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Attachment 5.3.b: Cost estimation Approach

Ausgrid's 2024-29 Regulatory Proposal

Empowering communities for a resilient,
affordable and net-zero future.



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1. Introduction

1.1 This document's purpose

This document outlines Ausgrid's approach to the development, maintenance and application of cost estimations applied within the Network Investment Governance Framework (NIGF).

1.2 This document in context

This document supports all material items related to network capital investment for the FY24-29 regulatory submission

1.2.1 Related documents

Document	Description	Relevant sections
Investment Governance Framework (decision making process)	A framework which provides clear guidance and accountability for the development and approval of investments	All

1.3 Document overview

This document outlines Ausgrid's approach to cost estimation, detailing the key elements of:

- Cost estimation context within the NIGF
- Cost estimation development methods and their application within the NIGF process
- Systems and data used to build and maintain cost estimates
- The governance of cost estimations including accountability, monitoring / review and change management

The document also provides a number of unit cost benchmark comparisons iterating Ausgrid's commitment to continuously improve our cost-to-serve.

2. Executive summary

Ausgrid maintains a Network Investment Governance Framework (**NIGF**) to provide clear guidance and accountability for the planning, development, endorsement and approval of network investments. This paper outlines the systems, methodology and procedures used by Ausgrid to generate and govern cost estimates for Network Capital Projects, Programs and Sub-Programs. Ausgrid's cost estimation approach is centered on end-to-end continuity with a single source of truth through the various stages of investment planning:

- Investment planning;
- Network Delivery planning;
- Program and project planning;
- Resource & material planning / forecasting; and
- Performance reporting and benchmarking.

Ausgrid's cost estimation approach outlines development methodologies, review, monitoring and change control stages to support effective management of cost estimates throughout the gated approval stages within the NIGF. There are five cost estimation methods:

- Historical Analysis: actual costs review and application method;
- Planning Estimates: building block method of stacking scope modules together;
- Unit Rates: standard scoping option method for similar / repeatable scope;
- Preliminary Estimates: first principles method of a design concept; and
- Detailed Estimates: first principles method of a detailed design including specific market pricing.

Cost estimates for all methods are stored and maintained in an enterprise estimating system which provides controlled, standardised and validated source data.

Ausgrid uses the most relevant and accurate cost estimations throughout the investment governance life cycle. To maintain cost estimates as an accurate, up-to-date representation of expected costs and resource demand, Ausgrid monitors and reviews 'outturn costs (unit cost) against approved estimates. The reporting of unit cost vs unit rates allows Ausgrid to benchmark its performance against internal and external delivery partners. Benchmarking against industry peers is also periodically undertaken. The benchmarking outcomes are used to support the development of productivity improvements which are generally centered on review of work practices, supply chain improvements, process and technology improvements leading to more efficient unit rates.

3. Context

3.1 Why are we writing this document?

To detail how Ausgrid produce, maintain and apply cost estimations that underpin many of the critical NIGF components.

3.2 What have we learnt since the last proposal

Standardisation of the application of cost estimation methods within the NIGF.

3.3 What have customers told us

Our customers have told us the importance of delivering on time and on budget. Effective cost estimation and appropriate management and application of cost estimates are imperative to achieving this outcome.

4. Purpose and Introduction

4.1 Purpose

The purpose of this document is to detail Ausgrid’s approach to managing cost estimates. This document outlines the systems, methodology and procedures used to govern cost estimates for network capital projects and sub-programs. The methodology used reflects Ausgrid’s commitment to undertaking prudent and efficient network investments.

4.2 Introduction

Ausgrid’s approach to cost estimation of capital program and project costs seeks to ensure that the estimates produced:

- effectively and accurately price specialised electricity supply industry works;
- are flexible, contemporary, and comprehensive;
- comply with company Network Standards and engineering guidelines/practices;
- are based on scopes that meet Workplace Health and Safety (WHS), commercial, environmental and licence obligations; and
- provide the most accurate estimate given the available data/information.

An appropriate, well-governed cost estimation approach provides:

- improved expenditure forecast accuracy;
- increased confidence in delivery capability;
- the ability to monitor performance against targets; and
- the ability, over-time, to deliver cost-to-serve improvements.

Ausgrid has developed a methodology with a focus on standardisation and end-to-end consistency. Ausgrid’s methodology aligns the data used in investment decision making through business planning, forecasting to execution performance metrics as displayed in Figure 1.

