit prices, as approved by the AER.

3.3.2 Meter Installation Capex

The primary JEN justifications for the efficiency of its $8.2 million in meter installation excess expenditure were that:

- it's overall AMI costs (following their adjustments) show that Jemena benchmarks as the most efficient DNSP overall despite a median meter installation cost benchmark;
- its per unit prices reflected a competitive tender process; and
- it's volume variation is due to a timing variation, which was in turn due to government interventions that were unforeseeable and uncontrollable.

Energeia's review of JEN's meter installation capex found that its overall, adjusted meter capex category benchmark was $46.9 million above UED's efficient benchmark, and that its per unit cost of $277 and $222 ($ nominal) in 2014 and 2015, respectively, were higher than the sub-category efficient benchmark of JEN at $137 and $142 ($ nominal). The JEN benchmark was originally determined in our 2015 review, but has been adjusted 3.6% p.a. for labour inflation since 2013 and 15.6% for the increase experienced by UED in 2014.

Energeia previously considered the efficiency of Jemena's meter installation costs in our 2015 review, and found them to not reflect an efficient outcome on the basis that the tendering approach was flawed, no analysis of in-sourcing the work was carried out to demonstrate the efficiency of the outsourcing approach at the time, and the unit costs of UED, which while imperfect, were significantly lower.

Energeia notes that while UED's actual 2014 meter installation rates were within 16% of the efficient levels determined for UED in the 2015 review, JEN's meter installation rates over the same period were 103% higher than its own 2015 review determined efficient benchmark, which was 6% higher than UED's benchmark.[30] It's also noteworthy that UED's actual 2014 unit costs appear to represent a significant achievement in cost management in that it was 9% lower than its actual 2013 unit costs in real terms.

Based on the above analysis, Energeia concludes that the efficient level of JEN's excess expenditure in meter installation capex is $4.8 million. In our view, this additional allowance is efficient because it mostly represents a timing variation. The increase in the efficient price for JEN has been set based on the change in the performance of the benchmark efficient entity, UED, over a comparable period.

The remainder of JEN's excess expenditure on metering installation is in our view inefficient by the terms of the OIC. We are not satisfied that it reflects differences in JEN's key operating environment factors, as listed in OIC clauses 5I.7B-5I.8. It is worth noting that the 2015 review determined 2013 efficient benchmark does account for differences in operating environment factors, which is why JEN's allowance is higher than UED's.

3.3.3 Other Capex

JEN's primary justification for its $2.4 million in excess Other capex expenditure is that the program budget assumed completion by May 2013, but did not complete until June 2014. JEN maintains the higher costs due to greater 'no access' issues driven by government intervention were unforeseeable and uncontrollable.

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[29] *Review of Victorian Distribution Network Service Provider's Advanced Metering Infrastructure 2015 Charges Revision Application*, Energeia, December 2014, pg 28

[30] This analysis focuses on JEN's 2014 excess metering installation capex, 2015's excess is immaterial.

Energeia's review of JEN's Other capex found that JEN's Other capex category represents its second largest capex category, and a capex categorisation approach that makes it difficult to benchmark against other DNSPs, even UED. By moving these costs into Other capex, JEN reduces its level of costs in other areas, making comparisons difficult. Energeia's overall approach has therefore been to reallocate Other capex on a pro-rata basis.

Whether or not JEN's excess expenditure in the Other capex category is efficient under the OIC therefore requires determination of the relevant efficient entity. Given the lack of comparators, Energeia has used JEN's own efficient benchmark as determined by the AER in its 2012-15 budget determination. We have adjusted the 2013 figure of $21.5 per meter ($ nominal) by 59% for unforeseeable and uncontrollable changes in no access and labour inflation determined in our 2015 review, 3.6% for 2014 labour inflation, and 15.6% for the increase in end of program meter installation costs experienced by metering capex efficient benchmark UED.

Based on the analysis set out above, Energeia concludes that $1.2 million of JEN's Other capex excess expenditure is efficient under the OIC. This represents a $40.2 ($ nominal) per meter Other capex unit price, multiplied by the 26,782 installations completed in 2014. It reflects Energeia's view that the volume variation was not inefficient per se, but that around $1.3 million in pricing variation was inefficient under the OIC.

