Reset RIN Schedule 1, Section 5

XXX - RIN Section 5 - Jan2020 - Public

Regulatory proposal 2021–2026

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1 Introduction

This document provides responses to the 2021–2026 regulatory information notices (**RIN**) Schedule 1, section 5—replacement capital expenditure modelling. As such, this document provides content in relation to Workbook 1 – Regulatory determination, regulatory template 2.2 (**Workbook 1**) for the following asset groups in each section of the document:

- poles
- pole top structure (this asset group is excluded from the Australian Energy Regulator's (**AER**) replacement expenditure modelling)
- overhead conductors
- underground cables
- service lines
- transformers
- switchgear
- public lighting (this asset group is excluded from the AER's replacement expenditure modelling)
- SCADA, network control and protection (this asset group is excluded from the AER's replacement expenditure modelling).

We also report 'other' as an asset group in the annual Category Analysis (**CA**) RINs and Workbook 1. However, the miscellaneous, unspecified and heterogeneous nature of the asset categories and types within this group does not allow this expenditure group to be modelled using the AER's replacement expenditure model. As such the description of asset group is excluded from this document.

Throughout this document, statistics reported for 2019 and 2020 (which are not yet available) are based on the average of the 2016–2018 RINs.

2 Poles

2.1 Paragraph 5.1(a)(i)—Asset category description

2.1.1 (A) Asset scope and boundary issues

The asset scope consists of all poles and towers we own and operate as follows:

- wood poles (including staked poles)
- concrete poles
- steel poles
- steel towers.

Attached assets such as stays, pole top structures, staking systems and pole top plant (e.g. transformers) are often replaced as part of pole replacement.

2.1.2 (B) Age profile determination

The following assumptions were applied to determine the pole age profiles:

- Only our poles were included in the recorded quantities.
- Out of service poles were excluded from the reported quantities.
- A number of poles had an unknown or incorrect installation date. The detailed method for distributing these assets across the known population is contained within the Basis of Preparation document Table 5.2 Age Profile submitted with the annual Category Analysis RIN.[1]

Public lighting poles are excluded from this asset group and covered within the public lighting asset group.

2.1.3 (C) Main drivers of replacement

The main driver of replacement is the asset condition based on inspection regime and/or asset failure. Deteriorating asset condition, if left untreated, have potential risk (safety, bushfire, reliability and reputational) and cost (unplanned capital and operational expenses) consequences.

It is noted that staking of wood poles is a refurbishment (or an asset life extension) activity and not an asset replacement activity.

2.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, excavation, removal of old assets, hardware, installation, reinstatement and outage management.

The staking of wood pole includes the reinforcing stakes or nails or supports along. Replacement poles include the pole installation with associated cross arms, fittings and insulators. The project or program direct overheads have been proportionally allocated, where applicable, between this asset group, overhead conductor and pole top structure asset groups.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 for pole staking allows for extension of existing pole's life. The proposed replacement expenditure and quantities in Workbook 1, table

[1] CP ATT229: CitiPower, Category analysis RIN basis of preparation, 2018.

2.2.1 for the remainder of asset categories in this asset group allows for complete replacement of asset. In both instances, this cost is capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

2.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

2.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistic by referring to 2016-18 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, increasing safety risk etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 1 demonstrates the proportion of pole assets replaced due to various drivers that can be proxy by age.

Table 1 Proportion of assets replaced due to various drivers that can be proxy by age, poles, 2016-2020

Poles, asset category	2016	2017	2018	2019	2020
Staking of a wooden pole	100%	100%	100%	100%	100%
< = 1 kV; Wood	97.59%	98.99%	100%	98.86%	98.86%
> 1 kV & < = 11 kV; Wood	97.56%	100%	100%	99.19%	99.19%
> 11 kV & < = 22 kV; Wood		0%		0%	0%
> 22 kV & < = 66 kV; Wood		100%	100%	100%	100%
< = 1 kV; Concrete	100%	100%	100%	100%	100%
> 1 kV & < = 11 kV; Concrete		100%		100%	100%
> 11 kV & < = 22 kV; Concrete					
> 22 kV & < = 66 kV; Concrete					
< = 1 kV; Steel	100%	100%		100%	100%
> 1 kV & < = 11 kV; Steel					
> 11 kV & < = 22 kV; Steel					
> 22 kV & < = 66 kV; Steel					
Unweighted asset group overall	99.14%	99.42%	100%	99.52%	99.52%
Unit cost weighted asset group overall	97.90%	98.94%	100%	99.69%	99.69%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

2.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistic by referring to 2016-18 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 2 shows a share of pole assets replaced from asset failure that cannot be proxy by age (actual and forecast).

Table 2 Proportion of assets replaced due to asset failure that cannot be proxy by age, poles, 2016–2020

Poles, asset category	2016	2017	2018	2019	2020
Staking of a wooden pole	0%	0%	0%	0%	0%
< = 1 kV; Wood	2.41%	1.01%	0%	1.14%	1.14%
> 1 kV & < = 11 kV; Wood	2.44%	0%	0%	0.81%	0.81%
> 11 kV & < = 22 kV; Wood		100%		100%	100%
> 22 kV & < = 66 kV; Wood		0%	0%	0%	0%
< = 1 kV; Concrete	0%	0%	0%	0%	0%
> 1 kV & < = 11 kV; Concrete		0%		0%	0%
> 11 kV & < = 22 kV; Concrete					
> 22 kV & < = 66 kV; Concrete					
< = 1 kV; Steel	0%	0%		0%	0%
> 1 kV & < = 11 kV; Steel					
> 11 kV & < = 22 kV; Steel					
> 22 kV & < = 66 kV; Steel					
Unweighted asset group overall	0.86%	0.58%	0%	0.48%	0.48%
Unit cost weighted asset group overall	2.10%	1.06%	0%	1.05%	1.05%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

2.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

2.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

2.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

2.3.1 (i) Statutory requirements

None.

2.3.2 (ii) Internal planning and asset management approaches

Table 3 shows the asset management initiatives have been introduced or are planned to be introduced to enhance the management of poles.

