2018-22
POWERLINK QUEENSLAND REVENUE PROPOSAL

APPENDIX 7.01 - PUBLIC

Powerlink Queensland
Cost Estimating Methodology

Delivering better value

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1 Purpose

This document describes the cost estimating methodologies Powerlink Queensland has applied in the development of its Revenue Proposal, particularly:

- The general estimating process;
- The use of Base Planning Objects (BPOs) as the building blocks of cost estimating data;
- The approach to the development of project specific estimates; and
- The basis on which Powerlink has developed unit rates applied in its Capital Expenditure Replacement (Repex) Forecasting Model.

2 Organisational Structure

Powerlink maintains a dedicated in-house cost estimating team that manages all cost data and develops estimates required for network capital and operational refurbishment projects.

This approach ensures consistency in the estimating process and continuity in the maintenance and review of cost data from projects delivered over time. In addition, the retention of an in-house cost estimating function enables Powerlink to effectively monitor and benchmark the cost performance of its projects and those contractors engaged to provide project and construction services.

The estimating team works with infrastructure delivery teams responsible for project and construction management to develop project estimates and reconcile actual project costs in order to update cost estimating data sets.

2.1 Estimating framework

2.1.1 Estimate types

Powerlink adopts two formal estimating methodologies for network capital and operational refurbishment projects. This reflects a fit-for-purpose approach to estimating based on project complexity, risk and expected cost as detailed below:

- Concept Estimates: produced in response to a high-level project scope requiring the consideration of multiple options, typically developed for future investment needs or to support the detailed investigation of a confirmed investment need; and
- Project Proposals: developed in response to a detailed project scope for a single option, to support the full financial approval of a project consistent with Powerlink's corporate governance framework.

2.1.2 Cost estimating process

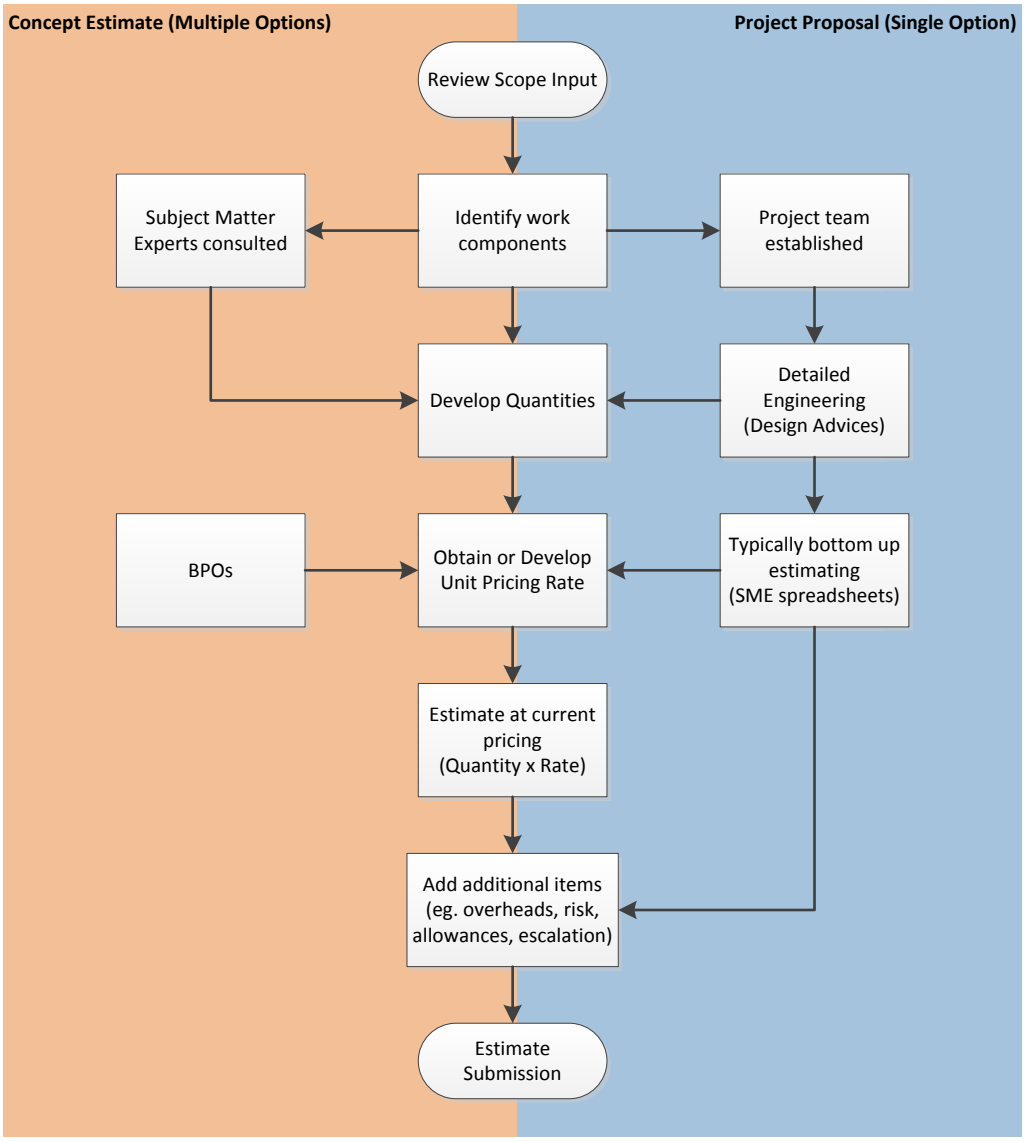
Powerlink applies a standard business process to develop project cost estimates.