3.3.4 Meter Data Collection Opex

In its 2017 Transition Charges Application, JEN claims its $2.5 million in excess meter data collection opex is efficient on the basis that the program carried on 13 months longer than budgeted due to unforeseeable and uncontrollable factors. Namely, program delays due to the government's interventions.[31]

Energeia's review of JEN's meter data collection opex excess expenditure found that JEN's opex category benchmark to be the highest of all Victorian DNSPs, and more than double that of the benchmark efficient entity UED. Given the lack of more granular charges data, and the gaps in the RIN data, a more granular, sub-category analysis would not be straightforward. What can be benchmarked is program completion timeframes, and Energeia found Powercor to be the benchmark efficient entity for program completion in our 2015 review. [32] We have not identified any new information to change our view that an efficient DNSP would have completed its program per the statutory timeframes, except for 'no access' customers.

However, a key change in JEN's operating environment factors since our 2015 review was the government's change in policy that allowed chronic access customers, of which there were 18,516 as at 1 April 2015, to remain on manual meter reading beyond the original end date of 31 December 2013 without paying the additional cost, which was not included in DNSP's AER approved 2014-15 budgets. From 1 April 2015, these customers were able to be charged an AER approved price for the extra manual meter reading costs.

Based on the above analysis, Energeia concludes that $0.3 million[33] in combined manual meter reading costs from 2014 to April 2015 due to no access customers is efficient excess expenditure under the OIC. However, we conclude that the remainder of the meter data collection excess operational expenditure is due to program delays beyond the benchmark efficient entity Powercor, and therefore inefficient.

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[31] *Advanced Metering Infrastructure, Transition Application*, Jemena, 31 May 2016, pg 32

[32] *Review of Victorian Distribution Network Service Provider's Advanced Metering Infrastructure 2015 Charges Revision Application*, Energeia, December 2014, pg 22

[33] The minor discrepancy with Table 5 is due to rounding in the table.

Energeia's above estimate of efficient manual meter reading excess expenditure applies the approved manual meter reading charge of $10.83 ($ nominal) per read per year[34] to the no access meter reads JEN reports as at 1 April 2015, scaled to the first three months of 2015 and 12 months of 2014 (adjusting for CPI).

3.4 AusNet Services

AusNet Services' (ANS) 2017 Transitional Charges Application included $103.0 million in excess expenditure, broken out in Table 6 by expenditure category. ANS notes that this represents 13.6% above than the AER approved budget over the 2009-15 period, but they point out that it is reasonably close to project cost overruns among major Australian infrastructure projects.[35] They also refer to the Victorian Auditor General's finding that 35% of Victorian government IT projects were completed over budget and 50% of them were late.[36]

