



# Jemena Electricity Networks (Vic) Ltd

## 2021-26 Electricity Distribution Price Review Regulatory Proposal

Attachment 05-05

AER repex modelling





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**AER repex modelling**  
**Assessing Jemena's replacement forecast**

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**A report to Jemena**

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**Confidential final**

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**17 January 2020**

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## Executive Summary

Nuttall Consulting has been engaged by Jemena Asset Management Pty Ltd on behalf of Jemena Electricity Networks (Vic) Ltd (Jemena) to undertake an assessment of its replacement capital expenditure (repex) forecast, which forms part of its regulatory proposal to the Australian Energy Regulator (AER) covering the five-year period from 1 July 2021 to 30 June 2026.

Our assessment *must* use the predictive model (called the repex model) and method that the AER has used in its recent draft decisions of the Queensland Distribution Network Service Providers (Queensland draft decisions). To undertake this assessment, we have used:

- data reported in Jemena's Category Analysis and Reset Regulatory Information Notices (RIN); and
- benchmark model parameters (ie median asset lives and unit costs across all NEM DNSPs) calculated and published by the AER in its Queensland draft decisions.

We have assessed **\$100.1 million** (\$2021) (44%) of Jemena's repex forecast using this method<sup>1</sup>.

Our assessment **supports** Jemena's repex forecast.

We have calculated the model repex **threshold forecast** to be **\$106.4 million** (\$2021), which is \$6.3 million above Jemena's repex forecast.

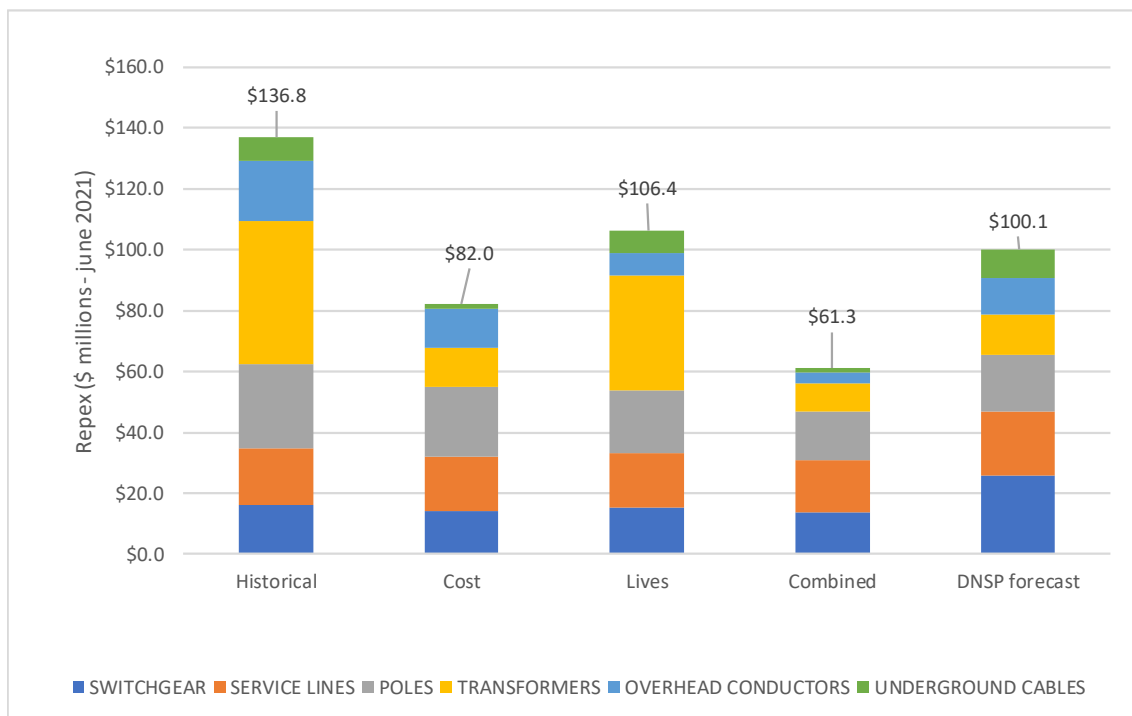
The AER assessment method calculates a repex forecast for four model scenarios, the results of which are shown in the figure below. The AER sets the threshold forecast to be the greater of the cost scenario and the lives scenario. For Jemena, the threshold forecast is set by the **lives scenario**, which uses its historical unit costs and comparative expected replacement lives<sup>2</sup>.

