

---

# Appendix 4A: Unit Rates

## P50 Unit Rates – Primary, Civil, Secondary and Lines

2023-27 Transmission Revenue Reset

PUBLIC

Submitted: 29 October 2020

Document number	NA
Issue number	1
Status	Approved
Approver	Ross Stewart
Date of approval	28/07/2020

## ISSUE/AMENDMENT STATUS

Issue Number	Date	Description	Author	Approved by
1	28/07/2020	Approved	T Thanga	Ross Stewart

### Disclaimer

This document belongs to AusNet Services and may or may not contain all available information on the subject matter this document purports to address.


The information contained in this document is subject to review and AusNet Services may amend this document at any time. Amendments will be indicated in the Amendment Table, but AusNet Services does not undertake to keep this document up to date.

To the maximum extent permitted by law, AusNet Services makes no representation or warranty (express or implied) as to the accuracy, reliability, or completeness of the information contained in this document, or its suitability for any intended purpose. AusNet Services (which, for the purposes of this disclaimer, includes all of its related bodies corporate, its officers, employees, contractors, agents and consultants, and those of its related bodies corporate) shall have no liability for any loss or damage (be it direct or indirect, including liability by reason of negligence or negligent misstatement) for any statements, opinions, information or matter (expressed or implied) arising out of, contained in, or derived from, or for any omissions from, the information in this document.

### Contact

This document is the responsibility of AusNet Services.

Please contact the indicated owner of the document with any inquiries.

  
 AusNet Services  
 Level 31, 2 Southbank Boulevard  
 Melbourne Victoria 3006

**Table of Contents**

**1 Introduction .....4**

**2 Basis of Rates .....4**

2.1 Scope and Estimate Assumptions ..... 4

**3 Unit Rates .....6**

3.1 Unit Rates – Primary Systems ..... 6

3.2 Unit Rates – Civil Works ..... 9

3.3 Unit Rates – Secondary Systems ..... 10

3.4 Unit Rates – Lines ..... 13

## 1 Introduction

The purpose of this document is to provide the unit rates that been applied to forecast capital expenditure for the 2023-2027 TRR and to explain the basis of each of the rates.

All rates are P50 and are presented in \$2019/20<sup>1</sup>. A P50 estimate is an estimate prepared at any stage of a project which has a 50% confidence factor of not being exceeded by cost at completion.

## 2 Basis of Rates

The basis of the unit rates used to develop the capital expenditure forecast is described in this section.

### 2.1 Scope and Estimate Assumptions

#### 2.1.1 Terminal Stations and Lines

The approach to forecasting capital expenditure categories is explained in the *Project Cost Estimating Methodology*. This document details the unit rates used in each category of capital expenditure.

The unit rates for terminal station asset replacements are compiled based on the project cost estimating spreadsheet (Top-down distribution estimate for option selection only). This spreadsheet is built up using a bottom up approach, with labour and materials itemised individually. The spreadsheet is maintained by Project Development Team.

The unit rates for lines replacements are compiled based on the project cost estimating database (Expert Estimator). This database is built up using a bottom up approach, with labour and materials itemised individually. The database is maintained by Project Development Team.

The following have been adopted in the preparation of the unit rates for works within the Terminal Station and lines:

- Material costs used in the unit rates presented in this document which are based on period contract pricing from suppliers has been identified in Table 1 below. These period contracts have been established through competitive tender process. Material cost for transformer bushings (section 3.1.4) and lines works (section 3.4) has been based on estimates obtained from contractors and manufacturers.

Period order items (Cost as of April 2014)
200kV Current Transformers
220kV Dead Tank Circuit Breaker
220kV Remote Operated Isolator
220kV Capacitive Voltage Transformer
66 kV Current Transformer
66kV Dead Tank Circuit Breaker
66kV Isolators
250 Battery Bank and Charger
48V Battery Bank and Charger
Protection relays
Protection Panels (without protection relays)

Table 1: Period order items

<sup>1</sup> 2014/15 is the AusNet Service financial year commencing 1 April 2014 and ending 31 March 2015

- Cost of producing project designs has been based on historical cost for similar projects. AusNet Services predominantly procures design services through a Design Service Provider (DSP) panel established through competitive tender process.
- Construction costs in the unit rates presented in this document have been derived from historical cost for similar projects. AusNet Services predominantly procures construction works through an Installation Service Provider (ISP) panel established through competitive tender process.
- AusNet Services internal cost i.e. Project Management, Quality Assurance, Site Supervision and Engineering support costs are based on DSP panel rates.
- Project Components Uncertainty<sup>2</sup> (value applied to reference estimate to arrive at P50 outcome).