Table 6 – AusNet's Excess 2014-15 Expenditure by Category

Real 2018 Dollars		Actual		Approved Budget		Requested Excess		Allowance		Difference	
Category	Type	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Capex		$ 58.6	$ 58.7	$ 2.4	$ 2.3	$ 48.1	$ 26.3	$ 19.3	$ 7.7	-$ 28.9	-$ 18.6
Meter Supply	**Capex**	**$ 26.1**	**$ 7.3**	**$ 2.4**	**$ 2.3**	**$ 24.2**	**$ 1.4**	**$ 12.5**	**$ 1.4**	**-$ 11.7**	**$ 0.06**
Total Meters	**Numbers**	**-**	**22,422**	**10,112**	**9,852**	**-**	**12,570**	**-**	**12,570**	**-**	-
Total Meters	**Capex**	**$ -**	**$ 3.6**	**$ 1.5**	**$ 1.5**	**$ -**	**$ 0.4**	**$ -**	**$ 0.4**	**$ -**	**$ -**
Mesh NIC + Antenna	Numbers	-	-	9,808.64	9,556.44	-	12,866	-	12,193	**0**	673
Mesh NIC + Antenna	Capex	$ -	$ -	$ 0.8	$ 0.7	$ -	$ 1.0	$ -	$ 1.0	$ -	-$ 0.1
3G NIC + Antenna	Numbers	-	-	303	296	-	-	-	377	0	377
3G NIC + Antenna	Capex	$ -	$ -	$ 0.1	$ 0.1	$ -	$ -	$ -	$ 0.1	$ -	$ 0.1
Rollout - Mesh NIC + Ante	Numbers	-	-	-	-	-	-	141,480	-	141,480	-
Rollout - Mesh NIC + Ante	Capex	$ -	$ -	$ -	$ -	$ -	$ -	$ 11.2	$ -	$ 11.2	$ -
Rollout - 3G NIC + Antenn	Numbers	122,579	-	-	-	122,579	-	4,375.68	-	- 118,203	-
Rollout - 3G NIC + Antenn	Capex	$ 22.4	$ -	$ -	$ -	$ 22.4	$ -	$ 1.3	$ -	-$ 21.1	$ -
WiMax NICs + Antenna	Numbers	33,389	$ 22,422	$ -	$ -	23,277	$ -	$ -	-	- 23,277	-
WiMax NICs + Antenna	Capex	$ 3.7	$ 3.7	$ -	$ -	$ 1.8	$ -	$ -	$ -	-$ 1.8	$ -
Meter Installation	**Capex**	**$ 14.3**	**$ 4.5**	**$ -**	**$ -**	**$ 14.3**	**$ 1.3**	**$ 6.8**	**$ 0.6**	**-$ 7.5**	**-$ 0.7**
Faults	Numbers	4,060	3,319	-	-	4,060	3,319	$ 4,060	3,319	-	-
New, Alts, Adds and Repl	Capex	$ 0.5	$ 1.3	$ -	$ -	$ 0.5	$ 1.3	$ 0.7	$ 0.6	$ 0.15	-$ 0.7
Rollout - Meter Installatio	Numbers	37,022	-	-	-	37,022	-	37,022	-	-	-
Rollout - Meter Installatio	Capex	$ 4.8	$ -	$ -	$ -	$ 4.8	$ -	$ 6.1	$ -	$ 1.4	$ -
Rollout - Module Installat	Numbers	69,862	8,833	-	-	69,862	-	-	-	-$ 69,862	-
Rollout - Module Installat	Capex	$ 9.0	$ 3.3	$ -	$ -	$ 9.0	$ -	$ -	$ -	-$ 9.0	$ -
Communications Infrastr	**Capex**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
IT	**Capex**	**$ 18.2**	**$ 46.9**	**$ -**	**$ -**	**$ 9.7**	**$ 23.6**	**$ -**	**$ 5.7**	**-$ 9.7**	**-$ 17.9**
Other	**Capex**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Opex		$ 50.3	$ 45.1	$ 20.4	$ 18.8	$ 15.7	$ 12.9	$ 9.2	$ 12.9	-$ 6.4	$ -
Meter Reading	Opex	$ 5.3	5.0	$ 0.5	$ 0.5	$ 2.6	$ 0.8	$ 0.8	$ 0.8	-$ 1.7	$ -
Meter Maintenance, Ove	Opex	$ 4.0	3.7	$ 2.8	$ 2.8	$ 1.2	$ 0.8	$ 1.2	$ 0.8	$ -	$ -
Meter Data Management	Opex	$ 5.4	5.4	$ 2.9	$ 2.8	$ 2.4	$ 2.4	$ 2.4	$ 2.4	$ -	$ -
Communications Infrastr	Opex	$ 9.0	9.7	$ 5.5	$ 5.6	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ -	$ -
IT	Opex	$ 17.0	14.6	$ 8.1	$ 6.9	$ 1.8	$ 6.7	$ 1.8	$ 6.7	$ -	$ -
Customer Service and PM	Opex	$ 9.7	6.8	$ 0.6	$ 0.1	$ 5.7	$ 0.1	$ 1.0	$ 0.1	-$ 4.7	$ -
Total		**$ 108.9**	**$ 103.8**	**$ 22.8**	**$ 21.1**	**$ 63.8**	**$ 39.2**	**$ 28.5**	**$ 20.6**	**-$ 35.3**	**-$ 18.6**

Source: Energeia, AusNet

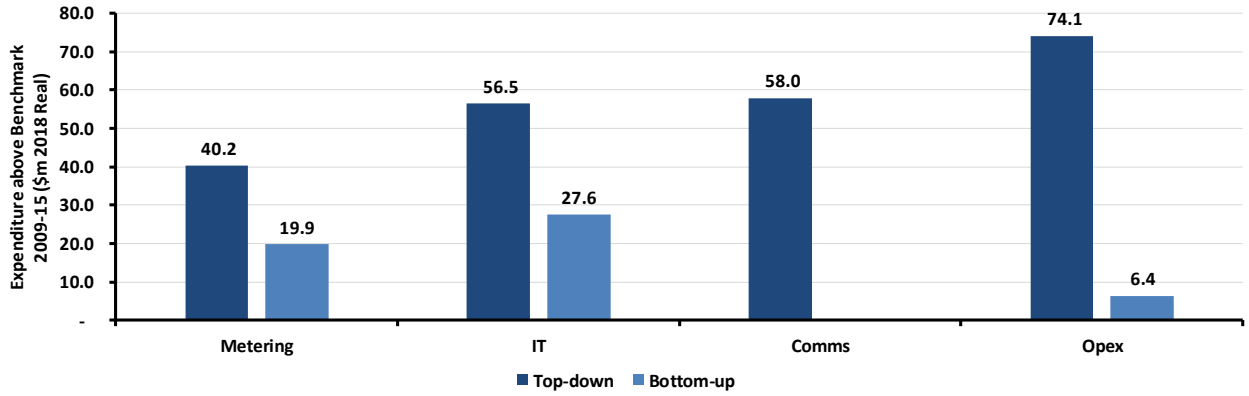
In summary, Energeia has concluded that $49.1 million of AusNet's requested $103.0 million in excess expenditure is efficient under the requirements of the OIC. Our conclusions regarding inefficient expenditure under the OIC are based on our findings that AusNet's costs are above the benchmark entity at the totex per meter, category opex and capex per meter, as well as sub-category (bottom up) level. It is also based on our exclusion of WiMax and comms switching costs already included in the 2011 budget.