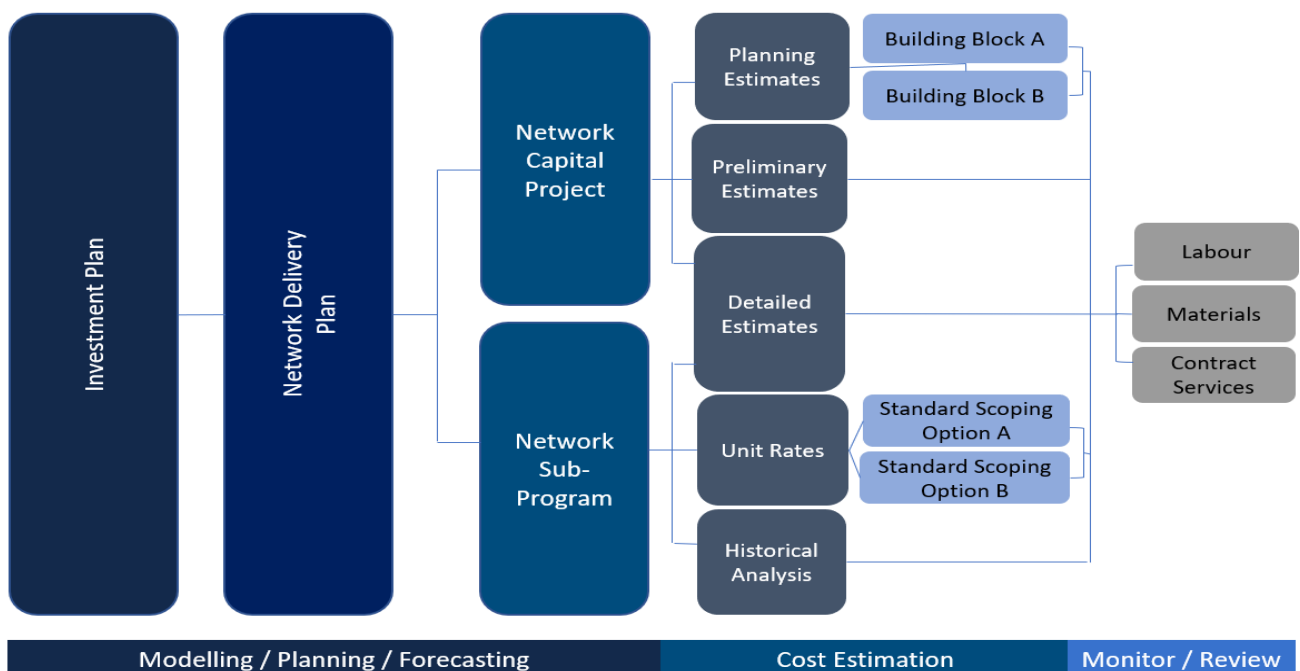
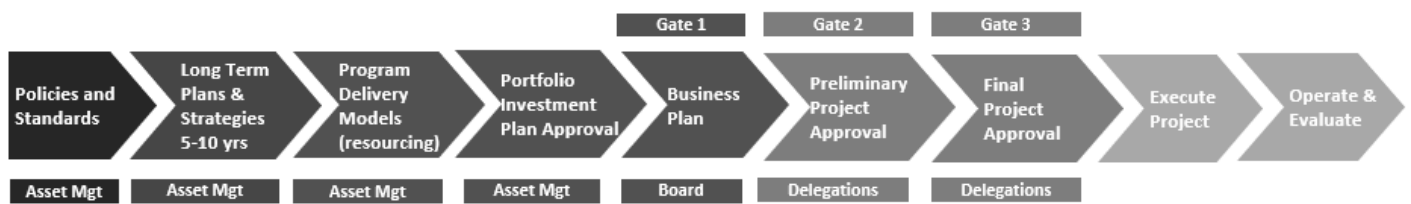


Figure 1: Ausgrid’s cost estimation methodology end-to-end continuity

5. Investment Governance

The NIGF has a gated investment approval process which follows the lifecycle of Network Capital Projects and Sub-Programs as indicated in Figure 2. The process is marked with three milestone gates at which approval is sought for the next stage of development based on economic appraisal. This provides the necessary inputs required to inform the basis of cost to benefit evaluation. For further information on the investment governance process refer to Company Policy Investment Governance Framework.

Figure 2: NIGF investment governance process



The company governs network investments through the investment process by using:

- Financial delegations for making investment decisions; and
- Internal committees to review and/or endorse the investment decisions.

For the purposes of cost estimation, investment types are broken down into two categories:

Table 1: NIGF investment types

Investment Type	Definition	Example
Network Project	A project is a discrete, non-recurring scope of effort that has explicit objectives and operates via a nominated schedule, budget and resources	The replacement of end of life oil insulated 33kV switchgear with gas insulated 33kV switchgear in a zone substation
Network Sub-Program	Network sub-program is a collection of projects that are: <ul style="list-style-type: none"> • Similar with respect to their asset category, delivery and objectives; and • Independent of each other but share or contribute to a common risk profile 	The replacement of defective low voltage cross-arms on distribution network poles

Each Network Project and Network sub-Program is reviewed, endorsed, and approved in accordance with company procedures.