Further explanation of the project cost estimating database and methodology is contained in the *Project Cost Estimating Methodology*.

### 2.1.2 Primary Works

- a) The unit rates are developed based on the assumptions that future project scopes will replace or install switchgear at one terminal station, as a minimum of:
  - a. Two similar primary plant

### 2.1.3 Secondary Works

- a) The unit rates are developed based on the assumptions that future project scopes will replace or install new protection and control systems at one terminal station, as a minimum of:
  - a. Two similar protection and control schemes, and
  - b. In case of bus protection, two bus protection schemes.
- b) The unit rates are developed based on the assumptions that auxiliary supplies (e.g. DC Board, AC Supplies) are adequate for given protection and control replacement works.

### 2.1.4 Overhead Lines

The unit rates are developed based on the following:

- a) 500kV, 330kV and 220kV single circuit, suspension tower replacement;
  - Replacement of 6 towers is used to generate total cost and then divided by 6 for unit tower cost.
- b) 500kV and 220kV Insulator replacement:
  - Insulator replacement unit rates are based on doing projects of various numbers of towers (See Section 3.3).
  - Conductor for 500kV “I” and “V” string is based on quad “orange”
  - Conductor for 220kV “I” and “V” string is based on twin “lemon”
- c) Groundwire replacement
  - ‘Like for Like’ and OPGW replacement in metro area is based on 10km line using “grape” conductor.
- d) Fall arrest system replacement
  - Rack fall arrest system is based on 26 terminal station sites.
  - Tower fall arrest is based on 2450 tower sites.

---

<sup>2</sup> Project Components Uncertainty is a calculation (or estimate) of the variability that occurs in all projects. This variability arises from uncertainty in pricing or volumes of component activities. The uncertainties are a portion of the difference between the outcome and assumptions in the reference estimate.

## 3 Unit Rates

### 3.1 Unit Rates – Primary Systems

The rates in this section have been used to estimate programs of expenditure associated with replacement of stations assets. These assets are located within the terminal stations used to transform extra high voltage to sub transmission voltages. Rates in this section are inclusive of civil, primary equipment and associated secondary works, unless otherwise specified.

#### 3.1.1 Allowances

The following items have been allowed for within the stations unit rates:

- Decommissioning and removal of existing equipment
- Supply, installation, testing and commissioning of equipment
- Earthworks, foundations and structures (where applicable)
- Cabling (secondary and power) (where applicable)
- Protection and control associated with the equipment including interfacing works (where applicable)
- Interplant connections
- Earthing modifications
- Operational outage costs (i.e. planning preparation of outages & network switching)
- Design
- AusNet Services internal labour costs ( i.e. Project Management, Quality Assurance, Site Supervision and Engineering support)
- Contractor indirect costs.

#### 3.1.2 Exclusions

The following items have been excluded from the stations unit rates:

- Planning and building permit applications
- Land acquisitions and easement creation
- Site surveys, geotechnical investigations and reports
- Additional cable ducts or cable trenches - assume existing is suitable and sufficient capacity
- Removal of contaminants such as asbestos, PCBs and contaminated soil
- Costs associated with any environmental works
- Communication systems and schemes
- Management reserve<sup>3</sup>
- Cost escalations
- Financing cost and corporate overheads
- Written-down values

---

<sup>3</sup> An amount of funds, budget, or time needed above the estimate to cover the costs of unforeseen factors related to the delivery of the project objectives, which are not provided for elsewhere in the total job costs. Management Reserve is to be administered at program level. These can include but are not limited to the occurrence of an unplanned or unforeseen event such as a natural event or a major safety incident and the change to planned assumptions, stakeholder issues (outage restrictions, community) and delayed access to site, industrial relations issues external to the Project / Program, and contractual issues or claims.

Management Reserve is the difference between P(90) (An estimate prepared at any stage of a project which has a 90% confidence factor of not being exceeded by cost at completion) and P(50) outcomes.

- Spares
- Operations and maintenance costs.
- Written-Down Values, line rebates and MIP Scheme<sup>4</sup>.