[34] *AMI Order in Council, Transition Application, Response to AER Questions Received 4 July 2016*, Jemena, 11 July 2016, pg 9

[35] *Advanced Metering Infrastructure Transition Charges Application*, AusNet, pg 17-18

[36] Ibid. pg 18

Figure 10 – AusNet's Expenditure Above Bottom-up and Top-down Benchmark Estimates



Source: Energeia, AusNet

The following sections detail Energeia's assessment of ANS's excess expenditure against the OIC criteria using the methodology outlined in Section 2 and the benchmarking results in Section 3.

3.4.1 Meter Supply Capex

ANS justification for its $25.6 million in excess expenditure on meter supply being efficient is that it is due to price and volume variations in meters and 3G modules relative to the 2014-15 budget allowance. The key drivers of the volume variations were delays in receiving the 3G modules, and ANS's WiMax-mesh network performance, which required more 3G modules than was allowed in the 2014-15 budget.[37] The price variation is due to 3G modules being cheaper than the prices assumed in the approved 2012-15 budget.

Energeia's review of ANS's meter supply excess expenditure found that the 3G volumes represented 17.3% of ANS total meters, compared to the 3% allowance in the budget based on Powercor's budget. Energeia's review of mesh network design documents provided by ANS in response to Energeia's request for more information found that their latest mesh based design called for 6.9% of meters with 3G capability. However, this design uses a MicroAP device that was not available in 2012, when the switch is to have occurred.

ANS key assertion is that a mesh solution would have been higher cost to deploy in 2012 than Powercor's, who was used as the benchmark efficient entity for ANS in the 2012-15 budget review.[38] Surprisingly, ANS have not produced a technical mesh design using Silver Spring Network's technology available at the time, so there is no new relevant information regarding the reasonableness of the claim, other than an update to a 13 page report by their GIS specialist consultant, which Energeia previously rejected on the basis of the lack of evidence linking its 'serviceability index' to the likely performance of a mesh radio network.[39]

Energeia considered multiplying the number of MicroAPs specified in the 2015 design by the cost of an Access Point (AP) in 2011, which is likely to show that the mesh solution would be significantly higher cost than using a 3G solution due to APs costing several times more than a 3G solution. However, we do not believe this to be a logical or correct approach, as the least cost 2015 design is not likely to represent the least cost 2011 design. Instead, and in the absence of a technical design for ANS based on technology available in 2011, Energeia believes the Powercor design remains the most reasonable design to assume.

In terms of metering capex category level benchmarking, Figure 7 shows ANS is $59 per meter higher than Powercor but $250 per meter higher than the category leader, UED. This figure already incorporates the

[37] Ibid. pg 23

[38] *Review of Responses to the AER's Draft WiMax Determination*, Energeia, November 2012

[39] *Ibid*. pg 13

AER's $21 million ($ real 2013) disallowance in the 2015 review. Nevertheless, the top-down benchmarking approach, which includes metering installation capex, suggests that ANS is still $40.2 million less efficient than Powercor. On a totex basis, ANS is $314 million less efficient than Powercor over the 2009-15 period.

Based on the above analysis, Energeia concluded that Powercor remains the benchmark efficient entity for metering and communications capex. We therefore maintain the view, in the absence of a technical study by Silver Springs Network based on technology available at the time, that the appropriate 3G percentage for the benchmark efficient entity is 3%, not the 17.3% actually incurred by ANS. We have therefore adjusted the numbers and ratios of meter supplied based on the 3% 3G ratio in Table 6.

