Zincara

From strategy to action

AER Access Arrangement 2017

AusNet Services

Prepared for

AUSTRALIAN ENERGY REGULATOR

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1. EXECUTIVE SUMMARY

The AER has engaged Zincara to provide technical advice on a number of matters related to the AusNet Services' capital expenditure. They include:

- Augmentation
- Connection
- Mains Replacement
- Other Capex
- Meter Replacement
- SCADA
- Communication System

In carrying out the review, Zincara has taken into consideration the requirements of the National Gas Law and the National Gas Rules. Zincara's approach was to review the submission provided by AusNet Services and responses provided by AusNet Services resulting from clarification sought by the AER.

The results of the assessment are discussed below.

1.1 AUGMENTATION

AusNet Services' forecast augmentation capex for the next AA period is $15.3 million which is 10% less than its current augmentation capex. Details of the costs are shown in the table below.

Table 1: Augmentation Projects – Capex ($000, 2017, direct)

Augmentation Projects	2018	2019	2020	2021	2022	Total
H12 Werribee	1,838	204	-	-	-	2,042
H21 Craigieburn (stage 1)	923	-	-	-	-	923
H23 Sunbury	189	-	-	-	-	189
H75 Warrnambool	-	235	-	-	-	235
H27 Bacchus Marsh	-	-	133	-	-	133
MP44 Brooklyn (Sunshine)	-	-	235	-	-	235
H96 Macedon Ranges	-	-	-	582	-	582
H21 Craigieburn (stage 2)	-	-	-	960	-	960
H68 St Leonards	-	-	-	-	2,134	2,134
TP61 Bendigo	-	-	-	-	1,021	1,021
TP System H68 Geelong South	3,728	920	-	-	-	4,648
Existing Facility Upgrades	-	1,532	204	409	-	2,145
Total	**6,678**	**2,890**	**572**	**1,951**	**3,156**	**15,247**

(Source: AER-AusNet IR #3: Q2: Table 5, 6, 7); note: rounding

Zincara reviewed the justification for each project, the timing and cost build but has not analysed the load growth which was used to justify the projects. The review of the load growth is carried out by a separate consultant and as such not part of Zincara's brief.

Conclusion

AusNet Services' justification for the projects range from not meeting the requirement of the Gas Distribution System Code (GDSC) to the risk of a single supply point to a network. Zincara believes that with the exception of the St Leonards project, the justification for the projects are reasonable and as such consider the projects to be prudent.

With respect to H68 St Leonards, Zincara notes that AusNet Services advised that the network reached its specified minimum pressures during winter of 2016. However, AusNet Services is not proposing to carry out any reinforcement until 2022 when its network modelling indicated that the pressure is 141kpa, marginally above that specified in GDSC. If the pressure had reached its minimum in 2016, Zincara would have expected AusNet Services to have proposed reinforcement earlier than 2022. In addition, as the pressure in 2022 is marginally above the minimum pressure, Zincara does not consider the project necessary even in 2022. Zincara believes that the project is most likely to occur in the next regulatory period, 2023–2028. Therefore, Zincara does not consider this project to be prudent. Given that Zincara does not recommend this project as prudent, Zincara has not made comments on its costs.

The costs for the projects have essentially been prepared using the costs of similar projects. AusNet Services has not carried out a bottom up cost build up which would have been Zincara's preference. Given AusNet Services' approach, Zincara's review consists of ensuring the like project and the forecast project have similar scope and as such would have similar costs. Zincara concluded that there is nothing that it has observed that is of concern and as such recommends accepting the cost as efficient.

1.2 CONNECTIONS

AusNet Services is proposing Connections capex of $198.7 million over the next AA period, with an estimated 83,000 connections.

Table 2: Connection Capex Forecast ($million, 2017 real)

AusNet - Connections	2018	2019	2020	2021	2022	Total
Residential	31.7	32.4	33.3	34.4	33.8	165.8
I&C - Volume	5.1	5.2	5.3	5.4	5.4	26.3
I&C – Tariff D	1.3	1.3	1.3	1.3	1.4	6.6
New Connections	**38.1**	**38.9**	**39.9**	**41.2**	**40.6**	**198.7**

(Source: Capex Model; AAI: Table 6.2) note rounding

AusNet Services' network contains some of Melbourne's fastest developing urban growth areas. In recent years, the growth areas of Wyndham and Melton have both experienced growth rates exceeding 5% per year, a trend that is expected to continue. Approximately 90% of new connections are located at network fringes within new estates in Western Victoria.

The forecast connection capex is made up of the number of connections multiplied by the unit cost of mains, services and meters for each customer class. Zincara understands that the review on the reasonableness of forecast connections has been carried out by a separate consultant and as such not part of Zincara's brief. Zincara's review is therefore focused on unit costs.

Conclusion

AusNet Services' network contains some of Melbourne's fastest growing developing urban growth areas. Its forecast capex is effectively business as usual, with unit rates being based on 2013-16 average unit rates with no further increases included, which also aligns with the awarding of contracts in 2013. These contracts have been approved for 8 years, although the term can be extended for a further two years, subject to performance.

On the basis of its review and analysis of AusNet Services' connections proposal, Zincara finds that the methodology for calculating the capex forecast and unit rates is reasonable and there are no step changes proposed that would impact the forecast. On that basis Zincara considers the connections capex efficient.

1.3 MAINS REPLACEMENT

AusNet Services is proposing Mains Replacement capex of $130.0 million (2017 direct) or $132.9 million (real 2017) over the next AA period, with an estimated 465 kilometres of mains to be replaced. While the forecast volume of replacement is reduced compared to the current period (580 kilometres), the unit rates will be higher, reflecting inner suburban and Geelong CBD mains replacement, resulting in the capex being 23% higher than for the current period of $108.3 million (real 2017) (ref: AAI: 6.5.2, page 120).

Table 3: Mains Replacement Capex ($million, 2017, direct)

Mains Replacement	2018	2019	2020	2021	2022	Total
Low Pressure	24.7	23.0	23.5	19.0	17.8	107.9
Medium Pressure	5.2	4.2	5.0	1.2	1.2*	17.0*
Reactive Mains & Services	1.0	1.0	1.0	1.0	1.0	5.1
Total	30.9	28.2	29.5	21.3	20.0	130.0

(Source: Capex Model – capex forecast – work code) * AusNet advise an error with its unit rate for consideration.

Zincara has analysed the following aspects of the mains replacement program.

- Prioritisation methodology;
- Failure analysis;
- Volume;
- Justification for the MP and reactive mains and services replacement; and
- Unit cost.

Conclusion

Failure Analysis

Zincara has analysed the leakage being experienced across AusNet Services' low and medium pressure networks, including analysis by mains material types. Additional data provided as a result of the AER's follow up questions has been able to demonstrate the impact of the mains replacement program on network performance up to the end of 2016. Typically the leakage rates in the low and medium pressure networks are improving, particularly in recent years. However, the early generation polyethylene (class 250 PE) is showing a slightly increasing leakage rate trend, albeit more steady than had been the case before 2013. As such AusNet Services has included some replacement of these mains in its medium pressure replacement program.

Zincara finds that AusNet Services' assessment of its network safety using leak incidence rate of mains and services is reasonable and prudent.

Volume of Mains Replacement

The proposed low pressure replacement profiles provided by AusNet Services, show that the scenario of 75% of the proposed replacement rate (which calculates at approximately 60 kilometres per year), would result in a marginally increased leakage rate. However, reviewing the profile, suggests that a replacement rate of approximately 70 kilometres per annum (total of 350 kilometres over the AA period) would enable AusNet Services to maintain the leakage rate and hence the safety risk of the network. Applying the proposed average unit rate to the reduced volume shows that this would reduce LP mains replacement capex by approximately $15 million, and extend the program by one to two years, subject to volumes in the 2023-2027 AA period.

In considering all of the information Zincara finds that a replacement rate of 70 kilometres per annum (350 kilometres for the AA period) to be prudent.

MP Mains Replacement

AusNet Services proposes to replace 55 kilometres, compared with 82 kilometres for the current period. However, Zincara was concerned that in order to replace the 24.7 kilometres identified as highest risk (refer Table 8 in the report), AusNet Services proposes a 55 kilometre program, with a significant portion being block replacement method. In response to a question from the AER (IR #13) for further justification, AusNet Services provided an explanation along with an NPV analysis.

Zincara has reviewed the information and the NPV analysis and finds that it more cost effective to undertake the program as proposed by AusNet Services. Along with the fact that the program for 2018-22 is reduced compared with the current AA period and AusNet Services would appear to have adequate skilled resources, Zincara considers AusNet Services' program to be prudent and cost efficient.

1.4 OTHER CAPEX

The following table shows AusNet Services' proposed capex for the two categories "Network Regulators" and "Consumer Regulators". The Network Regulator project refers to the replacement of regulators, heaters and associated miscellaneous works. The Consumer Regulator project refers to the replacement of the domestic and small I&C regulators. These costs have been included in the "Other Capex" categories in AusNet Services' submission.

Table 4: Other Assets Projects ($000, 2017, nominal)

Other Assets	2018	2019	2020	2021	2022	Total
Network Regulators	1,874	2,179	1,435	1,247	1,046	7,782
Consumer Regulators	2,545	2,499	2,679	2,511	2,722	12,945

(Source: Capex Model; IR #18)); Real 2017 dollars, including labour escalation

Zincara's analysis consists of reviewing the justification and estimation methodology for each of the projects.

Conclusion

Network Regulators
Following review and analysis of the various works proposed by AusNet Services for the next AA period, Zincara considers the identification of the equipment to be replaced is targeted and prudent.

In Section 6.4.3 of the AAI, AusNet Services had detailed its "project cost estimates and unit rates" methodology which it has applied to all of its projects. Zincara had reviewed the application of the methodology for other projects (e.g. mains replacement etc.) and had accepted the costs for the projects. Whilst there is no information on the unit costs provided for these projects, Zincara believes that having accepted the cost for other projects using the same methodology, there is no reason to consider that the application of this methodology for these projects will lead to a different outcome. As such, Zincara considers the cost to be efficient.

Consumer Regulators
The Consumer Regulator replacement program consists of the following:

- Domestic meter replacement;
- I&C "298" type regulator replacement;
- Miscellaneous I&C works program; and
- Reactive domestic regulator replacement.

The justifications for the works include leaking regulators, and reactive replacement for both I&C and domestic regulators. Zincara recognises that these issues could occur in a distribution network and as such considers the works to be prudent.

In relation to the costs, Zincara has accepted the cost as efficient for the same reason as that outlined in the section on Network Regulators.

1.5 METER REPLACEMENT

The following table shows AusNet Services' proposed capex for Meter Replacement.

Table 5: Meter Replacement Programs ($000, 2016, direct)

	2018	2019	2020	2021	2022	Total
In-Test / FLE	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	1,375
Domestic T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	19,265
I&C T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	3,303
No Access*	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	1,150
Reactive	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	4,850
Total	**6,092**	**6,488**	**5,875**	**5,398**	**6,089**	**29,942**

(Source: Meter Management Strategy: Tables 1, *20); * includes 'targeted no access' removal

AusNet Services' meter replacement strategy includes the following annual programs:

- In-service compliance testing of domestic meters;
- Time expired meter replacement programs to remove domestic, and I&C meters from the field at the end of their useful life (based on accuracy results);
- 'No access' meter replacement program to remove meters that have remained in the field beyond their in-service compliance period due to access restrictions;
- Reactive meter replacement to replace meters that are faulty or damaged.

Zincara has carried out a volume and unit cost analysis on the meter replacement capex.

Conclusion

Zincara considers that AusNet Services' Meter Replacement program has been well developed in accordance with good industry practice and in line with historical performance. Therefore Zincara considers that the programs are prudent, particularly noting efforts to target replacement of 'no access' meters.

AusNet Services proposes the use of new meters only and not refurbished meters. Zincara has reviewed the analysis and does not consider the program to be cost efficient. Zincara recommends the continuing use of refurbished meters and as such the forecast capex should be reduced by approximately $2.5 million.

1.6 DIGITAL METERING PROGRAM

AusNet Services has included a proposal to undertake a trial of remotely reading gas meters. AusNet Services[1] states that the program will analyse options to deploy smart gas metering and identify potential value in technology trial activities.

The cost of the trial is shown in the table below.

Table 6: Digital Metering Trial ($000, 2016, direct)

	2018	2019	2020	2021	2022	Total
Digital Metering Trial			330	1,082	250	1,662
Trial Total , including ICT			660	2,164	500	3,324

(Source: Meter Management Strategy (pg 39); Program of Works – Gas Digital Metering: Table 1)

Zincara has reviewed AusNet Services' justification for the project including the additional information sought by the AER.

Conclusion

AusNet Services says that an initial trial would be very much a technology/product trial, which should consider several options to evaluate the best solution for each component and that it would also be prudent to evaluate any potential customer benefits.

After evaluating AusNet Services' paper on technologies and metering issues, Zincara does not consider that information provided justifies a material capital expenditure of $3.3million. Zincara is of the view that a prudent service provider acting efficiently (NGR 97(1)(a)) could not justify spending $3.3million to assess potential customer benefits. Furthermore, Zincara does not believe that the expenditure falls under any of clauses in NGR 79(2). Zincara therefore does not consider the project prudent and efficient.

1.7 SCADA

The SCADA projects that AusNet Services proposes for the forecast period are shown in the table below.

Table 7: SCADA Program (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Fringe RTU Installation / Relocation	$'000						220
	Unit						6
End of Life Replacement	$'000						558
	Unit						62
Common Earthing Installation	$'000						250
	Unit						25
Slam Shut Indicator Installation	$'000						42
	Unit						5
Pressure Transmitter Installation	$'000						265
	Unit						15

[1] Appendix 6K: Program of Works – Gas Digital metering

Cabinet Circuit Breakers	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	35
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	55
Improved Data Capture and monitoring	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	297
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	55
Total Expenditure	**$'000**	**379**	**330**	**300**	**300**	**358**	**1,667**

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

As can be seen from the table above, the cost for each line item Zincara has reviewed is relatively small. Zincara has assessed the justification for each line item and the cost make up. Details of Zincara's conclusion are provided in the Section below.

Conclusion

The justifications for most of the projects range from equipment obsolescence to end of life replacement. In addition, there are RTUs that are no longer at the network pressure fringe location due to uneven increase of gas demand in the network. These RTUs have to be relocated to the true fringe locations.

AusNet Services had provided some cost make up for the projects and the assumptions behind the costs.

Zincara concurs that equipment have to be replaced if they are no longer supported or have reached their useful life. Zincara also accepts that RTUs have to be shifted to their true fringe locations in the network for effective network management. Zincara therefore considers the projects to be prudent.

In addition, Zincara accepts the costs of the projects based on the information provided by AusNet Services and as such recommends that the projects be considered efficient.

1.8 COMMUNICATION SYSTEMS

AusNet Services' gas distribution communications assets are located in and cover parts of Western Victoria. There are communication related assets at 230 sites. AusNet Services proposes to replace its field communication equipment in the forecast AA period. The table below shows the costs of the project.

Table 8 Communication Replacement Program Costs ($000 Real 2016)

Program	2018	2019	2020	2021	2022	Total
Replacement of Equipment	0	0	0	960.45	960.45	1,921

(Source: Appendix 6I Communication Systems Strategy-20161115)

The cost is to replace the equipment for the following:

- PTMP radios – 14 base stations;
- Trio remote modems -158 modems; and
- NextG modems – 62 modems

Conclusion

Zincara acknowledges that industry practice dictates that communication equipment that is no longer supported by the vendor should be replaced. It could be argued that the equipment does not necessarily fail at that time and that a phase implementation past the vendor ceasing support is practical especially since the estimated end of life is at 2023. However, given the criticality of the equipment, Zincara considers that it is prudent to have the equipment replaced prior to the end of life.

The justification for the replacement of the modems is the discontinuation of the 3G network. Telstra has advised[2] on its Investment Day that it was intending to exit the 3G network in 2020/21. This lines up with the timeframe that AusNet had indicated. Based on this, Zincara considers it prudent for AusNet to move to the 4G network.

Zincara is unable to be definitive on all the cost elements from the information provided but believes that AusNet would have sought indicative costs from the vendors and included a labour cost for the changeover. Given that Zincara has accepted AusNet's methodology for estimating its cost for the RTU project, Zincara believes that AusNet would have used the same methodology for this project. Zincara therefore recommends accepting the cost as efficient.

[2] Telstra Investment Day Presentation Nov 2016

2. INTRODUCTION

2.1 BACKGROUND

In December 2016, the Australian Energy Regulator (AER) received AusNet Services' revision to its Access Arrangement for the period 2018-2022. To assist in the review of the capital expenditure, the AER engaged Zincara P/L (Zincara) to advise it on some aspects of the forecast capital expenditure. In particular, the AER sought advice on the following topics:

- Augmentation
- Connections
- Mains Replacement
- Meter Management
- Other Costs
- SCADA
- Communication System

In providing the advice, Zincara had to take the following factors into account:

- the efficiency and prudence of the size, scope and timing of the AusNet Services' proposed capital expenditure (capex) allowances;

- the justification for each project or area of forecast capex ;

- the relationship of the capex allowances to the respective drivers of capex, and the efficiency and prudence of AusNet Services' proposed capex allowances in relation to these drivers;

- the efficiency and prudence of the AusNet Services' proposed capex allowances in relation to capex–opex (operating costs) interactions and potential trade-offs; and

- the appropriateness of the AusNet Services' methods for determining its proposed capex allowances, including whether the forecasts were arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.

2.2 DEFINITION FOR PRUDENCE AND EFFICIENCY

Zincara has used the following definitions in its analysis:

"Prudence", means "*caution in managing one's activities to avoid undesirable consequences*[3]*".* Zincara has interpreted this to mean that for the project to be prudent, the decision is made on the basis that it is timely for the project to proceed to rectify ongoing safety and reliability issues.

'Efficiency' means *functioning or producing effectively and with the least waste of effort*[3]. This means that the choice of which option to adopt for the project must be made on the

[3] Australian Concise Oxford Dictionary

basis that the most effective solution has been adopted. The "least amount of effort" refers to the cost of the project and in that context the project must be carried out at market rates.

"Good industry Practice" means that the actions that a prudent operator would adopt in in similar Australian conditions.

2.3 APPROACH

Zincara has carried out a desktop review on the material provided by AusNet Services and has assumed that the data provided is accurate. Zincara has not verified the accuracy or veracity of the data.

In carrying out this assessment, Zincara has adopted the following approach:

- Analyse the information provided in the Access Arrangement Information, Asset Management Plan and other supporting Plans and responses to AER's information requests (refer Appendix A);
- Determine what the strategic objectives of each project are;
- Consider whether the most efficient option has been adopted and the appropriateness of the timing of the project;
- Ensure that the estimated cost for the project meets the efficiency test; and
- Consider whether there are opportunities for trade-off between capex and opex

2.4 COST REPORTING

All costs shown in this report are in real 2017 dollars unless otherwise stated. Any reference to direct cost means that the cost includes escalation for labour but does not include overheads.

3. AUGMENTATION

3.1 INTRODUCTION

AusNet Services has forecast a 10% reduction in augmentation capex compared with the current AA period ($17.3 million).

Table 9: Forecast Augmentation Total Cost: ($million, 2017, real)

Augmentation Capex	2018	2019	2020	2021	2022	Total
Total	6.7	2.9	0.6	2.0	3.3	15.5

(Source: AAI: Table 6.2*)*

Table 10: Augmentation Capex Categories ($'000, 2017, direct)

Augmentation Capex	2018	2019	2020	2021	2022	Total
Pipe Reinforcements	3,665	950	368	1,542	3,156	9,681
New Facility Installations	3,013	409	-	-	-	3,422
Existing Facility Upgrades	-	1,532	204	409	-	2,145
Total	**6,678**	**2,890**	**572**	**1,951**	**3,156**	**15,247**

(Source: AER-AusNet IR #3: Q2: Table 1); rounding

The following table includes each of the Augmentation projects proposed by AusNet Services for the next AA period.

Table 3: Augmentation Projects – Capex ($'000, 2017, direct)

Augmentation Projects	2018	2019	2020	2021	2022	Total
H12 Werribee	1,838	204	-	-	-	2,042
H21 Craigieburn (stage 1)	923	-	-	-	-	923
H23 Sunbury	189	-	-	-	-	189
H75 Warrnambool	-	235	-	-	-	235
H27 Bacchus Marsh	-	-	133	-	-	133
MP44 Brooklyn (Sunshine)	-	-	235	-	-	235
H96 Macedon Ranges	-	-	-	582	-	582
H21 Craigieburn (stage 2)	-	-	-	960	-	960
H68 St Leonards	-	-	-	-	2,134	2,134
TP61 Bendigo	-	-	-	-	1,021	1,021
TP System H68 Geelong South	3,728	920	-	-	-	4,648
Existing Facility Upgrades	-	1,532	204	409	-	2,145
Total	**6,678**	**2,890**	**572**	**1,951**	**3,156**	**15,247**

(Source: AER-AusNet IR #3: Q2: Table 5, 6, 7); rounding

Note: In Appendix 6J: Network Capacity Strategy: Table 1 shows new facilities row as $1.30 million in 2019/20, whereas revised table provided in IR #3 response Q2 shows $409,000 giving an augmentation total for that year of $2.89 million. This is in line with the overall summary total in AAI: Table 6.2).

The Augmentation program provides for the installation of approximately 27 kilometres of mains reinforcement, 3 new facility installations and 5 capacity upgrades.

Consumption and Customer Forecasts (Appendix 4A) is a report prepared for AusNet Services by The Centre for International Economics. In this review Zincara has not attempted to verify growth forecasts noted in the Network Capacity Strategy (Appendix 6J) with information contained within the Consumption and Customer Forecasts report.

The Network Capacity Strategy provides an overview of each project (section 6) along with further project details (section 8). Upgrades to existing regulating Facilities are outlined in section 7.

Following requests for additional information by the AER, AusNet Services' response (IR #3) provided the following details:

- Network Capacity Strategy – Risk Assessment – projects < $1 million – includes options considered during planning analysis and cost breakdown analysis.
- Augmentation project justifications (includes winter testing details)
- Revised Expenditure tables

3.2 H12 WERRIBEE

Proposal: Install a new City Gate (*commencing 2017*) and lay 7 kilometres of 180NB P8 main.

Table 11: Werribee Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	1,021	204	-			1,225
City Gate	817	-	-	-		817

(Source: IR #3: Q2 Table 5 and 6)

AusNet Services shows expenditure for the City Gate commencing in 2017 ($1.021 million), with expenditure of $817,000 forecast for 2018 (per IR #3, Q2 Table 6).

AusNet Services has provided "Augmentation Project Analysis: Distribution – Werribee (Bulban Rd)" which includes fringe winter testing during 2016, and modelling showing areas of poor supply, particularly in the southern area. AusNet Services advises that the western growth corridor of Werribee has and is continuing to experience considerable development. The south western and northern fringe locations are expanding outwards resulting in supply pressures deteriorating. In 2015, a new city gate was commissioned in the northern precinct of the Werribee network (Mt. Cottrell). The south corridor of Werribee is deteriorating,

prompting the need for a new supply source in the south (the proposed Bulban Rd city gate and supply main).

The Werribee growth forecast ranges from 4.5% to 6% per annum over the 2018–22 AA period.

Network modelling indicates minimum pressures of 76kPa would be experienced in 2018 without the augmentation works, potentially affecting 1,160 customers and post augmentation minimum pressure of 160kPa. It is noted that supply main expenditure continues into 2019, while the modelling suggests improved minimum pressures will be achieved for winter 2018.

AusNet Services advised that the land acquisition for the city gate has been continuing for over 12 months and is expected to be completed during 2017.

Network planning shows a range of options with the proposed city gate and reinforcement being the only sustainable option.

The Gas Distribution Code specifies that the pressure in the network should not drop below 140kpa. Zincara considers that it is prudent to ensure that the pressures in the network meet the required regulatory minimum pressure. With the network modelling showing that the pressures will drop below the minimum regulatory pressure by 2018, Zincara considers that the project is prudent.