Table 3 Asset management initiatives to enhance the management of poles

Initiative	Implementation year	Impact on replacements
Stay policy updated to improve defect detection and appropriate priority assignment.	2016	No material impact
Diameter tape method of measuring pole diameter was introduced as the preferred method rather than using callipers.	2017	No material impact
Deep drilling of poles was reinforced with asset inspectors and all inspectors where trained in the deep drill method for assessing pole strength.	2017	No material impact
A special inspection of double staked poles was undertaken applying a new inspection method that incorporated WoodScan.	2018	No material impact
Pole inspection policy was updated as follows: • pole strength safety factors increased • visual assessment of wood poles added • special inspection of staked poles added • increased inspection frequencies for Additional Control-Serviceable poles	2019	Will be reflected in the 2019 Category Analysis RIN Table 2.2 Repex
Proposed increase in pole replacements due to pole calculator enhancements (to include an age-based strength reduction) to enable implementation of the risk based asset management approach.	2021	Refer to the Lines model forecast replacements in the 2021–2026 regulatory proposal.[2]

Source: CitiPower

2.3.3 (iii) Measureable asset factors

None.

2.3.4 (iv) Measureable and forecastable external factors

None.

2.3.5 (v)(A) Network technology/solution

The table below shows the network technology/solutions that have been introduced or are planned to be introduced to enhance the management of poles.

2 CP MOD 4.06 - Lines replacement - Jan2020 - Public

Table 4 Asset management initiatives to enhance the management of poles

Initiative	Implementation year	Impact on replacements
WoodScan pole strength assessment tool was introduced for unserviceable poles resulting in reduced pole replacements.	2017	Refer to 2017 and 2018 Category Analysis RIN Table 2.2 Repex submissions

Source: CitiPower

2.3.6 (v)(B) Non-network technology/solution

None.

2.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

2.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

3 Pole top structures

3.1 Paragraph 5.1(a)(i)—Asset category description

3.1.1 (A) Asset scope and boundary issues

The asset scope consists of pole top structures we own and operate as follows:

- cross-arms—timber/steel
- insulators
- all fittings and fasteners associated with cross-arms and insulators.

The following assets are often replaced as part of a cross-arm replacement:

- high voltage (**HV**) fuses including:
  - powder filled fuses
  - boric acid fuses
  - expulsion drop out (**EDO**) fuses
  - fault tamer fuses
- surge arresters
- low voltage services.

3.1.2 (B) Age profile determination

This information is not available and it is not reported in historical CA RINs.

3.1.3 (C) Main drivers of replacement

Pole top structures are replaced based on condition assessed during the cyclic inspection program in accordance with the cross-arm policy and insulator policy.

The main driver of replacement is the asset condition based on inspection regime and/or asset failure. Deteriorating asset condition, if left untreated, have potential risk (safety, bushfire, reliability and reputational) and cost (unplanned capital and operational expenses) consequences.

3.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, excavation, removal of old assets, hardware, installation, reinstatement and outage management. It includes cross-arms, fittings and insulators.

The project or program direct overheads have been proportionally allocated, where applicable, between this asset group, overhead conductor and pole top structure asset groups. The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

3.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

3.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistic by referring to 2016-18 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, increasing safety risk etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 5 demonstrates the proportion of pole top structures assets replaced due to various drivers that can be proxy by age.

Table 5 Proportion of assets replaced due to various drivers that can be proxy by age, pole top structures, 2016–2020

Pole top structures, asset category	2016	2017	2018	2019	2020
< = 1 kV	96.89%	96.56%	93.58%	95.68%	95.68%
> 1 kV & < = 11 kV	96.74%	100%	100%	98.91%	98.91%
> 11 kV & < = 22 kV	100%	66.67%	75.00%	80.56%	80.56%
> 22 kV & < = 66 kV	100%	66.67%	100%	88.89%	88.89%
Unweighted asset group overall	96.90%	96.62%	94.68%	96.07%	96.07%
Unit cost weighted asset group overall	96.91%	96.54%	95.39%	96.28%	96.28%

Note: empty cells indicate no asset replacement
Source: CitiPower

The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

3.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 6 shows a share of pole top structures assets replaced from asset failure that cannot be proxy by age.

Table 6 Proportion of assets replaced due to asset failure that cannot be proxy by age, pole top structures, 2016–2020

Pole top structures, asset category	2016	2017	2018	2019	2020
< = 1 kV	3.11%	3.44%	6.42%	4.32%	4.32%
> 1 kV & < = 11 kV	3.26%	0%	0%	1.09%	1.09%
> 11 kV & < = 22 kV	0%	33.33%	25.00%	19.44%	19.44%
> 22 kV & < = 66 kV	0%	33.33%	0%	11.11%	11.11%
Unweighted asset group overall	3.10%	3.38%	5.32%	3.93%	3.93%
Unit cost weighted asset group overall	3.09%	3.46%	4.61%	3.72%	3.72%

Note: empty cells indicate no asset replacement
Source: CitiPower

Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026.The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

3.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

3.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

3.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

3.3.1 (i) Statutory requirements

None.

3.3.2 (ii) Internal planning and asset management approaches

Table 7 shows the asset management initiatives have been introduced to enhance the management of pole top structures.

Table 7 Asset management initiatives introduced to enhance the management of poles top structures

Initiative	Implementation year	Impact on replacements
Cross-arm policy updated to improve defect detection and ensure appropriate risk based priority assignment	2014	No material impact
Insulator policy updated to include the application of pole top straps to restrain pole top assemblies resulting in reduced volumes of pole top assembly replacements	2014	No material impact
Insulator policy updated to improve defect detection of pole top assemblies and ensure appropriate risk based priority assignment	2016	No material impact
Priority policy change to redefine P3 defect management to allow re-inspection within the P3 rectification timeframe.	2017	No material impact
Priority policy change to redefine P3 defect items into non-deteriorating and deteriorating defect categories and remove the requirement to re-inspect non-deteriorating items.	2018	No material impact
Working in cooperation with water authorities to progressively remove assets from sewer poles.	2018	No material impact
Working in cooperation with tramway authorities to progressively separate network assets from tramway assets and assign/verify asset ownership.	2018	Refer to Yarra Trams step change in the 2021–2026 regulatory proposal.[3]

Source: CitiPower

3.3.3 (iii) Measureable asset factors

None.

3.3.4 (iv) Measureable and forecastable external factors

None.

3.3.5 (v)(A) Network technology/solution

None.

3.3.6 (v)(B) Non-network technology/solution

None.