Regarding the issue of meter supply capex for retrofit modules, a key issue is whether these should be included in the 2014-15 allowance when they were determined by the AER in the 2012-15 remittal to the Tribunal to have been incurred in 2011.[40] Given the Tribunal tested determination of costs being incurred by the benchmark efficient entity in 2011, the results of the category benchmarking, which show ANS's meter capex category benchmarking to be $38 million higher than Powercor, Energeia concluded that these costs do not appear to satisfy the OIC.

In summary, Energeia has adjusted ANS's volumes of WiMax, mesh and 3G meters to reflect the determined ratio of 97% mesh and 3% 3G modules. We have used the previously determined 3G module price of $273 and $280 ($ nominal) for 2014 and 2015, respectively, on the basis that we are dealing in a hypothetical benchmark efficient entity, and it would be inconsistent to use today's prices when the NICs are assumed to have already been rolled out in 2012, per the reasoning set out in the next section.

The result of our findings, analyses and conclusions is to set the efficient level of metering supply capex at $13.9 million, which is $11.7 million less than the excess expenditure claimed by ANS for meter supply capex.

3.4.2 Meter Installation Capex

ANS justifications for the efficiency of its $15.5 million in meter installation excess expenditure include that it reflects timing variations in its program, and that it reflects efficiently self-insured faulty meters, accounting for 37,022 and 4,060 installations, respectively. They also claim the retrofitting of 69,862 meters with 3G modules is efficient, as it was due to delays in their 3G module provider. This resulted in around $100 ($ nominal) per meter lower 3G module prices than those budgeted for in the 2012-15 remittal, but at a cost of $120-$351 ($ nominal) per module install, according to ANS.[41]

Energeia's review of ANS meter installation capex has found that its actual meter installation prices for 2014-15 are higher than the 3.6% wage inflated efficient benchmark set in the 2015 review of $154 and $160 ($ nominal) per meter in 2014 and 2015, respectively. ANS's actual module retrofitting prices in 2015 are also more than ten times higher than the $10.8 ($ nominal) per installation rates determined in the remittal. ANS were unable to provide a breakdown of actual 3G module installation unit costs in 2014.

Based on the above findings, Energeia concluded that $7.4 million of meter installation capex meets the OIC requirements to be considered efficient, but that $8.2 million net does not. Our $7.4 million estimate is based on the 2012-15 Final Determination unit price, adjusted by the 2015 Charges Review Final Determination, and multiplied by the number of meter installations only and excludes module retrofits.

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[40] *Final Decision, Advanced Metering Infrastructure Review, SPI, 2012-14 Budget and Charges Applications*, AER, February 2013

[41] *Advanced Metering Infrastructure Transition Charges Application*, AusNet, pg 32

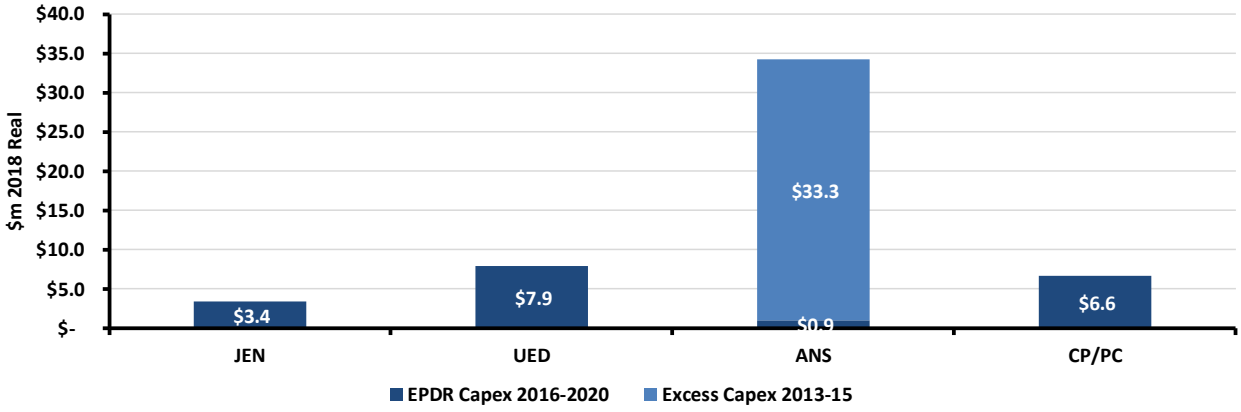
3.4.3 IT Capex

ANS IT capex excess expenditure was $33.3 million over the 2014-15 period. ANS claims the additional costs were driven by unforeseeable and uncontrollable complexity of the systems' implementation, migration and integration.[42] This complexity was compounded by the government's interventions. ANS also notes that $9 million ($ nominal) was to complete IT activities approved by the AER in the 2015 review.[43]

Energeia's review of ANS IT capex excess expenditure first attempted to determine whether the IT investments were made on a cost savings basis, which resulted in lower costs elsewhere, for example opex. No business cases were provided by ANS in response to Energeia's request. We find this response to be particularly troubling, as it suggests that ANS is not implementing good practice investment governance, which would have generated the business cases and made them easily available review.