3.2.1 Cost Analysis.

AusNet Services has not costed this augmentation using "bottom up" first principles, but has assessed similar projects as the basis of its analysis. The city gate has been costed using historically similar projects with the recent Mt Cottrell city gate ([redacted]) being the most relevant. It is noted that the proposed Bulban Rd city gate is shown in the analysis report as $1.8 million, with $1.0 million forecast to be spent during 2017.

For the reinforcement supply main, AusNet Services states it assessed a number of recent projects and has applied the unit rate for the Duncans Rd, Werribee reinforcement, being the most similar. It has discounted its unit rate assuming some efficiency due to the increased length of the proposed reinforcement, applying a unit rate of [redacted].

Zincara's preferred approach for preparing a cost estimate is to take a bottom-up approach which would make it very transparent on how the costs have been estimated. AusNet Services' approach is essentially to compare the project to other similar projects and apply any efficiency. Zincara does not consider this approach unreasonable but the methodology limits Zincara's ability to scrutinise the costs in detail. For the mains extension, AusNet Services has used the cost of a like project in the same area which has similar terrain and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

In relation to the city gate costs, based on its own experience Zincara is aware that the costs of city gate could vary considerably depending on the size and location of the city gate. Zincara considers that the cost of the city gate to be within the range of a small city gate and as such considers the cost to be efficient.

3.3 H21 CRAIGIEBURN (STAGE 1)

Proposal: Lay 4 kilometres of 180NB P10 supply main along Mickleham Road.

Table 12: Craigieburn Augmentation (stage 1) Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	923	-	-	-	-	923

(Source: IR #3: Q2 Table 5)

Note: Stage 2 augmentation project is planned for 2021 (see below).

AusNet Services advises that the northern growth corridor of Craigieburn has and is continuing to experience considerable development. Pressures are deteriorating at the Potter Street field regulator which predominantly supports this network. The augmentation work will deliver greater capacity to the western and northern fringes.

The Craigieburn growth forecast ranges from 5.0% to 5.6% per annum over the 2018–22 AA period.

Network modelling indicates minimum pressures of 110kPa would be experienced in 2019 without the augmentation works potentially affecting 1,500 customers. Following the proposed reinforcement minimum pressures have been modelled at 194kPa. AusNet Services has subsequently supplied winter testing information which shows fringe pressures have fallen below the minimum pressure of 140kpa during winter of 2016. In addition, the network regulators that normally injects gas into the network at 450kpa has had to be increased to 500kpa to maintain the minimum pressure.

Network planning options considered included "do nothing", "increasing operating pressures", "installing a new regulator closer to the network fringe" and the recommended "reinforcement – stage 1 (2018) and stage 2 (2021)". Given the fact that during 2016 there have been instances of supply pressure below 140kPa and frequent need to increase regulator pressures to 500kPa during the winter, along with modelling showing minimum pressures of 110kPa by 2019, Zincara considers that the augmentation to be prudent and the recommended reinforcement option is reasonable.

3.3.1 Cost Analysis.

AusNet Services states[4] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has based the unit rate on an historic reinforcement in Altona, with risk included for expected rocky conditions. It has discounted this unit rate for expected efficiencies due to the additional length of main being laid. The proposed unit rate is [redacted] giving total capex of $904,000.

Zincara's preferred approach for cost estimate methodology is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar

[4] Risk Assessment - Augmentation Projects <$1 million

project in an adjacent area, which would have similar terrain and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.4 H23 SUNBURY

Proposal: Lay 530 metres of 125NB P10.

Table 13: Sunbury Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	189	-	-	-	-	189

(Source: IR #3: Q2 Table 5)

While the Sunbury growth forecast ranges from 1.6% to 2.1% per annum, AusNet Services advises that fringe pressures are deteriorating. Following a question from the AER seeking further details (IR #11) AusNet Services' response advised that from the City Gate, the large diameter supply main extends to the west of the network, but to the east the 150mm main terminates and continues in small diameter (<80mm) mains, which are experiencing higher flow velocities, with choked flow anticipated. The mains were laid during the 1970s when the Sunbury township had natural gas commissioned and future growth may not have been anticipated at the time. This project will tie-in the existing 150mm main to an existing 100mm main to the north.

Network modelling indicates minimum pressures of 136kPa would be experienced in 2019 without the augmentation works potentially affecting 1,100 customers, with post augmentation achieving minimum pressures of 262kPa. The Sunbury network is supplied solely from the Sunbury city gate.

Further supporting information relating to winter testing has been provided along with network planning options. The proposed reinforcement provides a cost effective outcome. Zincara considers that the augmentation to be prudent and the recommended reinforcement option is reasonable.

3.4.1 Cost Analysis.

AusNet Services states[5] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has based the unit rate on an actual reinforcement in Marshall, Torquay, with risk included for expected rocky conditions. The proposed unit rate is [redacted] giving total capex of $185,000.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of Torquay, which would have similar conditions and as such similar main construction conditions except for rock. AusNet Services has allowed a contingency for rock which is reasonable given the terrain in Sunbury as compared to Torquay. On that basis, Zincara considers the cost to be efficient.

[5] Risk Assessment - Augmentation Projects <$1 million

3.5 H75 WARRNAMBOOL

Proposal: Lay 950 metres of 125NB P10.

Table 14: Warrnambool Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	235	-	-	-	235

(Source: IR #3: Q2 Table 5)

While the Warrnambool growth forecast ranges from 1.5% to 1.8% per annum, AusNet Services advises that the north eastern fringe pressure is deteriorating due to growth and the distance from the City Gate. The Warrnambool network is supplied solely from the city gate. The augmentation project will interconnect existing 150NB steel main and a nearby 100NB steel main allowing greater capacity, reduced risk of choked flow and improving outer fringe pressures.

Network modelling indicates minimum pressures of 141kPa in 2019 and dropping further to 112kPa in 2020 without the augmentation works, potentially affecting 900 customers. Minimum pressures would increase to 262kPa following the proposed augmentation.

Further supporting information relating to winter testing has been provided along with network planning options. The proposed reinforcement provides a cost effective outcome. Zincara considers that the augmentation to be prudent and the recommended reinforcement option is reasonable.

3.5.1 Cost Analysis.

AusNet Services states[6] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has based the unit rate on an actual reinforcement in Bendigo, which has similar conditions. The proposed unit rate is [redacted] giving total capex of $230,000.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar project and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.6 H27 BACCHUS MARSH

Proposal: Lay 500 metres of 180NB P10.

Table 15: Bacchus Marsh Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-	133	-	-	133

(Source: IR #3: Q2 Table 5)

[6] Risk Assessment - Augmentation Projects <$1 million

AusNet Services advises that Bacchus Marsh high pressure network is divided in to a northern and southern quadrant separated by the Western Highway with two interconnecting supply mains. Growth is occurring in the northern quadrant farthest away from the single City Gate.

The Bacchus Marsh growth forecast ranges from 2.6% to 2.9% per annum over the 2018–22 AA period.

Network fringe pressures show supply pressures were dropping below 140kPa and the city gate pressures were regularly operating up towards 490kPa prior to a reinforcement completed in 2016. Network modelling indicates minimum pressures of 132kPa would be experienced in the northern fringe of the network in 2021 without the augmentation works potentially affecting 700 customers. Following augmentation, minimum pressures would be 223kPa.

AusNet Services' planning options have been provided, and the proposed reinforcement provides a cost effective outcome. Zincara considers that it is prudent to ensure that the pressures in the network meet the required regulatory minimum pressure. With the network modelling showing the pressures will drop below the minimum regulatory pressure by 2018, Zincara finds that the project is prudent and the recommended reinforcement option is reasonable.

3.6.1 Cost Analysis.

AusNet Services states[7] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has based the unit rate on an historic reinforcement in Torquay, which has similar conditions. The proposed unit rate is [redacted] giving total capex of $130,000.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar project and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.7 MP44 BROOKLYN (SUNSHINE) (MP TO HP UPGRADE)

Proposal: Lay 870 metres of 125NB P10 and raise the operating pressure of an existing steel main from medium to high pressure.

Table 16: Brooklyn Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-	235	-	-	235

(Source: IR #3: Q2 Table 5)

[7] Risk Assessment - Augmentation Projects <$1 million

MP44 is a Medium Pressure network operating at 50kPa. AusNet Services advises that minimum fringe pressures have been experienced, reflected by customer complaints during times of peak winter demand. By interconnecting the network to a nearby High Pressure network, supply issues will be resolved. Following a request from the AER for further details of customer complaints, AusNet Services' response (IR #11) provided details on one complaint where the customer has experienced supply issues restricting their plant operation. There are an additional five customers that will benefit from the upgrade to high pressure.

AusNet Services placed a pressure chart recorder at the fringe of the network, confirming poor pressure down to 2-3kPa was being experienced.

The Brooklyn growth forecasts are around 1.1% per annum over the 2018–22 AA period.

Network modelling indicates minimum pressures of 18kPa in 2020 dropping to 14kPa in 2021 without the augmentation works potentially affecting <50 commercial customers. Note that the Gas Distribution System Code shows minimum pressure for Medium Pressure networks is 7kPa.

While the medium pressure network normally operates between 15-50kPa, AusNet Services states that it is currently running the network at 100kPa, via the Market Rd field regulator, to ensure industrial customers in Brooklyn can maintain their operations. AusNet Services states that the higher operating pressure is acceptable due to the material type of mains in the area.

The proposed augmentation (laying 125NB P10 and raise the operating pressure of the existing steel main from medium to high pressure) will provide high pressure to that section of the network with coated steel mains. AusNet Services states that the sections of the network with uncoated steel mains will continue to be operated at 100kPa, due to higher potential of these mains to fail.

The additional information from AusNet (IR #11) also noted that "upgrading the operating pressure to 450kPa will also mean that approximately 9km of main currently operating at 100kPa in isolation to the remainder of the MP network will be reinstated back to its original medium operating pressure of 50kPa. This will provide a back feed of supply into the 50kPa network and enable AusNet Services to open the isolation valves, providing a more secure MP network for the wider customer base. On that basis finds the augmentation to be prudent.

3.7.1 Cost Analysis.

AusNet Services states[8] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). The location is an industrial area with minimal traffic. For this project, AusNet Services has based the unit rate on an historic reinforcement in Howard St Bendigo, which has similar conditions. The proposed unit rate is [redacted] giving total capex of $230,000.

[8] Risk Assessment - Augmentation Projects <$1 million

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar project and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.8 H96 MACEDON RANGES

Proposal: Lay 2,000 metres of 200NB S7 (or Polyethylene equivalent).

Table 17: Macedon Ranges Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-		582	-	582

(Source: IR #3: Q2 Table 5)

Note: The Network Capacity Strategy document variously refers to HH2 Macedon Ranges (see section 6.5) and H96 Macedon Ranges (see section 8.1 Table 5). The augmentation details also differ from 2,700m of 200mm S7 to 2,000m of 180mm P9.

The Macedon Ranges growth forecast is around 1.0% per annum over the 2018–22 AA period.

Carlsruhe city gate supplies the Macedon Ranges field regulators as HP2 (900kPa). The SCADA graph provided by AusNet Services, shows that the inlet pressure of the Gisborne field regulator, at the bottom of the supply main, experiences inlet pressures of 550kPa. AusNet Services states that a minimum of 100kPa is required as differential across the regulator. With pressure falling below 550kPa at the inlet, and an outlet set pressure of 450kPa, the Gisborne field regulator will not sufficiently be able to supply the network. Duplicating the existing main for approximately 2km from the outlet of the Macedon Ranges field regulator considerably increases the inlet pressure to the Gisborne field regulator.

Capacity modelling with the ongoing growth in the Gisborne and New Gisborne network shows that the inlet pressure to the existing Gisborne Field Regulator falls to approximately 490kPa, limiting outlet pressure to the downstream network.

Network modelling shows poor supply along the HP2 main (between Woodend field regulator and Gisborne field regulator), and indicates minimum pressures of 490kPa would be experienced in 2022 without augmentation works potentially affecting 3,400 customers. Post augmentation minimum pressure would be 710kPa.

AusNet Services' planning options have been provided, and the proposed reinforcement provides a cost effective outcome. Zincara considers that the augmentation to be prudent and the recommended reinforcement option is reasonable.

3.8.1 Cost Analysis.

AusNet Services states[9] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this

[9] Risk Assessment - Augmentation Projects <$1 million

project, AusNet Services has based the unit rate on an historic reinforcement in Howard St Bendigo with expected rocky conditions and potential risk associated with environmental impact and cultural heritage assessment. It also in regional Victoria with site set up and travel fees included in the estimated cost. The proposed unit rate is [redacted] giving total capex of $570,000.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar project and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.9 H21 CRAIGIEBURN (STAGE 2)

Proposal: Lay 3.6 kilometres of 180NB P10.

Table 18: Craigieburn Augmentation (stage 2) Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-	-	960	-	960

(Source: IR #3: Q2 Table 5)

AusNet Services advises that the northern growth corridor of Craigieburn has and is experiencing considerable development. This stage 2 augmentation project is proposed to further extend the existing 180mm P10 main undertaken in Stage 1.

The Craigieburn growth forecast ranges from 4.2% to 5.4% per annum over the 2018–22 AA period.

Network modelling indicates minimum pressures of 158kPa in 2021 and 139kPa would be experienced in 2022 without the augmentation works, potentially affecting 800 customers. Post augmentation minimum pressures would be 198kPa. While the minimum pressures only drop below the regulatory minimum of 140kPa in 2022, Zincara acknowledges the high forecast growth rates and on that basis finds that this augmentation project is prudent.

3.9.1 Cost analysis.

AusNet Services states[10] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has based the unit rate on an historic reinforcement in Altona, with risk included for expected rocky conditions. It has discounted this unit rate for expected efficiencies due to the additional length of main being laid. The proposed unit rate is [redacted] giving total capex of $940,000.

Following a question from the AER regarding the higher unit rate for stage 2, compared with stage 1, AusNet Services' response (IR #11: Q15) notes that there are less efficiencies associated with stage 2, due to shorter mains augmentation, and also the fact that it is expected to encounter additional project planning, traffic management and excavation activities due to development of roads and other infrastructure in the intervening period.

[10] Risk Assessment - Augmentation Projects <$1 million

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of a similar project and as a such similar degree of difficulty in mains construction and has factored in the additional complexity due to the development of roads in the area. On that basis, Zincara considers the cost to be efficient.

3.10 H68 ST LEONARDS

Proposal: Lay 10.8 kilometres of 125NB P10.

Table 19: St Leonards Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-	-	-	2,134	2,134

(Source: IR #3: Q2 Table 5)

AusNet Services advises that the Bellarine Peninsula consists of numerous coastal towns that are expanding in development and size. The northern leg of the area is fed by one field regulator located in Leopold, with St. Leonards at the fringe. In addition all towns are fed from one supply main. The proposed augmentation provides a "link" between St. Leonards and Drysdale.

The St. Leonards growth forecast ranges from 3.0% to 3.8% per annum over the 2018–22 AA period.

The SCADA graph shows the fringe of the network, at St Leonards, has experienced capacity issues with pressures below 100kPa being experienced during the winter of 2016. The outlet pressure of the field regulator supplying St. Leonards has been regularly raised to 500kPa (fail safe mode) to maintain fringe pressures.

Network modelling indicates minimum pressures of 141kPa in 2022 and 130kPa would be experienced in 2023 without the augmentation works potentially affecting 750 customers. Post augmentation minimum pressures would be 172kPa.

Given the fringe pressures experienced during winter of 2016, AusNet Services may need to operate fail-safe routinely over the next few years until the augmentation is commissioned before winter of 2023.

Options include "do nothing", "increasing operating pressure of the regulator supplying the Bellarine Peninsula", alternate mains reinforcement (along Grubb Rd), and the proposed "linking" reinforcement. The proposed option provides additional capacity to the fringe (St. Leonards) as well as mitigation of the risk of third party damage resulting in a complete loss of supply to the Peninsula.

Zincara notes that AusNet Services advised that the network reached its specified minimum pressures during winter of 2016. However, AusNet Services is not proposing to carry out any reinforcement till 2022 when its network modelling indicated that the pressure is 141kpa, marginally above that specified in GDSC. If the pressure had reached its minimum in 2016,

Zincara would have expected AusNet Services to have proposed a reinforcement earlier than 2022. In addition, as the pressure in 2022 is marginally above the minimum pressure, Zincara does not consider the project necessary even in 2022. Zincara believes that the project is most likely to occur in the next regulatory period, 2023–2028. Zincara does not consider this project to be prudent.

3.10.1 Cost Analysis.

AusNet Services states[11] that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet has based the unit rate on an historic reinforcement in Howard St Bendigo (unit rate [redacted]). It has discounted this unit rate for expected efficiencies due to the additional length of main being laid. The proposed unit rate is [redacted] giving total capex of $2.090 million.

Given that Zincara does not recommend this project as prudent, Zincara has not made comments on its costs.

3.11 TP61 BENDIGO

Proposal: Lay 1,000 metres of 200NB S7 at transmission pressure.

Table 20: Bendigo Augmentation Cost: ($'000, 2017, direct)

Capex	2018	2019	2020	2021	2022	Total
Main	-	-	-	-	1,021	1,021

(Source: IR #3: Q2 Table 5)

AusNet Services advises that continued growth in the Bendigo network is forecast to result in inlet pressures to the existing Abel Street Field Regulator falling to approximately 570kPa limiting outlet pressure to the downstream network. The augmentation project will duplicate approximately 1,000 metres from the outlet of the Bendigo City Gate.

The Bendigo growth forecast ranges from 1.7% to 2.1% per annum over the 2018–22 AA period.

AusNet Services has provided the SCADA graph showing the inlet pressures to the Abel St field regulator fell below 1000kPa in 2016.

Network modelling indicates minimum pressures of 630kPa in 2022 and 570kPa would be experienced in 2023 without the augmentation works potentially affecting 35,000 customers. Post augmentation minimum pressure would increase to 745kPa.

In its Macedon Ranges augmentation proposal, AusNet Services stated that a minimum of 100kPa is required as differential across the regulator. Based on this information, with pressure falling below 570kPa at the inlet, and an outlet set pressure of 450kPa, the Abel St field regulator will not sufficiently be able to supply the network.

[11] Risk Assessment - Augmentation Projects <$1 million

AusNet Services has assessed some options including "Do nothing", "Install a new city gate in Bendigo" (not feasible given the location of APA's transmission pipeline) and proposed "duplication of existing transmission main".

Zincara notes that the project consists of a short transmission pipeline. Whilst in 2022, the 660kpa pressure at the inlet to the Able St Field Regulator is not its minimum specified pressure (570kpa), Zincara is aware planning and approval for transmission pipelines could be protracted. As such, Zincara believes that it is prudent to commence the transmission pipeline project with a reasonable lead time.

3.11.1 Cost Analysis.

AusNet states that through a commercial tendering process, it has a lump sum contract for the augmentation projects, which includes contractor labour and materials. AusNet Services has also included estimates for internal labour (around 5%). For this project, AusNet Services has assessed the unit rate of [redacted], similar to that for Waurn Ponds (unit rate of [redacted]). AusNet Services has not provided a detailed estimate.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet has used the cost of a similar project and as such a similar degree of difficulty in mains construction. On that basis, Zincara considers the cost to be efficient.

3.12 TP SYSTEM H68 GEELONG SOUTH – TP PIPELINE & FACILITIES

Proposal:

- City Gate installation (*approved in previous AA*)
- Lay 3.0 kilometres of 200NB S7 at transmission pressure (*approved in previous AA*)
- Field Regulator installation (H68 Geelong South) refer Table 6 in Strategy document

Table 21: Geelong South Augmentation Cost: ($'000, 2017, direct)

Capex	2017	2018	2019	2020	2021	2022	Total 2018-2022
Main	1000	1,532	511	-	-		2,043
City Gate (Waurn Ponds)	511	1,277	409				1,686
Field Regulator (Waurn Ponds)		919					919
Total	**1,511**	**3,728**	**920**				**4,648**

(Source: IR #3: Q2 Table 5 and 6) & (Augmentation Project Analysis – Transmission – Waurn Ponds, Geelong: Table 2)
Note: 2017 costs included to show the total project costs.

Note: Tables 5 and 6 (IR #3: Q2) show expenditure occurring with this project in 2017 and these have been included above for completeness, albeit they are not within the forecast expenditure for 2018-2022 AA period.

The Corio City Gate is the sole supply source to the Greater City of Geelong, the Surf Coast Shire and the Borough of Queenscliff. The City Gate currently supplies approximately 120,000 domestic customers and approximately 50 major tariff D customers.

Increased demand on AusNet Services' TP pipeline indicates that during periods of peak demand, pipeline supply pressures to the south of Geelong deteriorate considerably.

To ensure long term security of supply and maintain adequate capacity for future government Precinct Structure Plans (PSP), APA GasNet in consultation with AusNet Services proposed a Transmission Pipeline extension from the Southwest Pipeline to the southern fringe of the Geelong and Coastal Region. This project was identified in the 2013-17 AA period and expenditure was approved in the final decision.

At the termination point of APA's TP extension (also approved in 2013-17 AA period), AusNet Services will construct a new City Gate facility (including two field regulators) and lay a TP pipeline interconnect creating a dual fed network.

A number of issues during the current AA period have delayed the joint project, in particular negotiations for an easement owned by Boral Ltd. AusNet Services advises that an agreement has been finalised with contract documents awaiting execution, which is expected by end February 2017 (IR #3 Q6).

During the delay period, poor network pressures and customer outages in Torquay and Jan Juc resulted in AusNet laying a 15,000m 180NB HP pipeline augmentation prior to the winter of 2015. This is considered to be a temporary solution only and does not meet the future capacity needs with the growth on the surf coast/Geelong, and leaves the Geelong network still as a sole supply.

The growth forecast ranges from 1.7% to 2.1% per annum over the 2018–22 AA period.

This project is contingent on the construction of AusNet Services and APA transmission pipelines (ref: IR #3 Q6), with AusNet Services' pipeline forecast to commence in 2017 and APA pipeline in 2018, followed by the city gate from late 2018 and field regulator from late 2018.

Factors that could impact timing include:

- Cultural and heritage requirements
- Environmental requirements
- Percentage of rock
- Local council requirements

AusNet Services has provided SCADA fringe pressure results from 2014 to present time. The data shows that the reinforcement in 2015 lessened the immediate low pressure issues in Torquay and Jan Juc, however, pressures will continue to deteriorate with projected continued growth and the new precinct structure plan release of Spring Creek. There have been minimum pressure events below 140kPa during 2015 and 2016 and a number of occasions requiring increased regulator pressures around 490kPa.

Network modelling shows poor supply in Torquay and Jan Juc during 2019.

Network options assessed by AusNet Services include "do nothing", "increase capacity of existing Corio city gate" and the proposed option "install additional supply point to the south of the network". The benefits of the proposed option is that it provides an additional supply point at the southern fringe as well as additional capacity for Geelong network at the lowest cost.

Following questions regarding this project from the AER, AusNet Services' response (IR #11:Q17) provides additional information that has enabled Zincara to complete its analysis and review of the project. Firstly, AusNet Services confirms that there are no changes to the justification for the project since it was originally approved by the AER for the current AA period, noting that the 11km HP reinforcement to increase fringe pressures in the Torquay/Jan Juc region did not provide the Geelong network with an additional supply point, nor did it increase the available capacity in the HP2 main.

AusNet Services also stated that there has been no material change to material and labour costs since that time, with the project scope unchanged.

Given the previous approval of the project, the benefits of security of supply at the southern fringe as well as additional capacity for Geelong network, Zincara considers that the augmentation to be prudent.

3.12.1 Cost Analysis.

- Waurn Ponds city gate. AusNet Services has assumed this is similar to Winchelsea [redacted] and Mt Cottrell [redacted]. Additional cost relates to the cost of land purchase.

- Waurn Ponds field regulator. AusNet Services states this is similar to Coburns Rd [redacted] and Ballarat similar completed cost as Coburns Rd. AusNet Services estimate this field regulator cost as $900,000.