3.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

3 CP BUS 9.02: CitiPower, *Relocation of assets on Yarra Trams poles*, January 2020.

3.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

4 Overhead conductors

4.1 Paragraph 5.1(a)(i)—Asset category description

4.1.1 (A) Asset scope and boundary issues

The asset scope consists of all bare conductor types, HV aerial bundled cable (**ABC**), low voltage (**LV**) ABC, covered conductors and associated connectors, joiners, armour rods, vibration dampers, and ties at all voltages we own and operate as follows:

- all aluminium alloy conductor (**AAAC**)
- all aluminium conductor (**AAC**)
- cadmium copper conductor (**CdCu**)
- copper conductor (**Cu**)
- aluminium conductor—zinc-coated (galvanized), steel reinforced (**ACSR/GZ**)
- aluminium conductor—aluminium coated (aluminised) steel reinforced (**ACSR/AZ**)
- aluminium conductor—aluminium clad steel reinforced (**ACSR/AC**)
- steel conductor/galvanised (**SC/GZ**)
- steel conductor/ aluminium clad (**SC/AC**)
- HV ABC
- covered conductor (**CC**)
- LV ABC.

The following attached assets are often replaced as part of a conductor replacement:

- poles
- pole top structures
- HV fuses including:
  - powder filled fuses
  - boric acid fuses
  - EDO fuses
  - fault tamer fuses
- surge arresters
- low voltage services.

4.1.2 (B) Age profile determination

The following assumptions were applied to determine the overhead conductor age profiles:

- Out of service overhead conductor were excluded from the reported quantities.
- Overhead conductor lengths reported are those recorded as computed length in the geographic information system (**GIS**).

- The age profile of overhead conductors contains a number of records where the installation date of the asset is unknown or incorrect. The Basis of Preparation document Table 5.2 age profile submitted with the annual Category Analysis RIN includes the methodology of distributing these across the known age profile.[4]

4.1.3 (C) Main drivers of replacement

The main driver of replacement is the asset condition based on inspection regime and/or asset failure. Deteriorating asset condition, if left untreated, have potential risk (safety, bushfire, reliability and reputational) and cost (unplanned capital and operational expenses) consequences.

4.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, excavation, removal of old assets, hardware, installation, reinstatement and outage management.

It excludes cross-arms, fittings and insulators as they are accounted for in the pole top structure asset group. The project or program overheads have been proportionally allocated, where applicable, between this asset group, poles and pole top structure asset groups.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

4.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

4.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, increasing safety risk etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 8 demonstrates the proportion of overhead conductor assets replaced due to various drivers that can be proxy by age.

4 CP ATT229: CitiPower, Category analysis RIN basis of preparation, 2018.

Table 8 Proportion of assets replaced due to various drivers that can be proxy by age, overhead conductors, 2016–2020

Overhead conductors, asset category	2016	2017	2018	2019	2020
< = 1 kV	100%	100%	84.91%	94.97%	94.97%
> 1 kV & < = 11 kV	100%		100%	100%	100%
> 11 kV & < = 22 kV ; SWER					
> 11 kV & < = 22 kV ; Single-Phase					
> 11 kV & < = 22 kV ; Multiple-Phase					
> 22 kV & < = 66 kV					
Unweighted asset group overall	100%	100%	87.08%	95.69%	95.69%
Unit cost weighted asset group overall	100%	100%	86.39%	95.46%	95.46%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

4.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 9 shows a share of overhead conductor assets replaced from asset failure that cannot be proxy by age.

Table 9 Proportion of assets replaced due to asset failure that cannot be proxy by age, overhead conductors, 2016–2020

Overhead conductors, asset category	2016	2017	2018	2019	2020
< = 1 kV	0%	0%	15.09%	5.03%	5.03%
> 1 kV & < = 11 kV	0%		0%	0%	0%
> 11 kV & < = 22 kV ; SWER					
> 11 kV & < = 22 kV ; Single-Phase					
> 11 kV & < = 22 kV ; Multiple-Phase					
> 22 kV & < = 66 kV					
Unweighted asset group overall	0%	0%	12.92%	4.31%	4.31%
Unit cost weighted asset group overall	0%	0%	13.61%	4.54%	4.54%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

4.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

4.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

4.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

4.3.1 (i) Statutory requirements

None.

4.3.2 (ii) Internal planning and asset management approaches

Table 10 shows the asset management initiatives have been introduced or are planned to be introduced to enhance the management of overhead conductors.

Table 10 Asset management initiatives introduced to enhance the management of overhead conductors

Initiative	Implementation year	Impact on replacements
Policy created for the management of HV ABC incorporating a requirement for an annual Acoustic inspection of HV ABC inspection program	2016	No material impact
Conductor risk model introduced to prioritise conductor replacements	2017	No material impact
Thermographic and Corona Inspection policy updated to include an additional requirement to inspect HV and LV lines in coastal area	2018	No material impact
Annual LIDAR for conductor clearances to be developed and will result in an increase conductor replacement volumes	2020	Refer to the Lines model forecast replacements in the 2021–2026 regulatory proposal.[5]

Source: CitiPower

4.3.3 (iii) Measureable asset factors

None.

4.3.4 (iv) Measureable and forecastable external factors

None.

4.3.5 (v)(A) Network technology/solution

None.

4.3.6 (v)(B) Non-network technology/solution

None.

4.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

4.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

[5] CP MOD 4.06 - Lines replacement - Jan2020 - Public

5 Underground cables

5.1 Paragraph 5.1(a)(i)—Asset category description

5.1.1 (A) Asset scope and boundary issues

Includes all cable types that we own and operate, as well as terminations, cabus cable termination boxes, cable heads and XLPE joints.

5.1.2 (B) Age profile determination

The following assumptions were applied to determine the underground cable age profiles:

- Out of service underground cables were excluded from the reported quantities.
- The computed underground cable length for three phase cable runs that utilise three separate single core cables has been divided by three, to enable consistent cable length reporting regardless of actual cable configuration installed.
- Where an underground cable voltage was unknown, quantity of underground cable was apportioned across the other underground cable voltages, in direct proportion with the known sub-category quantities.
- Where an underground LV cable type was unknown, the quantity of underground cable was apportioned across the other underground LV cable types in direct proportion with the known sub-category quantities.

5.1.3 (C) Main drivers of replacement

Asset defects captured through inspection and/or asset failures are the main drivers of replacement for this asset class.

We have a very small targeted replacement program for underground cables. Underground cables are managed through defects and fix on failure approach. Additionally, we replace damaged sections in piecemeal fashion. Regular scheduled tests for oil filled and XLPE cables include insulation and sheath resistance tests and oil DGA tests. Engineering assessment is applied to prioritise cable defects.

Currently asset replacement is reactive and is based on observed and reported data including fault repair cable condition assessments, defects gathered through inspection and planned maintenance activities as well as reported incidents (e.g. connection failure, safety or fire incident). Sections of cables identified by this process and where the continued operation of the cable in its current state poses unacceptable performance or safety issues, will have approval sought for planned replacement (or an efficient functional alternative to replacement).