Energeia's review also considered whether ANS's IT capex was simply bringing forward investments that other DNSPs, facing the similar circumstances to ANS, had included in their 2016-2020 EPDR submissions instead. Figure 11 presents the results of our research, which shows that ANS's 2014-15 IT capex excess and its approved 2016-20 IT capex are more than double that of the next largest DNSP's, being UED. In fact, it is larger than the combined programs of all the other DNSPs combined.

Figure 11 – AusNet's 2014-15 Excess and Approved 2016-22 IT Capex vs. other DNSP's



Source: Energeia, AusNet, UED, CitiPower, Powercor and Jemena

On a 2009-15 basis, Energeia's review found ANS's IT capex per meter to be 50% higher than the next highest DNSP, being UED. ANS has raised concerns that all the other DNSPs were able to share IT costs through their joint programs. Energeia has already stated its view that a joint development program was an option for ANS, and therefore within their control.[44] Nevertheless, compared against a very conservative efficient benchmark entity, being CP and PC combined, ANS's IT capex is still $56.5 million higher.

Based on the above findings and analyses, Energeia concludes that $5.7 million of ANS' IT capex excess expenditure is efficient under the terms of the OIC. This amount reflects the CP/PC approved expenditure over the 2016-20 period less ANS' already approved $0.9 IT capex budget, and has been allowed on the basis that ANS claims that it did not include its IT refresh in its EPDR proposal while others did.

3.4.4 Opex

ANS justifies most of its $28.6 million in excess opex expenditure on the basis that the AER found this to be the efficient level of opex in the AER's 2016-2020 EPDR Final Determinations. Meter reading, customer

[42] Ibid. pg 35

[43] Ibid.

[44] *Review of Responses to the AER's Draft WiMax Determination*, Energeia, November 2012, pg 25

service and PM services were justified on the basis of program delays, which ANS claims were unforeseeable and uncontrollable, and therefore represent efficient costs under the OIC.

Energeia's review found that ANS opex per customer over the 2009-15 period was the second highest of all DNSPs, as shown in Figure 7. It was over $108.7 per meter or $74.1 million higher than the benchmark efficient entity for opex, which Energeia concludes was Powercor. However, the AER determined an efficient opex level for AusNet over the 2016-20 period, which Energeia accepts as the more relevant benchmark.

Energeia's review of excess meter reading operational expenditure found that Powercor was again the relevant benchmark, having completed its deployment on time under similar conditions to those faced by ANS. We have used ANS as the relevant benchmark for customer service and PM services excess operational expenditure, taking the 2012-15 approved unit rates, and grossing them up by the 2015 review result of 20.3% to reflect changes in no access rates and wage inflation, and then multiplying by installations.

Based on the above findings and analysis, Energeia concluded that $22.2 million out of ANS's $28.6 opex excess expenditure is efficient under the OIC. This reflects a $1.7 million reduction in meter reading opex due to replacing ANS's 2014 figure with the AER's inflation adjusted 2016 meter reading allowance. It also reflects a $4.7 million reduction in customer service and project management opex due to replacing the ANS figure with the 2013 unit prices, adjusted for no access and wage inflation factors.

Appendix 1 – About Energeia

Energeia Pty Ltd (Energeia) based in Sydney, Australia, brings together a group of hand-picked, exceptionally qualified, high calibre individuals with demonstrated track records of success within the energy industry and energy specialist academia in Australia, America and Europe.

Energeia specialises in providing professional research, advisory and technical services in the following areas:

- Smart networks and smart metering
- Network planning and design
- Policy and regulation
- Demand management and energy efficiency
- Sustainable energy and development
- Energy product development and pricing
- Personal energy management
- Energy storage
- Electric vehicles and charging infrastructure
- Generation, including Combined Heat and Power (CHP)
- Renewables, including geothermal, wind and solar PV
- Wholesale and retail electricity markets

The quality of our work is supported by our energy-only focus, which helps ensure that our research and advice reflects a deep understanding of the issues, and is often based on first-hand experience within industry or as a practitioner of theoretical economic concepts in an energy context.

Energeia's Relevant Experience

Energeia's recent smart metering and smart grid related engagements are summarised below.