For this scenario, the model predicts a lower repex forecast compared to the Jemena forecast for the switchgear, services, conductors and underground cables asset groups, with the reduction in the switchgear and overhead conductor groups being the most significant (\$10.5 million and \$4.8 million lower respectively). However, this reduction is more than offset by the model predicting a higher forecast for the poles and transformers asset groups, with transformers being the most significantly higher (\$24.5 million higher).

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<sup>1</sup> This covers repex reported to the asset groups that the AER considers are 'modellable', namely Poles, Overhead Conductor, Underground Cables, Services, Transformers and Switchgear. The remaining repex forecast is associated with repex in the other asset groups not covered by the AER's assessment using its repex model.

<sup>2</sup> The comparative expected replacement lives are defined for each asset category in the model as the longer of Jemena's historical lives or the AER benchmark median life. The cost scenario is the complementary scenario to the life scenario but uses comparative unit costs and historical lives, where the comparative unit costs are defined for each asset category to be the lower of the Jemena's historical unit costs, Jemena's forecast unit cost or the AER benchmark median unit cost.



Finally, it is worth noting that to prepare these results, we have calculated Jemena’s historical unit costs and lives using the most recent four years of reported RIN data (2015 to 2018). We have used this four-year period as we understand that this is the period used by the AER in its most recent draft decisions. We have however also tested the sensitivity of the threshold forecast to alternative five- and three-year periods. In both cases, we still found the threshold to be above Jemena’s forecast and set by the lives scenario, with the threshold increasing to \$110 million using a five-year period and increasing further to \$121 million using a three-year period.

# 1 Introduction

## 1.1 Background and scope

Jemena Asset Management Pty Ltd on behalf of Jemena Electricity Networks (Vic) Ltd (Jemena) has engaged us, Nuttall Consulting, to undertake an assessment of its replacement capital expenditure (repex) forecast, which forms part of its regulatory proposal to the Australian Energy Regulator (AER) covering the five-year period from 1 July 2021 to 30 June 2026.

Our assessment *must* use the predictive model (called the repex model) and method that the AER has used in its recent draft decisions of the Queensland Distribution Network Service Providers (Queensland draft decisions).

This document serves as the report detailing this assessment.

All expenditure and costs shown in this report represent **direct real June 2021 dollars**.

## 1.2 Nuttall Consulting experience in this task

Nuttall Consulting, using Dr Brian Nuttall (the author of this report), developed the excel workbook that serves as the basis of the AER's repex model and advised the AER on the model's possible roles and application in regulatory determinations.

Moreover, we have been engaged by numerous DNSPs to apply the model and advise on its use to assess repex forecasts, including the methodology currently applied by the AER.

## 1.3 Key information sources

We have used the following information to undertake our assessment of Jemena's repex forecast

- Jemena's Category Analysis Regulatory Information Notices (RINs), covering the following data and templates:
  - Jemena's historical repex and replacement volumes from 2014 to 2018, contained in template 2.2
  - Jemena's 2018 age profile, contained in template 5.2
- Jemena's Reset Regulatory Information Notice (Reset RIN), covering the following data and templates:
  - Jemena's replacement capex forecast, covering the period from 2019/20 to 2025/26, which is in the format of template 2.2 of the Reset RIN

- Jemena's historical pole staking data, indicating the cost and volume of replaced staked wooden poles, by voltage, and the cost and volume of the staking of wooden poles, by voltage, covering the period from 2009 to 2018.
- The set of AER median asset unit costs and lives, as the AER applied in the most recent Queensland draft decisions.

We have also held a number of workshops and telephone meetings with relevant Jemena personnel to discuss the model, clarify data requirements, and discuss the model's results.

## 2 Assessment approach

Our assessment approach is based upon that used by the AER in its most recent decisions, including the latest NSW and ACT decisions (2019-2024) and Queensland draft decisions (2020-2025).

The repex model is described in some detail in the AER repex model manual<sup>3</sup> and the latest AER assessment approach is described in detail in the AER decision documents, most notably the following documents published as part of the draft decisions of the Queensland DNSPs:

- Section B, of the AER capex assessment outline, draft decisions 2020-25, October 2019
- Section A.4, of Attachment 5: Capital expenditure, Draft decision 2020-25.