5.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, trenching, excavation, removal of old assets, cable, joints, conduit, communication, monitoring system, installation or cable laying or pulling, new joining pits, terminations on switchgear and outage management.

The project or program overheads have been proportionally allocated, where applicable, between this asset group, switchgear and/or transformers asset groups.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

5.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

5.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, technological obsolescence, increasing safety risk etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 11 demonstrates the proportion of underground cables assets replaced due to various drivers that can be proxy by age.

Table 11 Proportion of assets replaced due to various drivers that can be proxy by age, underground cables, 2016–2020

Underground cables, asset category	2016	2017	2018	2019	2020
< = 1 kV	100%	100%	100%	100%	100%
> 1 kV & < = 11 kV	100%	100%	85.08%	95.03%	95.03%
> 11 kV & < = 22 kV	100%		100%	100%	100%
> 33 kV & < = 66 kV			100%	100%	100%
Public lighting underground cable			100%	100%	100%
Unweighted asset group overall	100%	100%	90.26%	96.75%	96.75%
Unit cost weighted asset group overall	100%	100%	86.87%	95.62%	95.62%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

5.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 12 shows a share of underground cable assets replaced from asset failure that cannot be proxy by age.

Table 12 Proportion of assets replaced due to asset failure that cannot be proxy by age, underground cables, 2016–2020

Underground cables, asset category	2016	2017	2018	2019	2020
< = 1 kV	0%	0%	0%	0%	0%
> 1 kV & < = 11 kV	0%	0%	14.92%	4.97%	4.97%
> 11 kV & < = 22 kV	0%		0%	0%	0%
> 33 kV & < = 66 kV			0%	0%	0%
Public lighting underground cable			0%	0%	0%
Unweighted asset group overall	0%	0%	9.74%	3.25%	3.25%
Unit cost weighted asset group overall	0%	0%	13.13%	4.38%	4.38%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

5.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

5.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

5.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

5.3.1 (i) Statutory requirements

None.

5.3.2 (ii) Internal planning and asset management approaches

None.

5.3.3 (iii) Measureable asset factors

None.

5.3.4 (iv) Measureable and forecastable external factors

None.

5.3.5 (v)(A) Network technology/solution

In 2018 we invested in new testing equipment to better identify insulation defects and faults. This has not had a material impact.

5.3.6 (v)(B) Non-network technology/solution

None.

5.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

5.3.8 (vii) Supporting Information

Please refer to the Replacement chapter in our 2021–2026 regulatory proposal.

6 Services

6.1 Paragraph 5.1(a)(i)—Asset category description

6.1.1 (A) Asset scope and boundary issues

Includes all overhead service types and associated connectors, attachment fittings, service protection devices (incorporating fuses), junction boxes and connection devices we own and operate.

6.1.2 (B) Age profile determination

The following assumptions were applied to determine the service line age profiles:

- Only in-service lines were in included in reported quantities.
- LV underground service conductor age profile has been adjusted to report the number of services installed instead of the total length of services installed.
- LV overhead service conductor age profile has been adjusted to report the number of services installed instead of the total length of services installed.

6.1.3 (C) Main drivers of replacement

The main driver of replacement is the asset condition based on inspection regime and/or asset failure. Deteriorating asset condition, if left untreated, have potential risk (safety, reliability and reputational) and cost (unplanned capital and operational expenses) consequences.

6.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, removal of old assets, hardware, installation and connection.

It excludes customer switchboard and metering, and also network utility cross arms, fittings and insulators as they are accounted for in the pole top structure asset group. The project or program overheads have been proportionally allocated, where applicable, between this asset group, poles and pole top structure asset groups.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

6.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

6.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, increasing safety risk, jurisdictional directives, fixed periodic frequency etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 13 demonstrates the proportion of services replaced due to various drivers that can be proxy by age.

Table 13 Proportion of assets replaced due to various drivers that can be proxy by age, services, 2016–2020

Services, asset category	2016	2017	2018	2019	2020
< = 11 kV ; Residential ; Simple Type	82.14%	91.30%	86.02%	86.49%	86.49%

Source: CitiPower

6.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 14 shows a share of services replaced from asset failure that cannot be proxy by age.

Table 14 Proportion of assets replaced due to asset failure that cannot be proxy by age, services, 2016–2020

Services, asset category	2016	2017	2018	2019	2020
< = 11 kV ; Residential ; Simple Type	17.86%	8.70%	13.98%	13.51%	13.51%

Source: CitiPower

Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category.

6.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

6.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

6.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

6.3.1 (i) Statutory requirements

None.

6.3.2 (ii) Internal planning and asset management approaches

Table 15 shows the asset management initiatives have been introduced to enhance the management of services.

Table 15 Asset management initiatives introduced to enhance the management of services

Initiative	Implementation year	Impact on replacements
LV aerial service cables ground clearance policy updated to define a service in line with Electricity Safety Regulations 2009.	2014	No material impact
Improved inspection method for PVC/Dog-bone services to include a close inspection at the point of attachment and more detailed inspection instructions.	2018	Refer to the 2021–2026 regulatory proposal Lines model for forecast replacements and category analysis RIN 2.2 Repex for historical replacements.[6]
Façade mounted safety issues have led to increased costs for the maintenance of services fixed to building facades.	2019	Refer to the 2021–2026 regulatory proposal Lines model.[7]

Source: CitiPower

6.3.3 (iii) Measureable asset factors

None.

6.3.4 (iv) Measureable and forecastable external factors

None.

6.3.5 (v)(A) Network technology/solution

Table 16 shows the network technology initiatives have been introduced to enhance the management of services.

Table 16 Asset management initiatives introduced to enhance the management of services

Initiative	Implementation year	Impact on replacements
A meter data analytics application has been developed and implemented to identify faulty neutral connections. This is conducted in conjunction with site verification through neutral integrity testing leading to increased volume of service cable replacements.	2018	Refer to the 2021–2026 regulatory proposal Lines model for forecast replacements and category analysis RIN 2.2 Repex for historical replacements.[8]

Source: CitiPower

6.3.6 (v)(B) Non-network technology/solution

None.

6.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

6 CP MOD 4.06 - Lines replacement - Jan2020 - Public

7 CP MOD 4.06 - Lines replacement - Jan2020 - Public

8 CP MOD 4.06 - Lines replacement - Jan2020 - Public

6.3.8 (vii) Supporting Information

Please refer to the Replacement chapter in our 2021–2026 regulatory proposal.