A Project Sponsor is allocated to each project to coordinate and define the project scope, request project estimates and sponsor subsequent phases of project execution.

After receiving a project estimate request, a Project Team is formed including the Project Sponsor, Project Manager, Estimator and Subject Matter Experts (SMEs). The SMEs may include designers, construction support, safety, environment, cultural heritage and/or landholder relations representatives as required by the project scope. The Project Manager will lead the Project Team and coordinate the development of the project estimate, while liaising with the Project Sponsor to ensure that the project estimate aligns with the requirements of the project scope.

The high level procedure for the development of a network project estimate is set out in Figure 1.

Figure 1: Network project cost estimation methodology



Source: Powerlink data.

In general terms, a project estimate will provide the following information:

- Scope of work;
- Assumptions used in determining the project scope and cost;
- Single Line Diagrams (SLD);
- Plant layout drawings;
- Project schedule;
- Delivery strategy;
- Project delivery risks; and
- Project dependencies.

For each project estimate, Base Planning Object (BPO) rates are used to develop top-down project estimates to compare against any bottom-up estimates developed by SMEs within the Project Team. BPOs are discussed further in the next section.

The Project Manager in consultation with the Estimator will also determine project specific allowances and risk to be included in the overall project estimate.

Internal comparison of each project estimate is performed against actual historical project costs and recent construction/procurement costs.

Each project estimate is subject to peer and line manager review to ensure the quality and consistency of delivered project estimates. Project estimates of less than $20m require the approval of the Manager Projects and above $20m require the approval of the Executive Manager.

2.1.3 Base Planning Objects

Powerlink's project estimates are developed by means of its estimating cost database that is underpinned by BPOs. BPOs are rates that contain all of the expected costs of delivering a defined unit of work.

Using actual historical project cost data that has been collected and progressively updated over the last decade, Powerlink has derived a range of BPOs for each of the following asset classes:

- Substations primary plant;
- Substations secondary systems;
- Transmission lines structures; and
- Telecommunications components.

In addition, Powerlink has developed BPOs for common costs (such as site establishment and mobilisation).

Each BPO is composed of costs for labour, plant, equipment, procured materials, contracted services and other sundry expenses. The BPOs also incorporate standard allowances that are representative of the costs that are likely to be incurred in each unit of activity. By way of example, transmission lines structure BPOs include standard allowances based on an expected average number of road, rail and river crossings, the ratio of suspension tower to tension structures, geotechnical conditions, wet weather days and remote site living allowances.

When Powerlink identifies new plant, technology or project delivery methods that improve efficiency in project delivery and maintenance, new BPOs are developed. A new BPO is developed based on:

- The defined scope and implementation method; and
- Costs initially determined by a combination of tendered contract prices for those components of the BPO that are the subject of procurement or contracted services and recent cost data for relevant activities delivered by Powerlink.

The BPO input costs are regularly reviewed by using cost data sourced from current procurement contract prices, Consumer Price Index (CPI) adjustments, exchange rates and labour rates.

2.1.4 Estimating risk and allowances

Having regard to the particular attributes of a project scope, the Project Team will also develop project specific allowances and risk.