6. Methodology

The purpose of this section is to describe the application, lifecycle and methodology used to develop, monitor and maintain each cost estimate method at each investment governance approval stage.

6.1 Overview

A cost estimate should be a representative and accurate expectation of delivering a scope of work that reflects current delivery capability. Figure 3 shows Ausgrid's estimate development process which outlines the lifecycle of a cost estimate detailing the develop, monitor and maintain stages.

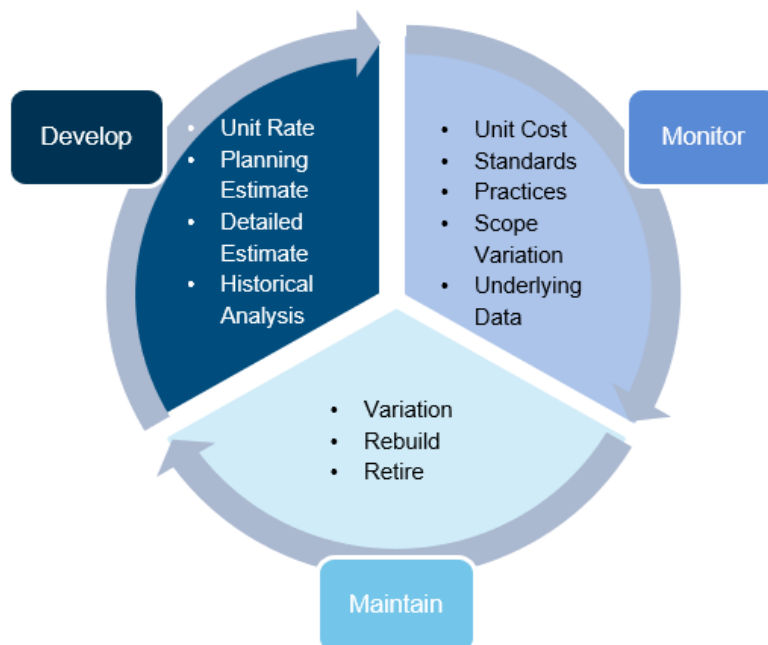


Figure 3: Lifecycle of an Ausgrid cost estimate

Ausgrid have 5 broad cost estimation methods:

1. Historical Analysis
2. Planning Estimates
3. Unit Rates
4. Preliminary Estimates
5. Detailed Estimates

The cost estimation method used varies through each stage of the investment governance life cycle as per the overview in Chapter 2. In selecting which method to apply against an investment type, the following is considered:

- The trade-off between effort and cost (value proposition) and;
- The trade-off between unique and standard solutions.

The estimate accuracy is to be appropriate for the stage of the program/project within the Investment Governance life cycle and is based on available data/information, not on pre-determined ranges of accuracy.

Table 2: Application of cost estimation types at NIGF approval stages

Investment Governance Approval Stages					
Investment Type	Sub-Type	Example	Gate 1	Gate 2	Gate 3
Network Project	Area Plan (large-scale, long-term network capacity investment)	Upgrade of zone substation from 33kV to 132kV	Planning Estimate	Preliminary/ Detailed Estimate	Detailed Estimate
Network sub-Program	Planned & Conditional (condition-based distribution network asset investment)	11kV kiosk type substation switchgear replacement	Unit Rate	Unit Rate	Unit Rate / Detailed Estimate
	High Volume / Low Cost (repetitive network minor asset investment)	Streetlight luminaire replacement	Historical Analysis	Historical Analysis	Historical Analysis / Unit Rate

6.2 Historical Analysis

Historical Analysis is a process for reviewing actual costs on completed works across a period. Ausgrid uses historical analysis more often to calibrate, validate, and monitor cost estimation accuracy and performance. There are instances of high volume, low-cost repetitive programs with volumetric delivery strategies that make other cost estimation methodologies impracticable. In these cases, where historical cost actuals are assessed to be efficient, the values are applied as a unit rate at the program level.

6.3 Planning Estimate

Planning estimates are a set of scope 'building blocks' that are combined in various combinations to produce an estimate of a large / complex project. Ausgrid utilises planning estimates for Gate 1 approval of Network Area Plan Projects to build an estimate which is based on the initial project concept brief where site specific constraints and scope are not yet exhaustively defined. The building blocks are estimates of small blocks of scope built from first principals estimating. The building blocks are maintained to reflect current network standards and construction techniques.