Review of Victorian DNSPs' 2009-11 Advanced Metering Infrastructure Budgets

The Australian Energy Regulator engaged Energeia to undertake a review of Victorian Distribution Network Service Providers' (DNSPs) 2009-2011 budget proposals for Advanced Metering Infrastructure against the regulatory criteria specified in the revised Order in Council.

Review of Advanced Metering Infrastructure Enabled Load Control Performance Levels

A Victorian DNSP engaged Energeia to undertake a review of current load control enabling performance levels and to make recommendations considering the impact of updated use case benefits and communications cost information.

Review of Overseas Regulation of Smart Metering Information for Customers

An Australian jurisdictional regulator engaged Energeia to review the arrangements in place in comparable overseas jurisdictions and the experience of EnergyAustralia during their roll out of interval meters and ToU pricing to nearly 140,000 customers using between 15MWh and 160MWh per annum (p.a.).

Best Practice Regulation of Smart Metering

A smart metering vendor engaged Energeia to identify policy and regulatory options for improving the smart meter deployment in Victoria. The engagement included a detailed review of leading international smart metering deployments in California, Texas, Pennsylvania, Ontario and Sweden.

International Smart Meter Based Energy Retailing: Review and Recommendations

A top-tier Australian energy retailer engaged Energeia undertake a review of international deployments of smart metering and ToU based products to identify innovation and key lessons learned. The purpose of the engagement was to identify innovative products that the retailer could consider deploying across its smart meter enabled customer base.

Smart Meter Enabled Retail Product Development and Trialling

An Australian energy retailer engaged Energeia to support the design, development, justification and trialling of three innovative smart meter enabled electricity pricing plans that would save customers money, improve the retailer's margin and reduce customer churn.

Smart Meter Enabled Network Product Development and Trialling

A NSW DNSP engaged Energeia to support the design, development, justification and trialling of innovative, smart meter enabled network tariffs that could reduce network investment costs, save end user customers money and improve retailer margins. The engagement included the design of a robust sampling approach that would enable the rigorous quantitative assessment of product impacts on key performance indicators.

Review of Advanced Metering Infrastructure Related Threats and Opportunities in Australia

A top-tier Australian energy retailer engaged Energeia to undertake a review of emerging threats and opportunities in the electricity sector as it transitions to a more intelligent platform (smart grid) over the next five to ten years. The key area of focus was the deployment of advanced metering infrastructure and related customer energy technologies, products and services.

Smart Grid Design and Development

Energeia was engaged by a major Australian utility to develop a smart grid solution for minimising the costs and carbon intensity of generating power in a remote island energy system. The engagement included designing a fit-for-purpose smart grid concept, developing functional and technical specifications, supporting market engagement, modelling project costs and benefits, and developing the project business case.

Smart Grid, Smart City Proposal Support

Energeia was engaged by a DNSP to support the development of their winning proposal for the $100M Smart Grid, Smart City project. The engagement included the development of a retailer value proposition and engagement strategy, development of the project's delivery and operating models, and development of related proposal documentation.

Network of the Future Design

A top tier field services provider engaged Energeia to support the development of a Network and Substation of the Future concept design and development roadmap. The engagement included researching international best practice, facilitating a number of concept development workshops with project stakeholders, developing the client proposal, and sourcing the skilled resources needed to deliver it.

Future Operating Model Design

An Australian DNSP engaged Energeia to support the development of their Future Operating Model blueprint and roadmap to 2026. The engagement included facilitating a series of whole-of-business workshops to gain strategic alignment on the DNSP's future customers, network and organisation, and the development of documentation to support stakeholder engagement and communication.

Embedded Networks for Electric Vehicles

Energeia was engaged by a leading electric vehicle infrastructure company to review the existing market arrangements around embedded networks and to provide recommendations regarding how these arrangements may be used to support the deployment of electric vehicle charging infrastructure.

Appendix 2 – Resumes of Key Personnel

EZRA BEEMAN

MANAGING DIRECTOR

PROFILE

Ezra Beeman has consulted on business strategy, asset transactions, contract structuring, energy and information technology, market design and industry regulation for company directors, executives and managers of major oil, gas and power companies across Europe, the Americas and the Asia Pacific region.

Ezra's industry career has spanned a number of strategic and internal advisory roles where he helped propel EnergyAustralia into a position of international leadership in smart metering, products and services. During his time with the company, he built a reputation for tackling some of the company's toughest challenges and achieving exceptional results.

In addition to his consulting and utility executive experience, Ezra is an internationally recognized expert on advanced metering infrastructure, wholesale and retail markets, customer research, and demand response.