- Mt Duneed TP extension. AusNet Services has applied a unit rate of [redacted], giving a total project TP extension of $3 million. Following a request for further information from the AER regarding the development of this cost component, AusNet Services advised (IR #11) that a subject matter expert has provided an estimate of total project cost for the large diameter steel pipe installation, which has been used to derive the forecast unit rate. Further, due to the infrequency of Transmission Pressure projects AusNet Services had only one project (Rees Road) for which historic project costs were available to validate the Mt Duneed TP main. The Rees Road project resulted in costs of [redacted] due to extreme laying depth (5m) and 100% rock. AusNet Services says that rather than developing more detailed costs internally at the time of early project planning, they are established through competitive tender process closer to the project delivery.

Zincara has compared the cost of this project with that approved by the AER in the 2012 review and considers that the project costs are similar. As such, Zincara considers the costs to be efficient.

3.13 EXISTING FACILITY UPGRADES

Table 22: Existing Facility Upgrades ($'000, 2017, direct)

Existing Facility Upgrades	2018	2019	2020	2021	2022	Total
City Gate – Werribee (Forsyth)		919				919
City Gate – Werribee (Heaths)		613				613
Field Reg – Werribee (Lock)				204		204
Field Reg – Pt. Henry (Buckley)			204			204
Field Reg – Melton (Coburns)				204		204
Total		**1,532**	**204**	**409**		**2,145**

(Source: IR #3: Q2, Table 7)

AusNet Services states (ref: response IR #3: Q8) that where the driver of a project is capacity, the project costs have been accounted for in the Network Capacity Strategy. Where a project has capacity and reliability drivers, the project costs are allocated to the Network Regulator Strategy.

AusNet Services states that it commissioned Oil Gas Power International (OGPI) to undertake a capacity study on the Werribee network City Gate (and Field Regulator) stations, with resulting recommendations of upgrades required to meet the long term capacity requirements. AusNet Services has provided a copy of Study. AusNet Services also states that these works will ensure that the required capacity is supplied as well as maintaining compliance with maximum gas flow velocity requirements. IR #3 Q8 response includes an explanation of how the forecast demand has been determined, with existing capacity and forecast demand shown in Table 4 (also in Appendix 6J: Network Capacity Strategy). AusNet Services also states that results of fringe pressure monitoring tests using winter testing and real-time SCADA data validate the justification for these projects, and are included in project justification documents provided to AER (ref: IR #3, Q3).

Calculations of demand forecast. In its response (IR #3: Question 8) AusNet Services says that it used as an example Forsyth Rd City Gate, where actual flow is multiplied by forecast growth of 6.2% for two years, and this is added to the existing design capacity to arrive at forecast demand in 2019.

AusNet Services' response (IR #11) provided the further information to enable Zincara to fully review the project justification, which it finds to be reasonable and prudent.

3.13.1 Cost Analysis.

AusNet Services' response (IR #11: Q18) also included further details to explain how the cost estimates were developed. It says that detailed cost estimates were not typically developed at this early stage of project planning. Cost estimates have been developed with consideration of historic projects where they exist. In this case AusNet Services has assessed three project types:

- City Gate upgrades – most complex
- City Gate upgrades – less complex
- Field Regulator upgrades

Two of the projects (Forsyth Road and Heaths Road) fit in the complex City Gate upgrade category, with the cost estimate based on the Corio CG regulator upgrade which was completed in 2016 at a cost of [redacted]. AusNet Services has provided details of the scope of work for the two City Gate upgrades and the basis of the cost estimates.

Three projects (Hamilton CG, Derrimut CG and Lock Ave CG) fit within the less complex City Gate upgrade category and are based on two projects completed in 2014 and 2015 (Ballarat and Bendigo respectively). The cost estimate is $200,000 for each of these projects.

The two Field Regulator upgrades (Buckley Grove, Coburns Road) have been estimated based on two upgrades completed in 2016.

Zincara's preferred approach for preparing a cost estimate is a bottom-up approach which is outlined in Section 3.2.1. For this project, AusNet Services has used the cost of similar projects. On that basis, Zincara considers the cost to be efficient.

3.14 CONCLUSION

AusNet Services' Augmentation projects for the next AA period include pipe reinforcements, new facility installations and existing facility upgrades. As part of its review and analysis, Zincara has assessed the efficiency and prudency, as well as timing of the augmentation projects, and in particular, the quality and level of information provided by AusNet Services as part of its project justification. Zincara considers each of the augmentation projects assessed in this report to be prudent and cost efficient, except for one reinforcement project (H68 St Leonards).

With respect to H68 St Leonards, Zincara notes that AusNet Services advised that the network reached its specified minimum pressures during winter of 2016. However, AusNet Services is not proposing to carry out any reinforcement until 2022 when its network modelling indicated that the pressure is 141kpa marginally above that specified in GDSC. If the pressure had reached its minimum in 2016, Zincara would have expected AusNet Services to have proposed reinforcement earlier than 2022. In addition, as the pressure in 2022 is marginally above the minimum pressure, Zincara does not consider the project necessary even in 2022. Zincara believes that the project is most likely to occur in the next regulatory period, 2023–2028. Therefore, Zincara does not consider this project to be prudent. Given that Zincara does not recommend this project as prudent, Zincara has not made comments on its costs.

This results in a capex reduction of $2.134 million ($ 2017, direct) and a revised total Augmentation capex of $13.113 million ($ 2017, direct).

4. CONNECTIONS

4.1 INTRODUCTION

AusNet Services is proposing Connections capex of $198.7 million over the next AA period, with an estimated 83,000 connections.

Table 23: Connections Capex Forecast ($million, 2017, real):

AusNet - Connections	2018	2019	2020	2021	2022	Total
Residential	31.7	32.4	33.3	34.4	33.8	165.8
I&C - Volume	5.1	5.2	5.3	5.4	5.4	26.3
I&C – Tariff D	1.3	1.3	1.3	1.3	1.4	6.6
New Connections	**38.1**	**38.9**	**39.9**	**41.2**	**40.6**	**198.7**

(Source: Capex Model; AAI: Table 6.2) note rounding

AusNet Services' network contains some of Melbourne's fastest developing urban growth areas. In recent years, the growth areas of Wyndham and Melton have both experienced growth rates exceeding 5% per year, a trend that is expected to continue. Approximately 90% of new connections are located at network fringes within new estates in Western Victoria.

AusNet Services states[12] that from 2015, it has allocated its contractor overheads to direct cost (rather than as overheads) and when this changed allocation of overheads is accounted for, the forecast new connections capex is 1.2% higher than in the current period of $196.3 million, despite a 2.3% increase in the forecast volume of new connections in the next period. AusNet Services forecasts additional residential connections due to marketing initiatives, which Zincara calculates to contribute approximately 1.6% of the increased forecast volumes.

AusNet Services has forecast approximately 1,318 additional connections as a result of its marketing initiatives, which represents capex of $2.68 million. These connections are incorporated within the forecasts covered by this report (i.e. not additional).

AusNet Services is forecasting connections capex as ongoing business as usual, with unit rates reflecting the current AA period (2013-16) and volumes substantiated by external consumption and customer forecast review. Its connections contract was awarded in 2013 and continues through the next AA period. Its methodology for calculating the capex forecast is reasonable and there are no step changes proposed that would impact the forecast.

It is noted that 2016 included relatively higher capex arising from the connection of new estates with large supply mains and rock conditions. It is expected that these conditions will reoccur throughout the forthcoming AA period and hence Zincara accepts that it is

[12] Access Arrangement information: section 6.5.3

reasonable to include 2016 within the averaging period proposed by AusNet Services (i.e. 2013-16).

AusNet Services states[13] that it has achieved significant savings in relation to new connections, which is largely attributable to AusNet Services' lower unit costs than those approved at the last review. These efficiency gains flow through to capex forecast for the next AA period, which relies on unit rates which are typically based on historical averages.

4.2 CONNECTIONS CAPEX FORECAST METHODOLOGY

AusNet Services considers[14] that its historical unit rates are reflective of the efficient costs of providing connection services. The averaging period used by AusNet Services is four years (2013-2016), which it believes strikes an appropriate balance between its two objectives, stating that:

- the period should be long enough to capture sufficient data points that are reflective of the wide range of connection projects, while
- a shorter period captures current information, it risks being distorted by one-off projects or short term drivers that can lead to abnormal unit rates
- it aligns with the period since the awarding of the connections contractor in 2013

Following a request for further information from the AER, AusNet Services' response stated (ref: IR #4: Q1) that its approach to the proposed residential connections unit rates involved the following steps:

- Dividing total annual residential connections capex from 2013-16 by total volumes for the same period
- Converting the 2013-16 unit rates into real 2017 dollars
- Computing an average of unit rates

The same approach was undertaken for I&C unit rates, with the exception of an additional step to remove tariff D capex from the annual I&C capex.

4.3 SERVICE PROVIDER

Following a competitive tendering process over an extended period of time, AusNet Services awarded its Gas Services Contract to Downer and this came into effect from April 2013. The contract has been approved for 8 years, expiring March 2021, although the term can be extended out to a maximum March 2023 subject to performance. Details of the tender and selection process are included in AusNet Services' response IR #1.

4.4 DEMAND FORECAST

Forecast gross customer growth[15] for the forthcoming AA period is 2.3% per annum, or approximately 83,000 new customers (including new regional town growth). This is

[13] Access Arrangement Information: section 6.3.2
[14] Access Arrangement Information: section 6.5.3, and its response IR #1
[15] Access Arrangement Information: section 6.5.3 and responses; IR #1; IR #4.

attributable to strong residential growth, although slightly moderated from that observed from 2010-15 which averaged 2.5% per annum.

During the current AA period (2013-17), residential connection volume is expected to be 79,700 along with 1455 I&C (tariff V) connections, giving a total of approximately 81,155 connections.

AusNet Services advises that forecast customer numbers are substantiated in a report from CIE. Zincara notes that the volume forecasts are being reviewed separately by the AER.

Table 24: Volume of Connections

	2018	2019	2020	2021	2022	Total
Residential	15,913	16,151	16,435	16,761	16,276	81,536
I&C (V)	277	280	284	288	283	1412

(Source: Capex Model; IR #1; IR #4)

I&C (tariff D). The Capex Model shows a forecast of $1.289 million per year ($2017, excluding escalation, overhead and customer contributions). Including escalation the total forecast for 2018-2022 is $6.6 million.

4.5 MARKETING STRATEGY

AusNet Services is proposing an expanded marketing program, which is described in the AAI: Opex section. While not specifically mentioned within the AAI Connections section, Zincara has reviewed the growth forecast sections and confirmed that additional "marketing" connections have been incorporated within the residential volume forecast. Comparing the Gross Connections Forecast (AAI: Table 4.3) and Impact of Residential Customer Numbers of Marketing Proposal (AAI: Table 4.7) with the forecast volumes in the table above, shows 1,318 additional connections is included in the forecast. By way of understanding the capex associated with the marketing initiatives, Zincara has applied the average residential unit rate to calculate capex of $2.68 million.

4.6 UNIT RATES FORECAST AND ANALYSIS

AusNet Services[16] has provided a Capex Model that provides the unit rates and volumes used to determine the connections capex forecast. Following a request for further information from the AER, AusNet Services' response (IR #1 and IR #4), provided detailed inputs to the capex model.

The forecast unit rates are an average of actual and expected unit rates from 2013-16.

AusNet Services states that the contractor support costs have been reallocated from overhead to direct costs since April 2015. Accordingly the 2013-16 cost data used to determine the forecast unit rate has been normalised by allocating support costs to direct capex, to ensure this forecast unit rate will reflect AusNet Services' reported costs in the future. However, the change means that the forecast unit rates are higher than the unit rates observed from the capex date reported prior to April 2015.

[16] Capex Model; IR #1; IR #4:Q4

On a like-for-like basis (normalising the 2013-16 unit rates to include support costs as direct capex), the average forecast residential unit rates are $2,033 and the I&C unit rates are $23,296 (both including escalation). For the period from 2013-16, the average residential unit rate was $2,029 and for I&C the average unit rate was $23,509 (both including escalation) (ref: AAI: 6.5.3). The I&C unit rate includes tariff D, which will be separated out during the analysis so as not to distort the I&C (Volume) unit rates. Tariff D connections are fully funded by the customer.

In response to questions from the AER, AusNet Services stated[17] that it considers a four-year average of actual unit rates (adjusted for change in overheads as noted above) is the best forecast period (2013-16) for the forthcoming period. AusNet Services notes that actual unit rates in 2016 were around 20% higher than the proposed unit rates due to the connection of a number of new estates with large supply mains and rock conditions. While these conditions are expected to reoccur throughout the forthcoming AA period, the use of 2016 data in isolation would distort the unit rate and not likely to result in a prudent and efficient forecast. AusNet Services provided data[18] showing the impact on the average unit rates of varying the averaging period to three (2014-16), five year (2012-16) or six year (2011-16). Given the fact that the contractor also aligns with the proposed unit rate period, Zincara considers that the 2013-16 period is appropriate.

Analysing the Capex Model direct cost unit rates (i.e. excluding escalation), confirms that AusNet Services is applying the current period average unit rates for the forecast period, as shown in the following table. This table also shows the unit rates for I&C (tariff V) which excludes the contract (Tariff D) connections.

Table 25: Connection Unit Rates ($2017, direct)

Connections	Current AA period	Forecast AA Period
Residential	$1,983	$1,983
I&C (Volume)	$18,163	$18,163

(Source: Zincara analysis from Capex Model; AAI 6.5.3). Note: I&C (V) is average of 2013-16

The following table shows these the unit rates with escalation included, in line with details included in AusNet Services' AAI (section 6.5.3).

Table 26: Connection Unit Rates ($2017, real)

Connections	Current AA period	Forecast AA Period
Residential	$2,029	$2,033
I&C (Volume)	$18,279	$18,615
I&C (incl. tariff D)	$23,509	$23,296

(Source: Zincara analysis from Capex Model and AAI: section 6.5.3). Note: I&C V is average of 2013-16

Zincara's analysis of unit rates for residential and I&C (V), in particular, support that they are reasonably developed and consistent with other businesses. On this basis, Zincara considers the costs to be efficient.

[17] AusNet Services response: IR #1
[18] AusNet Services response: IR #1

4.7 BENCHMARK ANALYSIS

The following table represents Zincara's calculation of total connection unit rates, based on information contained within the Capex Forecast Model.

Table 27 Connections Analysis Average Unit Rates ($, 2017, direct)

Component Unit Rates	Mains	Service	Meters	Total
Residential	397	1,190	397	1,983
I&C (V)	5,448	8,173	4,541	18,163

(Source: Zincara analysis; Capex Model)

The following table shows this analysis with costs including escalation.

Table 28 Connections Analysis Average Unit Rates ($, 2017, real):

Component Unit Rates	Mains	Service	Meters	Total
Residential	407	1,220	407	2,033
I&C (V)	5,585	8,378	4,654	18,617

(Source: Zincara analysis; Capex Model)

By way of a benchmark comparison, with the other two Victorian Distribution businesses, all three have relatively similar forecast unit rates for residential connections, with AusNet Services having the lowest rate. This is in spite of having a higher metering component. Due to the variety of contracting arrangements across the businesses, only AGN provided information that enabled a further breakdown of residential connections into new estate, existing home, and multi-user.

For I&C connections, AGN and AusNet Services have similar forecast unit rates, while Multinet's rate is significantly lower. There was also significant variation across the businesses for mains, services and meters, which may reflect the variation in size and location of I&C (tariff V) connections

4.8 CONCLUSION

AusNet Services' network contains some of Melbourne's fastest growing developing urban growth areas. Its forecast capex is effectively business as usual, with unit rates being based on 2013-16 average unit rates with no further increases included, which also aligns with the awarding of contracts in 2013. These contracts have been approved for 8 years, although the term can be extended for a further two years, subject to performance.

AusNet Services engaged The Centre for International Economics to prepare its consumption and customer forecasts. AusNet Services is also proposing an expanded marketing campaign which it forecasts will result in an additional 1,318 connections.

On the basis of its review and analysis of AusNet Services' connections proposal, Zincara finds that the methodology for calculating the capex forecast and unit rates is reasonable and there are no step changes proposed that would impact the forecast. On that basis Zincara finds the Connections capex prudent and efficient.

5. MAINS REPLACEMENT

5.1 INTRODUCTION

AusNet Services is proposing Mains Replacement capex of $130.0 million (2017 direct) or $132.9 million (real 2017) over the next AA period, with an estimated 465 kilometres of mains to be replaced. While the forecast volume of replacement is reduced compared to the current period (580 kilometres), the unit rates will be higher, reflecting inner suburban and Geelong CBD mains replacement, resulting in the capex being 23% higher than for the current period of $108.3 million (real 2017) (ref: AAI: 6.5.2, page 120).

Table 29: Mains Replacement Capex ($million, 2017, direct)

Mains Replacement	2018	2019	2020	2021	2022	Total
Low Pressure	24.7	23.0	23.5	19.0	17.8	107.9
Medium Pressure	5.2	4.2	5.0	1.2	1.2*	17.0*
Reactive Mains & Services	1.0	1.0	1.0	1.0	1.0	5.1
Total	30.9	28.2	29.5	21.3	20.0	130.0

(Source: Capex Model – capex forecast – work code) * AusNet advise an error with its unit rate for consideration.

Table 30: Mains Replacement Capex ($million, 2017, real)

Mains Replacement	2018	2019	2020	2021	2022	Total
Total	31.1	28.6	30.2	22.0	21.0	132.9

(Source: AAI: Table 6.2)

AusNet Services states that safety is the main driver of the mains replacement program, which can manage the risks associated with aged and compromised mains and services. "*AusNet Services assesses the safety of its assets with regard to the leak incidence per kilometre of mains and services. The proactive replacement of ageing/deteriorating gas distribution mains to reduce or maintain leakage is central to the provision of safe and reliable network services. The primary driver of the mains replacement program is, therefore, to reduce or maintain the safety risk of the network.*"[19]

The two key components of its proposed mains replacement program include:

- Low pressure mains replacement (LPMR). AusNet Services proposes the replacement of 410 kilometres (82 kilometres per year), of targeted and prioritised replacement, down from an average of 99 kilometres per annum during 2013-17 period. AusNet Services states that the program targets the worst performing and the most deteriorated mains.

- Medium pressure replacement (MPR). AusNet proposes the replacement of 55 kilometres (11 kilometres per year), targeting the replacement of unprotected steel

[19] Access Arrangement Information: section 6.5.2 (pg. 119),

networks and first generation polyethylene mains, compared with 16 kilometres per annum in the 2013-17 period.

AusNet Services also proposes some Reactive Replacement of mains and service, with a forecast capex of approximately $5 million.

AusNet Services' current program of replacing LP mains with HP mains dates back to 2003 and is currently expected to be completed by 2025. In addition, during the current AA period, AusNet Services commenced a program of replacing its highest risk MP mains.

5.2 CURRENT PERIOD

Zincara notes that AusNet Services has provided very little information to explain its performance during the current period, compared with the AER approved capex allowance and volumes. The AER had requested additional information (IR #13: Q6) but AusNet Services' response focussed on 2016 and its program for 2017. No information was provided to explain the underspend for the period to date.

Low Pressure Mains Replacement

In its 2013-17 determination the AER provided capex allowances based on replacing 415 kilometres of LP mains. In September 2016, the AER approved a cost pass through application to extend the LP mains replacement program by 85 kilometres, giving a total 500 kilometres for the current period.

AusNet Services stated (IR #13) that it is forecasting full completion of 500 kilometres of LP mains during the current AA period. However, it has confirmed that it did not complete its forecast program for 2016, completing a total of 63 kilometres, and a total of 400 kilometres during the period 2013-16. Delays have been caused by deferral in the handover of projects and suspensions of works while some crews aligned training competencies with AusNet Services' requirements. AusNet Services has completed a further 23.5 kilometres from January to early April 2017 and it expects to complete the remaining 106 kilometres during this year.

Total leaks on the LP network have declined by 68% from over 1,460 in 2006 to around 460 in 2016 and leakage incident rates have also improved, particularly over the last three years (ref: IR # 13: updated figure 8 – which is shown as Figure 1 in this report).

Medium Pressure Replacement

The AER approved capex to replace 82.5 kilometres of MP mains during the current period, which AusNet Services states it is on track to complete. AusNet Services also states that it is on track to replace all cast iron MP mains by the end of 2017. AusNet Services noted (AAI: page 133) that the large increase in the forecast MP unit rate relative to the current period is due to the fact that there were a relatively large proportion of MP mains upgraded or abandoned, which can be delivered at significantly lower unit rates.

Total leaks on the MP network have declined from 292 in 2010 to 163 in 2016. Leakage incident rates on the MP network have also shown an improvement since 2010 (ref: IR # 13: updated figure 8 – which is shown as Figure 1 in this report).

5.3 FORTHCOMING ACCESS ARRANGEMENT PERIOD - 2018-2022

The forecast mains replacement program plans to replace 82 kilometres per annum of LP mains (totalling 410 kilometres), down from an annual average of 99 kilometres for the current period, and 11 kilometres per annum of MP mains (totalling 55 kilometres), compared with 16 kilometres per annum for the current period. AusNet Services says that it has derived the proposed volumes through a risk based approach to leakage management aimed at maintaining current levels of network risk.

AusNet Services says that higher unit rates will apply during the next AA period which reflects the greater complexity of work in inner suburban areas and the Geelong CBD.

Table 31: Mains Replacement – 2018 to 2022 ($million, 2016, direct)

Mains Replacement		**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
Low Pressure	*Volume (km)*	*85*	*84*	*83*	*79*	*78*	*410*
	$million	24.2	22.5	23.0	18.6	17.4	105.7
Medium Pressure	*Volume (km)*	*17*	*15*	*17*	*3*	*4*	*55*
	$million	5.1	4.2	4.9	1.2	1.8*	17.2*
Reactive	$million	1.0	1.0	1.0	1.0	1.0	5.0
Total Volume (km)		*102*	*99*	*100*	*83*	*82*	*465*
Total Capex ($million)		**30.3**	**27.7**	**28.9**	**20.8**	**19.6**	**127.3**

(Source: Mains & Services Strategy: Table 15; 16; 17)
Note 1: Capex: real 2016, direct excludes overheads and CFC
Note 2: * MP capex is revised due to an error by AusNet in its initial submission (ref: IR #3: Q10 response)

5.3.1 Mains replacement prioritisation methodology

AusNet Services aims to maintain network risk and reliability by reducing the incidence of leaks and outages. AusNet Services uses a three step prioritisation process[20]:

Step 1 – Network pressure identification. AusNet Services says that it assesses its networks based on four key factors of risk, asset status, environmental and economic cost. "*Risk is the key factor, and key priority for the mains replacement program*". The outcome identifies low pressure and medium pressure networks for replacement.

AusNet Services' Risk Weighting analysis (ref: Table 4 below) shows the relative risk associated with different material types at different pressures, with the following material types showing the highest leakage rate and risk weighting:

- Cast Iron. These assets are susceptible to cracking and have the highest leakage incidence per kilometre.

- PE CL250 (P4). This was the original grade of high density polyethylene laid in the 1970s. However, the material has been found to be susceptible to cracking during and after the squeeze off process. AusNet Services indicate that its experience and anecdotal evidence suggests that it has had many failures originating from the location where pipe

[20] Appendix 6E: Mains and Services Strategy: section 7

has been previously squeezed off. This is discussed in more detail in the MP mains replacement analysis, later in this report.

- Unprotected steel. These mains have the potential to deteriorate quickly under certain ground conditions. AusNet Services states that the cost of reactive replacement "…..is often over 10 times higher than the cost of proactive replacement."