### 3.1.3 Switchyard Bay Equipment Replacement

#### 3.1.3.1. 500kV

##### Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 500kV 3 Phase CT's.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
2	Replacement of 500kV Live Tank Circuit Breakers.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
3	Replacement of 500kV ROI.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
4	Replacement of 500kV CVT's.- single phase	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]

#### 3.1.3.2. 220kV

##### Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 220kV 3 Phase CT's.	Remove existing. Supply, install & commission new on existing structure.	[C-I-C]
2	Replacement of 220kV Dead Tank Circuit Breakers.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
3	Replacement of 220kV ROI.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
5	Replacement of 220kV CVT's.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]

<sup>4</sup> MIP Scheme: Market Impact Parameter Transmission Incentive Scheme.

## 3.1.3.3. 66kV

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 66kV 3 Phase CT's.	Remove existing. Supply, install & commission new on existing structure.	[C-I-C]
2	Replacement of 66kV Dead Tank Circuit Breakers.	Remove existing. Supply, install & commission new complete with foundation.	[C-I-C]
3	Replacement of 66kV ROI.	Remove existing. Supply, install & commission new on existing structure.	[C-I-C]
4	Replacement of 66kV MVT's.- single phase	Remove existing. Supply, install & commission new on existing structure.	[C-I-C]
5	Replacement of 66kV Cap Bank Circuit Breakers.	Remove existing. Supply, install & commission new.	[C-I-C]

## 3.1.4 Major Primary Equipment Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 500kV Transformer Bushing.	Remove existing. Supply, install & commission new single phase 500kV transformer bushing	[C-I-C]
2	Replacement of 220kV Transformer Bushing.	Remove existing. Supply, install & commission new single phase 220kV transformer bushing	[C-I-C]
3	Replacement of 66kV Transformer Bushing.	Remove existing. Supply, install & commission new single phase 66kV transformer bushing	[C-I-C]

## 3.1.5 Major Primary Cap Banks

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 66kV Live tank Cap Bank CB-Pow Controlled	Remove existing. Supply, install & commission.	[C-I-C]
2	Replacement of 220kV Live tank Cap bank CB – POW Controlled	Remove existing. Supply, install & commission.	[C-I-C]
3	Replacement of Surge arrestors 22kV	Remove existing. Supply, install & commission.	[C-I-C]
4	Replacement of Surge arrestors 66kV	Remove existing. Supply, install & commission.	[C-I-C]



Item	Project Name	Scope of Work Summary	Cost ('000)
5	Replacement of Surge arrestors 220kV	Remove existing. Supply, install & commission.	[C-I-C]
6	Replacement of 66kV 50MVar Capacitor Banks cans (excluding inrush reactors and switchgear)	Remove existing. Supply, install & commission.	[C-I-C]
7	Replacement of Diesel generator	Remove existing. Supply, install & commission.	[C-I-C]

### 3.1.6 CTs and VTs

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replacement of 330kV CT (3 phase)	Remove existing. Supply, install & commission.	[C-I-C]
2	Replacement of 330kV VT (1 phase)	Remove existing. Supply, install & commission.	[C-I-C]
3	Replacement of 22kV CT (3 phase)	Remove existing. Supply, install & commission.	[C-I-C]
4	Replacement of 22kV VT (1 phase)	Remove existing. Supply, install & commission.	[C-I-C]
5	Replacement of 66kV CT (3 phase)	Remove existing. Supply, install & commission.	[C-I-C]
6	Replacement of 220kV CT (3 phase)	Remove existing. Supply, install & commission	[C-I-C]
7	Replacement of 550kV CT (3 phase)	Remove existing. Supply, install & commission	[C-I-C]

## 3.2 Unit Rates – Civil Works

### 3.2.1 Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Replace Security Perimeter Fence including gate.	Remove existing & install new Electric Fence based on 800 Metres.	[C-I-C]
2	Replace Control Building.	Remove existing & install new Control Building based on 600	[C-I-C]

Item	Project Name	Scope of Work Summary	Cost ('000)
		square metres. Does not include Protection Panels & Asbestos Removal.	
3	Re Dress Yard Surface.	Remove existing & install New based on 10,000 square metres.	[C-I-C]
4	Oil Treatment Plant (to suit 150MVA Transformer.	Remove existing & install New.	[C-I-C]
5	Replace fire hydrant system (per Metro station).	Remove existing & install New.	[C-I-C]
6	Replace switchyard lightning (per light)	Remove existing & install New based on 10 lights on poles and 10 lights on existing structures	[C-I-C]
7	Civil/Security	Remove existing and install new	[C-I-C]
8	CCTV per site-Large Site	Remove existing and install new	[C-I-C]
9	SCADA controlled switchyard lighting-Large Site	Remove existing and install new	[C-I-C]

### 3.2.2 New

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Station Road (Sealed)	Install new based on 100 metres.	[C-I-C]
2	Earth Grid	Install new based on 10,000 square metres.	[C-I-C]
3	Rural Fire System	Supply & Install new Rural Fire System.	[C-I-C]
4	Add Fire Hydrant to Existing System	Add fire hydrant to existing system.	[C-I-C]

## 3.3 Unit Rates – Secondary Systems

The rates in this section have been used to estimate programs of expenditure associated with secondary assets. These assets are located within Terminal Stations and include items such as line protection, transformer protection and Bus protection.