6.4 Unit Rates

Unit rates are a per unit estimate of expected cost required to complete a representative scope of works. Ausgrid utilises the Delphi Method to develop Gate 1– 3 unit rates in Network Sub-Program projects where the scope is similar and repeatable. The Delphi Method is a systematic and qualitative method centred on engaging subject matter experts to provide and calibrate standard scoping options, labour, material and contract services. Ausgrid implements the Delphi Method of development as below:

Table 3: Delphi method unit rate development stages

Step	Detail
Engage	Engage delivery partner Subject Matter Expert's (SME) relevant to the Network Sub-Program scope.
Scope	Define scope and detail inclusions, exclusions, and assumptions. This may result in multiple Standard Scoping Options.
Systemise	Delivery Partner SME's develop construction plans to deliver the defined Scope/s. These are then built into the estimator system which includes labour hours by skill, bill of materials and contracted services such as traffic control, excavation services, survey etc.
Calibrate	Calibrate and challenge the delivery partners data by utilising internal historical actuals, industry averages and peer feedback.
Apply	Where there are multiple standard scoping options or multiple delivery partners, unit rates are weighted based on scope prevalence and location.

6.5 Preliminary Estimates

Preliminary estimates are site specific project estimates based on a design concept brief and are developed from first principals estimating. First principles estimating is an exhaustive bottom up build of resource requirements, materials and contract services required to complete each individual component and stage of a complex project. Preliminary estimates are applied at Gate 2 approval stage of network projects.

6.6 Detailed Estimates

Detailed estimates are site-specific project estimates and are based on the final detailed design scope of works, developed from first principals estimating. Detailed estimates are applied at Gate 3 stage approval of network projects. Where required by an irregular scope, detailed estimates are also used for Gate 3 approvals of Network Sub-Program Projects.

There are two primary differences between preliminary and final detailed estimates:

- Addition of specific market pricing (evaluated tenders)
- Application of contingency based on risk modelling

7. Systems and Data

This section outlines the system as well as the underlying data sources used to produce enterprise estimates.

7.1 Enterprise Estimating System

Ausgrid utilises an enterprise estimating system to produce, store and maintain its cost estimates. The estimating system facilitates a standardised approach to build unit rates using current and relevant underlying data including;

- Network construction standards
- Contributory role labour rates
- Stock and market material pricing
- Contract service rates
- Escalations

7.2 Data and Supporting Systems

All underlying data inputs are updated prior to the initiation of the annual business planning cycle or as required by the change control process. Ausgrid's enterprise estimating system is integrated with several systems and datasets which allow cost estimates to be built with current and accurate underlying data inputs. These include:

- **Ausgrid's Enterprise Resource Planning (ERP) system:** supplies internal labour rates, material prices and actual cost capture. The system also provides historical actual costs allowing unit rates to be updated and calibrated for improved accuracy.
- **Market Average Catalogues:** build and maintain industry average pricing for materials, resources, and services. Ausgrid utilises this data for work components which are not delivered internally or provided under contract agreements.
- **Specific Market Pricing:** For Gate 3 Approval of projects with large externally delivered components, specific market / tender pricing is obtained using industry standard evaluation which covers the components of price, experience, methodology, sustainability and capacity to deliver.

8. Cost Estimation Governance

8.1 Key Principles

The key principles guiding the development of cost estimates are as follows:

- reduce the variance between estimates, budget and actual performance;
- documentation of assumptions and validation of inputs where possible;
- review of rates and methodology;
- protection of commercially sensitive information;
- unit rates are to reflect 'normal' business processes as far as practical; and
- continuous improvement of models as better data or performance metrics come to light.

8.2 Accountability

Ausgrid's Asset Management division is accountable for cost estimation governance. All cost estimation processes are approved in line with NIGF and delegation of authority levels. The Estimating and Unit Rates (EUR) function within Asset Management has the responsibility for implementation and execution of cost estimation in practice. EUR are also responsible for ensuring any changes to cost estimation processes are communicated, understood and embedded into business systems and processes.

8.3 Monitoring and Review

There are several internal and external influences that could impact cost estimates in a material way. Ausgrid monitors and reviews cost estimates for unit rates, building blocks and preliminary and detailed estimates via the following processes.