7 Transformers

7.1 Paragraph 5.1(a)(i)—Asset category description

7.1.1 (A) Asset scope and boundary issues

Includes pole top transformers, ground mounted transformers (indoor/outdoor), kiosks, zone substation (**ZSS**) power transformers and regulators we own and operate.

Boundary issues for pole top and ground mounted transformers (indoor/outdoor) constitute:

- surge arrester replacement
- pole replacement
- LV/HV cable terminations replacement
- protection, control and communications
- LV/HV connections replacement.

Boundary issues for ZSS power transformers constitute:

- LV/HV connections replacement
- surge arrester replacement
- cable termination replacement
- protection replacement.

7.1.2 (B) Age profile determination

The following assumptions were applied to determine the transformer age profiles:

- Only in service (in-commission) transformers were included in reported quantities.
- Only our transformers were included in reported quantities.
- Where transformer voltages, capacities or phase types were unknown, the quantity of transformers was apportioned proportionately across the known sub-categories. The resulting numbers were then rounded to provide whole numbers.
- The age profile of transformers contains a number of records where the installation date of the asset is unknown or incorrect. Please refer to the Basis of Preparation document table 5.2 age profile, submitted with the annual Category Analysis RIN for the methodology of distributing these across the known age profile.[9]

7.1.3 (C) Main drivers of replacement

Asset condition based on inspection regime, operational experience and/or asset failure for distribution transformers. Asset condition and load index based on inspection and testing regime, operational experience, emergency cost, etc. and/or asset failure for ZSS transformers. More detail is discussed below.

The condition of ZSS transformers is determined by calculating a HIs using the condition-based risk management (**CBRM**) model, which is a third party model by EA Technology used by utilities worldwide to predict asset

[9] CP ATT229: CitiPower, Category analysis RIN basis of preparation, 2018.

replacement and investment both internally and to regulators. The CBRM model uses latest asset condition data to calculate an overall HI to predict timing for asset replacement. The HI is calculated using a combination of measures, including age, operational history, operational context, oil test results and diagnostic testing undertaken on transformer bushings and the OLTCs. The HI is calculated in several stages (initial HI1, intermediate HI2 and final HI Y0) and then used to calculate the probability of failure under various scenarios. Combined with an understanding of the consequence of asset failure, this provides a measure of risk against each asset, and ultimately the network, making it a powerful tool to prioritise asset investment. Asset expenditure is typically set to maintain (or reduce) existing risk levels at an acceptable level over each regulatory period.

In particular, the CBRM model:

- forecasts risk as the monetised value of potential loss
- is in use with numerous distributors across the world
- has been specifically calibrated and tested by EA Technology for our ZSS power transformer population.

The model applies asset information using rules that are consistent with the engineering principles and experience of our subject matter experts. The rules allow for some level of subjectivity but are transparent and available for scrutiny and improvement. The results of the CBRM model, and the rules, are subject to sensitivity tests to ensure that the model produces meaningful results. In comparison to standard statistical models, the CBRM model can use limited data, and unknown data quality, from across the asset base to produce a meaningful measure of asset risk. In addition, whereas statistical models may be considered “top-down”, the CBRM model is considered a “bottom-up” asset replacement decision tool.

7.1.4 (D) Unit cost scope

The cost in this asset category includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistic, factory acceptance testing (**FAT**) (if applicable or larger zone substation transformers), all associated zone substation hardware (oil, fan, tap-changer, surge arrestor or bushings), all associated distribution substation hardware (HV/LV switch/fuse, termination, and concrete plinth), removal of old assets, connection, and commissioning.

The project or program overheads have been proportionally allocated, where applicable, between this asset group and other asset groups that typically are delivered together.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

7.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

7.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, technological obsolescence, increasing safety risk etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 17 demonstrates the proportion of transformers replaced due to various drivers that can be proxy by age.

Table 17 Proportion of assets replaced due to various drivers that can be proxy by age, transformers, 2016–2020

Transformers, asset category	2016	2017	2018	2019	2020
Pole Mounted ; < = 22kV ; < = 60 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; > 600 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; < = 60 kVA ; Multiple Phase					
Pole Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Multiple Phase	71.43%	50%	100%	73.81%	73.81%
Pole Mounted ; < = 22kV ; > 600 kVA ; Multiple Phase					
Kiosk Mounted ; < = 22kV ; < = 60 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; > 600 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; < = 60 kVA ; Multiple Phase			0%	0%	0%
Kiosk Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Multiple Phase	0%	100%		50%	50%
Kiosk Mounted ; < = 22kV ; > 600 kVA ; Multiple Phase	0%			0%	0%
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; < = 60 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 600 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; < = 60 kVA ; Multiple Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 60 kVA and < = 600 kVA ; Multiple Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 600 kVA ; Multiple Phase	0%	100%	100%	66.67%	66.67%
Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; < = 15 MVA	0%			0%	0%

Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; > 15 MVA and < = 40 MVA					
Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; > 40 MVA					
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; < = 15 MVA	0%	0%	0%	0%	0%
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; > 15 MVA and < = 40 MVA	0%			0%	0%
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; > 40 MVA	0%			0%	0%
Unweighted asset group overall	27.78%	54.55%	39.13%	40.48%	40.48%
Unit cost weighted asset group overall	31.09%	87.69%	100.00%	72.93%	72.93%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

7.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 18 shows a share of transformers assets replaced from asset failure that cannot be proxy by age.

Table 18 Proportion of assets replaced due to asset failure that cannot be proxy by age, transformers, 2016–2020

Transformers, asset category	2016	2017	2018	2019	2020
Pole Mounted ; < = 22kV ; < = 60 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; > 600 kVA ; Single Phase					
Pole Mounted ; < = 22kV ; < = 60 kVA ; Multiple Phase					
Pole Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Multiple Phase	28.57%	50%	0%	26.19%	26.19%
Pole Mounted ; < = 22kV ; > 600 kVA ; Multiple Phase					
Kiosk Mounted ; < = 22kV ; < = 60 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; > 600 kVA ; Single Phase					
Kiosk Mounted ; < = 22kV ; < = 60 kVA ; Multiple Phase			100%	100%	100%
Kiosk Mounted ; < = 22kV ; > 60 kVA and < = 600 kVA ; Multiple Phase	100%	0%		50%	50%
Kiosk Mounted ; < = 22kV ; > 600 kVA ; Multiple Phase	100%			100%	100%
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; < = 60 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 60 kVA and < = 600 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 600 kVA ; Single Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; < = 60 kVA ; Multiple Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 60 kVA and < = 600 kVA ; Multiple Phase					
Ground Outdoor / Indoor Chamber Mounted; < 22 kV ; > 600 kVA ; Multiple Phase	100%	0%	0%	33.33%	33.33%
Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; < = 15 MVA	100%			100%	100%

Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; > 15 MVA and < = 40 MVA					
Ground Outdoor / Indoor Chamber Mounted; > = 22 kV & < = 33 kV ; > 40 MVA					
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; < = 15 MVA	100%	100%	100%	100%	100%
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; > 15 MVA and < = 40 MVA	100%			100%	100%
Ground Outdoor / Indoor Chamber Mounted; > 33 kV & < = 66 kV ; > 40 MVA	100%			100%	100%
Unweighted asset group overall	72.22%	45.45%	60.87%	59.52%	59.52%
Unit cost weighted asset group overall	68.91%	12.31%	0%	27.07%	27.07%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

7.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

7.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

7.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

7.3.1 (i) Statutory requirements

None.

7.3.2 (ii) Internal planning and asset management approaches

From 2016 the use of the combination of health indices (**HI**) and load index (**LI**) matrix for ZSS power transformers has decreased the volume of effective replacements. Historical Category Analysis RIN submissions contain the number of replaced transformers in Table 2.2 Repex.

In 2019 we introduced the use of the risk monetisation models for ZSS power transformers. Refer to the 2021–2026 regulatory proposal and associated zone substation risk monetisation models for the impact.

A bushing replacement program is underway for ZSS power transformers—due to some past failures, we have already replaced our highest risk oil filled bushings from our network during the 2016–2020 period and are continuing to do targeted replacement of our oil filled bushing population with Resin impregnated paper bushings. Historical Category Analysis RIN submissions contain the number of bushings replaced per year, included in the Table 2.2 Repex 'Other' category.

7.3.3 (iii) Measureable asset factors

None.

7.3.4 (iv) Measureable and forecastable external factors

None.

7.3.5 (v)(A) Network technology/solution

None.

7.3.6 (v)(B) Non-network technology/solution

None.

7.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

7.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

8 Switchgear

8.1 Paragraph 5.1(a)(i)—Asset category description

8.1.1 (A) Asset scope and boundary issues

Includes ZSS switchboards, all circuit breakers (**CB**) (LV-66KV), all air break switches (**ABS**) and gas switch types, all isolators (LV-66KV), fuse and surge diverters, ring main unit (**RMU**) and all automatic circuit reclosers (**ACR**) types.

Boundary issues for ZSS switchboard and all CBs constitutes:

- could include protection, control and communication component
- LV/HV cable terminations
- LV/HV connections.

Boundary issues for RMUs constitutes:

- cable replacement
- protection, control and communication component.

Boundary issues for all ACRs and pole mounted switches constitutes:

- pole replacements
- communication and control unit replacements.

8.1.2 (B) Age profile determination

As per the Basis of Preparation document table 5.2 age profile, submitted with the annual Category Analysis RIN for the methodology.[10]

8.1.3 (C) Main drivers of replacement

Asset condition based on inspection regime, operational experience and/or asset failure for distribution or overhead line switchgear. It is noted that some portion within this asset category are proactively replaced due to safety concerns. Asset condition and risk profile based on inspection and testing regime, operational experience such as fault history, health indices, value of lost load, emergency cost, etc. and/or asset failure for zone substation switchgear. More detail is discussed below.

We measure and maintain HIs for this particular asset group, especially for higher voltage equipment, from which it can form a risk profile and compare it with the cost of replacement to justify investment.

EA Technology was engaged to develop the CBRM models for ZSS CBs. The CBRM model utilises information, knowledge, engineering experience and judgement for the identification and justification of targeted asset replacement.

CBRM is used as a decision support tool to assist the quantification, communication and management of asset related risk, particularly issues associated with end of asset life. The CBRM process produces computer models that provide quantitative representation of current and projected asset condition, performance and risk. Models can then be used to evaluate possible asset replacement strategies and investment scenarios to arrive at a proposal that best meets the strategic objectives of the organisation.

10 CP ATT229: CitiPower, Category analysis RIN basis of preparation, 2018.

CBRM seeks to overcome problems of non-availability of reliable and consistent data that is necessary to construct a valid population based statistical models. This problem is particularly acute in the electricity distribution industry where assets have long lives (often many times longer than a typical computer information system), and are subject to many factors that cause asset sub populations within a general asset class to behave differently i.e. manufacturer make and model differences, quality characteristics, installation practices, operating environment and usage histories).

Rather than use a purely statistical representation of the asset population, CBRM models seek to make the best possible use of available information by combining asset information, operating context, operating history and condition information using rules that are consistent with sound engineering principles and asset specific operating experience. Models are adjusted and calibrated so that the output and behaviour of each model is consistent with historical observations and asset performance. Where CBRM models incorporate subjective subject matter expert judgment, it is codified by rules and is applied consistently.

CBRM offers advantages over statistical based approaches in that all available information, including physical observations of condition are incorporated into the assessment, and applied to individual assets within the model. The objective is to produce asset risk rankings and projections to inform asset management strategy as well as providing higher quantity level forecasts necessary for budget and regulatory purposes.

A core feature of the CBRM methodology is the ability to age assets into the future and forecast future HIs, probability of failure and risk.

8.1.4 (D) Unit cost scope

The cost in this asset category includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistics, hardware, removal of old assets, connection, and commissioning. It also represents any zone substation civil cost such as structure or foundation. It excludes zone substation civil costs such gantry structures and electrical costs such as corresponding busbar and secondary system. At distribution level, it excludes cross arms, poles, UGOH and fencing.

The project or program overheads have been proportionally allocated, where applicable, between this asset group and other asset groups that typically are delivered together.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

8.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

8.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, technological obsolescence, increasing safety risk, jurisdictional directives etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 19 demonstrates the proportion of switchgear replaced due to various drivers that can be proxy by age.