### 3.3.1 Allowances

The following items have been allowed for in the secondary unit rates:

- Decommissioning and removal of existing equipment
- Protection and control associated with the equipment including interfacing works
- Supply, installation, testing and commissioning
- Control cabling from cubicle to ITC
- Inter-cubicle wiring
- Cubicle earthing and cable tray

- Modification and interfacing works
- Design cost
- AusNet Services internal labour costs ( e.g. Project Management, Quality Assurance, Site Supervision and Engineering support)
- Contractor indirect costs

### 3.3.2 Exclusions

The following items have been excluded from the secondary unit rates:

- Building modification or extension works
- Removal of asbestos
- Communication systems and schemes between the stations
- Non-standard / site specific installations
- Management reserve
- Cost escalations
- Financing costs and corporate overheads
- Operation and maintenance costs
- Spares.
- Written-Down Values, line rebates and MIP Scheme.

### 3.3.3 Protection and Control Equipment

#### 3.3.3.1. 66kV

Item	Project Name	Scope of Work Summary	Cost ('000)
1	66kV X&Y Differential Feeder Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
2	66kV X&Y Bus Protection Scheme Replacement	Remove existing. Supply, install & commission new.	[C-I-C]
3	66kV Bus Tie Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
4	66kV Anti-Islanding Scheme	Supply, install & commission new.	[C-I-C]
5	66kV Load Shed Scheme	Supply, install & commission new.	[C-I-C]
6	66kV Auto Close Scheme	Supply, install & commission new.	[C-I-C]
7	Cap Bank protection for 66kV	Remove existing, supply, install and commission new	[C-I-C]

#### 3.3.3.2. 220kV

Item	Project Name	Scope of Work Summary	Cost ('000)
1	220kV Line X Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
2	220kV Line Y Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]

## Appendix 4A: Unit Rates

3	220kV Single CB Management (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
4	220kV Bus X & Y Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
5	220kV Transformer X & Y Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
6	220kV Transformer X Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
7	220kV Transformer Y Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
8	Cap Bank protection for 220kV	Remove existing, supply, install and commission new	[C-I-C]

## 3.3.3.3. 500kV

Item	Project Name	Scope of Work Summary	Cost ('000)
1	500kV Line X Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
2	500kV Line Y Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
3	500kV Single CB Management (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
4	500kV Bus X & Y Protection (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
5	500kV Transformer X & Y Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
6	500kV Transformer X Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
7	500kV Transformer Y Protection & Control (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]

## 3.3.3.4. SCIMS and DC supplies

Item	Project Name	Scope of Work Summary	Cost ('000)
1	SCIMS System – Three rack cabinet complete installed (Replacement of Old RTU's (e.g. MD3000))	Remove existing. Supply, install & commission new. Connect relays serially to new SCIMS and update relay panel wiring to remove redundant hardwiring. Remove local alarm system. Install new HMI.	[C-I-C]
2	SCIMS System – Two rack cabinet complete installed	Remove existing. Supply, install & commission new. Connect relays	[C-I-C]

Item	Project Name	Scope of Work Summary	Cost ('000)
	(Replacement of Old RTU's (e.g. MD3000))	serially to new SCIMS and update relay panel wiring to remove redundant hardwiring. Remove local alarm system. Install new HMI.	[C-I-C]
3	SCIMS System – One rack cabinet complete installed (Replacement of Old RTU's (e.g. MD3000))	Remove existing. Supply, install & commission new. Connect relays serially to new SCIMS and update relay panel wiring to remove redundant hardwiring. Remove local alarm system. Install new HMI.	[C-I-C]
4	48V Battery Bank, Chargers & Dist Board (X & Y) – 1000Ah (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
5	250V Battery Bank, Chargers & Dist Board (X & Y) – 600Ah (Replacement)	Remove existing. Supply, install & commission new.	[C-I-C]
6	Energy meters panel	Remove existing. Supply, install & commission new	[C-I-C]

### 3.4 Unit Rates – Lines

#### 3.4.1 Allowances

The following items have been allowed for within the stations unit rates:

- Decommissioning and removal of existing equipment
- Supply, installation of equipment
- Earthworks, foundations and structures (where applicable)
- Operational outage costs (i.e. planning preparation of outages & network switching)
- Design, geotechnical investigation and shop details/drafting (where required)
- AusNet Services internal labour costs (i.e., Project Management, Quality Assurance, Site Supervision and Engineering support)
- Contractor indirect costs.