QUALIFICATIONS

- Masters of Applied Finance, Macquarie University, Australia
- Bachelor of Arts in Economics and Philosophy, Claremont McKenna College, United States

SUMMARY OF EXPERIENCE – ENERGEIA

As the Managing Director, Ezra has overall responsibility for achieving the company's vision of becoming Australia's leading specialist consultancy and industry research firm. Ezra is responsible for setting and delivering the company's research agenda and developing new business. In this role his major achievements have been:

- Advising and supporting 21 companies pursuing ground-breaking outcomes in FY10, representing a broad cross-section of Australia's energy industry.
- Developing a 20 year industry roadmap for the establishment of a smart grid in Australia on behalf of the Electricity Networks Association (ENA).
- Authoring two chapters of EnergyAustralia's winning proposal for the $100M Smart Grid, Smart City project and contributing to its overall development.
- Developing a smart grid solution for minimising the costs and carbon intensity of generating power in a remote system on behalf of Hydro Tasmania.
- Reviewing over $2 billion in Victorian distribution network's smart grid budget proposals on behalf of the Australian Energy Regulator (AER).
- Creating a continuous improvement process for promoting best available technology for energy efficiency and carbon reduction on behalf of Newcastle City Council.
- Identifying international best practice in smart meter enabled retail pricing and related customer protections on behalf of the Essential Services Commission (ESC) of Victoria.
- Developing a business plan and authoring a winning proposal for the supply of electrical vehicle charging infrastructure on behalf of ChargePoint Australia.
- Creating a value framework, integrated network and retail price and benefits capture strategy to maximise the value of demand response on behalf of a new entrant retailer.
- Estimating the market and network value of demand response across a range of service levels on behalf of CitiPower-Powercor.

- Identifying the key risks and opportunities related to smart metering and the emerging smart energy market strategy on behalf of Origin Energy.
- Authoring major studies of the smart energy market, personal energy management and electric vehicles on behalf of Integral Energy, Hydro Tasmania, Energex and Ergon.

SUMMARY OF EXPERIENCE – ENERGY AUSTRALIA

As the A/Mgr – Alliance Strategy, Ezra was responsible for managing the implementation of two Alliances to deliver up to $1.5B in capital projects over five years. In this role his major achievements were:

- Managing the legal and commercial negotiations to achieve commercial alignment, and developing a comprehensive Alliance implementation plan, including a resourcing model for $8B capital program

As the A/Executive Mgr – Strategic Services, Ezra was responsible for the coordination of the Executive team on behalf of the Executive General Manager, Network. His duties included:

- Providing advice to the Executive General Manager, Network; Strategy development, business planning and divisional communication; performance measurement, monitoring and reporting; Board, ministerial and inter-divisional interfaces and coordination of the executive management team

As the Mgr – Network Metering & Pricing Strategy, Ezra was responsible for the formulation, justification and delivery of company's strategic pricing and metering initiatives. His responsibilities included:

- Leading the development and delivery of the $500M Advanced Metering Infrastructure (AMI) strategy, which included Australia's largest technology pilot & customer research study
- Driving the deployment of Australia's largest smart metering fleet and representing the Division during a $70M strategic metering procurement

As the Network Business Consultant, Ezra was responsible for internal business consulting, including:

- Providing strategic advice to senior management on B2B, metering, pricing and retail services; managing retail market interfaces, including internal service providers; managing strategic initiatives including the Time-of-Use (ToU) / interval meter rollout; leading negotiations between EA Network, retailers and end-users, and increasing faltering ToU project output from 2,500/ year to 16,000/ year.

SUMMARY OF EXPERIENCE – CAMBRIDGE ENERGY RESEARCH ASSOCIATES

As the Senior Associate, Global Gas & Power, Ezra provided expertise to the group's four regional gas and power teams. Projects included:

- Overseeing the Asia Pacific gas and power component of a Board level strategy project; lead author of long-term N.A. gas scenarios study and editor and co-author of regional Latin American power sector briefings.

As an Associate Director, European Power, Ezra was a senior member of a team serving 50 clients. His role was responsible for the network sector, retail & wholesale markets and player strategy, ad-hoc client advisory service and new business development. In this role Ezra's achievements were;

- Becoming the youngest Associate Director in the company's history; leading projects on retailer entry and an international investment framework; developing a pan-European pricing model for due diligence on $800M IPP; providing Board level due diligence to a major trading bank's generator investment in South Australia.

Ezra Beeman has published more than 15 articles and papers in his field of expertise.