Project specific allowances are made for those events that are likely to occur on a project of similar scope under similar conditions, the costs for which are not reflected in the relevant BPO/s. An example of this would involve an allowance for above average wet weather conditions that typically occur in high rainfall areas of Queensland (such as Far North Queensland and the Wet Tropics). The costs associated with any allowances are incorporated into the base cost of a project estimate, with the expectation that the approved capital or operating budget should include provision for these allowances in order to successfully deliver the project scope.

Risks are those events that have the potential to occur but are beyond the control of the Project Team. Risks are not provided for within a BPO. Risk components are identified for consideration of the Project Sponsor in the approved project budget, but are not included within the base cost of the project estimate.

3 Powerlink's Repex Model Unit Rates

3.1 Background

Powerlink has applied the AER's Repex Model to forecast its capital reinvestment expenditure for the 2018-22 regulatory period. The Repex Model requires unit rates to be defined for the quantities of each asset category forecast within the model. The following sections outline Powerlink's approach to the development of Repex Model unit rates.

3.2 Methodology

The unit rates used in the Repex Model are based on Powerlink's BPOs.

For each unit rate used in the Repex Model, the external direct job costs (materials, equipment and construction costs) are derived from the corresponding BPO. Using historical data from completed estimates, these direct costs were then adjusted to include:

- Contractor Indirect Job Costs (IJC) and mobilisation/demobilisation;
- Design costs;
- Project management costs;
- Commissioning costs;
- Procurement oncost; and
- Project development costs.

3.2.1 Asset group and asset category data unit rates

Powerlink has developed asset groups and asset categories for which it requires a unit rate, categorised in a manner similar to that reported in its annual Regulatory Information Notice (RIN) data.

Powerlink has adopted the following asset groups which are described in Tables 1 to 5:

- Substation switchbays;
- Secondary systems;
- Telecommunications;
- Buildings and infrastructure; and
- Transmission lines.

Within each asset group, there are a number of asset categories against which each unit rate is defined.

Table 1: Substation switchbays asset group unit rates

Asset category	Comment	Unit rate ($AUD)	Unit of measure
< = 33kV; air insulated circuit breaker		[redacted]	ea
> 33kV & < = 66kV; air insulated circuit breaker		[redacted]	ea
> 66kV & < = 132kV; air insulated circuit breaker	132kV Air Insulated Switchgear 1 x 3 phase circuit breaker within single feeder bay	[redacted]	ea
> 132kV & < = 275kV; air insulated circuit breaker	275kV Air Insulated Switchgear 1 x 3 phase circuit breaker within 1.5 circuit breaker diameter feeder bay	[redacted]	ea
> 275kV & < = 330kV; air insulated circuit breaker		[redacted]	ea
< = 33kV; air insulated isolator/earth switch		[redacted]	ea
> 33kV & < = 66kV; air insulated isolator/earth switch		[redacted]	ea
> 66kV & < = 132kV; air insulated isolator/earth switch	132kV Air Insulated Switchgear 3 phase 2 x isolator/1 x earth switch within single feeder bay	[redacted]	ea
> 132kV & < = 275kV; air insulated isolator/earth switch	275kV Air Insulated Switchgear 3 phase 3 x isolator/4 x earth switch within 1.5 circuit breaker diameter feeder bay	[redacted]	ea
> 275kV & < = 330kV; air insulated isolator/earth switch		[redacted]	ea
< = 33kV; voltage transformer		[redacted]	ea
> 33kV & < = 66kV; voltage transformer		[redacted]	ea
> 66kV & < = 132kV; voltage transformer	132kV Air Insulated Switchgear 3 x 1 phase capacitor voltage transformer (CVT) within single feeder bay	[redacted]	ea
> 132kV & < = 275kV; voltage transformer	275kV Air Insulated Switchgear 3 x 1 phase CVT within 1.5 circuit breaker diameter feeder bay	[redacted]	ea
> 275kV & < = 330kV; voltage transformer		[redacted]	ea
< = 33kV; current transformer		[redacted]	ea
> 33kV & < = 66kV; current transformer		[redacted]	ea
> 66kV & < = 132kV; current transformer	132kV Air Insulated Switchgear 3 x 1 phase current transformer (CT) within single feeder bay	[redacted]	ea
> 132kV & < = 275kV; current transformer	275kV Air Insulated Switchgear 3 x 1 phase CT within 1.5 circuit breaker diameter feeder bay	[redacted]	ea
> 275kV & < = 330kV; current transformer		[redacted]	ea