Table 19 Proportion of assets replaced due to various drivers that can be proxy by age, switchgear, 2016–2020

Switchgear, asset category	2016	2017	2018	2019	2020
< = 11 kV ; Fuse	42.59%	100%	100%	80.86%	80.86%
< = 11 kV ; Switch	14.29%	0%	0%	4.76%	4.76%
< = 11 kV ; Circuit Breaker		0%	32.00%	16.00%	16.00%
> 11 kV & < = 22 kV ; Switch					
> 11 kV & < = 22 kV ; Circuit Breaker					
> 22 kV & < = 33 kV ; Switch					
> 22 kV & < = 33 kV ; Circuit Breaker					
> 33 kV & < = 66 kV ; Switch		80.00%		80.00%	80.00%
> 33 kV & < = 66 kV ; Circuit Breaker	42.59%	100%	100%	80.86%	80.86%
Switchgear Other	99.42%	99.11%	94.52%	97.68%	97.68%
Unweighted asset group overall	83.62%	95.60%	79.13%	86.12%	86.12%
Unit cost weighted asset group overall	63.49%	94.65%	92.57%	83.57%	83.57%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

8.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 18 shows a share of switchgear assets replaced from asset failure that cannot be proxy by age.

Table 20 Proportion of assets replaced due to asset failure that cannot be proxy by age, switchgear, 2016–2020

Switchgear, asset category	2016	2017	2018	2019	2020
< = 11 kV ; Fuse	57.41%	0%	0%	19.14%	19.14%
< = 11 kV ; Switch	85.71%	100%	100%	95.24%	95.24%
< = 11 kV ; Circuit Breaker		100%	68.00%	84.00%	84.00%
> 11 kV & < = 22 kV ; Switch					
> 11 kV & < = 22 kV ; Circuit Breaker					
> 22 kV & < = 33 kV ; Switch					
> 22 kV & < = 33 kV ; Circuit Breaker					
> 33 kV & < = 66 kV ; Switch		20.00%		20.00%	20.00%
> 33 kV & < = 66 kV ; Circuit Breaker	57.41%	0%	0%	19.14%	19.14%
Other	0.58%	0.89%	5.48%	2.32%	2.32%
Unweighted asset group overall	16.38%	4.40%	20.87%	13.88%	13.88%
Unit cost weighted asset group overall	36.51%	5.35%	7.43%	16.43%	16.43%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

8.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

8.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

8.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

8.3.1 (i) Statutory requirements

None.

8.3.2 (ii) Internal planning and asset management approaches

None.

8.3.3 (iii) Measureable asset factors

None.

8.3.4 (iv) Measureable and forecastable external factors

None.

8.3.5 (v)(A) Network technology/solution

None.

8.3.6 (v)(B) Non-network technology/solution

None.

8.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

8.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

9 Public lighting

9.1 Paragraph 5.1(a)(i)—Asset category description

9.1.1 (A) Asset scope and boundary issues

This asset group includes lanterns owned and operated by us as well as public lighting poles that have the sole purpose of supporting one or more public lighting lanterns.

9.1.2 (B) Age profile determination

The following assumptions were applied to determine the public lighting age profiles:

- Only in-service and billable assets were included in reported quantities.
- Cost share status was used to separate between major roads and minor roads.
- Where 'year lantern changed' = 1960, 1970 & 2001 and 'year lantern manufactured' varied, 'year lantern manufactured' was used in preference to 'year lantern changed'.
- Where 'cost share status' = 'full cost (VicRoads)' or 'other', these were added to Cost Shared (4/10)(6/10) (Major Road).
- The allocation of public lighting poles between major and minor roads is based on the proportion of lights installed in each road classification.

9.1.3 (C) Main drivers of replacement

Fixed periodic frequency, irrespective of age or condition assessment as it is more economical to do so and/or asset failure for luminaires and lamps.

Asset condition based on inspection regime and/or asset failure for brackets and poles.

9.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant & equipment, mobilisation & travel, and the project or program overheads. The cost represents the procurement, inventory, logistics, hardware, removal of old assets, and installation. It includes luminaires, lamps, brackets and poles.

The project or program overheads have been proportionally allocated, where applicable, between the respective asset categories in this asset group that typically are delivered together. Cost share status was used to separate between major roads and minor roads assets.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

9.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

9.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as asset condition, technological obsolescence, increasing safety risk, fixed periodic frequency etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 21 demonstrates the proportion of public lighting replaced due to various drivers that can be proxy by age.

Table 21 Proportion of assets replaced due to various drivers that can be proxy by age, public lighting, 2016–2020

Public lighting, asset category	2016	2017	2018	2019	2020
Luminaires ; Major Road	0.95%	0.60%	20.90%	7.49%	7.49%
Luminaires ; Minor Road	0.54%	0.63%	29.36%	10.18%	10.18%
Brackets ; Major Road	12.50%	5.26%	85.53%	34.43%	34.43%
Brackets ; Minor Road	14.29%	10.64%	66.16%	30.36%	30.36%
Lamps ; Major Road					
Lamps ; Minor Road					
Poles / Columns ; Major Road	18.18%	9.52%	87.13%	38.28%	38.28%
Poles / Columns ; Minor Road	37.50%	12.77%	64.80%	38.35%	38.35%
Unweighted asset group overall	2.51%	1.82%	32.19%	12.17%	12.17%
Unit cost weighted asset group overall	10.60%	5.30%	43.42%	19.78%	19.78%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

9.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 22 shows a share of public lighting assets replaced from asset failure that cannot be proxy by age.

Table 22 Proportion of assets replaced due to asset failure that cannot be proxy by age, public lighting, 2016–2020

Public lighting, asset category	2016	2017	2018	2019	2020
Luminaires ; major road	99.05%	99.40%	79.10%	92.51%	92.51%
Luminaires ; minor road	99.46%	99.37%	70.64%	89.82%	89.82%
Brackets ; major road	87.50%	94.74%	14.47%	65.57%	65.57%
Brackets ; minor road	85.71%	89.36%	33.84%	69.64%	69.64%
Lamps ; major road					
Lamps ; minor road					
Poles/columns ; major road	81.82%	90.48%	12.87%	61.72%	61.72%
Poles/columns ; minor road	62.50%	87.23%	35.20%	61.65%	61.65%
Unweighted asset group overall					
Unit cost weighted asset group overall	97.49%	98.18%	67.81%	87.83%	87.83%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

9.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

9.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

9.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

9.3.1 (i) Statutory requirements

None.

9.3.2 (ii) Internal planning and asset management approaches

None.

9.3.3 (iii) Measureable asset factors

None.

9.3.4 (iv) Measureable and forecastable external factors

None.

9.3.5 (v)(A) Network technology/solution

None.

9.3.6 (v)(B) Non-network technology/solution

None.

9.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

9.3.8 (vii) Supporting Information

Refer to the Alternative Control Services chapter in our 2021–2026 regulatory proposal.

10 SCADA, network control and protection systems

10.1 Paragraph 5.1(a)(i)—Asset category description

10.1.1 (A) Asset scope and boundary issues

This asset group covers protection relays, network communications assets, including RTUs, supervisory cable, and distribution communications assets.

