5.06

Unit cost methodology

Ausgrid

Technical Guide

NETWORK	Document No	:	NW000-T0096
	Amendment No	:	0
	Approved By	:	Head of Asset Investment
	Approval Date	:	06/02/2018
	Review Date		06/02/2021

NW000-T0096 **NETWORK UNIT COST METHODOLOGY**

Network Unit Cost Methodology

Contents

1 Purpose

The purpose of this document is to describe the principles, methodology and procedures used by Ausgrid to develop unit rate estimates for capital projects and programs for the 2019-2024 regulatory period. The document describes Ausgrid's specific context and how this affects the rate build-up, the approach that Ausgrid has taken to construct the rates, and provides an outline of how the procedure is carried out.

2 Background

Ausgrid supplies electricity to over 1.7 million homes and businesses across Sydney, the Central Coast and the Hunter. The delivery of projects and programs is undertaken through nine regions within this area, including: Chatswood, Homebush, Hornsby, Lower Hunter, Newcastle, Oatley, Ourimbah, Upper Hunter and Zetland. These regions vary considerably in many ways, including population density, the built environment, traffic volume and network configuration. Additionally, some programs, due to their nature and complexity, are delivered by the same business group across all regions. The business groups that deliver programs across all regions include Field Services - Construction and Maintenance, Technical Operations and Transmission Mains.

The continual supply of safe, reliable and affordable electricity to Ausgrid's distribution area requires continual investment (i.e. capital expenditure) in network infrastructure. Ausgrid has identified needs that must be addressed over the upcoming regulatory period and has developed projects and programs to fulfil these needs. The cost of delivering these projects and programs will vary across the different regions that make up Ausgrid's network, due to the variability in conditions mentioned above.

The majority of the capital investment that Ausgrid is proposing to carry out during the upcoming regulatory period can be separated into unique capital projects and structured programs of work. Unique capital projects are referred to as "major projects" while the programs of work can be further divided into replacement programs, referred to as "REP" where the primary driver is the need to replace poor condition assets in the network, and duty of care programs, referred to as "DOC", where the primary driver is a regulatory compliance, staff safety, or community safety requirement.

To ensure that the estimated costs associated with these activities are prudent and efficient, a well-defined and transparent procedure is in place that defines how the estimates are to be produced. This document fulfils this purpose.

3 Unit cost scope and investment governance

3.1 Scope of unit costs

Ausgrid's Cost Allocation Method (CAM) governs the manner in which Ausgrid allocates costs to the services it provides. The CAM provides Ausgrid's cost hierarchy and cost disaggregation process. The unit cost methodology applies to only the direct expenditure for a cost object. Direct expenditure includes labour, materials and contracted services where the expenditure is allocated directly to a cost object via time sheeting (e.g. labour) or invoicing (e.g. materials and contracted services). For further information, refer to the Ausgrid Cost Allocation Method (November 2013).

The scope of this document is limited to Standard Control Services Network Capex. Non-network capex and Alternate Control Services are developed under a separate methodology.

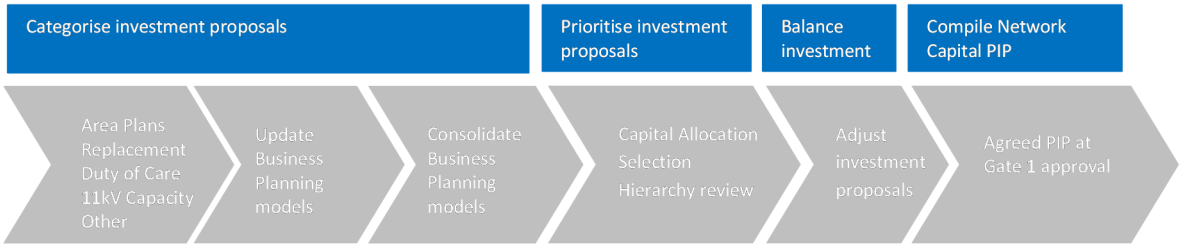
Some projects and programs, such as Operation Technology and Innovation and strategic land acquisition, have been independently evaluated at project level and are therefore not covered in the scope of this document.