In this section, we summarise the key aspects of the AER's latest approach, which are most relevant to understanding the results presented in the next section. Readers should refer to the AER documents for more detailed explanations of the repex model and the AER assessment approach.

### 2.1 Overview of the assessment approach and threshold forecast

The AER uses its repex model to define a **threshold** repex forecast for a large component of the DNSP's repex forecast. Notionally, this component of the DNSP's repex forecast is accepted if it is less than the threshold amount. The component of the DNSP's repex forecast assessed by the repex model covers the following six asset groups (as defined in RIN Tables 2.2.1 and 5.2.1):

- poles
- overhead conductors
- underground cables
- services
- transformers
- switchgear.

Importantly, the threshold amount represents the **aggregate** repex over the regulatory period being assessed i.e. it is not a year-by-year figure or a figure developed for each asset group or category. As such, it may be that the DNSP's forecast for some asset categories

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<sup>3</sup> See AER website



can be above the threshold forecast for those categories, provided this is offset by other categories where the DNSP's forecast is below the threshold.

That said, the AER may use its other assessment techniques (eg trending and engineering reviews) to test the DNSP's repex forecast further.

## 2.2 The four repex model scenarios

The AER uses the repex model to calculate alternative repex forecasts for **four scenarios**. The scenarios are defined by variations in the asset unit costs and asset lives, which form inputs to the repex model.

To understand these four scenarios, it is first useful to define various unit cost and asset life data sets that are required to prepare the four scenarios (Table 1).

**Table 1 Assessment asset unit cost and life data sets**

Input	Name	Comment
Unit costs	Historical	The average unit costs of the assessed DNSP over the most recent historical period, as reported through template 2.2 of its category analysis RIN.
	Forecast	The average unit costs of the assessed DNSP over the next regulatory period, as reported through template 2.2 of its Reset RIN.
	AER median	A set of unit costs calculated by the AER based on the median historical unit cost across all DNSPs.
	Comparative	The set of unit costs that are the minimum of the historical, forecast and AER median unit cost for each asset category.
Lives	Historical	The mean population life of the assessed DNSP over the most recent historical period, as reported through the replacement volumes in template 2.2 of its category analysis RIN. Note, this parameter must be calculated via the repex model using the 'calibration' process described in the AER repex model manual.
	AER median	A set of lives calculated by the AER based on the median life across all DNSPs.
	Comparative	The set of lives that are the maximum (ie longest) of the historical and AER median life for each asset category.

The four model scenarios use the historical and comparative unit costs and lives as shown in Table 2 below.

Table 2 AER assessment scenarios

ID	Scenario	Unit costs	Lives
1	Historical	Historical	Historical
2	Costs	Comparative	Historical
3	Lives	Historical	Comparative
4	Combined	Comparative	Comparative

The four scenarios can be interpreted as follows:

- The Historical scenario is a type of intra-company benchmark forecast, which produces a forecast assuming the DNSP maintains the asset lives and unit costs it has been able to achieve in the recent historical period.
- The Costs and Lives scenarios are two more aggressive scenarios (ie they will typically produce a lower forecast than the Historical scenario). These two scenarios separately consider the forecast assuming either historical unit costs or lives can be improved. In this regard, any historical unit costs or lives that are worse than the median unit cost or life move to the median. The Costs scenario also moves the unit cost to the forecast unit cost in circumstances where this is lower than both the historical and median unit cost.
- The Combined scenario is the most aggressive forecast (ie this scenario will typically produce the lowest forecast). This scenario assumes all unit costs and lives can move to their median (or the forecast unit cost if it is lower).

## 2.3 Defining the threshold forecast

The threshold forecast is calculated as the **maximum** aggregate forecast given by the Costs and Lives scenarios. The key points to note here are:

- The threshold must be lower than the forecast given by the Historical scenario, and so, the threshold assumes some improvement is achievable from the approach historically adopted by the DNSP.
- But by using the maximum of the forecast given by the Costs and Lives scenarios (ie not the minimum or the forecast from the Combined scenario), the assumed improvements within the threshold are the least aggressive of the remaining scenarios<sup>4</sup>.