10.1.2 (B) Age profile determination

The following assumptions were applied to determine the age profile of protection/SCADA:

- Only in-service assets were included in reported quantities
- Data is sourced from the Relay Setting Information System (**RESIS**). SAP project data is used to qualify RESIS data.

10.1.3 (C) Main drivers of replacement

A CBRM methodology is used to drive planned replacement expenditure requirements. This considers technology obsolescence, asset age, and asset reliability, and consequence of failure.

Replacements due to asset failure drive unplanned operating expenditure.

10.1.4 (D) Unit cost scope

The cost in this asset group includes the materials, labour, plant and equipment, mobilisation and travel, and the project or program overheads. The cost represents the procurement, inventory, logistics, hardware, and termination, removal of old assets, connection, and commissioning. It excludes any zone substation civil cost such as demountable building, switch-room building, switchyard trenching, and any primary electrical assets.

The project or program overheads have been proportionally allocated, where applicable, between this asset group and other asset groups that typically are delivered together.

The proposed replacement expenditure and quantities in Workbook 1, table 2.2.1 allows for complete replacement of asset within the described boundary. These costs are capitalised.

It is noted that projects and programs of work are usually delivered to resolve an issue or constraint and includes multiple asset categories that has been demarcated and described separately by the AER for its review and modelling purpose.

10.2 Paragraph 5.1(a)(ii)—Asset replacement drivers during 2016–2020

10.2.1 (A) Replacement due to various drivers that can be proxy by age

We calculated this statistics by referring to 2016–2018 CA RINs, table 2.2.1 and dividing the quantity replaced by the total quantity replaced and failed. We assumed that all the replacement quantities reported in the CA RIN, table 2.2.1 represents asset replacement due to various factors (such as technological obsolescence, asset age and asset reliability etc.) that can be proxy by asset age. Therefore, it is expected that such expenditure activities can be largely captured by the AER replacement expenditure modelling methodology. Table 23 demonstrates the proportion of SCADA, network control and protection assets replaced due to various drivers that can be proxy by age.

Table 23 Proportion of assets replaced due to various drivers that can be proxy by age, SCADA, network control and protection, 2016–2020

SCADA, network control and protection, asset category	2016	2017	2018	2019	2020
Field devices	70.79%	50.00%	35.14%	51.97%	51.97%
Local network wiring assets					
Communications network assets					
Master station assets					
Communications site infrastructure					
Communications linear assets					
AFLC					
Unweighted asset group overall	83.62%	95.60%	79.13%	86.12%	86.12%
Unit cost weighted asset group overall	63.49%	94.65%	92.57%	83.57%	83.57%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group are being replaced in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. The AER should consider the average historical proportion of the remainder of asset categories if the replacement expenditure model identifies replacement in 2021–2026 regulatory period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

10.2.2 (B) Replacement due to other drivers

This statistics represent annual replacement activities due to asset failures only. We calculated this statistics by referring to 2016–2018CA RINs, table 2.2.1 and dividing the quantity failed by the total quantity replaced and failed. Failed assets are replaced like-for-like immediately. It is noted that asset failure can occur at any point in time in asset life and therefore the asset age cannot be a proxy for such reactive or emergency expenditure activities. Such expenditure activities should not be reviewed using the AER replacement expenditure modelling methodology. Table 24 shows a share of SCADA, network control and protection replaced from asset failure that cannot be proxy by age.

Table 24 Proportion of assets replaced due to asset failure that cannot be proxy by age, SCADA, network control and protection, 2016–2020

SCADA, network control and protection, asset category	2016	2017	2018	2019	2020
Field devices	29.21%	50.00%	64.86%	48.03%	48.03%
Local network wiring assets					
Communications network assets					
Master station assets					
Communications site infrastructure					
Communications linear assets					
AFLC					
Unweighted asset group overall	29.21%	50.00%	64.86%	48.03%	48.03%
Unit cost weighted asset group overall	29.21%	50.00%	64.86%	48.03%	48.03%

Note: empty cells indicate no asset replacement
Source: CitiPower

Not all the asset categories within this asset group had failure in this current regulatory period, and thus some asset categories do not have proportional statistics to report in the above table. Asset failure can occur at any point in time in asset life (due to a range of issues that are beyond our control such as weather, manufacturing defect, accident, etc.) and we are unable to foresee or forecast proportion of assets that will fail in 2021–2026. The AER should therefore consider the average historical proportion of the remainder of asset categories to represent the failure proportion in 2021–2026 period of such missing asset category. The unweighted and weighted average historical proportion statistics for the asset group is provided in the above table.

10.2.3 (C) Additional assets due to augmentation, extension or development

No replacement expenditure has occurred in the current regulatory period due to augmentation, extension or network development within any asset categories in this asset group. The proportion of new asset each year due to such factors can be calculated referring to 2016–2018 CA RINs, tabs 2.3(a), 2.3(b) and 2.5 (for new quantities added). There are also asset quantities associated with the 'non-material projects' collectively summarised and reported at the bottom of tables 2.3.1 and 2.3.2. All such asset quantities are due to augmentation, extension and development of network.

10.2.4 (D) Additional assets due to other drivers

No additional replacement expenditure has been recorded in the current regulatory period due to other factors within any asset categories in this asset groups.

10.3 Paragraph 5.1(b)—Changes in asset replacement drivers during 2011–2026

10.3.1 (i) Statutory requirements

None.

10.3.2 (ii) Internal planning and asset management approaches

None.

10.3.3 (iii) Measureable asset factors

From 2019, a CBRM methodology is used to drive planned replacement expenditure requirements. This considers technology obsolescence, asset age, and asset reliability, and consequence of failure. The effect of this change is outlined in our replacement protection model.[11]

Previously, reliability centred maintenance (**RCM**) was used to forecast replacement expenditure requirements for this asset category. CBRM is a more comprehensive approach and aligns with industry best practise.

10.3.4 (iv) Measureable and forecastable external factors

None.

10.3.5 (v)(A) Network technology/solution

None.

10.3.6 (v)(B) Non-network technology/solution

None.

10.3.7 (vi) Other significant matters

We are not aware of any other significant factors that have affected network replacement expenditure requirements for the previous, current and forthcoming regulatory control periods.

10.3.8 (vii) Supporting Information

Refer to the Replacement chapter in our 2021–2026 regulatory proposal.

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[11] CP MOD 4.10 - Protection replacement - Jan2020 - Public.