3.2 Investment governance

A three-stage project development process manages the maturing of the project scope and definition, providing the necessary inputs in forming the basis of the project cost evaluation. The process is marked with three key milestone gates at which approval is sought for the next stage of development based on an economic appraisal and increasing level of accuracy. For further information on the investment governance process (refer Company Policy – GV000-Y0032 – Investment Governance Framework).

Unit costs are used in the development of investment proposals at the early phase of the investment governance process. The unit costs apply in the first chevron in Figure 1 and form the basis for the majority of expenditure at Gate 1 approval.

Figure 1: Pre Gate 1 process



The project development and economic appraisal[1] process applies to all capital investments undertaken by Ausgrid and a varying number of projects are found at each stage of development at any given time.

In the context of the timing for the revenue proposal submission to the AER, the short lead time for replacement and duty of care programs results in the majority of these programs being at the planning stage (i.e. Gate 1). The long lead time for Major Projects results in some of the projects in the 2019-2024 expenditure forecast being at either Gate 2 or Gate 3.

As can be seen in Table 1, the majority of the forecast expenditure is developed using the planning estimate unit rates.

[1] NIS424 Economic Appraisal

Table 1: Proportion of capex programs at each project development stage at time of regulatory submission

Governance gate	Project Development Stage	Typical proportion of major programs capex within 19/24 regulatory submission					
		Major projects	Rep & DoC planned & conditional	Rep & DoC reactive	11kV capacity	LV capacity	Cust. Connection
Gate 1 (PIP)	Planning estimate	72%	100%	100%	100%	100%	100%
Gate 2	Preliminary estimate	26%	0%	N/A	0%	0%	0%
Gate 3	Detailed estimate	2%	0%	N/A	0%	0%	0%

4 Unit cost estimating methods

Unit cost estimates are constructed for different project types as shown in Table 2. The estimating methodology also differs by project / program development stage as shown in Table 2.

Table 2: Cost estimating methods

Project Development Stage	Typical proportion of major programs capex					
	Major projects	Rep & DoC planned and conditional	Rep & DoC reactive	11kV capacity	LV capacity	Cust. Connection
Planning estimate	Bottom-up (building blocks)	Bottom-up and historical	Historical (at the pool level)	Top down and historical trend analysis	Top down and historical trend analysis	Top down and historical trend analysis
Preliminary estimate	Bottom-up (site considerations)	Bottom-up	Bottom-up	Top down and historical trend analysis	Top down and historical trend analysis	Top down and historical trend analysis
Detailed estimate	Market	Bottom-up and market	Bottom-up and market	Bottom-up and market	N/A – not estimated	Bottom-up and market

The estimating input is provided through a Development Brief prepared for Major projects and a Program Brief prepared for programs of work (refer Company Procedure – NW000-P0084 Network Investment Governance Preliminary Assessment). The Development Brief/Program Brief is the base document informing the cost estimate.

4.1 Estimating Systems

Three main estimating systems are used to support the development of the costing methods.

4.1.1 ATAD

The ATAD estimator, an external software package, developed for electrical contracting work has been tailored by Ausgrid to estimate the costs of network infrastructure projects.

Both internal and external data sources serve as basic cost component inputs to the system; labour rates (including on-costs), material costs and contracted services costs are frequently validated and updated to maintain accuracy.

4.1.2 CCL Estimator

Distribution cable installation projects (up to 22kV) within major projects are estimated through the Contract Cable Laying (CCL) Estimator package, which has a similar bottom-up approach to ATAD but is tailored for cable assets. The system is based on competitive contractor rates and incorporates Ausgrid's specifications for laying underground cable (i.e. trench profiles, backfill and reinstatement requirements).

4.1.3 Ausgrid Financial Management System (SAP)

Ausgrid's financial management system captures actual data and historical records, historical vendor quotes, and period contract rates or supply agreements, and externally sourced costs from the construction/engineering industry for material costs and contracted services costs. These costs can be accessed to develop estimated costs for future projects.

4.2 Bottom-Up Estimates

Bottom-up estimates are developed using ATAD and CCL Estimator. The bottom-up estimating approach is based on a defined scope of work.

Where historical costs have been utilised as part of the bottom-up estimates, these have been presented in constant 2016/17 dollars. Escalators of each component of the forecast unit costs (i.e. internal labour, contracted services, materials) have been applied.