<sup>4</sup> By 'least aggressive' improvements in this context, we mean that in defining the threshold repex forecast, the AER is selecting whichever of the comparative lives data set (ie the longer lives compared to historical lives) or comparative unit costs data set (ie the lower unit costs compared to historical unit costs) results in the higher repex forecast over the next regulatory period. Noting that this threshold scenario forecast will still be below the Historical scenario forecast.

## 2.4 The Jemena model developed for our assessment

For our assessment, we have constructed a repex model of the Jemena network to reflect the model we understand the AER is most likely to develop for its assessment purposes. This model reflects Jemena's forecast in the six 'modellable' asset groups noted above.

The modelled component represents **\$100.1 million** (44%) of Jemena's repex forecast over the next regulatory period (2021/22 to 2025/26).

This model uses the age profile data as reported by Jemena in its 2018 category analysis RIN. As such, the model is forecasting on a calendar year (CY) basis, with the first forecast year being 2019. As the next regulatory period is due to move to a financial year (FY) basis, covering the periods from 1 July 2021 to 30 June 2026, in order to calculate the model forecast over this period, we sum half of the model forecast in the 2021 and 2026 model years, along with the full forecast in the 2022, 2023, 2024, and 2025 model years.

To calculate historical unit cost and lives, we have used the four-year period from CY2015 to CY2018 as reported in Jemena's category analysis RINs<sup>5</sup>. This period represents the most recent audited data available at the time of proposal submission. We have used a four-year period as we understand that this is the period used by the AER in the repex modelling it used to support its Queensland draft decisions.

That said, as we will discuss in the next chapter, we have tested the sensitivity of this assumed period by also calculating the threshold for a five- and three-year historical period.

To calculate the comparative unit costs and lives, we have used the set of median unit costs and lives as published by the AER within its Queensland draft decisions<sup>6</sup>.

Finally, it is worth noting that we would expect the AER to use the historical 2019 RIN data when this data is published by Jemena, and possibly move to a five-year calibration period. It will also most likely recalculate the median unit costs and lives when new historical RIN data is published by all the DNSPs.

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<sup>5</sup> Historical RIN repex has been escalated to real June 2021 dollars using escalation rates provided by Jemena.

<sup>6</sup> We have escalated the AER median unit costs by 1.75% to change from June 2020 dollars to June 2021 dollars.

### 3 Repex forecast assessment

In this section we discuss our assessment of Jemena's forecast, using the scenarios discussed in the previous section. In keeping with the AER's recent approach, this assessment is focused on the aggregate repex forecast. However, we will also highlight the asset groups where Jemena's forecast differs to the threshold forecast most significantly, as this may suggest where the AER could focus its other assessment techniques.

#### 3.1 Assessment findings

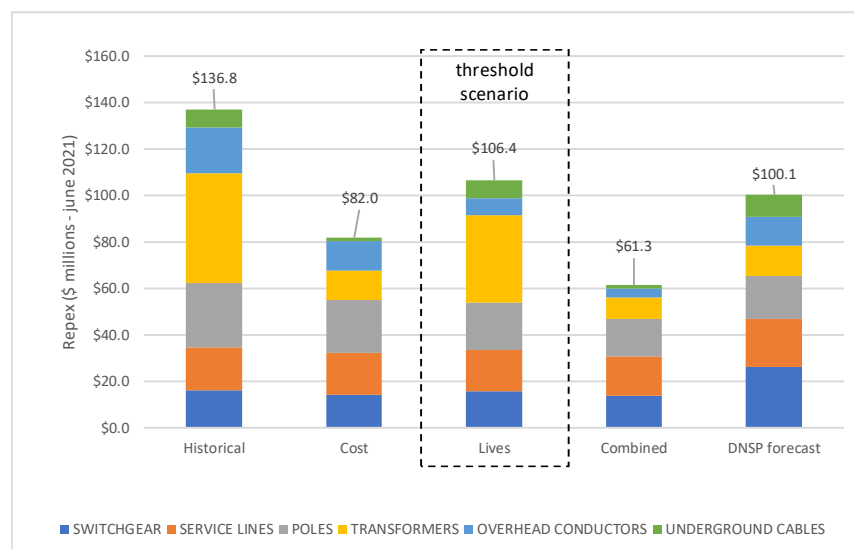
Our assessment **supports** Jemena's repex forecast.