Table 2: Secondary systems asset group unit rates

Asset category	Comment	Unit rate ($AUD)	Unit of measure
Secondary systems bay	Protection Relays, control system, panel and wiring associated with a primary plant switchbay.	[redacted]	ea
Secondary systems non-bay	Control and monitoring assets not associated with a specific bay (e.g. substation HMI, remote monitoring equipment).	[redacted]	ea
Metering	Duplicate type 2 metering.	[redacted]	ea

Table 3: Telecommunication assets group unit rates

Asset category	Comment	Unit rate ($AUD)	Unit of measure
Communication network assets	Includes a single multiplexer, communications rack, fibre driver or digital microwave radio replacement.	[redacted]	Ea

Table 4: Buildings and infrastructure asset group unit rates

Asset category	Comment	Unit rate ($AUD)	Unit of measure
Substation buildings, excluding amenities	Replacement of a demountable control room building.	[redacted]	Ea
Communication buildings	Replacement of a demountable communications building.	[redacted]	Ea
Site infrastructure, substations	Replacement of substation site infrastructure, not included within other unit rates.	[redacted]	Ea
Site infrastructure, communications	Replacement of telecommunications site infrastructure, not included within other unit rates.	[redacted]	Ea

Table 5: Transmission lines asset group unit rates

Asset group	Asset category	Unit rate ($AUD)	Unit of measure
Total cost per tower replacement: • assuming whole line to be replaced • old tower decommissioning • new tower costs: materials, construction • conductors: typical span length for voltage • average 400m of conductor, OPGW, OHEW	> 66kV & < = 132kV; Single Circuit	[redacted]	Twr
	> 132kV & < = 275kV; Single Circuit		Twr
	> 275kV & < = 330kV; Single Circuit		Twr
	> 66kV & < = 132kV; Multiple Circuit		Twr
	> 132kV & < = 275kV; Multiple Circuit		Twr
	> 275kV & < = 330kV; Multiple Circuit		Twr
Total cost per tower for tower refit/refurbishment existing tower retained • for each structure • 1% of members, 5% of bolts plus painting • insulator (suspension & tension) retained • OHEW & OPGW retained	> 66kV & < = 132kV; Single Circuit		Twr
	> 132kV & < = 275kV; Single Circuit		Twr
	> 275kV & < = 330kV; Single Circuit		Twr
	> 66kV & < = 132kV; Multiple Circuit		Twr
	> 132kV & < = 275kV; Multiple Circuit		Twr
	> 275kV & < = 330kV; Multiple Circuit		Twr
Total cost per tower for tower refit/refurbishment existing tower retained • for each structure • 1% of members, 5% of bolts plus painting • insulator (suspension & tension) replaced • OHEW & OPGW replaced	> 66kV & < = 132kV; Single Circuit		Twr
	> 132kV & < = 275kV; Single Circuit		Twr
	> 275kV & < = 330kV; Single Circuit		Twr
	> 66kV & < = 132kV; Multiple Circuit		Twr
	> 132kV & < = 275kV; Multiple Circuit		Twr
	> 275kV & < = 330kV; Multiple Circuit		Twr
Conductor replacement works only	> 66kV & < = 132kV; < = 100MVA	[redacted]	km
	> 66kV & < = 132kV; > 100MVA & < = 400MVA		km
	> 66kV & < = 132kV; > 400MVA		km
	> 132kV & < = 275kV; > 200MVA & < = 600MVA		km
	> 132kV & < = 275kV; > 600MVA		km
	> 275kV & < = 330kV; 1200MVA		km

The following sections provide a high-level description of the basis on which each unit rate has been derived, including the specific inclusions or exclusions for each unit rate. This information has been provided to assist the AER and stakeholders in forming an independent view of the cost of each unit rate against the defined scope and to ensure that Powerlink has not double-counted any item within and between unit rates.

3.2.2 Substation switchbays

The unit rates derived for substation switchbays have been developed using indicative projects based on the following scope:

- In situ replacement of 132kV substation comprising of 4 Feeder bays, 2 Transformer bays, 1 Bus Coupler bay and 1 Capacitor Bank Bay; and
- In situ replacement of 275kV Substation comprising of 6 Feeder bays, 2 Transformer bays, 6 Coupler bays, 1 Reactor bay and 1 Capacitor Bank Bay.