Table 32: Risk Weighting Results

Pressure Tier	Material	Length (km)	Ave annual LIR	Gas Flow Ratio	Risk Weighting
HP	Steel Protected	2289	0.02	11.95	0.24
	PE	7055	0.02	11.95	0.24
MP	Steel Protected	305	0.09	4.01	0.36
	Steel Unprotected	147	0.76	4.01	3.05
	PE	204	0.05	4.01	0.20
	Class 250 PE (P4)	39	0.95	4.01	3.81
LP	Steel Unprotected	70	0.46	1.00	0.46
	Cast Iron	266	1.07	1.00	1.07
	PVC	420	0.14	1.00	0.14
	PE	18	0.07	1.00	0.07

(Source: Mains & Services Strategy: Figure 17)

Step 2 – Replacement rate. AusNet Services states that the leading determinant of the replacement rate, or volume, is the maintenance of leakage rates to acceptable and sustainable levels. Secondary drivers being age profile, technical life, and economic assessment.

Step 3 - Postcode prioritisation. The final stage of the methodology is to prioritise the identified lengths and pressures into location specific areas in order to develop the annual replacement program. These location specific areas are identified by postcode, with a prioritisation methodology that considers both risk and consequence.

Risk. AusNet Services determines the energy release factors in each postcode, by multiplying the leakage rate (leaks/km) and the gas flow ratio to determine the "energy release rate".

Consequence. Utilises "population density" of each postcode, intended to measure the number of people that are potentially exposed to harm in the event of a gas leak.

The energy release rate is then multiplied by the population density. This enables postcodes to be prioritised for mains replacement.

Zincara has reviewed AusNet Services' prioritisation methodology and based on its experience finds the methodology reasonable.

5.4 LOW PRESSURE MAINS REPLACEMENT PROGRAM

For the forecast period, 2018 – 2022, AusNet Services is proposing the following low pressure mains replacement program.

Table 33: Forecast LP Mains Replacement Capex, Volumes and Unit Rates – 2018-2022

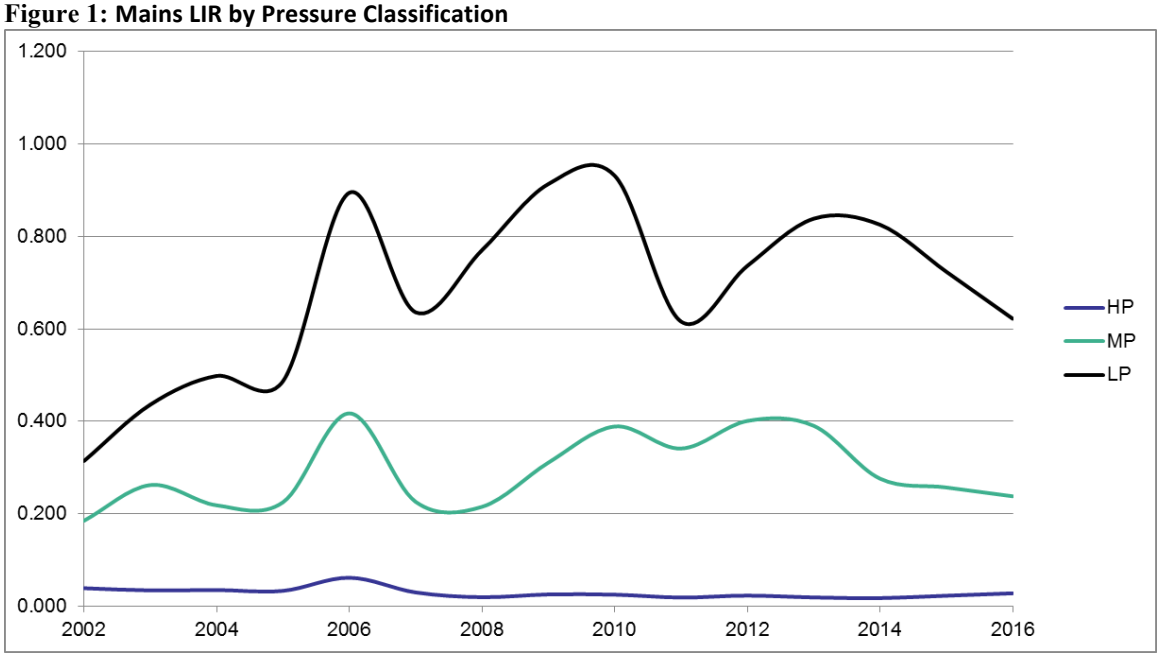
LP mains replacement	2018	2019	2020	2021	2022	Total
Volume (km)	85	84	83	79	78	410
Capex ($million)	24.2	22.5	23.0	18.6	17.4	106
Unit Rates ($/m)	284	266	276	235	223	

(Source: Mains and Services Strategy: Table 15) Note: Capex: real 2016, direct excludes overheads and CFC

5.4.1 Failure Analysis

As noted in the introduction above, AusNet Services assesses the safety of its assets with regard to the leak incidence per kilometre of mains and services. The proactive replacement of ageing/deteriorating gas distribution mains to reduce or maintain leakage is central to the provision of safe and reliable network services. The primary driver of the mains replacement program is, therefore, to reduce or maintain the safety risk of the network.

Figure 1: Mains LIR by Pressure Classification



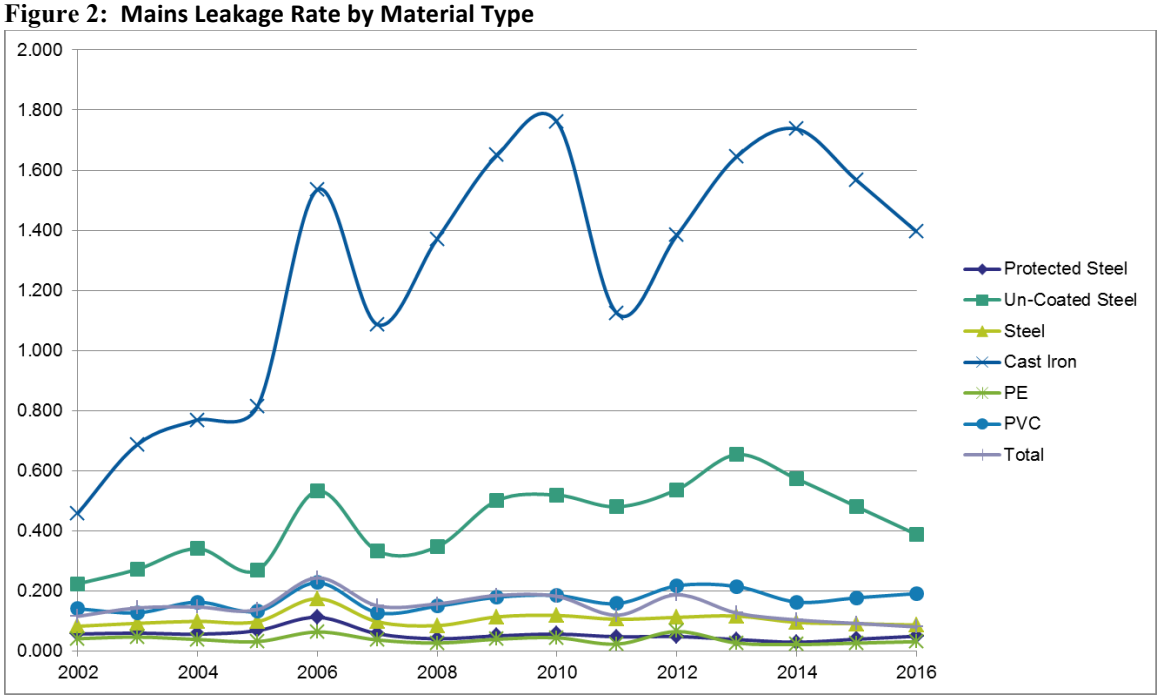
(Source: Mains and Services Strategy: Figure 8, (IR #13) updated to include 2015 and 2016)

The above figure shows the Leak Incident Rate (LIR) for both Low Pressure and Medium Pressure mains since 2002. Following a request from the AER for more current data reflecting performance during 2015 and 2016, AusNet Services has provided[21] updated charts and their associated data. As can be seen in the above figure, the LIR has shown a generally improving trend, particularly over the last three years. AusNet Services states that the proactive replacement of LP mains has managed to maintain leakage rates on the

[21] AusNet Services response: IR #13

network since 2006 with an average LIR below 0.8 and down to 0.62 in 2016. It is also noted that the total number of leaks on the LP network have declined by 68% from over 1,460 in 2006 to around 460 in 2016. Further analysis of mains leakage rate by material is shown in the following chart.

Figure 2: Mains Leakage Rate by Material Type



(Source: Mains and Services Strategy: Figure 11, (IR #13) updated to 2016)

The above chart shows that cast iron has the highest leakage rate compared with other material types. While AusNet Services states[22] that cast iron fractures is used to prioritise mains replacement, Zincara has not seen any supporting information showing the volume of Fractures or Fracture Incident Rates (FIR) in AusNet Services' analysis. Unprotected steel shows the next highest LIR.

While AusNet Services states that the replacement programs have been successful in maintaining leakage rates on the poor performing material types, the above chart shows that there has been an increasing trend for cast iron up to 2014. However, since that time the trend has been improving and the LIR is around 1.4 in 2016. Unprotected steel had a slightly increasing trend but that has been improving since 2013 and the LIR in 2016 is around 0.4.

Zincara believes that these results demonstrate that the mains replacement program has been successful in managing leaks in the LP network.

5.4.2 Volume

AusNet Services states that the primary driver of its mains replacement program is to reduce or maintain the safety risk of the network.

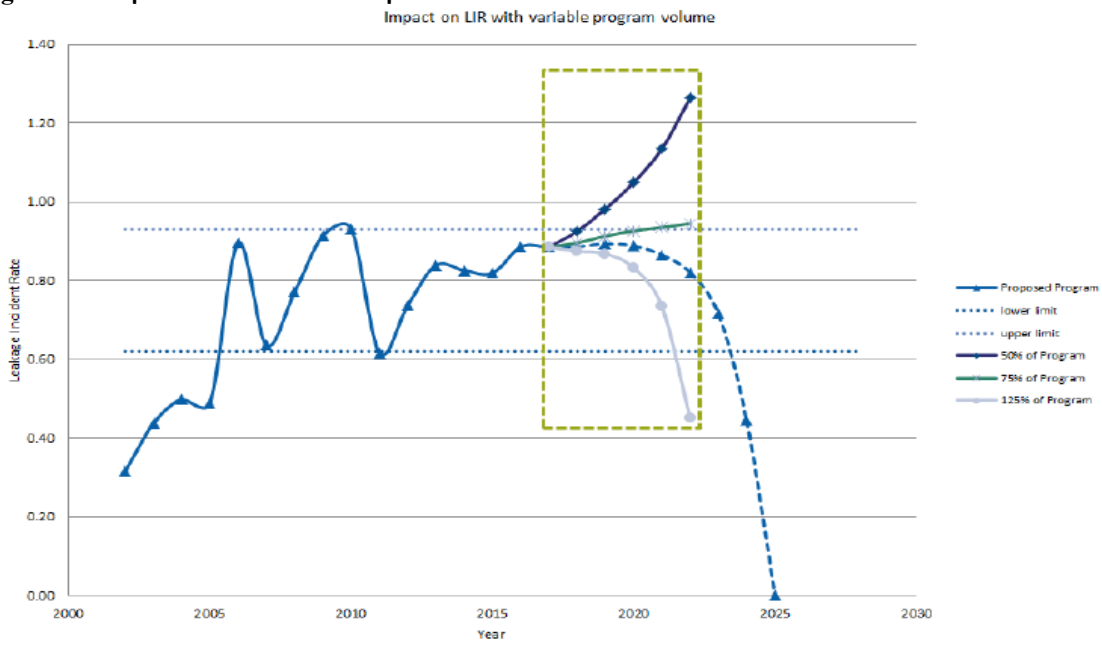
AusNet Services also says (ref: Strategy: 7.1.2.1) that it is committed to completing the replacement of the LP network by 2025 and so a lower replacement rate, than proposed by

[22] Appendix 6E: Mains and Services Strategy: section 4.4.2

AusNet Services, would compromise that objective. It also recommends a "*smooth replacement profile helps maintain consistency of work and the skilled workforce….and ultimately lower unit rates*." The historical replacement profile is consistent with the proposed program.

AusNet Services says that its low pressure mains replacement program analysis demonstrates that an average replacement rate of 82 kilometres per annum of LP mains ensures that leakage rates are kept within a band that reflects the maximum and minimum leakage rates over the recent years, which have been used to define the "maintain" case. This is reflected in the chart below, which projects flat leakage rates during the 2018-22 AA period, followed by a decline until the program completion in 2025.

Figure 3: Proposed Low Pressure Replacement Profile



(Source: Mains and Services Strategy: Figure 19, updated by IR #13: Q2)

AusNet Services states that with a decreased replacement rate the network may be at risk of increased leaks. However, AusNet Services had not initially provided any supporting information to describe this analysis and whether other replacement rates had been assessed. Following a request from the AER for further information in this regard, the above chart has been provided along with AusNet Services' explanation[23].

In the above figure, AusNet Services has developed three scenarios to assess the impact on leakage rate (i.e. 50%, 75% and 125% of the proposed program). AusNet Services says that the results show that lower mains replacement volumes result in increased leakage rates that can quickly move outside the band that is representative of maintaining current leakage rate performance levels (shown as dotted lines). Conversely, completing substantially greater volumes is expected to result in the leakage rate improving more rapidly than is required and therefore would not be considered prudent or efficient.

The figure shows that the 75% rate, which is approximately 60 kilometres per year, would result in marginally increased leakage rate. Zincara estimates that a replacement rate of 70 kilometres (94% rate) would enable AusNet Services to maintain the safety risk of the

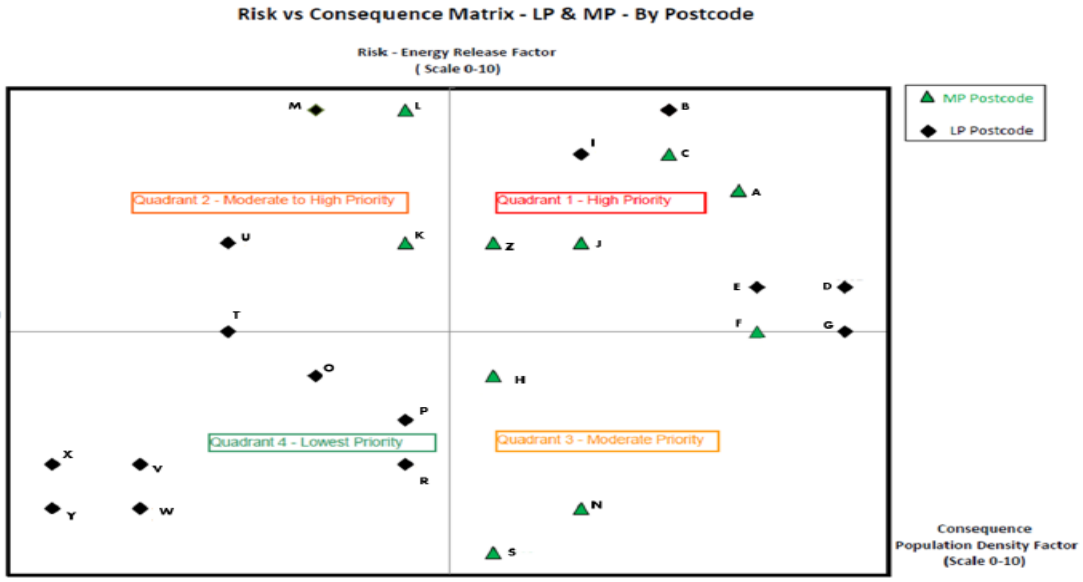
[23] AusNet Services response: IR #13: Q2

network. This equates to 350 kilometres over the five-year AA period. Applying the proposed average unit rate to the reduced volume shows that this would reduce LP mains replacement capex by approximately $15 million, and extend the program by one to two years subject to volumes in the 2023-2027 AA period. Considering the above analysis, Zincara believes that the LP mains replacement rate of 70 kilometres per year would achieve AusNet Services' safety risk objective of maintaining the leakage rate.

5.4.3 Prioritisation

AusNet Services' mains replacement prioritisation methodology has been described above. The final stage of the methodology is to prioritise the identified length, by relevant operating pressures into location specific areas, in order to develop the replacement program. These areas are identified by postcode with a prioritisation methodology that considers both risk and consequence. AusNet Services defines risk as the postcode leakage rate, while consequence is influenced by the population density in that postcode. Using this analysis, AusNet Services has developed a matrix which provides visual representation of results of the prioritisation methodology for both the LP and MP mains replacement programs. The matrix shows four categories of priority with the various postcodes placed, based on their risk and consequence factors, see Figure 4 below. Once the postcodes have been identified the areas are then reviewed to ensure that the network can adequately supply the upgrade, and that there is enough capacity left on the existing network to maintain supply.

Figure 4: Risk v Consequence Matrix for Postcode Priority



(Source: Mains and Services Strategy: Figure 24)

Zincara has reviewed AusNet Services' prioritisation methodology and in its experience agrees that it is a reasonable basis of selecting and ranking postcodes for mains replacement.

5.4.4 Unit Rates

Unit Rate Methodology. AusNet Services has reviewed the unit rates[24] at the postcode level, to capture costs associated with local conditions (e.g. traffic, ground conditions, and vegetation). The unit rate analysis comprises:

- Postcodes where mains replacement has been undertaken in recent years and historical cost data exists. AusNet Services uses a classification system based around the characteristics and complexities of the streets with mains to be replaced. The complexity system ranges from a score of one for a simple street, to a score of five for a complex street (heavy traffic, multiple shops, hard surfaces and/or restrictions from local council and other authorities). A postcode unit rate is then derived by assessing historic projects with equivalent complexity; and

- Postcodes where no replacement has been undertaken and therefore no historical cost data exists. For these postcodes small mains replacement projects were developed for estimation, taking into account location specific complexities. Two such projects were developed for each postcode (one in commercial zoned area and one in a residential area), providing two unit rates per postcode. Considering the length of mains to be replaced in residential and commercial areas, a weighted average has been used to derive the postcode specific unit rate.

In response to the AER's request for further details regarding the above unit rate methodology (IR #3: Q10), AusNet Services provided spreadsheets showing details of classification assignment to individual streets within postcodes, the summation of these and the calculation of unit rates using similar historical projects or estimated projects. AusNet Services advised that estimated projects were undertaken by an external service provider and then reviewed and validated by AusNet Services personnel.

The following table shows AusNet Services' forecast LP unit rates, built up from postcode specific unit rates calculated in accordance with the Unit Rate methodologies outlined earlier in this report (ref: Mains and Services Strategy: 10.1).

Table 34: LP Mains Replacement Unit Rates – Overall Summary ($/m, 2016, direct)

Low Pressure	2018	2019	2020	2021	2022
Unit rate	284	266	276	235	223

(Source: Mains and Services Strategy: Table 15) Capex: real 2016, direct excludes overheads and CFC

AusNet Services states that the higher unit rates in the earlier years reflect the completion of complex inner suburban postcodes including Kensington, Flemington, Footscray and Yarraville and the Geelong CBD, where unit rates are forecast to exceed [redacted] in some cases. Once the complex postcodes are complete, the unit is forecast to decrease as country towns are addressed, such as Hamilton and Stawell (unit rates of [redacted]).
The Mains and Services Strategy document, section 10.1, details the unit rate determination and provides details of length of mains replacement for each postcode, along with the unit rates and capex profiles, refer strategy document figure 28 (LP length replaced by postcode and year) and table 11 (capital expenditure profile LP replacement which also includes unit rates per postcode).

[24] Appendix 6E: Mains and Services Strategy: section 10

In response to a question from the AER regarding any new mains replacement contracts, AusNet Services has advised (IR #13: Q8) that it has recently finalised a number of contracts for 2017-2018 LP mains replacement program, but not for any subsequent years. While unit rates presented in its response to IR #3 where, at that stage based on tender evaluation documents, the current information is available following completion of final negotiations. AusNet Services lists six postcode projects comparing unit rates provided in IR #3 and current revised (contract) unit rates. While the contract rates are typically lower than the earlier information, they are not materially different.

Zincara has analysed the unit rate methodology and detailed spreadsheets used in calculating unit rates and agrees that they are reasonable for developing unit rates and estimates for mains replacement in each of the postcodes.

5.5 MEDIUM PRESSURE MAINS REPLACEMENT PROGRAM

For the forecast period, 2018 – 2022, AusNet is proposing the following medium pressure mains replacement program.

Table 35: Forecast MP Mains Replacement Capex, Volumes and Unit Rates – 2018-2022

MP mains replacement	2018	2019	2020	2021	2022	Total
Volume (km)	17	15	17	3	4	55
Capex ($million)	5.1	4.2	4.9	1.2	1.8*	17.2*
Unit Rates ($/m)	303	283	299	361	499*	

(Source: Mains and Services Strategy: Table 16) Capex: real 2016, direct excludes overheads and CFC
Note 1: * MP capex is revised due to error by AusNet with initial submission unit rate (ref: IR #3: Q10 response)

5.5.1 Failure Analysis

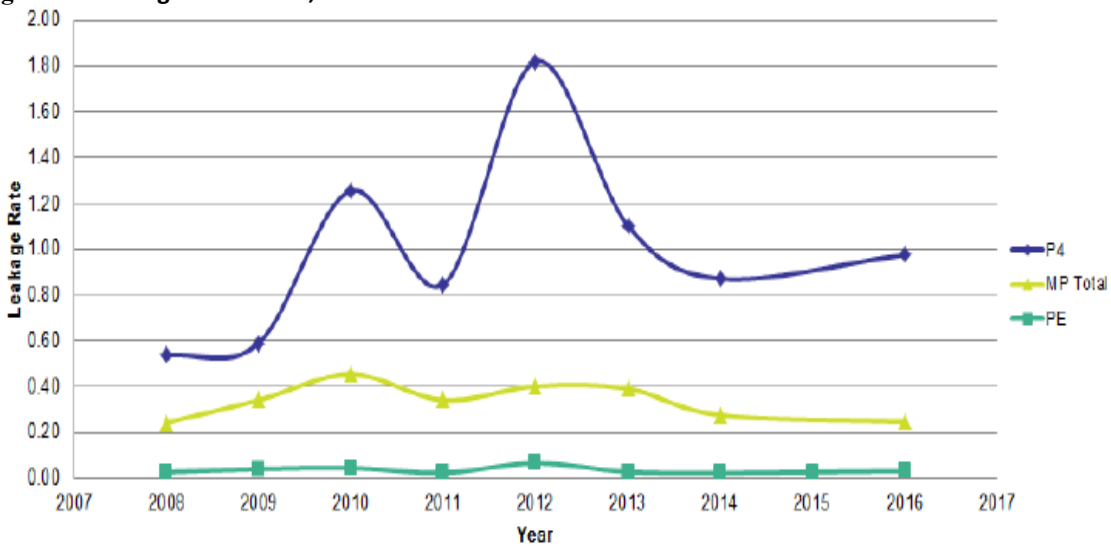
AusNet Services expects that all cast iron will be replaced by the end of 2017.

AusNet Services states that the introduction of the medium pressure mains replacement program in 2013 has slightly reduced the leakage rates due to its targeted approach, with removal of high risk cast iron mains. Figure 1 (Mains LIR by Pressure Classification) above, includes the LIR for MP mains. Following a request from the AER for more current data reflecting performance during 2015 and 2016, AusNet Services has provided updated charts and their associated data (IR #13). As can be seen in the above figure, the LIR has shown a generally improving trend, particularly over the last three years, and the LIR for 2016 is 0.24.

AusNet Services has undertaken a review of the worst performing material types on its MP network. Around 73% of the MP network demonstrates low and stable leakage rates and presents minimal risk, with the remaining 27% exhibiting significantly higher leakage rates that are similar to that of the low pressure network. With the additional risk of energy released on a MP leak compared with low pressure, AusNet Services maintains that it is critical that the high risk assets are replaced in order to maintain safety. The worst performing mains of the MP network includes the unprotected steel and class 250 PE. AusNet Services states that the replacement strategy will be similar to its current programs including both like for like replacement and block renewal, targeting the high risk areas (ref: Mains and Services strategy: 7.1.2.1).