The **\$100.1 million** modellable component of Jemena's repex forecast is less than the **\$106.4 million** threshold forecast given by this approach, which is set by the Lives scenario.

Table 3 and Figure 1 summarise the four scenario results.

**Table 3 Assessment study results summary (\$ millions – Real June 2021)**

Scenario	Scenario forecast (\$ millions)
Historical	\$136.8
Costs	\$82.0
Lives (threshold scenario)	\$106.4
Combined	\$61.3



**Figure 1 Assessment scenario results**

The Lives scenario sets the threshold repex forecast, as this scenario is the greatest of the Costs and Lives scenario. This result suggests that Jemena's asset lives typically compare more favourably to other DNSPs than its unit costs do. That is, there are less opportunities (in an aggregate repex sense) where median lives are being substituted for Jemena's historical lives than when median (or forecast) unit costs are substituted for Jemena's historical unit costs.

Further, given Jemena's forecast is less than the Lives scenario but above the Cost scenario, then in aggregate its forecast lives must be longer than the median lives, whereas its forecast unit costs must be higher than the median unit costs. That said, some caution is needed in appreciating this result as Jemena's *apparent* higher unit costs could be a function of its longer lives or its circumstances, and so, this result may not reflect inefficient costs.

Jemena's forecast is well below the Historical scenario, which suggests that there is some efficiency improvement allowed for in the forecast, compared to its recent historical practices.

Jemena's forecast is well above the Combined scenario. However, as discussed in the previous chapter, this is an aggressive scenario<sup>7</sup>. Given the methodology the AER uses to calculate the comparative unit costs and lives for this scenario, it seems reasonable that a DNSP's repex forecast could be above this scenario, while still being compliant to the NER capex criteria.

It is also worth noting that these findings can be sensitive to the historical period used to calculate the historical unit costs and lives used in each scenario. As we discussed in the previous chapter, we have used the four-year period from 2015 to 2018 for these purposes, as we understand that this is the period used by the AER in its Queensland draft decisions. We have also examined how the threshold value and assessment finding could change if a five-year period (2014-2018) or three-year period (2016-2018) was used.

In both cases, we still found the threshold to be above Jemena's forecast and set by the lives scenario, with the threshold increasing to \$110 million using a five-year period and increasing further to \$121 million using a three-year period.

## 3.2 Asset group results

Table 4 below shows the repex forecast of the four assessment scenarios broken down into the six modelled asset groups. For comparison purposes, this table also shows the comparable Jemena repex forecast in these six asset groups.

This table indicates that there is a range of variations between the threshold forecast and Jemena forecast at the asset group level, with some asset groups having a higher threshold forecast and others having a lower threshold forecast.

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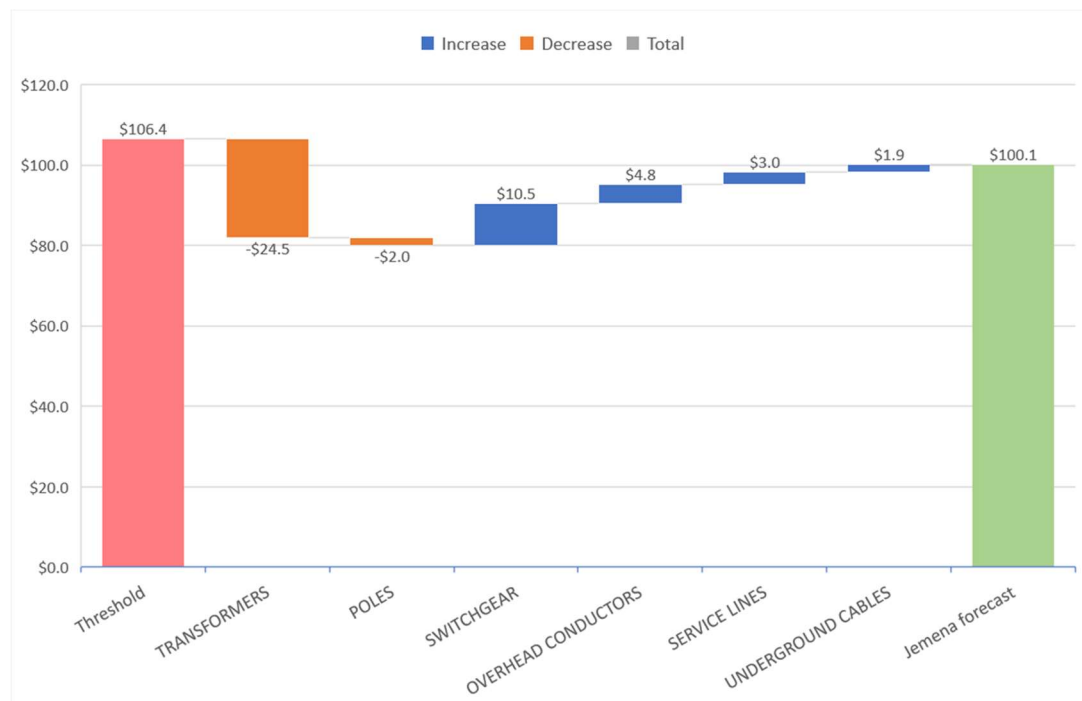
<sup>7</sup> By 'aggressive' in this context, we mean that for this scenario, the AER is selecting both the comparative lives data set (ie the longer lives compared to historical lives) AND the comparative unit costs data set (ie the lower unit costs compared to historical unit costs) such that this scenario will produce the lowest repex forecast over the next regulatory period of the four scenarios.