#### 3.4.2 Exclusions

The following items have been excluded from the stations unit rates:

- Planning and building permit applications
- Land acquisitions, easement creation and landowner compensation
- Additional cable ducts or cable trenches - assume existing is suitable and sufficient capacity
- Removal of contaminants such as asbestos, PCBs and contaminated soil
- Costs associated with any environmental works or heritage issues
- Communication systems, underground fibre and multiplex equipment racks etc (for OPGW)
- Management reserve

- Cost escalations
- Financing cost and corporate overheads

### 3.4.3 Tower Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	500kV single circuit suspension transmission tower replacement with new 500kV single circuit suspension tower.	Remove existing tower. Supply, install & commission new tower also includes 50 metre access track and crane pad.	[C-I-C]
2	330kV suspension transmission tower replacement with new 330kV suspension tower.	Remove existing tower. Supply, install & commission new tower also includes 50 metre access track and crane pad.	[C-I-C]
3	220kV single circuit suspension transmission tower replacement with new 220kV single circuit suspension tower.	Remove existing tower. Supply, install & commission new tower also includes 50 metre access track and crane pad.	[C-I-C]

### 3.4.4 Insulator Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	500kV strain insulator replacement with new 500kV composite strain insulator (10 towers).	Supply, install & commission new quad insulator per phase for one circuit for one tower.	[C-I-C]
2	500kV V-string suspension insulator replacement with new 500kV composite suspension insulator (10 towers).	Supply, install & commission new quad orange V-string insulator per phase for one circuit for one tower.	[C-I-C]
3	500kV I-string suspension insulator replacement with new 500kV composite suspension insulator. (500 towers and using Live Line techniques).	Supply, install & commission new single I-string insulator per phase for one circuit for one tower.	[C-I-C]
4	220kV strain insulator replacement with new 220kV composite strain insulator. (10 towers).	Supply, install & commission new twin insulator strain per phase for one tower for one circuit.	[C-I-C]
5	220kV I-string suspension insulator replacement with new 220kV composite suspension insulator (750 towers and using Live Line techniques).	Supply, install & commission new single I string insulator per phase for one circuit for one tower.	[C-I-C]

## 3.4.5 Ground-wire Replacement

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Direct retrofit of existing ground-wire with like for like replacement metropolitan area.	Remove existing. Supply, install & commission.	[C-I-C]
2	Direct replacement of existing ground-wire with OPGW replacement metropolitan area	Remove existing. Supply, install & commission.	[C-I-C]
3	Critical crossing single span ground-wire replacement like for like.	Remove existing. Supply, install & commission new, includes cradle block.	[C-I-C]

## 3.4.6 Fall Arrest

Item	Project Name	Scope of Work Summary	Cost ('000)
1	Rack System Fall Arrest	Supply & install new fall arrest per terminal station site.	[C-I-C]
2	500 kV Tower System Fall Arrest.	Supply & install new fall arrest on single flat top delta type tower.	[C-I-C]
3	330 kV Tower System Fall Arrest.	Supply & install new fall arrest on single flat top delta type tower.	[C-I-C]

## 3.4.7 Conductor

Item	Project Name	Scope of Work Summary	Cost ('000)
1	220 and 330kV two conductor in Bundle proactive replacement (per km) Urban	Remove existing. Supply, install & commission.	[C-I-C]
2	66kV one conductor proactive replacement (per km) - Urban	Remove existing. Supply, install & commission.	[C-I-C]
3	220 and 330kV two conductor in Bundle – proactive replacement (per km) - Rural	Remove existing. Supply, install & commission.	[C-I-C]
4	66kV one conductor proactive replacement (per km) - Rural	Remove existing. Supply, install & commission.	[C-I-C]
5	500kV four conductor bundle proactive replacement (per km) Urban	Remove existing. Supply, install & commission.	[C-I-C]
6	500kV four conductor in Bundle proactive replacement (per km) – Rural	Remove existing. Supply, install & commission.	[C-I-C]
7	By Pass per km	Remove existing. Supply, install & commission.	[C-I-C]