8.3.1 Unit Rates and Building Blocks

Unit rates and building blocks are continuously monitored for event driven and periodic influences. The factors are categorised into two trigger categories and actioned as below:

Table 4: Event driven triggers

Trigger	Responsible	Description	Frequency
Work Practice Change	Delivery Partner	Where there is a change in work practice or process (including safety requirements) that results in an appreciably different cost or resource demand	As Required
Network Standards Change	Engineering	Where an approved Network Standard (NS) change results in an appreciably different cost or resource demand.	Upon NS Update Release

Program Scope Change	Portfolio Planning	Where approved changes to a Program Brief (PB) impacts the allowable scope resulting in an appreciably different cost or resource demand.	Upon PB Update Release
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Table 5: Periodic triggers

Trigger	Responsible	Description	Frequency
>20% Long Standing Unit Cost Variance	Unit Rate Lead	Where reporting indicates the actual unit cost varies (>+/- 20%) from the unit rate over a significant period	Annually
Underlying Data	Unit Rate Lead	Unit rate underlying data (e.g. labour rates, material prices, contract service rates etc)	Twice Annually

8.3.2 Preliminary and Detailed Estimates

Preliminary and detailed estimates are reviewed periodically throughout their lifecycle, once at each approval stage in accordance to the NIGF and finally at project completion. A post project completion review is triggered where the final project exceeds 120% of the initial approved budget. The review is conducted with the project manager, project development manager and the original project estimator in which they will review;

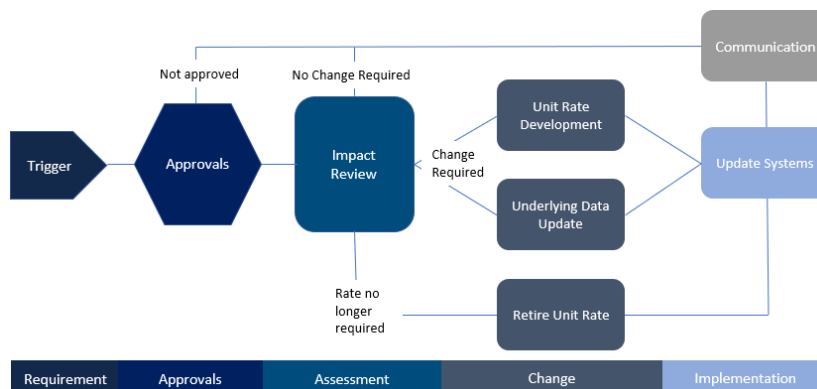
- Scope variation
- Market price variations
- Influencing site factors
- Force majeure

8.4 Change Management

8.4.1 Unit Rates and Planning Estimates

Where the monitoring and review processes identify a valid trigger, the change control process is initiated. For unit rates and building blocks the process is detailed in Figure 4.

Figure 4: Ausgrid unit rate change control process flow



8.4.2 Preliminary and Detailed Estimates

Preliminary and detailed estimates are updated as required to the level of available data at each gated stage of approval. Post Gate 3 approval, any changes to the cost estimate follows Ausgrid's project budget governance where variations are approved with appropriate justification by the appropriate sub delegation.

9. Glossary

Term	Explanation
Construction plan	Refers to the program of works in the form of a schedule required to deliver the task. This schedule clearly lays out activities, their respective dependencies as well as any resource required. These plans are provided by the respective delivery partners to the level of accuracy required for the stage of the project, normally 80%.
Contingency	Cost associated with the materialisation of unforeseen and unavoidable project risks. Although contingency cost is included in the total authorisation sought, it is not part of the base case NPV/NPC calculations. Contingency provides an indication of potential costs associated with project delivery risk
Contracted services	Service performed by an external party
Development Brief	This document defines the required outcomes of a project (technical, commercial, and timing) and refers to other planning documents that contain the justification
Direct cost	Costs directly posted to a project. This includes normal time labour allocation, overtime labour allocation, materials and contracted services booked directly to the project
Forecast	The forecast position is an estimate of the likely expenditure and milestone compliance over a stipulated period
Indirect costs	Costs not directly booked to projects. These can be indirect labour costs of the centre, or the allocation of items such as vehicle costs or information technology originally booked to the cost centre and attributed to the projects worked on by the centre via costing sheet rates
Labour costs	A combination of direct labour rates (wages or salary) and statutory on-costs and overheads
Material costs	Cost of materials required to deliver the project
Program	Collection of projects/tasks that are similar with respect to their asset category, delivery, and objectives and are independent of each other but share or contribute to a common risk profile
Risk	The effect of uncertainty on objectives
Unit Cost	A unit cost is the per unit actual cost to complete a scope of works measured as a median
Unit Rate	A unit rate is a per unit estimate of expected cost required to complete a representative scope of works
LWP	Live Work Pause – a period where Ausgrid completed a major live work safety overhaul

10. Unit Cost and Benchmark comparison

This chapter provides examples of unit cost benchmarking which detail Ausgrid's performance against its internal targets and industry peers.