The scale of the variations is shown further in Figure 2 below, which shows a ‘waterfall’ chart of the asset group differences between the assessment threshold forecast and Jemena forecast.

This figure and table indicates that the Switchgear, Services, Overhead Conductors and Underground Cables asset groups have a lower model threshold forecast than the Jemena forecast. The Switchgear asset group is the most significant asset group with the threshold forecast \$10.5 million lower than the Jemena forecast.

**Table 4 Asset group results summary**

Asset group	Replex forecast (\$ millions – June 2021)				
	Jemena forecast	AER assessment scenario			
		Historical	Cost	Lives (threshold)	Combined
SWITCHGEAR	\$26.0	\$16.2	\$14.3	<b>\$15.5</b>	\$13.6
SERVICE LINES	\$20.7	\$18.5	\$17.8	<b>\$17.7</b>	\$17.1
POLES	\$18.6	\$27.5	\$22.7	<b>\$20.6</b>	\$16.2
TRANSFORMERS	\$13.2	\$47.2	\$13.0	<b>\$37.8</b>	\$9.1
OVERHEAD CONDUCTORS	\$12.1	\$19.9	\$12.7	<b>\$7.4</b>	\$3.8
UNDERGROUND CABLES	\$9.4	\$7.5	\$1.5	<b>\$7.5</b>	\$1.5
<b>Total</b>	<b>\$100.1</b>	<b>\$136.8</b>	<b>\$82.0</b>	<b>\$106.4</b>	<b>\$61.3</b>



**Figure 2 Asset group differences between Threshold forecast and Jemena forecast**

The most significant asset category driving this difference is '> 11 kV & ≤ 22 kV; Circuit Breakers', with the threshold forecast \$15.5 million lower than the Jemena forecast. This difference is due to the forecast unit cost used by Jemena (\$351k), which is much higher than its historical unit cost (\$58k) and the AER median (\$56k)<sup>8</sup>.

Other notable asset categories with a significantly lower threshold forecast<sup>9</sup>, include:

- **OVERHEAD CONDUCTORS > 11 kV & ≤ 22 kV; Multiple-Phase (\$3,750k difference)**

This difference is due to a combination of the forecast volume/life and forecast unit cost differences.

The Jemena forecast replacement volume is higher than the threshold forecast (31.1 compared to 16.6 replacements), and so, the asset life inherent in the Jemena forecast must be shorter than the comparative life. The comparative life is set by the AER median and is 10 years longer than Jemena's historical life (72.3 years compared to 62.4 years).

Jemena's forecast unit cost (\$162.7k) is much higher than Jemena's historical unit cost (\$78.4k) and the AER median (\$88.6k).

- **POLES ≤ 1 kV; Wood (\$2,912k difference)**

This difference is mainly due to the forecast volume/life difference.

The Jemena forecast replacement/staking volume is higher than the threshold forecast (4,169 compared to 2,413), and so, the asset life inherent in the Jemena forecast must be shorter than the comparative life. The comparative life is set by the AER median life, which is longer than Jemena's historical life (66.4 years compared to 63.2 years).