The cost components within the scope of work are estimated individually by asset or resource and are based on data from internal and external sources.

The building blocks for bottom-up estimates are typically:

- Labour;
- Contracted Services; and
- Materials and Equipment

These are aggregated to form unit costs that are used in the development of project cost estimates

4.3 Historical Analysis

The use of historical estimating has been used where past costs are efficient (assessed via benchmarking) or can be adjusted to reflect current and expected efficient practices. The unit costs in this category tend to be for programs with high (recurring) volumes and stable cost trends over time at a program level.

Historically analysis is typically used for programs where it is not practical to rely on an average bottom-up estimate due to the unknown variability between projects. An example is distribution underground cable laying where the degree of traffic control and ground condition is not known in advance. The models use an appropriate sample of projects to form efficient unit rates for the 2019-24 regulatory proposal.

4.4 Top down

Top down estimating has been used where either historical unit costs are not considered to represent the future unit costs or where there are no historical costs from which the unit rates can be established.

The top down estimating process employs a benchmark rate sourced from either AER RIN data or other comparable data sources. Further details are provided in section 7.

4.5 Market rates

Market rates are used in the later stages of the project development and approval cycle. Market rates are those rates quoted to Ausgrid by contractors for a defined scope of work.

5 Major Projects

Ausgrid define a Major Project as works which are primarily site-specific and associated with a sub-transmission area strategy (i.e. an Area Plan). A Major Project is typically a solution to network related issues that can be bundled together to enable least cost delivery rather than addressing each issue in a piecemeal manner.

5.1 Stages of major project unit cost estimating

Unit costs for Major Projects are developed using a bottom-up method. The level of detail and accuracy of the estimate increases as the project progresses through Gate 1, Gate 2 and Gate 3.

The estimates used in the 2019-24 regulatory proposal, are a mix of Gate 1, Gate 2 and Gate 3. Given the long lead time of Major Projects, it is expected that there will be a high level of committed expenditure in the early years of the regulatory period (i.e. Gate 3), with the later years based on estimates that have Gate 1 approval. This is shown in Table 3.

Table 3: Major Projects contribution to the 2019-2024 regulatory period forecasts by project development stage

Project development stage	FY19	FY20	FY21	FY22	FY23	FY24	Average FY20-24
Planning estimate (Gate 1)	7%	35%	63%	79%	97%	100%	72%
Preliminary estimate (Gate 2)	45%	59%	36%	21%	3%	0%	26%
Detailed estimate (Gate 3)	48%	6%	1%	0%	0%	0%	2%

5.2 Gate 1 – Planning estimate

For projects at the planning stage, planning estimates are based on standardised building block estimates produced using ATAD. The estimates for the building blocks are developed through the analysis of expenditure on previous projects, construction industry cost estimating guides, and information from suppliers.

The building blocks are designed so that from a high-level scope description of a substation, cable or overhead line, an estimate can be developed. For example, a cost estimate can be produced for

a scope description such as a “zone substation with 2-transformers, 2 incoming and 10 outgoing feeders”.

The purpose of the planning estimate is to facilitate the consideration of options and solutions at the investment proposal stage so that investments can be prioritised for Gate 1 approval. The bottom-up estimating approach to the building blocks (e.g. a transformer) creates both an accurate and streamlined process for developing a range of project options with indicative cost estimates.

5.3 Gate 2 – Preliminary estimate

Preliminary estimates utilise the same building blocks as in the Planning estimate, however, at this stage, there is more known about the project scope (as documented in Development Brief), such as the site layout or cable route. This allows a more accurate estimate of the costs to be developed. The project scope has transitioned from a high-level description at Gate 1, to a concept design at Gate 2 from which an estimated cost is more accurately defined.

5.4 Gate 3 – Detailed estimate

The Detailed estimate is based on project specific specifications and designs, against which tenderers provide pricing. There is a high degree of accuracy in the estimate.

6 Programs (REP and DOC Unit Rates)

Programs of work consist of distribution network replacement and duty of care works that are delivered by the field based workforce.

