AER repex model outline for electricity distribution determinations

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Contents

Shortened forms

Shortened form	Extended form
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
capex	capital expenditure
distributor	electricity distribution network service provider
Guideline	Expenditure forecast assessment guideline for electricity distribution
NEM	National Electricity Market
NER	National Electricity Rules
NGR	National Gas Rules
repex	replacement expenditure
RIN	Regulatory Information Notice
SCADA	supervisory control and data acquisition

Repex model outline overview

This appendix provides a guide to our repex modelling process and sets out:

- relevant background information
- the data we use in the repex model
- the key assumptions underpinning our repex modelling approach
- the repex model outcomes under different scenarios.

Background

In 2012 the AEMC published changes to the NER and NGR.[1] Following these rule changes, the AER undertook a "Better Regulation" work program, which included publishing a series of guidelines setting out our approach to regulation under the new rules.

The Guideline lists predictive modelling as one of the assessment techniques we may employ when assessing a distributor's repex.[2] We have used the repex model since 2009–10 and have refined the model over time.

The repex model is a statistical tool used to conduct a top-down assessment of a distributor's repex forecast. Discrete asset categories within six broader asset groups are analysed using the repex model. These six asset groups are: poles, overhead conductors, underground cables, service lines, transformers and switchgear.

The repex model forecasts the volume of assets in each category that a distributor will replace over a 20-year period. The model analyses the age of assets already in commission and calculates the time at which a distributor will replace them, based on historical replacement practices. The model derives the total replacement expenditure forecast by multiplying the forecast replacement volumes for each asset category by an indicative unit cost.

The repex model advises and informs us where to target a more detailed bottom-up review, and to define a substitute repex forecast if necessary.

Unmodelled repex

The repex model is most suitable for asset groups and categories where there is a moderate to large asset population of relatively homogenous assets. It is less suitable for assets with small populations or those that are relatively heterogeneous. For this reason, we exclude SCADA and 'other' asset groups from the modelling process and

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1 AEMC, *Final rule determination: National electricity amendment (Economic regulation of network service providers) Rule 2012,* 29 November 2012.

2 AER, *Better regulation: Expenditure forecast assessment guideline for electricity distribution,* November 2013, p. 14.

do not use predictive modelling to directly assess the asset categories within these groups.

We also exclude pole-top structures because many distributors do not have the asset age profile data needed to model these asset categories.

Excluded asset categories

We do not model asset categories reported by three distributors or less. This is because the model cannot make a meaningful comparison on unit costs or expected replacement lives with other distributors. Examples include 132kV underground cables and Stobie poles.

Similarly, we may also exclude unique assets or repex projects on a case-by-case basis, where we determine that they will adversely affect the modelling results. These assets or projects will generally be very high value compared with similar assets in the same asset group.

Data collection

The repex model requires the following input data:

- the age profile of network assets currently in commission
- expenditure and replacement volume data of network assets
- the mean and standard deviation of each asset's expected replacement life.

These data are derived from distributors' annual regulatory information notice (RIN) responses, reset RINs and from the outcomes of the unit cost and expected replacement life benchmarking across all distribution businesses in the NEM.[3]

Category analysis RINs include historical asset data and reset RINs provide data corresponding to distributors' proposed forecast repex over the upcoming regulatory control period. Adopting a standardised approach to network asset categories allows us to compare and assess the relative prices of cost inputs as required by the capex criteria.

Calibration

The calibration process estimates the average age at replacement for each asset category using the observed historical replacement practices of a distributor. We call the length of the historical period analysed during this process the 'calibration period'. We select the calibration period that best reflects a distributor's future repex requirements. In doing so, we have regard to changes in legislative obligations or other factors.

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3 In both RINs, the templates relevant to repex are sheets 2.2 and 5.2.

The calibrated expected replacement lives is different to the replacement lives that distributors report. This is because we assume the following during the calibration process:

- The calibration period is a historical period where a distributor's replacement practices are largely representative of its expected future replacement needs.[4]
- We do not estimate a calibrated expected replacement life where a distributor did not replace any assets during the calibration period, because the calibration process relies on actual historical replacement volumes to derive a mean and standard deviation.
- Where a calibrated replacement life is not available, we substitute the value of a similar asset category.

Scenario analysis

The repex model will produce forecasts for each of the following scenarios:

1. Historical unit costs and calibrated expected replacement lives
2. Comparative unit costs and calibrated expected replacement lives
3. Historical unit costs and comparative expected replacement lives
4. Comparative unit costs and comparative expected replacement lives

where:

- comparative unit costs are the minimum of a distributor's historical unit costs, its forecast unit costs and the median unit costs across the NEM
- comparative replacement lives are the maximum of a distributor's calibrated expected replacement life and the median expected replacement life across the NEM.

The 'cost scenario' analyses the level of repex a distributor could achieve if it improves its historical unit costs to comparative unit costs. The 'lives scenario' analyses the level of repex a distributor could achieve if improves its calibrated expected replacement lives to comparative expected replacement lives. The 'combined scenario' analyses the level of repex a distributor could achieve if it improves both its historical unit costs and calibrated expected replacement lives to comparative costs and lives.

The repex model results set a threshold against which we compare the distributor's forecast repex. Where a distributor's forecast exceeds the threshold, we will seek further information to understand this difference. In some cases, we use the threshold as the starting point for our substitute estimate.