Class 250 PE (P4). AusNet Services says (IR #13: 5) that this first generation of polyethylene mains is performing worse than other PE mains, and the MP network as a whole. As can be seen in the following figure, P4 is showing a higher leakage rate than MP overall, with an increasing trend, albeit more stable since 2013.

Figure 5: Leakage Rate on P4, PE and Overall MP Network



(Source: AusNet's response IR #13: Q5)

This pipe material is known to have poor slow crack resistance compared to current generation PE pipe. Squeeze off on the P4 material is therefore more at risk of initiating crack in the pipe wall, adding to the risk of failure. On this basis, AusNet Services considers this material type to have the highest risk on the MP network. AusNet Services noted that research is currently being undertaken by Energy Pipelines CRC, titled "An investigation into the mechanisms and property changes that lead to wall failure in ageing polyethylene pipes."

Table 8: Risk Analysis of MP Network

Network Indicators	Steel-protect	Steel-unprotect	Poly Cl. 250	PE
Leakage rate (leaks/km)	0.09	0.76	0.95	0.05
Risk Weighting	0.36	3.05	3.81	0.20
Length / % of network	305km / 44%	147km / 21%	39km / 6%	204km / 29%
Highest risk*	2.4km	13.1km	7.6km	1.6km
Block replacement	7.9km	1km	23km	0.2km

(Source: Strategy: Figure 20 and Figure 17); * Highest risk – based on 2 leaks in 4 years

The "risk weighting" in the above table represents the average annual leaks/km multiplied by the gas flow ratio, indicating the risk of energy released.

For "gas flow ratio", AusNet Services applies a factor of 1 for low pressure, factor of 4 for medium pressure and factor of 11.95 for high pressure, which shows the relative release of energy resulting from the differing pressure mains.

In the above table, AusNet Services has identified the highest risk mains as those that "*exhibit a leakage rate of two leaks per section of main in a four-year period. This is the same methodology as was accepted by the AER at the last access arrangement review (ref: AER, Final Decision – part 2: attachments, March 2013, p47)*". These total 24 kilometres and are a mix of material types, mainly including unprotected steel and Class 250 PE.

5.5.2 Volumes and Prioritisation

With all cast iron replaced on the MP network by the end of 2017, the MP mains replacement program is forecast to be reduced from the current period volume of 82 kilometres to 55 kilometres over the 2018-22 AA period. The most deteriorated and poor performing mains have been used to quantify the program. With reference to the above table there are 24 kilometres of "highest risk" mains, including unprotected steel and class 250 PE mains. In addition AusNet Services proposes to replace an additional 30 kilometres of steel and class 250 PE mains that it has classified as "poor condition" and which are in close proximity to highest risk mains.

AusNet Services says (ref: mains and services strategy: 10.2) that of the 24.7 kilometres of "highest risk" MP mains 7.2 kilometres are identified to efficiently be replaced with a block renewal approach. Where the HP supply is in close proximity, and the poor performing MP mains within the network are close to each other, block renewal is an efficient renewal approach. Of the 37.5 kilometres included in the block renewal replacement, 27 kilometres have been identified as poor performing class 250 PE mains (70%). The remaining 17.5 kilometres will be replaced in a like for like manner as they are not within an efficient distance of a HP supply.

In summary, AusNet proposes:

- 37.5 kilometres by Block Replacement
- 17.5 kilometres by Like-for-like Replacement

It is noted from the table above, the risk weighting for MP unprotected steel and Class 250 PE (P4) mains is higher than that of LP cast iron and unprotected steel. Zincara does not disagree with the risk weighting but does not agree that the risk weighting relativities between LP and MP should be used to justify the medium pressure mains replacement.

The LP-HP program objective is to replace the low pressure network, which is due to the long term potential safety issue associated with the time it would take to replace the aging cast iron mains. The MP program objective is to address current, present safety issues. It is therefore not relevant to justify the replacement of the MP network because it has a higher risk weighting than the LP network.

The LP–HP mains replacement program was initiated to remove the LP network from the system due to the deterioration of the network and capacity issues. Due to the size of the LP network, it is necessary to progressively replace the old material i.e. cast iron and unprotected steel over a twenty or thirty year period. In addition, the most efficient method of replacing these LP mains is to insert new pipes into the old pipes and upgrade the areas into high pressure. As such a block renewal method was considered the most efficient approach. With insertion, the inserted pipe is smaller in diameter than the old LP mains and to provide sufficient capacity it is necessary to convert the LP areas to HP. However, due to

the location of the HP network, it is necessary to convert the areas closest to the high pressure network before converting the higher priority LP areas (i.e. converting the outer suburban LP network before converting the inner suburbs).

The MP network does not have a capacity issue and is not as large as the LP network. Therefore the justification of replacing some or the entire MP network should be based on the condition of the network and the difficulty of managing the resulting risk through a maintenance program. As such, Zincara believes that it is prudent to only replace the highest risk mains of 24.7 kilometres.

Considering AusNet Services' program target's the highest risk mains (24.7 kilometres) but proposes to replace a total of 55 kilometres by a combination of block and like-for-like, the AER sought further information from AusNet to justify the prudence and efficiency of this approach. AusNet's response (IR #13: Q3 – Q4) notes that it firstly identifies high-risk mains (two leaks on a main in four years). Then it determines the most efficient program delivery approach to replace these mains. In some circumstances, it was identified that block replacement was the most efficient and feasible solution compared to like-for-like replacement. This resulted in a program comprising 37.5 kilometres of block replacement and 17.5 kilometres of like-for-like replacement being identified as the most efficient solution.

AusNet Services has provided details of its NPV analysis to demonstrate that replacing the high risk MP network through block replacement is more cost-effective than maintaining the network though operational activities. The cash flow analysis shows that a combination of like-for-like replacement and managing leaks through operational measures (option 2) is a more costly approach than the proposed bulk replacement approach (option 1). While option 1 involves a higher upfront capital cost, the ongoing O&M costs are relatively low as the poor performing mains are removed from the network. In contrast, option 2 involves materially higher O&M costs over the long term. In NPV terms, option 1 offers a lower cost than option 2. In addition there are the safety benefits through reduction of risk with bulk replacement.

Zincara has reviewed the NPV analysis and agrees that it shows AusNet Services' program to be the most cost efficient approach and on that basis recommends the program.

5.5.3 Unit Rates

The MP unit rate is expected to increase steadily with the ratio of like for like replacement increasing compared to the block renewal approach. In response to questions from the AER for additional information relating to development of the unit rates, AusNet Services provided response (IR #3) and spreadsheets of MP unit rates and how they have been developed.

Table 36: MP Mains Replacement Unit Rates – Overall Summary ($/m, 2016, direct)

Medium Pressure	2018	2019	2020	2021	2022
Unit rate	303	283	299	361	449*

(Source: Mains and Services Strategy: Table 16) Capex: real 2016, direct excludes overheads and CFC
Note 1: * MP capex is revised due to error by AusNet in initial submission (ref: IR #3: Q10 response)

AusNet Services noted an error in its MP unit rate for 2022, which should be $499/m rather than $338/m used in capex model and Table 16 of the Mains and Services Strategy, adding a total capex of $0.6 million. AusNet Services notes that this unit rate reflects the bottom-up build undertaken. AusNet Services offered to provide an updated capex model reflecting the change if required by the AER (ref: IR #3: Q10 response). AusNet Services has also provided a sample of contracts and contractor estimates supporting the proposed unit rates for both Block and Like for Like.

The MP mains replacement program includes, like-for-like and block replacement, which vary considerably in cost due to efficiencies achieved with block replacement.

Table 37: MP Mains Replacement, Unit Rate Comparison ($/m, 2016, direct)

	Block	Like-for-Like	Total
Proposed Length	37.5km	17.5km	55km
Average unit rate $/m	247	454	313

(Source: Mains and Services Strategy: Table 12) Capex: real 2016, direct excludes overheads and CFC

AusNet Services has based its block unit rate on the average rate of three projects (in Sunshine) completed in 2016 with similar characteristics (unit rates ranged from [redacted] to [redacted]).

The like-for-like unit rate reflects recently a completed project of similar complexity along with estimates developed by an external service provider. AusNet Services states (AAI: page 133) that the large increase in the forecast MP unit rate relative to the current period is due to the fact that there were a relatively large proportion of MP mains upgraded or abandoned, which can be delivered at significantly lower unit rates.

Zincara has analysed the unit rate methodology and agrees that they are reasonable for developing unit rates and estimates.

5.6 REACTIVE MAINS AND SERVICES PROGRAM

There are two types of works included:

- Minor mains and services replacement – where mains and services have failed and require urgent replacement. For mains, these reactive renewals are less than 20 metres.

- Alter/lower mains and services – where mains have been found to impact other buried utilities or have insufficient depth of cover.

Both are reactive in nature and occur when maintenance (e.g. repairing a leak) is considered inefficient considering the condition of the asset.

The historical average for the last five years has been used to forecast reactive mains replacement for the 2018-22 period, totalling [redacted] jobs per year for renewing defective mains and [redacted] jobs per year for lower/alter mains (non-chargeable).

The historical five year average has been used to forecast reactive service replacements, totalling [redacted] defective service renewals per year and [redacted] lower/alter service replacements.

Table 38: Reactive Mains and Services ($millions, 2016, direct)

	2018	2019	2020	2021	2022	Total
Renew defective mains & services	0.9	0.9	0.9	0.9	0.9	4.4
Lower/alter mains & services	0.1	0.1	0.1	0.1	0.1	0.6
Total	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**5.0**

(Source: Mains and Services Strategy: Table 17)

5.7 CONCLUSION

5.7.1 Failure Analysis

Zincara has analysed the leakage being experienced across AusNet Services' low and medium pressure networks, including analysis by mains material types. Additional data provided as a result of the AER's follow up questions has been able to demonstrate the impact of the mains replacement program on network performance up to the end of 2016. Typically the leakage rates in the low and medium pressure networks are improving, particularly in recent years. However, the early generation polyethylene (class 250 PE) is showing a slightly increasing leakage rate trend, albeit more steady than had been the case before 2013. As such AusNet Services has included some replacement of these mains in its medium pressure replacement program. Zincara finds that AusNet Services' assessment of its network safety using leak incidence rate of mains and services is reasonable and prudent.

5.7.2 Volume of LP Mains Replacement

The proposed low pressure replacement profile shows that the scenario of 75% of AusNet Services' proposed replacement rate (refer to figure 3 above), which calculates at approximately 60 kilometres per year, would result in marginally increased leakage rate. However, reviewing the profile, suggests that a replacement rate of approximately 70 kilometres per annum (total of 350 kilometres over the AA period) would enable AusNet Services to maintain the leakage rate and hence the safety risk of the network. Applying the proposed average unit rate to the reduced volume shows that this would reduce LP mains replacement capex by approximately $15 million, and extend the program by one to two years, subject to volumes in the 2023-2027 AA period. In considering all of the information Zincara finds that a replacement rate of 70 kilometres per annum (350 kilometres for the AA period) to be prudent.

5.7.3 MP Mains Replacement

AusNet Services proposes to replace 55 kilometres, compared with 82 kilometres for the current period. However, Zincara was concerned that in order to replace the 24.7 kilometres identified as highest risk (refer Table 8 in the report), AusNet Services proposes a 55 kilometres program, with a significant portion being block replacement method. In response to a question from the AER (IR #13) for further justification, AusNet Services provided an explanation along with an NPV analysis. Zincara has reviewed the information and the NPV analysis and finds that it more cost effective to undertake the program as proposed by AusNet Services. Along with the fact that the program for 2018-22 is reduced compared with the current AA period and AusNet Services would appear to have adequate skilled resources, Zincara considers AusNet Services' program to be prudent and cost efficient.

6. OTHER CAPEX

6.1 INTRODUCTION

The following table shows AusNet Services' proposed capex for the two categories "Network Regulators" and "Consumer Regulators". These costs have been included in the "Other Capex" categories in AusNet Services' submission.

Table 39: Other Assets Projects ($'000, 2017, nominal)

Other Assets	2018	2019	2020	2021	2022	Total
Network Regulators	1,874	2,179	1,435	1,247	1,046	7,782
Consumer Regulators	2,545	2,499	2,679	2,511	2,722	12,945

(Source: Capex Model; IR #18)); Real 2017 dollars, including labour escalation

AusNet Services has submitted to the AER its Network Regulator Strategy and its Consumer Regulator Strategy which provide information relating to most of the capex associated with network regulators and consumer regulators. AusNet Services proposes the following projects:

- **Network Regulators.** Replacement of regulators, heaters and miscellaneous works.
- **Consumer Regulators.** Replacement programs covering domestic and small I&C regulators.

In each of its strategies, AusNet Services has identified regulator types that it proposes require replacement during the next AA period. These regulators are either obsolete or faulty to the extent that a proactive replacement program needs to be considered.

For domestic consumer regulators, AusNet Services is proposing a new strategy to proactively replace regulators at the same time as meter replacements are being undertaken. This strategy aims to reduce the increasing trend of leaks at the regulator.

6.2 NETWORK REGULATORS

The network regulator replacement program is related to the city gate and field regulators. Through its maintenance programs and failure analysis, AusNet Services has identified equipment requiring replacement to ensure the ongoing safety, reliability and integrity of its networks. Most of the proposed replacements are part of an ongoing program and based on the performance of its city gates and field regulators, which are critical components of its networks. The following table provides the summary of proposed capex for the next AA period.

Table 40: Regulator Strategy replacements - Capex ($'000, 2016, direct)

Regulator Strategy Capex	2018	2019	2020	2021	2022	Total
Welker Jet Regulator upgrade	400	400	350	-	-	1,150*

Grove Regulator replacement	390	390	390	1,050	850	3,070
Heater replacement - reliability	[redacted]	[redacted]	[redacted]	-	-	1,210
Heater replacement - change	[redacted]	[redacted]	[redacted]	-	-	1,200
Heater – new installation	[redacted]	[redacted]	[redacted]	-	-	160
City Gate – lighting installation	[redacted]	[redacted]	[redacted]	-	-	100
Miscellaneous network regulator	150	150	50	150	150	750
Total Regulator capex	**1,780**	**1,970**	**1,240**	**1,050**	**850**	**7,640**

(Source: Regulator Strategy: Table 5; Capex Model)

* Note: With respect to the Welker Jet Regulator replacement program, Zincara notes that there is a discrepancy between the capex shown in the summary table and the detailed information later in AusNet Services' Regulator Strategy document (refer: Regulator Strategy: Table 5 (summary) and Table 6 (detailed)). The detailed table includes capex of $350,000 in 2021 (replacing two units) which is omitted in the summary table.

AusNet Services' networks include 38 City Gates, 106 Field Regulators and 73 District Regulators. Within recent years some of the regulator types, including Grove and Welker Jet / Jet Stream, have had reliability issues and have required replacement.

6.2.1 City Gates

The critical component within the city gate station is the pressure regulator valves. Failure of these regulators can cause the over pressurisation of the downstream assets. The ongoing extension of the network, to accommodate the strong residential growth in western Victoria, results in the construction of new city gates as well as upgrading the capacity of existing city gates. The following table shows the types of regulators and their age profile.

Table 41: City Gate - Regulator Types

Regulator Type	Number of City Gate sites	Age Profile (install year)
Welker Jet / Jet Stream	11	1971 - 2001
Grove	3	1973 - 1987
Axial Flow	15	1990 - 2015
Gorter	7	2006 - 2016
Apperflux	2	2014 - 2016

(Source: Regulator Strategy: Table 3)

6.2.2 Field Regulators

As with the City Gates, the critical component within the Field Regulator station is the pressure regulator valves. Failure of these regulators can cause the over pressurisation of the downstream assets. The number of regulators is increasing as new field regulators are installed to meet the growth in demand for residential gas connections. The following table shows the types of regulators used and their age profile.

Table 4: Field Regulator – Regulator Types

Regulator Type	Number of Field Regulator sites	Age Profile (install year)
Jet Stream	2	1971 - 2001
Grove	36	1969 - 1995
Fisher	3	1979 - 1988
Axial Flow	63	1990- 2015
RMG 850	1	2014 - 2015

(Source: Regulator Strategy: Table 4)

6.2.3 District Regulators

As a result of the mains replacement program the demand for gas through the district regulators is steadily declining, and so there is little requirement for investment other than maintaining the sites safety and reliability. AusNet Services does not propose any capex for these regulator stations.

6.2.4 Heaters

AusNet Services currently has 36 heaters installed at various city gates. A heater is required at every city gate due to the large temperature drop caused by the pressure reduction process. There are three different types of heaters:

Water Bath Heater – these are the most widely used types of heaters with 26 installed. This type of heater utilises a gas burner to maintain the temperature of a large vessel of water. A gas pipe then coiled through the water bath to allow heat exchange to take place. These heaters have been installed at some of AusNet Services' older city gates and are still being installed in the new city gate sites.

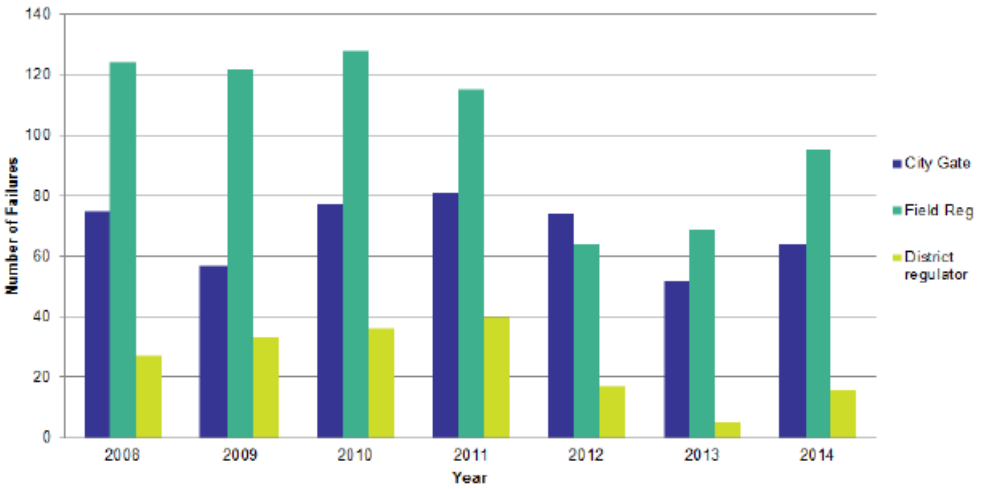
Heat Exchanger – these types of heaters utilise a gas boiler to heat water which is circulated by an electric pump through a heat exchanger where the heat is transferred into the gas stream.

Electric Heat Tracer Element – This system consists of electric heat elements wrapped around the external surface of the above ground pipework to transfer heat into the gas stream.

6.2.5 Failure Analysis

The following table shows the historical failure data for the regulator stations.

Figure 6: Regulator Stations – Number of Failures



(Source: Regulator Strategy: Figure 6)

6.2.6 City Gate Performance

The common city gate failures are associated with the Welker Jet and Jet Stream regulators. These include leaking hydraulic fluid, inability to hold a set pressure and even full component breakdown. AusNet Services advised that its proactive replacement program of these regulators, prioritising the highest fault sites, has decreased the number of city gate breakdown failures.

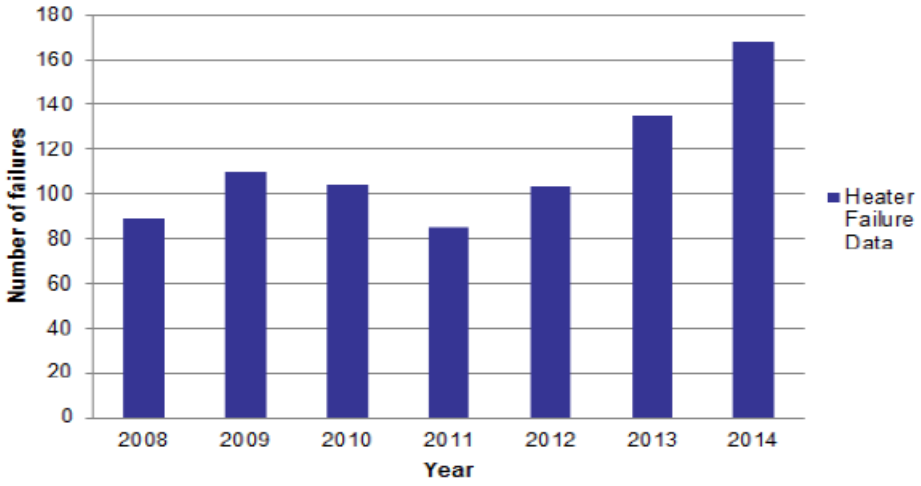
6.2.7 Field Regulators Performance

The most common breakdown associated with the field regulators is flooding of underground pits. Other issues relate to high pressure alarms, particularly where the field regulators are feeding small residential networks. When there is minimal flow through the regulator it closes down, which is known as 'lock up'. These regulators are designed for high flow and in some instances are aged and worn, cannot achieve 100% lock up, and as a result high pressure on the inlet will seep through. AusNet Services advised that it is addressing the low flow in some areas by tying the small networks into other networks increasing the minimum flow rate through the site.

6.2.8 Heaters Performance

The heaters perform a critical function at city gate stations by preventing temperature related breakdowns which occur when temperatures fall below 0^0C.

Figure 7: Heaters – Number of Failures



(Source: Regulator Strategy: Figure 7)

The main cause of failures is when the pilot light is extinguished. AusNet Services advised that the Forsyth Rd city gate heater, in particular, has a high occurrence of pilot light failures. The Bacchus Marsh heater has failures associated with the electrical het elements shorting out one by one, effectively reducing the maximum heating capacity of the site and it has now reached a critical point where the heater cannot provide sufficient heat energy required for the flow rates of the gate station.

AusNet Services has introduced a routine annual servicing of the heaters using a type B appliance technician, replacing one of the 6 monthly heater operational checks. Introduced in 2015, the servicing appears to have increased the reliability of some of the worst performing heaters.

6.2.9 Risk Assessment

In its Regulator Strategy, AusNet Services has detailed the risks associated with the Regulators and Heaters. Zincara has reviewed the analysis and based on its experience, agrees with the risks identified. Given the failure analysis and risk identification, AusNet Services has introduced a proactive replacement program for Welker Jet / Jet Stream and Grove regulators. With respect to the Heater risks, AusNet Services manages these through maintenance and replacement.

6.2.10 Welker Jet Regulator Replacement Program

AusNet Services introduced a replacement program in response to the trend of breakdowns associated with these regulators. Most of the faults relate to leaking hydraulic fluid which is the operating medium for these regulators. If the leak is large enough then hydraulic pressure will drop, compromising the regulators ability to reduce the pressure of the gas stream, resulting in regulator failure and the potential for over pressure in the downstream pipelines. Failures occurring at the “bung” are also typical, resulting in hydraulic pressure loss and rendering the regulator unable to reduce the pressure of the gas stream.

A review of these failures has found that the causes include changes of flow and inlet pressure characteristics through greater fluctuation of inlet pressure and flow demand. Also a reduced strength of the bungs with changed manufacturing process for the spare parts.

With the introduction of the regulator replacement program using an alternate regulator that functions more appropriately to current conditions, AusNet Services has experienced reduced faults, improving the safety of the sites and reduced operational expense required to attend reoccurring faults.

AusNet Services proposes to replace these regulators with Gorter R100 and the Pietro Fiorentini Reflux regulators. These are designed to handle large pressure reductions and have exceptional turn down when dealing with large fluctuations in flow and inlet pressure. These regulators have a proven reliability on both AusNet Services' network and gas networks around the world. For smaller capacity city gate sites Axial Flow type regulators are installed, with the Pietro Fiorentini Apperflux also suitable.

Given that Zincara concurs with the risk assessment and that the ongoing program was introduced in response to a breakdown, Zincara considers the project to be prudent.