10.1 Overview

In efforts to continuously reduce the cost-to-serve our customers, Ausgrid monitors its unit rates and unit cost against the National Energy Market (NEM) median. In alignment with the Replacement Expenditure (**REPEX**) modelling (Item 3.10) the NEM median values are calculated by taking all the Distribution Network Service Providers (**DNSP**) Regulatory Information Notices (**RIN**) for a three year period (FY19 to FY21) then;

- Escalating to real FY24 dollars;
- Dividing spend by volume to give a unit cost per DNSP;
- Deriving the median as per the Australian Energy Regulator's (AER) REPEX modelling methodology

The following examples have been selected based on advice provided within Revised Proposal Attachment 5.15.1 Nuttall Consulting Supplementary Repex Review (January 2019). This report details some of the challenges Ausgrid has in completing with the AER benchmarking due to the asset groupings in the RIN.

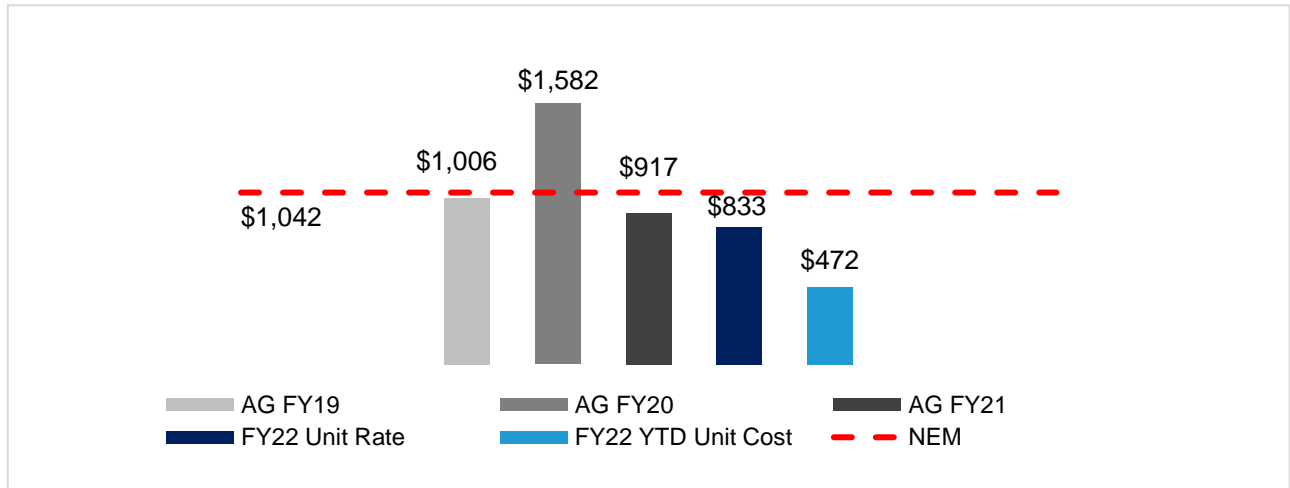
Many of the examples are impacted by the FY19 and FY20 Live Work Pause (LWP). During this period Ausgrid completed an exhaustive overhaul of electrical infrastructure safe work procedures. This process required delivery partners to adapt to the new work requirements.

10.2 6.2 Benchmark Examples

10.2.1 Low Voltage (LV) Overhead Residential Service Wire Replacement

LV overhead service wire replacement program is the like for like (modern equivalent) replacement of overhead service wires to residential customer premises. Ausgrid replaces approx. 30,000+ LV services annually.

Figure 5: Ausgrid unit cost vs unit rate and NEM median for Low voltage overhead service wire replacement



As can be seen in Figure 5, FY20 was impacted heavily by the Live Work Pause (**LWP**) which required the development of new work arrangements such as additional safety planning meetings and supervision of live work tasks. Post LWP, new work practices were introduced, and continuous improvements measures realised which saw unit cost begin to trend down and outperform the NEM median. Continuous improvement measures include;

- Automation of customer mail out notifications in line with the National Energy Customer Framework (NECF)
- Cross-skilled line worker / electrical service operator pole crews

10.2.2 Condemned Low Voltage Wood Pole Replacement

Condemned low voltage wood pole replacement program is the like for like replacement of conditionally failed distribution poles, including supporting hardware such as cross-arms and insulators. Ausgrid replaces approx. 2000 condemned distribution poles annually

Figure 6: Ausgrid unit cost vs unit rate and NEM median for replacement of low voltage condemned poles