The unit rates have also been calculated on the basis that a complete substation switchbay is being replaced in situ within the existing Powerlink substation.

This approach ensures that the unit rate reflects the actual cost of delivering the work within the scope of a typical project and using an efficient project delivery methodology. Substation switchbay unit rates are inclusive of civil, primary equipment and associated switchbay common works, unless otherwise specified.

Inclusions

The following cost items have been included in the switchbay unit rates:

- Decommissioning and removal of existing equipment;
- Supply, installation, testing and commissioning of equipment (including other equipment as required i.e. surge arrestors);
- Foundations and structures (where applicable);
- Cabling between the field marshalling kiosk and primary equipment;
- Interplant connections;
- Landing beams and associated strung bus replacement (where applicable);
- Supply and installation of support insulators;
- Fixed bus modifications;
- Earthing modifications;
- Replacement of gravel around equipment (where applicable);
- Conduit modifications (where applicable);
- Network switching and staging of outages;
- Design (internal/external where applicable);
- Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs); and
- Contractor indirect costs.

Exclusions

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

- Planning and building permit applications;
- Land acquisitions and easement creation;
- Secondary systems replacement – included in secondary systems unit rates;
- Bulk earthworks and roadworks – included in relevant site infrastructure unit rate;
- Replacement of switchyard lighting – included in relevant site infrastructure unit rate;
- Alterations to landing spans and/or first structure away from the beam;

- Asset disposal written-down values;
- Spares; and
- Operating and maintenance costs.

3.2.3 Substation secondary system assets

The unit rates derived for substation secondary system assets allow for the replacement of secondary system bays within existing Powerlink substations. The unit rates have been divided into three categories described below.

Secondary systems bay unit rate

A secondary system bay asset includes the protection relays, control system, panel and wiring associated with a primary plant switchbay. A secondary systems bay unit rate has been developed using indicative projects based on the following scope:

- In situ replacement of 132kV substation comprising of 4 Feeder bays, 2 Transformer bays, 1 Bus Coupler bay and 1 Capacitor Bank Bay; and
- In situ replacement of 275kV substation comprising of 6 Feeder bays, 2 Transformer bays, 6 Coupler bays, 1 Reactor bay and 1 Capacitor Bank Bay.

The unit rates have also been calculated on the basis that an entire secondary systems bay asset is being replaced in situ within the existing Powerlink substation. This approach ensures that the unit rate reflects the actual cost of delivering the work within the scope of a typical project and using an efficient project delivery methodology.

Powerlink has simplified the unit rate for the secondary systems bay by taking an average of the unit rate derived for a 275kV and 132kV substation, as the costs of the secondary system were comparable irrespective of the voltage at which the relevant primary plant switchbay operates.

Secondary system non-bay unit rate

At each substation, Powerlink has a non-bay secondary system asset which includes control and monitoring assets not associated with a specific primary plant switchbay (e.g. Bus zone protection, substation Human Machine Interface (HMI), Supervisory Control and Data Acquisition (SCADA) links to the control centre and remote monitoring equipment). The secondary systems non-bay unit rate is not applicable for a telecommunications site.

An average secondary systems non-bay unit rate was developed by averaging the direct costs of the following equipment BPOs within Powerlink's cost estimating system:

- Common services;
- Master station;
- High speed monitoring equipment;
- Power quality monitoring;
- Local control facility;
- DC supplies; and
- Weighted average of High Impedance Bus Zone Scheme (90%) and Low Impedance Bus Zone Scheme (10%).

Metering secondary system rate

Metering secondary systems are required for revenue metering installations at the generator, distribution network service provider, transmission network service provider or customer connection level. Metering secondary systems are generally replaced if the majority of the secondary systems at a substation are replaced (with new metering units installed in a new control building). The unit rate was developed by using the direct costs of a duplicated Type 2 Metering BPO.

Inclusions

The following items have been included in the secondary systems unit rates discussed above:

- Decommissioning and removal of existing equipment;
- Supply, installation, testing and commissioning of equipment;
- Protection and control associated with the equipment, including interface works;
- Cabling between the cubicle and field marshalling kiosk;
- Inter-cubicle wiring;
- Cubicle earthing;
- Remote end protection modifications;
- Design cost (internal/external where applicable);
- Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs); and
- Contractor indirect costs.