As detailed in Table 6 of the Regulator Strategy document, AusNet Services proposes to replace the Welker Jet / Jet Stream regulators at [redacted] city gate sites at a cost of [redacted], and x city gate site ([redacted]) at a cost of [redacted], giving a total program cost of $1.55 million. However, as shown in Table 5 of the Regulator Strategy document, the total cost of this project is only shown as $1.15 million. The table below shows the difference.

Table 42: Welker Jet Regulator Replacement ($000, 2016, direct)

Welker Jet Regulator upgrade	2018	2019	2020	2021	2022	Total
Table 5 - Regulator Strategy	400	400	350	-	-	1,150
Table 6 - Regulator Strategy	400	400	400	350	-	1,550

Source: Network Regulator Strategy

Zincara believes it is most likely to be an error in Table 5.

6.2.11 Grove Regulator Replacement Program

Grove regulators are still operating at 3 city gate sites and many field regulator sites. Grove regulators were installed as far back as early 1970s and are experiencing reliability issues. Further, the regulators are now obsolete and no longer supported by the manufacturer for spare parts. AusNet Services says that spare parts have a limited shelf life.

Failures with Grove regulators include failure to hold the required outlet pressure due to deterioration of the units, in particular the "sleeve" which maintains pressure control. The use of substandard spare parts increases the likelihood of further regulator failures.

AusNet Services' proposal is to continue regulator replacement at all identified city gate and field regulators with a HP outlet. AusNet Services proposes to replace these regulators with Axial Flow regulators or Pietro Fiorentini Apperflux regulators. Modifications are also required to the existing pipework.

While Grove regulators are also installed at District Regulators (HP/MP to LP), they are not included in this program as the District regulators are being decommissioned as part of the

LP mains replacement program. The replacement program for I&C sites is part of the separate Regulator (Customer) Strategy.

During the next AA period, AusNet Services proposes to replace the Grove regulators at the 3 remaining city gate sites at a cost of [redacted], and [redacted] field regulator sites at a cost of [redacted], giving a total program cost of $3.07 million ($2016, direct).

Given that this is an ongoing program and that there have been a number of reliability issues, Zincara considers the project to be prudent.

6.2.12 Heater Replacement Program

AusNet Services has categorised the heater replacement program, based on the drivers for replacement:

- Reliability and capacity;
- Change in risk profile; and
- New heater installations

Reliability

Bacchus Marsh and Forsyth Road heaters have been identified for replacement based on historical performance and heater design not meeting the future capacity needs of the network. Heater rebuilds of certain sections of the heater is required at Lara, Sydenham and Lancefield to increase the reliability of the heaters.

Bacchus Marsh is currently operating an electric heat tracing heater. However, the elements have been shorting out one by one effectively reducing the maximum heating capacity of the site. At the rate of failure being experienced, the heater will be incapable of meeting the required heating capacity by 2020. It is proposed to replace the heater with a heat exchanger type heater. Forecast capex is [redacted] ($2016, direct).

Forsyth Road heater has become prone to breakdowns associated with pilot light failure. The forecasted growth associated with the Werribee network also results in the heater not being able to meet the capacity demand. It is proposed to replace the heater with a water bath heater. Forecast capex is [redacted] ($2016, direct).

Lancefield heater is a heat exchanger type, with the main issue being that it overheats the gas when the gas flow is low. The heater detects this as high gas pressure and locks out the heater operation as a safety mechanism, requiring a maintenance crew to attend site, check operation and reset. Re-build works include replacing a three way valve and modifying the program logic. Forecast capex is [redacted] ($2016, direct).

Lara and Sydenham heaters are old water bath and heat exchanger types respectively. They experience pilot light failures, requiring maintenance crews to attend site, check operation and relight the pilot. It is proposed to replace the gas train and burner of the heaters. Forecast capex is [redacted] ($2016, direct) for each heater. Given the reliability issues of the above heaters, Zincara considers it prudent to have them replaced.

Change of temperature profile

Due to the introduction of the APA compressor station at Winchelsea, the APA network operation has changed, resulting in the potential for some city gates to see maximum inlet pressure of 10.2MPa rather than the typical design of 7.4MPa. This impacts the temperature affect which can potentially drop to -50^{0}C at the outlet of the city gates and therefore has a material impact on the risk profile. Wyndham Vale and Colac city gates have been identified as being impacted by this changed profile. It is proposed to replace the existing heaters with new water bath heater with redundant burner systems. Forecast capex is [redacted] ($2016, direct) for each heater.

Zincara notes the change in the temperature profile and the effects on the existing heaters. As such, Zincara considers it prudent to have the heaters replaced.

New Heater installation

Ballan and Wallace city gates do not currently have heaters. These sites have minimal flow rates, meaning risks of low temperatures are not as apparent. However, there are risks of ice formation on the inside of instrument tubing and pilot regulators. It is proposed to install Vortex type heaters which will only heat the instrument lines. They require minimal modifications to the city gate but need fuel supplies. These heaters also require minimal maintenance compared to a water bath heater or heat exchanger. Forecast capex is [redacted] ($2016, direct) each.

Zincara is aware of the issues relating to ice formatting on control systems and as such considers the installation of the heaters to be prudent.

6.2.13 City Gate Lighting Installation Program

In order to facilitate any maintenance works at night (usually in response to failures), AusNet Services is proposing to install lighting for sites operating with a maximum inlet pressure of 10.2MPa. These sites are selected due to the risks associated with failures requiring shutdown should outlet temperatures fall below -30^{0}C. The program will facilitate maintenance works at night, reducing the risk of brittle failures on the networks and lose of supply to customers.

It is proposed to install lighting at 5 city gate sites, consisting of light pole in the vicinity of the heater control panel and a light mounted to the kiosk in front of the entrance. These lights would be located outside of the hazardous areas so do not need to be rated for use in hazardous zones. Forecast capex is [redacted] ($2016, direct) per site.

Zincara recognises the safety issues relating to night work and as such considers the project to be prudent.

6.2.14 Miscellaneous Network Regulator Works

While not included in AusNet Services' Network Regulator Strategy document, the Capex Model shows an annual allowance for miscellaneous network regulator capital works. Following a request for information from the AER, AusNet Services provided a response (IR #18) that provided some details of the program. This work involves minor asset

replacements at city gate sites that are identified from maintenance operations or faults that occur on site and are of a relatively urgent nature to complete.

AusNet Services has provided some examples of the work such as the reactive replacement of a water bath heater coil which was deemed to be unserviceable during a routine maintenance inspection and required replacement (Cobram City Gate). Also, during a routine maintenance inspection on the regulators at Sunbury city gate there were low flows between the primary and secondary regulators with the primary regulator unable to maintain a constant pressure set-point. The miscellaneous capex was used to change the way the regulators were controlled through the replacement of the regulators' pilot controllers.

AusNet Services has proposed a provision of approximately $150,000 ($2016, direct) per annum, for the next AA period, which is in line with AusNet Services' expenditure during the current AA period.

Based on its experience, Zincara acknowledges that there will be reactive minor works required to effectively maintain network regulator sets. The annual forecast provision is in line with historic actuals. Given the importance of maintaining the effective operation of network regulating assets, Zincara considers the work to be prudent and the provision to be cost efficient.

6.2.15 Conclusion

Following review and analysis of the various works proposed by AusNet Services for the next AA period, Zincara considers the identification of the equipment to be replaced is targeted and prudent.

In Section 6.4.3 of the AAI, AusNet Services had detailed its "project cost estimates and unit rates" methodology which it has applied to all of its projects. Zincara had reviewed the application of the methodology for other projects (e.g. mains replacement etc.) and had accepted the costs for the projects. Whilst there is no information on the unit costs provided for these projects, Zincara believes that having accepted the cost for other projects using the same methodology, there is no reason to consider that the application of this methodology for these projects will lead to a different outcome. As such, Zincara considers the cost to be efficient.

Note: With respect to the Welker Jet Regulator replacement program, Zincara notes that there is a discrepancy between the capex shown in the summary table and the detailed information later in AusNet Services' Regulator Strategy document (refer: Table 5 (summary) and Table 6 (detailed)). The detailed table includes capex of $350,000 in 2021 (replacing two units) which is omitted in the summary table. Zincara believes that there is an error in Table 5 (summary).

6.3 CUSTOMER REGULATORS

A customer regulator is a regulator that reduces the network pressure to a gas pressure required for a domestic or industrial/commercial customer. The table below shows consumer regulator replacement programs for domestic and small I&C regulators

Table 43: Consumer Regulators Strategy - Capex ($'000, 2017, nominal)

Consumer Regulators	2018	2019	2020	2021	2022	Total
I&C '298'	261	185	387	265	267	1,365
Proactive Domestic	1,041	1,025	975	887	1,052	4,980
Miscellaneous I&C	205	206	207	208	209	1,034
Reactive Domestic	1,038	1,073	1,110	1,151	1,194	5,566
Total Consumer Regulators	**2,545**	**2,499**	**2,679**	**2,511**	**2,722**	**12,945**

(Source: Capex Model and IR #18); rounding; real 2017 dollars including labour escalation

AusNet Services' Consumer Regulators Strategy outlines programs for regulator replacements based on asset performance (in particular leakage rates) and obsolescence. In addition, the Capex Model includes other forecasts relating to Consumer Regulators, however no reference is made in the Strategy document to justify these ad-hoc programs.

AusNet Services has approximately 646,500 domestic and 17,000 Industrial and Commercial connection points, with each containing a metering unit accompanying the regulator unit.

6.3.1 Industrial / Commercial regulator stations

Industrial and Commercial (I&C) regulators supply varying outlet pressure ranges from 1.1kPa up to 100kPa depending on the customer's requirements and system supply pressure capacity. An I&C meter installation can be either single regulator run or dual regulator run depending on the customer's reliance on a continuous gas supply and the impact an outage will have on their process.

Larger meter-regulator installations classified as "system operations" units have asset related data recorded in AusNet's asset database. Approximately 13% of I&C regulators are classified as system operations units. These regulators are subject to a preventative maintenance program involving a 6 monthly Operational Check and 12 monthly Full Operational Check. A full overhaul/upgrade is completed every 6 years or 10 years depending on the type of asset, to maintain the safety and integrity of the station through upgrading degraded components, undertaking performance tests, recalibrating set points and touching up paintwork where required. The program ensures that fault and leak levels are maintained at acceptable levels.

In its Consumer Regulator Strategy (ref: Figure 9), AusNet Services shows a summary of fault callouts for the period September 2013-April 2015. There are an average of 5 fault callouts per month. However, there is no clear trend in the nature of faults and the type of equipment on which they occur. AusNet Services notes that of the 150 fault callouts to I&C sites, only 19 were attributed to breakdown of a regulator unit. Valves and meters together

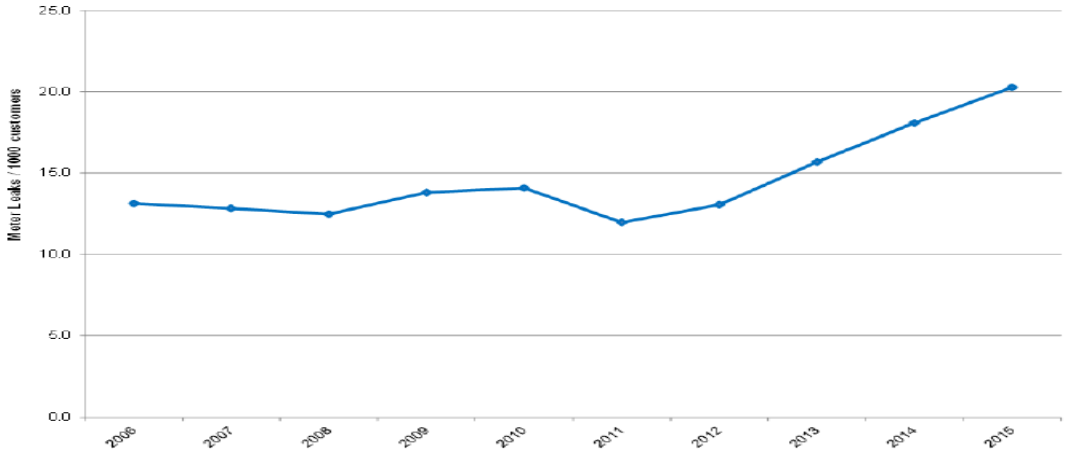
account for more than half of the faults at these sites. The nature of the fault in 70% of the cases is attributed to a leak. Regulator specific faults account for just 13% of breakdowns suggesting that they are generally reliable.

6.3.2 Domestic Regulators

Domestic regulating units supply residential customers (Tariff V). The standard metering pressure for a domestic customer is 1.1kPa for low and medium pressure services, and 2.75kPa for high pressure services. Installations can range from a single regulator-meter to multiple regulator-meters in a stack that supply multiple apartment units. Unlike meters, AusNet Services does not record data associated with domestic regulators and hence the age profile of these regulators is not known.

For these units a "meter" leak is classified as a leak on the gas meter, valve, regulator or meter inlet and these leaks account for an average 70% of all leaks on the gas network, with the remaining 25% attributed to mains and services assets. A measure of performance of these assets is the number of recorded "domestic meter leaks" per 1000 customers, however the measure does not differentiate between leaks that occurred on the meter or attached regulator.

Figure 8: Domestic Meter Leaks per 1000 customers



(Source: Consumer Regulators Strategy: Figure 11)

The above graph shows an increasing trend, particularly since 2012. At the end of 2015, the leakage rate was about 20 leaks/1000 customers. AusNet Services' analysis shows that the increasing leakage rate trend correlates with the increasing failure rates of domestic regulators, with about 91% of leaks occurring on a component of the regulator. In 60% of these cases the regulator had to be replaced. The remaining regulator leaks were due to a leaking joint.

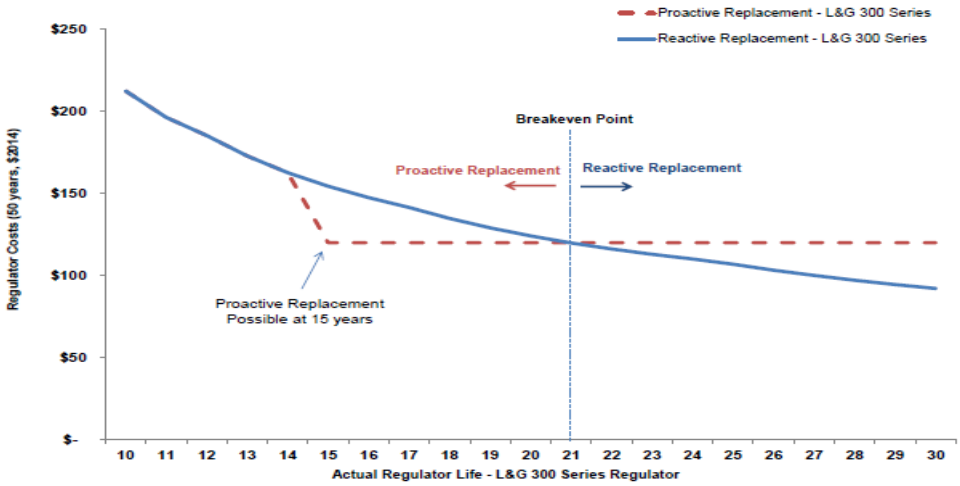
6.3.3 Risk Assessment

The Consumer Regulators Strategy (ref: section 3) provides a description of the risks associated with the operation of domestic and I&C regulators and the consequence associated with regulator failures. Zincara has reviewed the analysis and based on its experience, agrees with the risks identified.

6.3.4 Domestic and Small I&C Regulators Replacement Program

Historically, domestic regulators have not been subject to planned maintenance and have only been replaced when they are faulty. However, the increasing leakage rate suggests that this historical approach does not sufficiently maintain the safety of the network. AusNet Services has evaluated a revised strategy whereby the regulator is changed concurrently with the meter replacement program. This approach would significantly decrease the labour component of the regulator change as only a small incremental labour cost would be incurred. AusNet Services' comparison analysis shows that the labour component would be [redacted] for a proactive program versus [redacted] for a reactive replacement program. The following figure shows a comparison between the operational costs of implementing a regulator replacement program in conjunction with the meter replacement program and continuing with reactive replacement.

Figure 9: Modelled Operational Cost Comparison – Reactive v Proactive Replacement



(Source: Consumer Regulator Strategy: Figure 12)

The figure shows that a proactive regulator replacement program in conjunction with the meter replacement program is cost effective between 15 to 21 years. Both meters and regulators have a design life of 15 years, however, the meter replacement program is based on end-of-life primarily determined by meter accuracy. Typically, meter testing shows that they need to be replaced within the range of 15 to 21 years so the proactive regulator replacement program in conjunction with meter replacement would appear to be economic.

AusNet Services says that "*a program involving replacement of regulators at the time the meter is replaced will result in economic replacement of most regulators. The program should result in most regulators meeting or exceeding their design life, reduce the number of gas leaks and arrest the increasing gas leak trend.*"

On that basis, AusNet Services proposes a strategy whereby:

- Domestic regulators are replaced at the same time as the meter; and
- Continue with no scheduled maintenance on domestic regulators.

With respect to material cost of the regulator, AusNet Services has proposed a Landis & Gyr 300 series regulator as the replacement. AusNet Services advised in its response (IR #18) that it is in negotiation for a new contract commencing during [redacted] and as such it doesn't have a price, however, similar regulators are around [redacted] each.

The actual volume of regulator replacements would align with the domestic meter replacement program, which in turn is based on the time-expired meter testing outcomes as described in AusNet Services' Meter Management Strategy. AusNet Services' Capex Model forecasts the volume of regulator replacements as [redacted], which does not directly align with the Meter Management Strategy. However, given the fact that there is some uncertainty until meter testing is undertaken, the volume is reasonable. AusNet Services has forecast capex of $4.98 million (nominal) over the next AA period.

Following assessment of AusNet Services' Regulator Strategy covering leakage trends and proposed revised strategy, Zincara considers the approach to be prudent and the costs efficient, when undertaken as part of the meter replacement program. However, as this is a new strategy, Zincara recommends that AusNet Services monitors its program and leakage performance, to determine its effectiveness in reducing leakage rates and ongoing cost efficiencies are being realised. The program should be reassessed during the following AA review to determine whether it continues to be prudent and cost efficient. It is also noted that this program, running in parallel with the ongoing reactive domestic regulator program (estimated volume in excess of approximately 67,000) would see over 190,000 regulators changed during the next AA period, which is approximately 30% of the total number of domestic regulators.

6.3.5 I&C '298' type regulator replacement

The Fisher 298 regulators are a higher capacity regulator typically installed on I&C installations. These regulators are now obsolete, with spare parts required for 6-yearly maintenance, increasingly more difficult and expensive to source. As such AusNet Services proposes a replacement program using a modern equivalent, Pietro Fiorentini 'Norval' regulator to prevent increasing maintenance costs over the long term. This replacement is a direct bolt-on for the Fisher 298 regulator. AusNet Services proposes that the selected sites would be based on the schedule of sites planned for full maintenance, to achieve cost efficiencies. It also says that the nominated replacement regulator is more cost effective to maintain ($452pa compared with $2,467pa).

In its Capex Model, AusNet Services forecasts a total of [redacted] regulators to be replaced during the next AA period at a unit rate around [redacted].

On the basis that the Fisher 298 regulators are now obsolete and spare parts increasingly difficult to source, Zincara considers the works to be prudent. In Section 6.4.3 of the AAI, AusNet Services had detailed its "project cost estimates and unit rates" methodology which it has applied to all of its projects. Zincara had reviewed the application of the methodology for other projects (e.g. mains replacement etc.) and had accepted the costs for the projects.

Whilst there is no specific information on the unit cost provided for these projects, Zincara believes that having accepted the cost for other projects using the same methodology, there is no reason to consider that the application of this methodology for these projects will lead to a different outcome. As such, Zincara considers the cost to be efficient.

6.3.6 Miscellaneous I&C Works

I&C regulators occasionally experience failures which necessitates replacement of low value capital items, or have been identified through risk assessment as requiring urgent replacement. As part of an ongoing program, AusNet Services says that replacement of items must meet the following criteria:

- Replacement – replacement of an existing asset only
- Low capital value – less than $20,000
- Reactive in nature – as a result of failure of the existing asset or identified as requiring urgent replacement through risk assessment.

AusNet Services lists examples of equipment that could be included:

- Mechanical protection bollards
- Enclosures
- Pipe supports, valves etc
- Actuators
- Auxiliary equipment

In response to a request from the AER for further information AusNet Services says in its response (IR #18) that there is no historical data available for this work program, which it believes may be caused by contractors not coding the relevant costs to this specific program. By way of example of the type of works carried out under "Miscellaneous I&C Works", AusNet Services has provided a sample business case. The business case is effectively a capex pre-approval for the project owner (Manager of Engineering – Gas Networks) covering minor works, less than $20,000, and reactive in nature.

Based on its experience, Zincara acknowledges that there will be reactive minor works required to effectively maintain I&C meter sets. As noted above, AusNet Services cannot provide any supporting information as to the ongoing level of activity during the current period which would typically be required as a basis in assessing the forecast for the next AA period. However, based on its experience, Zincara considers the work to be prudent and the cost provision reasonable.

6.3.7 Reactive Domestic Regulator Replacements

In its Capex model, AusNet Services shows "customer regulators - ad-hoc" (work activity 3014), comprising "miscellaneous work" and "domestic regulators". In its "Appendix 6F: Consumer Regulators Strategy" there is mention of "miscellaneous I&C works" (section 4.2.3) but not domestic regulators. Following a request from the AER for further information, AusNet Services' response (IR #18) provided some clarification, noting that domestic regulators capex relates to reactive domestic regulator replacement and miscellaneous relates to minor reactive I&C regulator works. Miscellaneous I&C works is covered this report in Section 6.3.6, above.

AusNet Services provided the following table showing the number of domestic regulators replaced on a reactive basis in the current AA period. The table shows that the volume of domestic regulators replaced on a reactive basis has been increasing sharply. While the

current period average is 11,284 per year, AusNet Services has forecast a total of [redacted] over the next AA period (average of [redacted] per year), reflective its expectation that the increasing trend will continue. Given the replacements during the current period Zincara considers that the forecast volume is reasonable.

Table 6: Domestic Regulators – Reactive Replacement - Volume

Year	Regulators Replaced - volume
2013	6,269
2014	8,720
2015	12,342
2016	17,806

(Source: IR #18: Q2); * Forecast as shown in Capex Model

The forecast unit rate of approximately [redacted] is in line with the current period and gives a total forecast capex of $5.566 million (nominal). Replacement of faulty regulators is required in order to maintain supply to customers and on that basis Zincara considers this program to be prudent and the costs efficient.

6.3.8 Conclusion

AusNet Services' Consumer Regulators Strategy outlines three programs. Additionally the Capex Model shows ad-hoc / miscellaneous regulator replacement.

Domestic regulator replacement – As a result of an increasing leakage rate trend, AusNet Services proposes a program to replace regulators in conjunction with its meter replacement program. Its analysis suggests it is economic to replace regulators using such a program if the regulators are between 15 years to 21 years old (design life of 15 years). While volumes would be contingent on the meter replacement program, for estimating purposes the Capex Model shows [redacted] regulators to be replaced with capex of $4.980 million (nominal) for the next AA period.

Following assessment of AusNet Services' Regulator Strategy covering leakage trends and proposed revised strategy, Zincara considers the approach to be prudent and the costs efficient. However, as this is a new strategy, with significant forecast expenditure over $5 million, Zincara believes that AusNet Services will need to closely monitor its program and its leakage performance, to determine its effectiveness in reducing leakage rates and whether cost efficiencies are being realised. The program should be reassessed during the following AA review to determine whether it continues to be prudent and cost efficient.

I&C '298' type regulator replacement - On the basis that the Fisher 298 regulators are now obsolete and spare parts increasingly difficult to source, Zincara considers the ongoing works to be prudent. The Capex Model forecasts [redacted] regulators to be replaced at a unit rate around [redacted]. In section 6.4.3 of the AAI, AusNet Services had detailed its "project cost estimates and unit rates" methodology which it has applied to all of its projects.