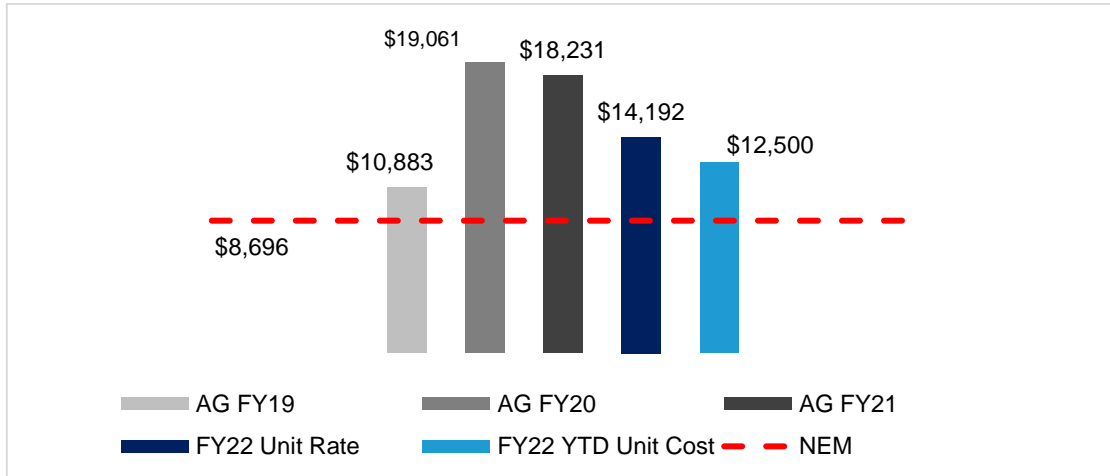


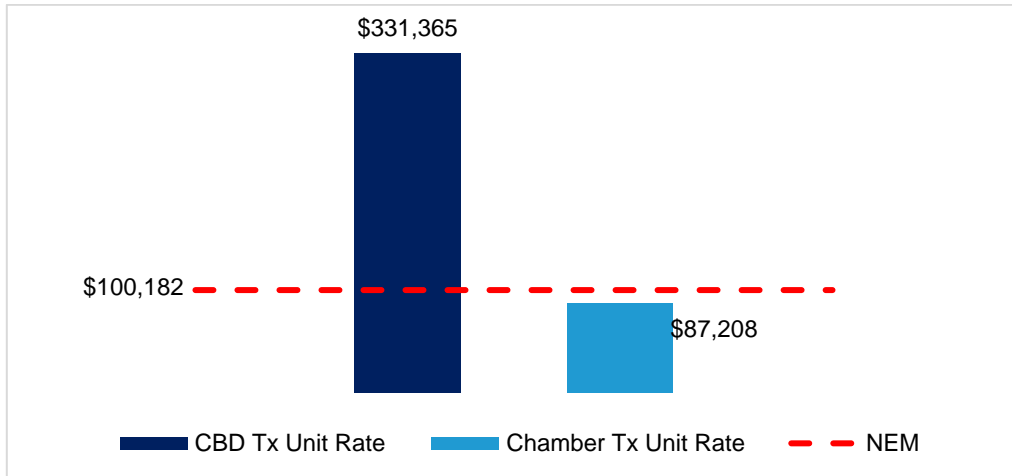
Figure 6 highlights FY19 was impacted heavily by the LWP which required all poles to be stood and changed over under network access permit. The additional planning and execution effort associated with an outage saw the unit cost rise.

Delivery partners have been implementing enabling initiatives to adapt to the new requirements which has seen the unit cost continue to trend down. Some of these initiatives include multiskilled crews, fleet optimisation and pole pre-dressing techniques.

10.2.3 Ground Mounted Distribution Power Transformer

The chamber or kiosk substation distribution transformer replacement program is the replacement of end of life distribution power transformers less than 600kVA power output.

Figure 7: Comparison of Ausgrid programs that contribute to the same NEM benchmark



Ausgrid is currently underperforming relative to the NEM median due to a specific asset type known as CBD conservator-type transformers. Seen in Figure 8, due to the asset design, CBD access constraints and environmental factors, these specific types of CBD transformers cost approx. 4x that of a standard chamber distribution transformer replacement as shown in Figure 7. Due to the risk profile and population of this asset type, it forms a large percentage weight of Ausgrid's FY24-29 RIN category unit rate. It is anticipated that once the CBD conservator-type transformer assets are able to be retired from the network, Ausgrid's Unit Cost is expected to outperform the NEM median, noting that in some parts of the Sydney CBD there is no credible alternative and so this style of transformer is continuing to be replaced 'like for like'.