- **SERVICE LINES ≤ 11 kV ; Residential ; Simple Type (\$2,490k difference)**

This difference is mainly due to the forecast volume/life difference.

The Jemena forecast replacement volume is higher than the threshold forecast (24,243 compared to 20,211), and so, the asset life inherent in the Jemena forecast must be shorter than the comparative life. The comparative life is set by the AER median life, but this is similar to Jemena's historical life (55 years).

- **TRANSFORMERS Pole Mounted; ≤ 22kV; > 60 kVA and ≤ 600 kVA; Multiple Phase (\$2,461k difference)**

This difference is due to a combination of the forecast volume/life and forecast unit cost differences.

The Jemena forecast replacement volume is higher than the threshold forecast (137 compared to 108 replacements), and so, the asset life inherent in the Jemena forecast

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<sup>8</sup> Note, the volume forecasts of Jemena and the model threshold are very similar.

<sup>9</sup> These are asset categories where the difference is greater than \$2 million.

must be shorter than the comparative life. The comparative life is set by Jemena's historical life (56 years), with the AER median life shorter (53.3 years).

Jemena's forecast unit cost (\$35.3k) is higher than Jemena's historical unit cost (\$22.0k) and the AER median (\$20.1k).

Offsetting the above reductions, the Poles and Transformers asset groups have a higher threshold forecast than the Jemena forecast. The difference in the Transformers asset group is the most significant, with the threshold forecast \$24.5 million higher than the Jemena forecast.

The most significant asset category driving this difference is 'Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV; > 15 MVA and < = 40 MVA', with the threshold forecast \$18.6 million higher than the Jemena forecast. This difference is due to the Jemena replacement volume forecast (2 replacements) being much lower than the threshold forecast (7 replacements). As such, the asset life inherent in the Jemena forecast must be longer than the comparative life, which is set by Jemena's historical life (58.2 years).

Other notable asset categories with a significantly higher threshold forecast<sup>10</sup>, include:

- **TRANSFORMERS Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; < = 15 MVA (\$9,149k difference)**

This difference is mainly due to the forecast volume/life difference.

Jemena is not forecasting the need to replace any units in the next regulatory period, but the threshold forecast includes 11.6 replacements. As such, the asset life inherent in the Jemena forecast must be longer than the comparative life, which is set by the AER median (64.1 years).

- **POLES Replacement of staked wooden poles (\$4,285k difference)**

This difference is mainly due to the forecast volume/life difference.

The Jemena forecast replacement volume is lower than the threshold forecast (101 compared to 353 replacements), and so, the asset life inherent in the Jemena forecast must be longer than the comparative life. The comparative life is set by Jemena's historical life (35.6 years), with the AER median life shorter (29.0 years).

It is important to note that the AER assessment method focusses on the aggregate repex forecast, and as such, there must be some expectation by the AER that there will be significant variations at the asset group and category level. Therefore, the above does not necessarily mean the AER will reject Jemena's forecast or have significant concerns with these specific asset categories.

### 3.3 Summary and conclusions

We have applied the AER's most recent repex model assessment method to Jemena's repex forecast.

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<sup>10</sup> These are asset categories where the difference is greater than \$2 million.



Using this method, we have calculated the model repex threshold forecast to be \$106.4 million, which is \$6.3 million above Jemena's modellable repex forecast of \$100.1 million. The model threshold forecast is set by the Lives scenario, which uses Jemena's historical unit costs and comparative expected replacement lives .

For this scenario, the model predicts a lower repex forecast compared to the Jemena forecast for the switchgear, services, conductors and underground cables asset groups, with the reduction in the switchgear and overhead conductor groups being the most significant (\$10.5 million and \$4.8 million lower respectively). However, this reduction is more than offset by the model predicting a higher forecast for the poles and transformers asset groups, with transformers being the most significantly higher (\$24.5 million higher).

We have also tested the sensitivity of the threshold forecast to using alternative five- and three-year periods to calculate the historical unit costs and lives. In both cases, we still found the threshold to be above Jemena's forecast and to be set by the Lives scenario, with the threshold increasing to \$110 million using a five-year period and increasing further to \$121 million using a three-year period.

We consider that this assessment **supports** Jemena's repex forecast.