Zincara had reviewed the application of the methodology for other projects (e.g. mains replacement etc.) and had accepted the costs for the projects. Whilst there is no specific information on the unit cost provided for these projects, Zincara believes that having accepted the cost for other projects using the same methodology, there is no reason to

consider that the application of this methodology for these projects will lead to a different outcome. As such, Zincara considers the cost to be efficient.

Miscellaneous I&C works program - Based on its experience, Zincara acknowledges that there will be reactive minor works required to effectively maintain I&C meter sets. As noted this report (see section 1.3.6) above, AusNet Services cannot provide any supporting information as to the ongoing level of activity during the current period which would typically be required as a basis in assessing the forecast for the next AA period. However, based on its experience, Zincara considers the work to be prudent and the cost provision of $1.034 million (nominal) for the next AA period to be reasonable.

Reactive domestic regulator replacements - AusNet has forecast a total of [redacted] regulator replacements over the next AA period (average of [redacted] per year), which is reflective of its expectation that the increasing trend will continue. Given the replacements during the current period Zincara considers that the forecast volume is reasonable. The forecast unit rate of approximately [redacted] is in line with the current period and gives a total forecast capex of $5.566 million (nominal). Replacement of faulty regulators is required in order to maintain supply to customers and on that basis Zincara considers this program to be prudent and the costs efficient.

7. METER REPLACEMENT

7.1 INTRODUCTION

The following table shows AusNet Services' proposed capex for Meter Replacement.

Table 44: Meter Replacement Programs ($000, 2016, direct)

	2018	2019	2020	2021	2022	Total
In-Test / FLE	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	1,375
Domestic T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	19,265
I&C T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	3,303
No Access*	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	1,150
Reactive	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	4,850
Total	**6,092**	**6,488**	**5,875**	**5,398**	**6,089**	**29,942**

(Source: Meter Management Strategy: Tables 1, *20); * includes 'targeted no access' removal

AusNet Services' meter replacement strategy includes the following annual programs:

- In-service compliance testing of domestic meters;
- Time expired meter replacement programs to remove domestic, and I&C meters from the field at the end of their useful life (based on accuracy results);
- 'No access' meter replacement program to remove meters that have remained in the field beyond their in-service compliance period due to access restrictions;
- Reactive meter replacement to replace meters that are faulty or damaged.

AusNet Services' proposed program forecasts the following volumes (smoothed) along with its unit rates for the next AA period.

Table 45: Meter Replacement Volume (smoothed) and Unit Rates ($2016, direct)

Meter Replacement	2018	2019	2020	2021	2022	Total	Unit Rate
In-Test / FLE	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Domestic T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
I&C T/E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
No Access	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Reactive	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Meter Management Strategy: Table 1; * included targeted no access removal & averaged unit rate)

7.2 VOLUME ANALYSIS

AusNet Services forecasts the volume of meters to be replaced as part of its meter replacement program, through analysis of its annual programs:

7.2.1 In-service compliance testing of domestic meters

Annual compliance testing is carried out on all domestic meter families. It does not include meters above 25m^3 per hour. AusNet Services notes that there are some meter types which are excluded from in-service testing and are removed when their initial compliance period has been reached. AusNet Services' Field Life Extension (FLE) testing is in accordance with AS/NZS 4944:2006 and in line with the Victorian gas distribution business industry practice.

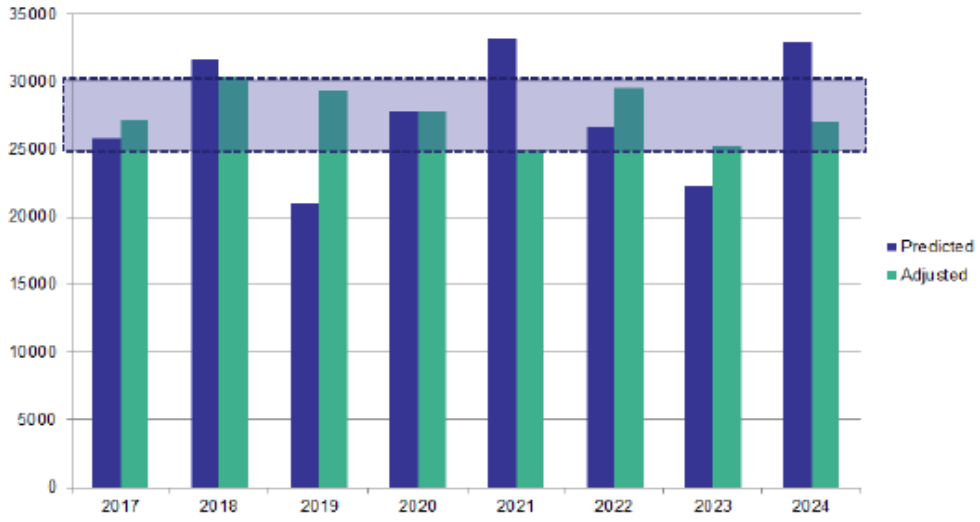
AusNet Services has developed its forecast volumes based on historical performance and established trends for specific meter types. For the next AA period AusNet Services forecasts 7,372 meters to be replaced.

7.2.2 Domestic meter replacement (Time Expired)

AusNet Services' annual replacement program replaces meters at the end of their compliance period with new meters, rather than refurbished meters (Zincara discusses this approach later in this report). Meter families due for removal have either failed their FLE testing or were not included within the testing process. During the current AA period, AusNet Services' program averaged around 26,500 replacements per year.

Results from FLE testing directly influence the volume of meters requiring replacement. Assumptions have been based on historical performance of meter families and FLE test results.

Figure 10: Smoothed v Unsmoothed Domestic Meter Replacement Profile



(Source: Gas Meter Management Strategy: Figure 8)

The "predicted" forecast volumes show a degree of variability across the next AA period, with the average replacement volume being approximately 28,000 per year. As shown in the above figure, the annual program ranges from around 21,000 up to 33,000. AusNet Services says that this variability places significant pressure on program delivery and unit costs. It considers that a sustainable replacement rate is around 25,000 to 30,000 per year. The above figure shows this band and the adjusted annual volumes. This smoothing is achieved by bringing forward the replacement of meter families before the end of their deemed useful life. For the next AA period AusNet Services forecasts 142,044 meters to be replaced.

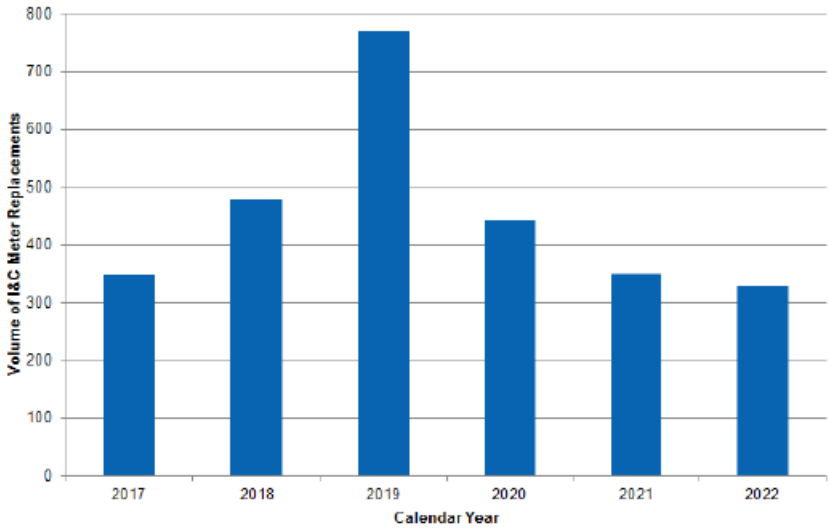
Based on its experience, Zincara considers that the assumptions used in developing the forecast volumes and the smoothing of the program to be prudent and cost efficient.

7.2.3 I&C meter replacement

I&C meters are not subject to in-service compliance testing and field life extension, with the exception of AL425 meter type. All I&C meters are replaced at the end of their initial in-service compliance period (typically 13 or 15 years). During the current AA period, AusNet Services' program averaged around 650 removals per year.

For I&C meter families the replacement volumes are not exposed to the same uncertainty as the domestic program. The large spike in 2019, is due to the forecast failure of the AL425 1997 meter family (497 meters). AusNet Services says that it considered smoothing the annual volumes, but the AL425 meters are small capacity and relatively low replacement cost, which will not materially affect labour and material availability. The volumes can be managed within AusNet Services' delivery capabilities. For the next AA period AusNet Services forecasts [redacted] meters to be replaced.

Figure 11: Annual I&C Meter Replacement



(Source: Gas Meter Management Strategy: Figure 9)

Based on its experience, Zincara considers that the assumptions used in developing the forecast volumes to be prudent and cost efficient.

7.2.4 'No access' meter replacement

These meters are those which remain in the field beyond their in-service compliance period, due to inability to access the meter. AusNet Services has a range of initiatives to remove these meters. AusNet Services introduced this program in 2012, in order to reduce the number of no access meters remaining in the field, which it estimates to be around 3,746 meters.

AusNet Services considers its historical 'no access' performance in developing its forecast for this program. Typically it has 2-3% no access of its respective time expired replacement program, and has applied a rate of 2.5% for the next AA period. In addition, there are 1,453 meters from earlier programs that are still in the field. AusNet Services is proposing a targeted program in 2019 to remove the 1,453 meters, using a separate tendered program to all other meter replacement programs which are currently delivered by its primary service provider.

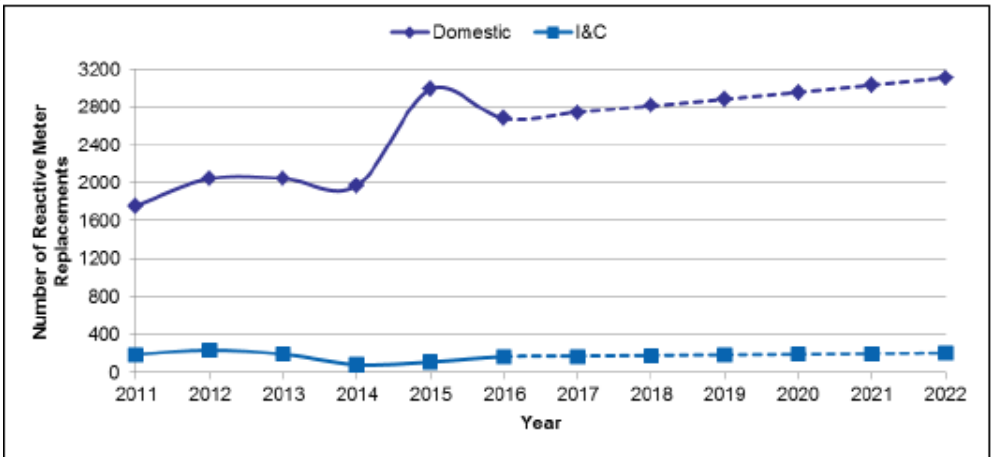
AusNet Services forecasts [redacted] meters in its no access program and a further [redacted] meters in the targeted program. Zincara notes that the volume total of [redacted] no access meters was not reflected in AusNet Services' Strategy summary table 1, but is shown in its detailed table 20. However, the capex is consistent in all associated tables. Zincara considers that the program to remove these overdue meters is prudent, given the fact that their respective meter families have previously failed the accuracy testing and condition of the meters is unknown due to lack of access. The approach of using a targeted program for the older no access meters is also prudent.

7.2.5 Reactive meter replacement

This program covers all failed or faulty meter types, often identified by the public. AusNet Services experienced a marked increase during 2015, compared with previous years, largely due to an increase in damaged meters and inadequate size. AusNet Services expects this trend to continue due to increased population density and increased load from gas appliances.

The volume of reactive meter replacements is based on historical performance, recent trend analysis and anticipated growth.

Figure 12: Forecast meter faults requiring reactive replacement



(Source: Gas Meter Management Strategy: Figure 10)

Based on the above figure, AusNet Services is forecasting a total of [redacted] domestic meter replacements and [redacted] I&C meter replacements. Zincara considers that the use of historical performance in forecasting the volumes for the next AA period is reasonable.

7.3 UNIT RATES ANALYSIS

AusNet Services has calculated its unit rates using a bottom-up approach for each program type. The unit rates comprise of the following:

- Internal labour: AusNet Services and Select Solutions project management costs;
- External labour (contractors): field replacement of meters, logistics, transportation and associated works (i.e. after hours refix, meter relocations); and
- Materials: meters and associated fittings

The following table summarises the unit rates for the programs, with the Reactive replacement program split into domestic and I&C meters for analysis.

Table 46: Meter Replacement Programs Unit Rates ($2016, direct)

Program	Volume	Material	Labour Internal	Labour External	Total
In-service compliance	7,372	[redacted]	[redacted]	[redacted]	[redacted]
Domestic time expired	142,044	[redacted]	[redacted]	[redacted]	[redacted]
I&C time expired	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
No access (including targeted)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Reactive replacement - Domestic	14,795	[redacted]	[redacted]	[redacted]	[redacted]
Reactive replacement – I&C	962	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Zincara analysis; Meter Management Strategy tables including * Table 20; Capex Model)

With reference to the unit rates contained in AusNet Services' Capex Model, Zincara noted that for In-service compliance testing, the unit rate of [redacted] for the next AA period is approximately 16% below that for 2017. Similarly, the unit rate for I&C time expired program is 9% below that for 2017, reflecting the variety of meter types and their respective unit rates. All other unit rates were in line with 2017 unit rates.

The following table provides a summary of the next AA period forecast for Domestic and I&C meter replacements, including total volumes, total capex and average unit rates.

Table 47: Domestic and I&C summary ($2016, direct)

Summary Programs	Volume	Capex	Unit Rate
Domestic meter replacements	169,157	$25.3 million	[redacted]
I&C meter replacements	[redacted]	$4.6 million	[redacted]

(Source: Zincara analysis)

The significant variation in AusNet Services' meter replacement program is its decision to discontinue the use of meter refurbishment for domestic meters. AusNet Services' whole of life analysis and its potential impacts are discussed in the following section.

7.3.1 Refurbished meters

AusNet Services says[25] that it only uses refurbished meters at I&C sites, where the cost savings outweigh any additional whole of life costs associated with refurbished meters. All domestic meters are disposed of and not refurbished once removed from the field, and are replaced with new meters. This change in strategy is driven by results from whole of life (50 years) cost analysis comparing the cost of a new and refurbished meter over several replacement cycles. The analysis considered the cost of replacement, administrative activities and field life extension testing. AusNet Services says higher costs associated with refurbished meters are attributed to the following:

- Historic performance of refurbished meters. On average refurbished meters have failed after during field life extension testing after 18 years in the field, which is lower than for new meters. AusNet also says that refurbishment rates have been as low as 30% ;

- Increasing cost to refurbished meters. AusNet says that the cost of these meters is expected to increase significantly over the next five year period. Administrative and handling costs add to the overall refurbishment cost; and

- Supply risk. AusNet has a growing concern that manufacturers may reduce or stop completely refurbishment services. Also the new meter cost has decreased by 30% compared to 15% for refurbished meters.

Following a request for further analysis from the AER regarding refurbishment versus new meter replacements, AusNet Services[26] provided an NPV analysis including sensitivity analysis. The NPV analysis was performed over a 50 year whole of life which resulted in a new meter being least cost for replacement. Zincara's review of the analysis noted that at shorter periods the difference between the two options narrowed. FLE test results are also key in the analysis (earlier failure of the refurbished meter making the new meter option more preferable), as was the suitability of the meter for refurbishment. Based on the whole of life NPV analysis (50 years), there is merit in moving to new meters at replacement rather than refurbishment, however there are several variables and assumptions that can vary the analysis, including a shorter timeframe (say over 40 years) which can change the result in favour of refurbished meters.

Based on a review of AusNet Services' NPV assumptions and analysis, Zincara considers that with so many variables and assumptions, the outcome is inconclusive. It also notes that the two other Victorian businesses continue to favour the refurbishment of meters option, which has been a longstanding industry practice.

Zincara considers that there is a capex impact in the short term, and certainly during the next AA period, which increases the material costs of all programs where domestic meter replacements occur. The following scenario considers the next AA period only, to reflect the short term capex impacts of new versus refurbished meters for meter replacement. In doing

[25] Meter Management Strategy: section 5.1.2
[26] IR #1

so, Zincara acknowledges that the long term view of capex would result in an entirely different outcome. Using information from AusNet Services' NPV analysis:

- In 2015, NPV analysis showed that 55% of replacement meters were refurbished, 25% were higher cost U10s and 25% were new Email 750 and Email EDMI U8.

- Assuming the larger U10s continue to be required at the above rate (i.e. 25%), then using the NPV analysis data, the new meter average unit rate, with 10% mark up for future contracts, is [redacted]. The refurbished meters, with 15% mark up for future contracts, is [redacted].

- There are 169,157 domestic meters forecast for replacement during the next AA period.

Scenario: Refurbished meters cover 55% of replacements, with new meters covering 25% and U10s covering 25%. In simplistic terms, the capex impact is the difference in price of the refurbished versus new meters for 55% of the replacements (i.e. [redacted] unit rate difference for 93,036 meters), resulting in a capex impact of approximately [redacted] million for the next AA period. However, Zincara is aware that other businesses are continuing to use refurbished meters, achieving around 70% of refurbished meters being used in their meter replacement programs, or up to 25,000 refurbished meters per year. Zincara considers that cost savings as a result of the continuation of refurbishment meters for the next AA period is approximately $2.5 million.

7.4 CONCLUSION

Zincara considers that AusNet Services' Meter Replacement program has been well developed in accordance with good industry practice and in line with historical performance. Therefore Zincara considers that the programs are prudent, particularly noting efforts to target replacement of 'no access' meters. Given the issue as to the use of new or refurbished meters in the program Zincara does not consider the program cost efficient, at least for the next AA period. Zincara recommends that the forecast capex should be reduced by approximately $2.5 million.

7.5 DIGITAL METERING PROGRAM

AusNet Services has included a proposal to undertake a trial of remotely reading gas meters. AusNet Services[27] states that the program will analyse options to deploy smart gas metering and identify potential value in technology trial activities. The trial is proposed to be carried in three phases:

- Phase 1 – Analysis, includes feasibility study of options

- Phase 2 – Conduct Trial, includes digitising and enabling remote access to approximately 5,000 gas meters.

- Phase 3 – Trail Summary / Conclusion, includes detailed assessment, planning and development of rollout strategy for the subsequent GAAR period.

[27] Appendix 6K: Program of Works – Gas Digital metering

The trial is proposed to cover a single feed network and seek to recover all meter data via AMI data collection infrastructure.

Table 48: Digital Metering Trial ($000, 2016, direct)

	2018	2019	2020	2021	2022	Total
Digital Metering Trial			330	1,082	250	1,662
Trial Total , including ICT			660	2,164	500	3,324

(Source: Meter Management Strategy (pg 39); Program of Works – Gas Digital Metering: Table 1)

Following a request from the AER for additional information AusNet Services' response (IR #1) included a discussion document "Smart Gas Meter considerations and prospective trials". The paper covers a range of issues, including potential benefits. It notes that the market for smart gas metering is growing and countries such as the UK, Italy and the USA have significant programs in progress.

AusNet Services says that an initial trial would be very much a technology/product trial, which should consider several options to evaluate the best solution for each component and that it would also be prudent to evaluate any potential customer benefits.

Two trial locations are mentioned, with one potentially being the township of Diggers Rest, which has approximately 600 domestic meters. Alternatively, the trial could operate in SP AusNet's electrical distribution network and install secondary meters in series on the household side of the billable meter. The advantage being that no third party utilities would be required and it would not require the development of significant back office systems. A variation could involve engagement with Multinet and with its permission, upgrade its gas meters (if appropriate) with AusNet Services's retro-fit trial technology.

After evaluating AusNet Services' paper on technologies and metering issues, Zincara does not consider that information provided justifies a material capital expenditure of $3.3million. Zincara is of the view that a prudent service provider acting efficiently (NGR 97(1)(a)) could not justify spending $3.3million to assess potential customer benefits. Furthermore, Zincara does not believe that the expenditure falls under any of clauses in NGR 79(2). Zincara therefore does not consider the project prudent and efficient.

8. SCADA

8.1 INTRODUCTION

The information on different projects associated with SCADA are covered in AusNet Services' document titled Appendix 6I – Supervisory Control and Data Acquisition Strategy – 20161123 (referred to as Appendix 6I).

The SCADA projects that AusNet proposes for the forecast period are shown in the table below.

Table 49: SCADA Program (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Fringe RTU Installation / Relocation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
End of Life Replacement	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Common Earthing Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Slam Shut Indicator Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Pressure Transmitter Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cabinet Circuit Breakers	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Improved Data Capture and monitoring	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Expenditure	**$'000**	**379**	**330**	**300**	**300**	**358**	**1,667**

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

As can be seen from the table above, the costs for each line item are relatively small. Zincara has reviewed each line item and details of the analysis are provided in the sections below. All references regarding the responses from AusNet to the AER are contained in AusNet's document IR#11.

8.2 FRINGE RTU INSTALLATION/RELOCATION

AusNet Services says[28] that its program of installing RTU's is mainly completed so that the control room can monitor the network pressures at the extremities. However, AusNet Services is proposing to install additional RTU's, the cost and numbers are shown in the table below.

[28] Page 13 Appendix 6I

Table 50: Fringe RTU Installation (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Fringe RTU Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
RTU Relocation	$'000			[redacted]			
	Unit			[redacted]			
Total	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

In its response to the AER, AusNet says that the installation of the five fringe RTU's will complete its program of installing RTU's in its network. The repositioning of a RTU is to ensure that the RTU is at the true fringe of a network.

8.2.1 Conclusion

A RTU is generally installed on a fringe point in the network to monitor the pressure at that point. AusNet Services has identified a number of areas in country towns without RTU's and as such proposes to install 5 RTU's.

Installing RTU's to monitor fringe pressures is a common practice in the gas industry. It is used to monitor the pressure at the lowest pressure point in the distribution system and is also used for future planning of the network. As such, it is reasonable for AusNet Services to install additional RTU's in areas that it has identified that currently have no monitoring system.

The fringe point of a network may change over time due to uneven growth at parts of the network. In relation to the relocation of an RTU, it is therefore, not uncommon for an RTU to be relocated when it is no longer installed at the network fringe point. The proposal to relocate an RTU from its current site would seem to be reasonable.

Zincara therefore considers the program to be prudent.

In relation to the unit cost, AusNet Services provided details of the unit cost in its response to the AER's question. The unit cost consists of [redacted] labour, [redacted] for material with a further [redacted] for connecting the RTU to electricity. AusNet Services also advised that the relocation cost is mainly labour ([redacted]). Zincara considers the cost to be in the order of magnitude for installing an RTU and relocating an RTU. Zincara therefore considers the cost to be efficient.

8.3 END OF LIFE REPLACEMENT

The End of Life Replacement consists of three works program:

- Solar Array Replacement;
- PC-1 Decommissioning Works; and
- Temperature Transmitter Works

8.3.1 Solar Array Replacement

AusNet Services indicated that there are 17 sites on the network which are supplied with solar panels and backup batteries. There are 10 sites which are solar powered that have exceeded their effective live of 15 years.

In addition, AusNet Services also says the backup batteries are also deteriorating over time and eventually will not hold sufficient charge. It expects the backup batteries will reach the end-of-life during the forecast period. It is proposing that the batteries and some auxiliary equipment e.g. battery boxes will need to be upgraded in conjunction with the solar panels.

The cost of the upgrading and replacement is shown in the table below.

Table 51: Solar Array Replacement (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Solar array replacement	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Solar battery backup	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Battery Box	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Expenditure	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

8.3.1.1 Conclusion

Most of the literature indicates that the effective life of solar panels is in the order of 20 – 25 years. However, at this stage, there is minimum literature about what happens to solar panels after the effective life and to what extend the panels degrade. Given that the locations of the solar panels are in remote sites, it would be prudent to be conservative on the effective life of the solar panel. As such, it would be prudent to change the panels over after 15years. Given that the solar battery backup and battery box changeover are part of the solar array replacement, Zincara also considers these replacements are also prudent.