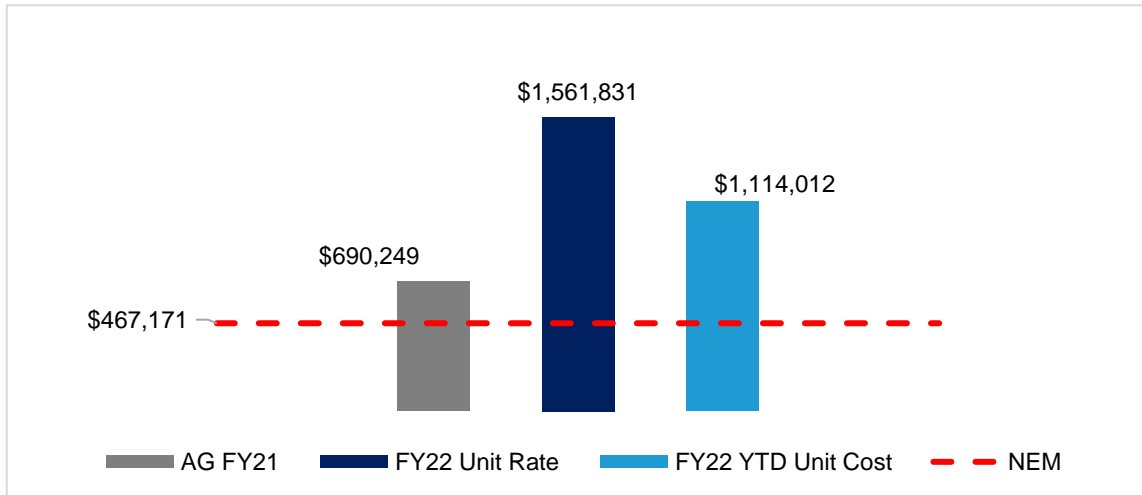
Figure 8: Images of the complex nature of CBD conservator-type transformer replacements



10.2.4 LV Underground Cable Replacement (km)

The LV underground cable replacement program is replacement of aged low voltage underground distributors including associated assets e.g. pillars, link boxes, underground services.

Figure 9: Volatility of cost seen since FY19

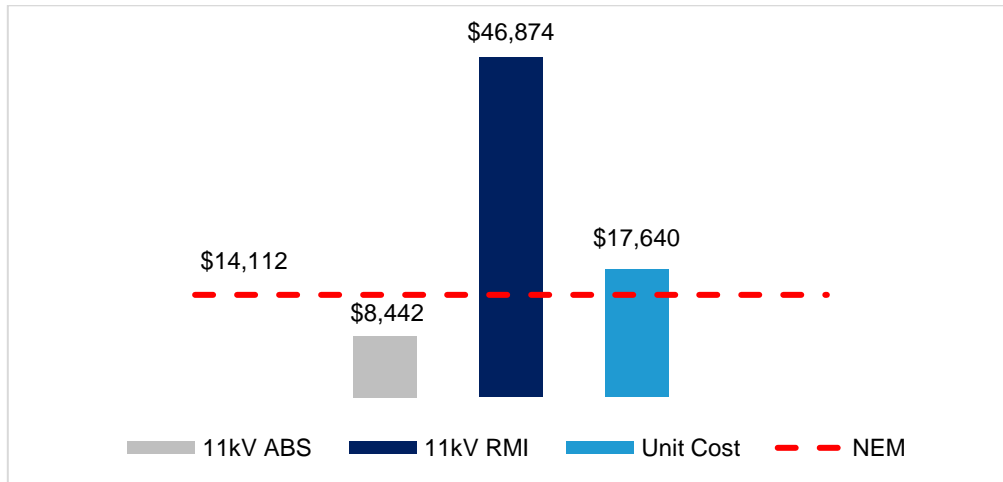


The market has seen extreme volatility in both excavation services and material prices over the last two years, shown in Figure 9. 80% of material and excavation services costs have suffered steep increases in unit price, particularly in the Sydney basin. Ausgrid is exploring new contract service engagement and delivery models to reduce the unit cost.

10.2.5 11kV Switchgear Switch

The 11kV Switchgear Switch program is the replacement of aged or risk identified high voltage switchgear excluding fuse switches and circuit breaker equipment.

Figure 10: Comparison of Ausgrid programs that contribute to the same NEM median bench



Due to network topography and asset population, Ausgrid has difficulty in performing to the NEM median. Compared to most other Australian DNSPs, Ausgrid has a higher ratio of ground mounted Ring Main Isolator (**RMI**) assets to overhead Air Break Switches (**ABS**). The operating requirements of an RMI makes them a significantly more complicated asset as shown in Figure [11] below, this impacts both the equipment and installation costs, with RMI's being approx. 5x the cost of an ABS seen in Figure [10] above.

In pursuing continuous improvement, Ausgrid is:

- Monitoring the unit cost
- Driving cost to serve improvements
- Resetting the unit rate once the unit cost outperforms.

Figure 11: 11kV air break switch (left) vs 11kV ring main isolator switch (right)