6.1 Ausgrid regions

Ausgrid’s field workforce is based across 9 distribution regions. Program level costs across each region differ due to two main drivers:

- Geographic (i.e. rural, urban and CBD); and
- Network configuration (i.e. the legacy network configuration and arrangements from the councils that amalgamated to form Ausgrid)

Difference in the geography across each region is the key reason for the variation in the cost of projects across the regions. Regions that have a high load density typically have a higher cost for a project of equivalent scope in a region with a lower load density. The increase in cost is attributed to a number of factors such as increase traffic control, night works, and increased planned outages.

There also exist different network configurations for similar assets across the various regions. This means that works involved in a project can differ across regions to achieve the same replacement outcome.

Each of Ausgrid’s nine regions produce cost estimates through *Asset Condition and Planning Summary – Planning Conceptual Project Cost Estimate* templates.

Ausgrid has reviewed variances between regional estimates to identify the most efficient work method for achieving the replacement outcome. Subject to the various geographic and network configuration constraints, Ausgrid has standardised its cost estimates based on the most efficient work methods.

6.2 Volume Weighted Average Estimate

In order to produce one unit rate for each program that is representative of a unit rate across all regions, the average of the regions' unit rates weighted by the volumes delivered by each region is calculated. The resulted volume weighted average unit rate is used for expenditure forecasting and RIN purposes.

6.3 Rep & DoC Planned and Conditional

The Rep & DoC Planned and Conditional program unit rates are developed using either bottom-up or historical methods (refer sections 4.2 and 4.3). For each program, each region develops a unit cost estimate based on the scope of work required for their geographic and network configuration.

For example, replacing 1 kilometre of LV Consac in the Zetland region has a different scope to replacing the same length of conductor in the Lower Hunter. Zetland requires copper conductor (for capacity reasons), multiple service connections (due to customer density) and trench excavations more frequently encounter rock. In the Lower Hunter, an aluminium conductor is used, there are fewer service connections required and the trench excavations are in softer ground. These regional variations can result in significant differences in the unit costs to deliver the same scope of work in different regions.

The region's estimates are consolidated and then compared to ensure that the basic scope requirements have been estimated consistently (e.g. the same length of conductor is being estimated). The unit rates are then developed using the volume weighted average as discussed in Section 6.2.

6.4 Rep & DoC reactive

Reactive expenditures programs are made up of unplanned investments associated with emergency asset replacements. These investments are related to unexpected asset failures driven by asset condition, safety, environment, customer or capacity.

The reactive nature of these programs does not allow for a bottom up estimate of the expenditure forecast. The scope, resourcing and time outlay are dictated by the nature, framing and location of the required investment and varies from one project to the next.

As such, unit rates do not exist and are not required for reactive programs. Refer Attachment 6.5.3 Repex program justifications, Part K Reactive programs for further information.

7 Load transfers, LV and 11kV capacity, Customer Connections and Reliability

7.1 11kV Load Transfers

Bulk load transfers of 11kV feeders involve the installation of new conductors between substations to shift load. They are crucial for certain major projects, allowing customers to remain connected to the network whilst augmentation and replacement works are undertaken. They are also necessary to allow Ausgrid to utilise the available capacity of newly constructed substations.

Similar to major project estimates detailed in section 5, 11kV load transfer costs are determined by the site conditions along the new route, and therefore are estimated using a tailored bottom-up approach. The load transfers fall into one of four categories: urban (non-CBD) underground load

transfers; CBD load transfers; standard connections to new switchgear; and overhead load transfers.

Overhead 11kV load transfers only form a minor portion of the total 11kV load transfers for major projects as it is typically not cost effective to achieve bulk 11kV load transfers using overhead construction. As such, unit costs have not been developed and estimates are produced on a case-by-case basis by the regional operation groups.

7.2 11kV Capacity

The 11kV Capacity Plan covers the installation of new 11kV underground cables and overhead conductors for the augmentation of Ausgrid's network. The plan is predominantly comprised of non-CBD 11kV network augmentation works.

The 11kV Capacity Plan is predominantly driven by customer load growth and connection driven network augmentations. Project specific estimates are not possible as these projects can only be accurately forecast two to three years in advance.

The expenditure forecast for this program is derived from planning analysis and modelling that estimates the expected capacity shortfall on each HV feeder and applies a benchmark unit rate on a per kVA basis.

As for the other sub-programs of the 11kV Capacity Plan, these are detailed below in Table 4.