The cost for each changeover is [redacted], which consists of [redacted] for labour and [redacted] for material. Zincara believes that the labour and material costs are in the right order of magnitude and such the cost to be efficient.

The unit cost for the solar battery back-up is [redacted]. The unit cost for the battery box is approximately [redacted]. Given that the costs are not material. Zincara recommends accepting the costs as efficient.

8.3.2 PC-1 Decommissioning

AusNet Services indicated that it has 220 RTU's in its network that have Kingfisher PC-1 modules. The PC-1 module is a device that sends fault alarm data back to the master SCADA station. In mid-2014, Kingfisher advised that it would cease manufacture of the PC-1 module and replace it with a new model called CP-12.

AusNet Services proposes to replace a number of the PC-1 modules with CP-12 modules so that it can use the removed PC-1 modules as spares. It also says that the replacement of a PC-1 module will also require the replacement of the backplane.

The list of PC-1 modules to be replaced is provided in Appendix 8.2.2 of the Appendix 6I document. The cost and number to be replaced are shown in the table below.

Table 52: PC-1 Decommissioning (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
PC-1 Decommissioning	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Expenditure	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

In its response to the AER, AusNet Services advised that the number of PC-1 modules to be replaced is based on historical rate. In 2016, there were five faulty units and the average replacement rate prior to 2016 is between 3-4 units per annum.

8.3.2.1 Conclusion

Zincara is aware that Kingfisher has announced that it will no longer be manufacturing PC-1 modules and has nominated CP-12 as one of the options for its replacement. Zincara therefore considers that it is reasonable for AusNet Services to replace some of its PC-1 modules and use those as spare parts for the existing units. Zincara also considers basing the replacement rate on its historical numbers is a reasonable approach.

In its response to the AER, AusNet Services provided details of the cost breakdown and the assumptions used in estimating the costs. The labour cost of [redacted] includes the cost of updating the drawings and any project management cost. Zincara considers the cost to be within the range of such activity and as such considers the cost to be efficient.

8.3.1 Temperature Transmitter Replacement

AusNet Services advised that a number of the temperature transmitters at the city gates can no longer be kept in service or fail to comply with the AS2381.1[29]. These temperature transmitters were manufactured by Rosemount 20-30 years ago and are no longer compliant with IECEx[30]. As such, AusNet Services proposes to replace all Rosemount-type temperature transmitters with Yologawa YTA110.

The cost and number of units to be replaced are shown in the table below.

Table 53: Temperature Transmitter Replacement (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Temperature Transmitter Replacement	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Expenditure	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

[29] AS2381.1 – Electrical Equipment for explosive gas atmosphere.
[30] IECEx – International Electrotechnical Commission system for certification to standards relating to equipment for use in explosive atmospheres.

8.3.1.1 Conclusion

As the temperature transmitters no longer comply with AS2381.1, Zincara believes that it is prudent that they be replaced. The total cost of replacement is [redacted] with a unit replacement of [redacted]. Zincara believes that the cost is not material and as such, recommends that the cost should be accepted.

8.4 COMMON EARTHING INSTALLATION

AusNet Services advised that installation of a common earth grid is required in city gate sites as it dissipates most of the charge from different equipment and ensures that there is no potential difference between different equipment within a city gate compound. It identified a number of city gates that are not connected to a common earthing grid even though the individual equipment is earthed. AusNet Services proposes that as the fencing of the sites are upgraded, common earthing will also be installed.

The cost of the common earthing project is shown in the table below.

Table 54: Common Earthing Installation (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Common Earthing Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)
Note: The table has been revised from [redacted] units and the cost revised corresponding. In IR#11, AusNet advised that there was an error in the Strategy table and it should be [redacted] units per annum.

In its response to the AER, AusNet advised that during the current AA period, it had installed common earthing in the new city gates at Mt Cottrell, Winchelsea and Bannockburn. It had also indicated that as part of its security-fencing program, the fences at Forsyth Rd, Diggers Rest and Melton city gates were upgraded and connected to a common earth.

8.4.1 Conclusion

Zincara understands that any earthing system can be separately or commonly earthed as long as the system complies with AS/NZS 2067. The decision to use either system is at the discretion of the business. As such, Zincara considers that AusNet Services decision to have a common earth is considered to be reasonable and as such, the upgrade to the common earth in existing city gate to be prudent.

The cost of each installing a common earth as set out in the table above is [redacted]. AusNet advised that the cost is based on [redacted] for labour and [redacted] for material. Zincara considers the cost to be reasonable and as such efficient.

8.5 SLAM SHUT B INDICATOR INSTALLATION

A slam shut panel is installed at a city gate to mitigate against overpressure of the pipeline due to regulator failure. An indicator switch is installed on each slam shut panel to inform the control room if the slam shut panel has been activated and the position of the panel.

Each city gate has two regulator runs and slam shut panels are installed on the valves at each regulator run.

AusNet Services advised that [redacted] of the sites only have an indicator switch installed on the slam shut panel on one of the regulator runs and as such proposes to install an indicator switch on the other slam shut panel for the other regulator run.

The cost and number of the installation are shown in the table below.

Table 55: Slam Shut B Indicator Installation (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Slam Shut Indicator Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$'000**	[redacted]	[redacted]				[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

8.5.1 Conclusion

An indicator switch on a slam shut panel is required to give the Control Room advance warning of a regulator failure. Zincara believes that only one switch was installed in one of the regulator run because that regulator run was nominated the main run and the second run was considered to be a backup and as such does not require an indicator switch. However, Zincara is also aware that maintenance practice has changed and that switching between regulator runs is not uncommon. Zincara therefore considers it reasonable for AusNet Services to install indicator switches on the five city gate sites which have only an indicator switch on the slam shut panel for one regulator run.

The total cost of the project is [redacted] and the cost for installing per switch is approximately [redacted]. Zincara considers that the total cost is not material and recommends accepting the cost of the project.

8.6 PRESSURE TRANSMITTER INSTALLATION

AusNet Services proposes to install a pressure transmitter on each of its high volume customers supplied from the transmission system. The pressure transmitter will send an alarm to the Customer and Energy Operations Team (CEOT) should pressure downstream of the meter installation become too high. The CEOT can then dispatch a gas fitter to investigate the issue.

The cost and number of installations are shown in the table below.

Table 56: Pressure Transmitter Installations (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Pressure Transmitter Installation	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

In its response to the AER, AusNet clarified that all the data including pressures for Tariff D customers are transmitted to AEMO. AEMO would then advise CEOT of any alarms that need investigation and rectification.

AusNet also advised that in one situation, it had experienced a near miss at a Tariff D customer's premise. The primary regulator had failed and the secondary regulator was solely carrying out the pressure reduction. If this regulator had failed as well, the whole meter installation could have shut off the gas supply to the customer or cause an unsafe situation.

If there is a pressure switch between the primary and secondary regulator, AusNet will have an early warning of the primary regulator failure which it can then attend to before any other failure.

AusNet also advised that a Tariff D customer contributes to the cost of the installation during the initial connection to the customer. It is then AusNet's responsibility to ensure that the equipment is operating safely. As AusNet had not identified the need for the pressure switch initially, it is now incumbent on AusNet to install the switch without any further contribution by the customer.

8.6.1 Conclusion

Zincara is aware that the meter installation for a Tariff D customer has a number of failsafe devices. The scenario that AusNet described would have shut down the unit, cutting off the gas supply to the customer rather than causing an unsafe situation. However, the additional pressure switch will give AusNet an early warning of the potential failure which it could respond to, avoiding the shutdown of the unit. On that basis, Zincara considers the project to be prudent.

The unit cost of the installation is [redacted] consisting of [redacted] for labour and [redacted] for material. AusNet advised that it had used the same basis for its labour cost as installing a common earth (Section 8.4). Zincara considers the cost to be within the range of what it expects and as such recommends the cost to be efficient.

8.7 CABINET CIRCUIT BREAKERS

AusNet Services advised that there are SCADA RTU cabinets which require Residual Current Device (RCD) protection for the safety of the personnel working inside the SCADA cabinets. Without the RCD protection, personnel are susceptible to electric shocks. The list of units that require the RCD protection is provided in Appendix 8.6 of the Appendix 6I document.

The cost and number of units are shown in the table below.

Table 57: Cabinet Circuit Breakers (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Cabinet Circuit Breakers	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

8.7.1 Conclusion

Zincara is aware that it is good industry practice to install RCD protection in metal cabinets for the protection of the personnel working on site. Zincara therefore considers it reasonable for any site without such devices to be installed with RCD.

The total cost of the project is [redacted] with a unit cost of approximately [redacted]. Zincara recommends accepting the cost, as it is not material.

8.8 IMPROVED DATA CAPTURE AND MONITORING

As part of the annual winter testing program, chart recorders are installed at various points of the network and residential locations. The charts are collated at the end of the 2-week chart run and sent back to the Gas Network Planning team for analysis. The cost of carrying out this activity is [redacted] per annum.

AusNet Services advised that to improve its data from the winter testing program, it had installed 35 digital pressure recorders with GPRS (2G) telecommunication systems. However, Telstra had closed down the GPRS (2G) network rendering these units obsolete.

AusNet Services has successfully trialled new standalone digital data recorders and is now proposing to progressively roll the new chart recorders out.

The numbers and cost of the roll out are shown in the table below.

Table 58: Improved Data Capture and Monitoring (Real 2016)

Program	CY	2018	2019	2020	2021	2022	Total
Improved Data Capture and monitoring	$'000	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Unit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**$'000**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(Source: Appendix 6I Supervisory Control and Data Acquisition Strategy-20161123)

In its response to the AER, AusNet says that it had 100 paper chart recorders which are up to 50 years old. Many of these recorders are no longer operational and are only used for spare parts.

In 2016, AusNet bought 32 Chrystal data loggers which will be used for the 2017 winter testing. The additional 55 will bring the fleet of data loggers to 87. AusNet will revaluate its requirements in five years.

AusNet also advised that there is no potential opex savings as the cost of carrying out the winter testing remains the same.

8.8.1 Conclusion

Zincara is aware that the winter testing program is a key part in the planning and modelling of the network. This means that reliable and accurate data from the recorders, as part of the winter testing, is an important part of the network planning process.

AusNet had advised that the additional 55 is a replacement of its fleet, of which it had already purchased 32. The purchase is to replace its old chart recorders. Zincara therefore considers it prudent for AusNet to purchase digital recorders to provide such data.

The unit cost of [redacted] is based on a quote from the supplier of the Chrystal chart recorder. Zincara consider the cost to be efficient.

8.9 SUMMARY

The justifications for most of the projects range from equipment obsolesce to end of life replacement. In addition, there are RTUs that are no longer at the network pressure fringe location due to uneven increase of gas demand in the network. These RTUs have to be relocated to the true fringe locations.

AusNet had provided some cost make up for the projects and the assumptions behind the costs.

Zincara concurs that equipment have to be replaced if they are no longer supported or have reached their useful life. Zincara also accepts that RTUs have to be shifted to their true fringe locations in the network for effective network management. Zincara therefore considers the projects to be prudent.

In addition, Zincara accepts the costs of the projects based on the information provided by AusNet Services and as such recommends that the projects be considered efficient.

9. COMMUNICATIONS SYSTEMS

9.1 INTRODUCTION

The information on different projects associated with SCADA are covered in AusNet Services' document titled Appendix 6L – Communication Systems Strategy – 20161115 (referred to as Appendix 6L).

AusNet Services' gas distribution communications assets are located in and cover parts of Western Victoria. There are communication related assets at 230 sites as shown in the table below.

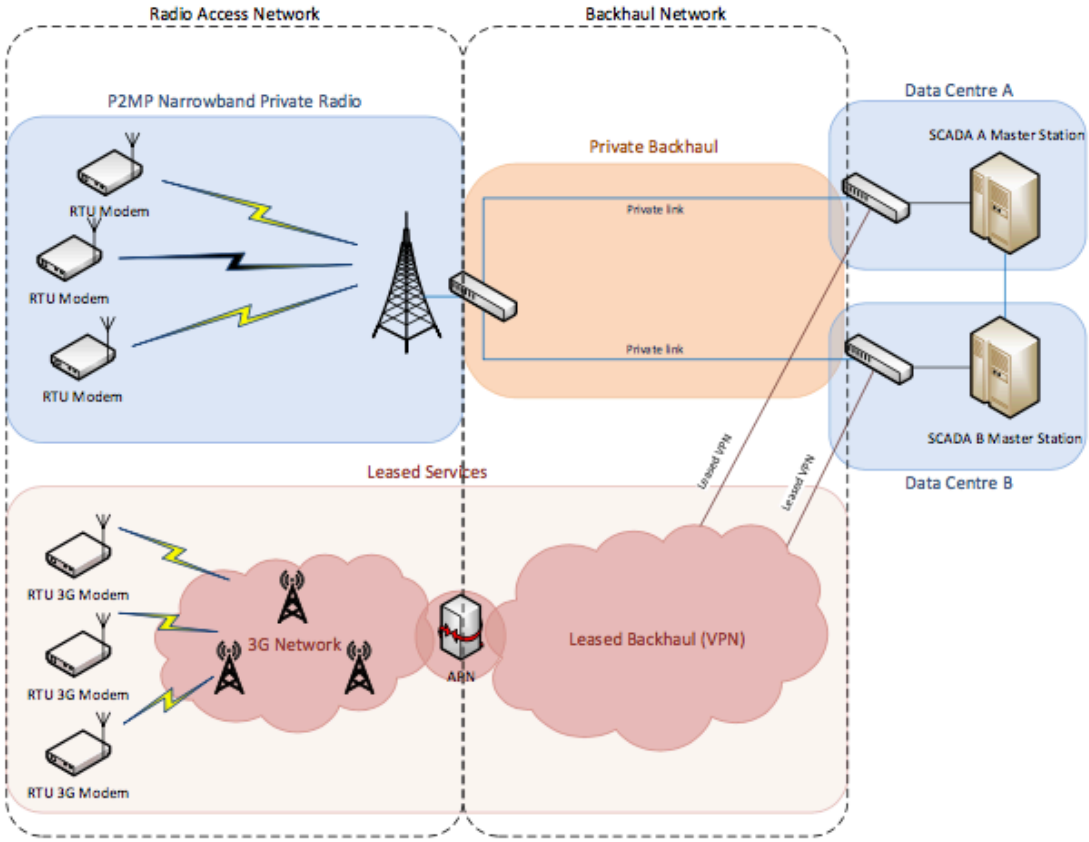
Table 59: Gas Distribution Communication Asset

Gas Communication Asset Locations	Quantity
Radio sites	9
Data/Control Centres	2
RTU's (Control or monitor regulator sites and fringe sites	219

(Source: Appendix 6L Communication Systems Strategy-20161115)

The communication system is configured as shown in the figure below.

Figure 13 Gas Communication Network Architecture



(Source: Appendix 6L Communication Systems Strategy-20161115)

The Radio Access Network provides communication between the field devices (RTU) to a concentration point for backhaul to backend systems.
The backhaul network incorporates various telecommunication and inter-networking components that enable the data from the concentration points to be carried to data centres.

The Radio Access Network utilises the following wireless technology for communicating with the RTU:

- Narrowband Point-to-Multi-Point (P2MP) Private Radio; and
- Leased (3G) services.

AusNet proposed to replace the communication equipment in the next AA period. The cost of the replacement program is shown in the table below.

Table 60: Communication Replacement Program Costs ($000 Real 2016)

Program	2018	2019	2020	2021	2022	Total
Replacement of Equipment	0	0	0	960.45	960.45	1,921

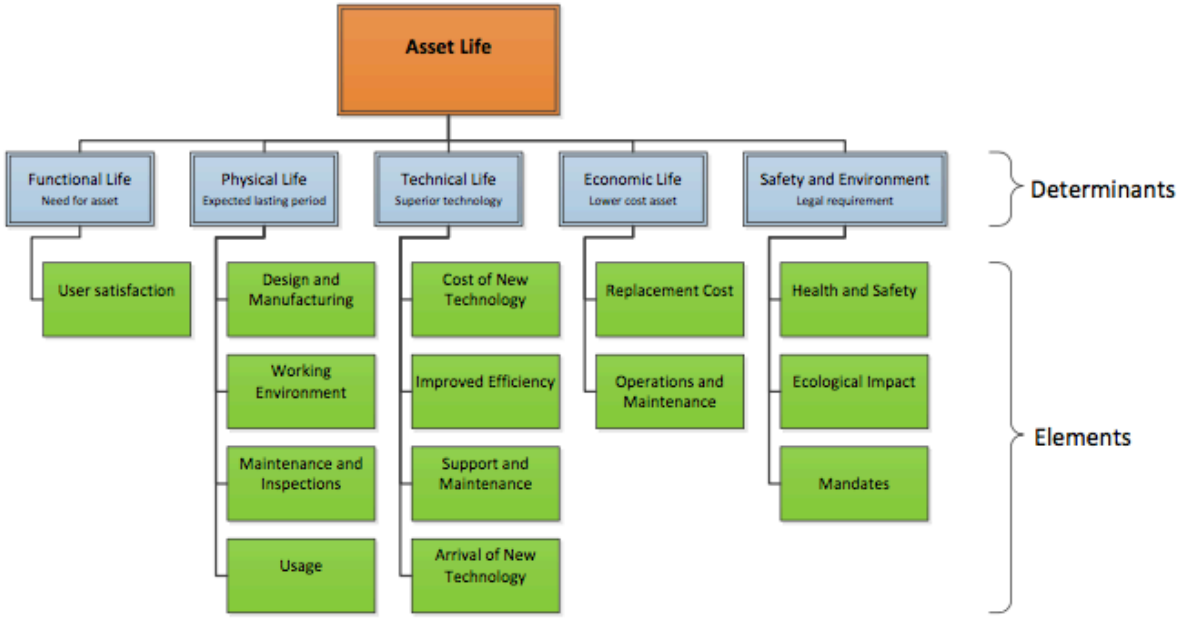
(Source: Appendix 6I Communication Systems Strategy-20161115)

Zincara's analysis and conclusions are details in the sections below.

9.2 ASSET CONDITION

AusNet Services used a set of criteria to determine the life of the assets. The asset life is based on the functional, physical, technological, economic and safety and environmental lives as shown in the figure below.

Figure 14: Determinants and Elements of Asset Life



(Source: Appendix 6I Communication Systems Strategy-20161115)

Using the above determinants, AusNet Services has categorised the life of an asset as shown in the table below.

Table 61: Description of Condition Scores

Condition	Description	Expected Lifetime
C1	Some aging or minor deterioration of a limited number of components Normal maintenance	More than 10 years
C2	No trends of deterioration in condition or performance recorded Normal maintenance	7-10 years
C3	Asset showing signs of deterioration in performance Manufacturer support is becoming limited Asset typically requires increased maintenance and monitoring	5-7 years
C4	Serious deterioration of asset performance Manufacture support and spares is typically not available Start planning process to replace considering risk and consequences or failure	Less than 5 years
C5	Extensive serious deterioration of asset performance Manufacturer support not available Depleted stocks of spares Lack of experience and skills required to maintain assets Immediately assess risk and replace based on assessment	End of Life

(Source: Appendix 6I Communication Systems Strategy-20161115)

Descriptions of the asset conditions are detailed below.

9.2.1 Narrowband Point-to-Multi-Point (P2MP) Private Radio

AusNet Services installed digital narrowband radios as part of an analogue radio and RTU replacement program in 2009. In 2011, AusNet Services installed an additional base station (at Brooklyn) to accommodate the high concentration and growth of gas devices in the western Melbourne metropolitan area. The network includes 8 narrowband P2MP radio base-stations. Each station can accommodate up to 40 end-devices per base-station/channel.

The P2MP radio equipment is manufactured by Schneider Electric (Trio). The model in service at the remote locations is the E-series ER45x and the base station model is E-series EB450. The E-series went out of sale in late 2015 but Trio has indicated that it will continue to support the equipment for a further seven years (2022).

The vendor released the Q-series in 2014 as the next generation of equipment and has advised that it is backward compatible with the E-series. However, all the Q-series features are only available if the entire end-to-end E-series devices are upgraded.

AusNet Services had rated its E-series devices as C3 and has forecast that the replacement of the devices is required prior to 2023.

9.2.2 Leased Services

AusNet Services advised that there are 62 leased 3G services being utilised for gas network RTUs. Since 2011, there has been a growth of leased services in western regional Victoria and the western areas of Melbourne.

All of AusNet Services' field devices use Telstra 3G technology. The end devices are 3G compatible Wavecom or Cybertec modems. There are currently no short to medium term

concerns for the service life but AusNet Services anticipates that the 3G network is likely to become end-of-life within 5-7years. AusNet Services categorises the assets as C2.

9.2.3 Backhaul Network

The Point-to-Point Narrowband Radio links utilise similar E-series radios from Schneider Electric (Trio). These units have similar end-of-sale and support constraints that apply to all Trio E-series radios. The condition of the radios is also classified as C3.

Other backhaul infrastructure not owned by the gas networks will be considered under other asset management practice.

9.3 REPLACEMENT PROGRAM AND COST

Based on the above condition assessment, AusNet Services proposes to replace the following:

- PTMP radios – 14 base stations;
- Trio remote modems -158 modems; and
- NextG modems – 62 modems

The scope of works includes:

- Equipment design, installation and commissioning;
- Transfer of service; and
- Update asset management systems with new asset data following completion.

The project cost breakdown is shown in the table below.

Table 62: Replacement Cost (Real 2017)

	Quantity	Cost $	Unit Cost $
PTMP radios	14	946,400	67,600
Trio remote modems	158	716,500	4,535
NextG modems	62	258,000	4,161

(Source: Appendix 6I Communication Systems Strategy-20161115)

9.4 CONCLUSION

Schneider Electric (Trio) has advised that it will no longer be supporting its E-series equipment after 2022. In addition, AusNet Services had assessed the condition of the assets and has deemed that the equipment has an end of life by 2023. As such, AusNet Services proposes that this equipment be replaced by 2022 and to avail itself of the latest features on the next generation technology.

Zincara acknowledges that industry practice dictates that such equipment that is no longer supported by the vendor should be replaced. It could be argued that the equipment does not necessarily fail at that time and that a phase implementation past the vendor ceasing support is practical especially since the estimated end of life is at 2023. However, given the criticality of the equipment, Zincara considers that it is prudent to have the equipment replaced prior to the end of life.

In relation to the discontinuation of the 3G, Telstra has advised[31] on its investment day that it was intending to exit the 3G network in 2020/21. This lines up with the timeframe that AusNet Services had indicated. Based on this, Zincara considers it prudent for AusNet Services to move to the 4G network.

AusNet Services provided the cost of the project as shown in Table 62. Zincara believes that the replacement cost for the PTMP radio includes an element of design and updating of asset details. Zincara is unable to be definitive on all the cost elements from the information provided but believes that AusNet Services would have sought indicative costs from the vendors and included a labour cost for the changeover. Given that Zincara has accepted AusNet Services' methodology for estimating its cost for the RTU project, Zincara believes that AusNet Services would have used the same methodology for this project. Zincara therefore recommends accepting the cost as efficient.

[31] Telstra Investment Day Presentation Nov 2016

Appendix E

References

Access Arrangement Information
Capex model
Appendix 4A: Consumption and Customer Forecasts
Appendix 6D: Network Regulator Strategy
Appendix 6E: Mains and Services Strategy
Appendix 6F: Consumer Regulators Strategy
Appendix 6G: Meter Management Strategy
Appendix 6J: Network Capacity Strategy
Responses to information requests from the AER
City Gate Capacity Analysis report by Oil Gas Power International (2016)
Smart Gas Meter considerations and prospective trials
Workbook – data supporting responses to IR #1: Q1,2,3 and 6
Appendix 6 J Supervisory and Data Acquisition Strategy
AER Information Request # 11
Appendix 6I Communication Systems Strategy-20161115
Telstra Investment Day Presentation Nov 2016