Our current approach sets the repex model threshold equal to the higher of the 'cost scenario' and the 'lives scenario'. This approach considers the inherent

[4] Each distributors' specific repex modelling workbook outlines more detailed information on the calibration period chosen.

interrelationship between the unit cost and expected replacement life of network assets. For example, a distributor may have higher unit costs than other distributors for particular assets, but these assets may in turn have longer expected replacement lives. In contrast, a distributor may have lower unit costs than other distributors for particular assets, but these assets may have shorter expected replacement lives.

Unit costs

This scenario compares a distributor's historical unit costs, forecast unit costs and median unit costs across the NEM.

The model derives historical unit costs from a distributor's category analysis RIN and derives forecast unit costs from a distributor's reset RIN.

The median unit costs across the NEM are based on each distributor's historical unit cost for each asset category. The model uses the median unit cost instead of the mean for comparative analysis purposes to remove the impact of outliers caused by unique network characteristics or data reporting anomalies.

Expected replacement lives

This scenario compares a distributor's calibrated replacement lives and the median expected replacement lives across the NEM, both of which the model calculates in the calibration process described in section 0. Median expected replacement lives are based on each distributor's calibrated replacement lives for each asset category. Once again, using the median value effectively accounts for any outliers.

The expected replacement life input used in the 'lives' and 'combined' scenarios is the maximum of a distributor's calibrated replacement life and the median replacement life across the NEM.

Non-like-for-like replacement

The staking of a wooden pole is the practice of attaching a metal support structure (a stake, nail or bracket) to reinforce an aged wooden pole.[5] Distributors have adopted this practice as a low-cost option to extend the life of a wooden pole. These assets require special consideration in the repex model because, unlike most other asset types, distributors do not install or replace them on a like-for-like basis.

The repex model mainly assumes that a distributor incurs repex on a like-for-like basis.[6] The repex model forecasts the volume of old assets to be replaced and not the volume of new assets that need to be installed. This is simple to deal with for assets replaced on a like-for-like basis—a distributor simply replaces the old asset is simply replaced by its modern equivalent.

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5 The equivalent practice for Stobie poles is "plating", which similarly provides a low-cost life extension. SA Power Networks carries out this process. For simplicity, this section only refers to the staking process.

6 For example, a distributor will replace a conductor rated to carry low-voltage with conductor of the same rating, not conductor rated for high-voltage purposes.

However, where old assets are commonly replaced with a different asset, the cost or expected life of the new asset may not match that of the modern equivalent. As the repex model forecasts the number of old assets that require replacement, it is necessary to make adjustments for the asset's unit cost and calibrated replacement life. The only asset group where this has a significant impact on the model results is wooden poles.

Staked and unstaked wooden poles

Our repex model treats staked wooden poles differently to unstaked poles. This is because staked and unstaked poles have substantially different expected replacement lives and different unit costs.

There are two asset replacements options and two associated unit costs that a distributor may make: replace the old pole with a new pole, or stake the old pole to extend its life.[7]

Staking is typically a one-off process. When a staked pole requires replacement, a distributor will install a new pole. The repex model assumes that the cost of replacing an in-commission staked pole is the same as the cost of a new pole.

Unit cost blending

For unstaked wooden poles that require replacement, there are two appropriate unit costs: the cost of installing a new pole; and the cost of staking an old pole. We use weighted average unit costs of staking or replacing unstaked poles to arrive at a blended unit cost.[8]

For staked wooden poles, we ask distributors for additional historical data on the proportion of staked wooden poles that are replaced. The unit cost of replacing a staked wooden pole is a weighted average based on the historical proportion of staked pole types that are replaced. Where historical data are not available, we use the asset age data to determine what proportion of the network each pole category represented and use this information to weight the unit costs.

Calibrating staked wooden poles

We give special consideration to staked wooden poles when determining their calibrated replacement lives. This is because the model uses historical replacement volumes in the calibration process. The RIN responses provide us with information on

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[7] When a wooden pole needs to be replaced, it will either be staked or replaced with a new pole. The decision on which replacement type will be carried out is made by determining whether the stake will be effective in extending the pole's life and is usually based on the condition of the pole base. If the wood at the base has deteriorated significantly, staking will not be effective and the pole will need to be replaced. If there is enough sound wood to hold the stake, the life of the pole can be extended and the pole can be staked, which is a more economically efficient outcome.

[8] For example, if a distributor replaces a category of pole with a new pole 50 per cent of the time and stakes this category of the pole the other 50 per cent of the time, the blended unit cost would be a straight average of the two unit costs. If the mix was 60:40, the unit cost would be weighted accordingly.

the volume of new assets installed over the calibration period. However, the repex model forecasts the volume of old assets that require replacement. Since the replacement of staked poles is not on a like-for-like basis, we make an adjustment during the calibration process.

We ask distributors to provide the number of staked poles that reach the end of their economic life and are replaced over the calibration period, so an expected replacement life can be calibrated. Where this information is not available, we estimate the number of staked wooden poles replaced over the calibration period based on the data we have available.

Consultation

We consulted with stakeholders on a number of assumptions made in our repex modelling assessment tool. We outlined our position in an explanatory note published in December 2019.[9]

9 AER, *Explanatory Note: AER review of repex modelling assumptions*, December 2019.