Table 4: 11kV Capacity Plan sub-programs

11kV Capacity Sub-Programs	*Cost Method*
CBD 11kV capacity reinforcement	Based on historical project costs
Works from the current regulatory period (*First Review Work in Progress*)	Bottom-up planning estimates
Fault level works	Based on historical project costs
Voltage regulation works	Based on a historical percentage of total capex

Furthermore, there are three components of the 11kV Capacity Plan which make adjustments for forecast expenditure accounted in other capex plans, as well as an adjustment for demand management projects.

7.3 LV Capacity, customer connections and reliability

The Low Voltage Plan is a network augmentation plan for assets predominantly driven by customer load growth at the low voltage level. The costing method utilises a top-down approach to determine unit costs based on historical project scopes. As with the 11kV Plan, specific LV projects are difficult to determine in advance and thus bottom-up project estimates are not possible. Furthermore, a top-down approach was used to counter:

- The inability of a bottom-up cost to capture available capacity of surrounding assets which can form part of the reinforcement solution; and
- The inability for bottom-up costs to forecast material variances between similar works.

The unit costs used in the forecasting model were based on an analysis of the cost of projects created and completed for the past three years between FY14 - FY17 and categorised by sub-program as follows:

- DC Capacity Chamber Program;
- DC Capacity Kiosk Program;
- DC Capacity LV Distributor Program;
- DC Capacity PT Program;
- LV Capacity Small PT Program;
- LV Distributor Capacity Distributor Program;
- LV Distributor Capacity Kiosk Program; and
- LV Distributor Capacity PT Program.

These underlie the LV Plan forecast when applied to projected volumes of work.

Further details of this methodology are contained in the Regulatory Information Notice (RIN) Schedule 1 Augex responses.

7.4 Customer Connections

The Customer Connection Plan uses a similar method to the Low Voltage Plan whereby the project cost estimates and volumes are based on an analysis of recently completed projects by sub-program. Unit costs are based on an average of project costs created and completed during the period FY15-17.

At the start of the current regulatory period a revised connection policy was introduced. This resulted in a change in the nature of the works funded under this program away from the funding of recoverable equipment. The majority of projects funded under this program relate to the connection of customer funded assets to the existing network. The scope of works funded under this program is determined on the basis of an assessment of the network and safety risks associated with the connection works.

Further details of this methodology are contained in the Regulatory Information Notice (RIN) Schedule 1 Connection responses.

8 Improvements since 2014-2019

The unit cost estimates for the 2019 -24 regulatory period are characterised by transparency and a greater level of granularity, demonstrating improvements in approach and method. The improvements stem from a process of learning and investigation that has resulted in global changes. The improvements are summarised in Table 5.

Table 5: Improvements in Unit Cost approach

Capital Work Stream	Description of method improvements
Global	· Unit costs based on direct costs only, indirect (overhead) costs are estimated separately and under a different method · Alternative Control Services are estimated separately and under a different method · Introduction of a more granular review and analysis process for larger projects and programs · Inclusion for consideration of workforce demand requirements
Major Projects	· Improved cashflow profiling (i.e. S-Curve) to align with historical and best practices

Capital Work Stream	Description of method improvements
	· Consideration of economy of scale for large cable and substation projects · Optimisation of delivery strategy at a project level · Desktop review of large projects at the planning stage
Planned Programs	· Separate unit costing at the distribution area and/or regional level · Separate unit costing for programs with multiple scopes and/or solutions · Alignment of global assumptions between distribution areas · Estimates based on Program Briefs issued by Asset Management · Detailed estimate write-up that includes: o Scope inclusion and exclusion assumptions o Internally versus externally sourced services o Bill of Material o Man hour breakdown by key skillset and crew size o Travel time o Linkage to existing transformation initiatives and proposed future efficiency savings
Reactive Programs	· Reactive expenditure forecast based on historical trending method at the asset group level (i.e. reactive pooling)
Other Programs	· 11kV capacity plan unit costs are now based on top-down, historical trending model in line with the LV capacity plan and customer connections plan. This is due to a significant reduction in expenditure requirement in the 2019-24 period.
Support Programs	· Support costs method (i.e. planning, GIS Data capture, Network control) are now considered network overhead costs and not included in direct cost forecasts.

9 Document Control

Branch Manager : Head of Asset Investment

Content Coordinator : Manager, Network Investment Governance