Exclusions

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

- Building modification or extension works;
- Removal of asbestos;
- Communication systems between the remote ends;
- Asset disposal written-down values;
- Spares; and
- Operating and maintenance costs.

3.2.4 Telecommunications assets

A single unit rate has been derived for telecommunication assets, based on the typical scope and cost of a telecommunications replacement project. The average unit rate represents a single multiplexer, communications rack, fibre driver or digital microwave radio replacement.

Inclusions

The following items have been included within the telecommunications assets unit rates:

- Decommissioning and removal of existing equipment;
- Supply, installation, testing and commissioning of equipment;
- Inter-cubicle wiring;
- Design cost (internal/external where applicable);
- Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs); and

- Contractor indirect costs.

Exclusions

The following items have been excluded from within the telecommunications assets unit rates:

- Communications building modification or extension works;
- Communication systems external to the substation;
- Cost escalations;
- Asset disposal written-down values;
- Spares; and
- Operating and maintenance costs.

3.2.5 Buildings and infrastructure assets

The unit rates derived for building and infrastructure assets allow for replacement of buildings and common site infrastructure within existing Powerlink substations and telecommunication sites.

The unit rate for site infrastructure covers all costs for replacement of equipment in a substation or telecommunication site not provided for within other unit rates (i.e. roads, station services, fencing, yard lighting, site drainage, security, amenities building, sediment dams, landscaping).

Inclusions

The following items have been included in the building and infrastructure assets unit rates:

- Decommissioning, repair and/or removal of existing infrastructure;
- Supply, installation, testing and commissioning of infrastructure;
- Design cost (internal/external where applicable);
- Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs); and
- Contractor indirect costs.

Exclusions

The following items have been excluded from within the building and infrastructure assets unit rates:

- Asbestos removals;
- Major earthworks;
- Asset disposal written-down values;
- Spares; and
- Operating and maintenance costs.

3.2.6 Transmission lines

The unit rates derived for transmission lines allow for replacement or refit of the structures/conductors associated with existing Powerlink transmission lines. Rates are inclusive of site access, civil, structural and associated conductor works, unless otherwise specified.

Powerlink does not anticipate relacing any conductors due to condition in the 2018-22 regulatory period. Minor works to conductors are however possible due to cut-in of feeders at substations where the related switchbay is being replaced.

Inclusions

The following items have been included in the transmission line unit rates:

- Decommissioning and removal of existing equipment;
- Supply, installation and commissioning of equipment;
- Foundations and structures (where applicable);
- Earthing modifications;
- Site surveys, geotechnical investigations and reports (where applicable);
- Minor access track upgrades;
- Landholder and stakeholder consultation;
- Network switching and staging of outages;
- Design (internal/external where applicable);
- Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs); and
- Contractor indirect costs.

Exclusions

The following items have been excluded from within the transmission line unit rates:

- Planning and building permit applications;
- Land acquisitions, easement creation and landowner compensation;
- Asset disposal written-down values;
- Spares; and
- Operating and maintenance costs.

3.3 Verification of unit rates used in Repex Model

The following sections outline the steps that Powerlink has taken to verify the unit rates used in the Repex Model.

3.3.1 Reconciliation between Category Analysis and Repex Model unit rates

The unit rates adopted in Powerlink's application of the Repex Model differ from those reported in Powerlink's annual Category Analysis RIN and Reset RIN due to three factors:

- The Repex Model unit rates include a corporate overhead (indirect cost) allocation, given they are developed from Powerlink's BPOs. However, the AER requires historical Category Analysis RIN and Reset RIN unit rates to be estimated on an "unburdened" basis. In other words, for businesses to exclude any allocation for overheads;
- Unit rates for new assets derived from the Category Analysis RIN information do not include costs to modify or enhance an existing asset or costs incurred after the asset has been capitalised[1]. For example, when a new replacement substation asset is commissioned, the cost of any necessary works on existing associated substation assets is capitalised into the existing asset's value not the new asset's value; and

[1] Powerlink has explained its approach in the Basis of Preparation documents supplied to the AER as part of its annual Category Analysis RIN response. See AER website: http://www.aer.gov.au/system/files/Powerlink%202013-14%20-%20Category%20Analysis%20RIN%20-%20Basis%20of%20Preparation%20D14%20149022.pdf

- Repex Model unit rates have been developed using Powerlink's BPOs (bottom-up) as opposed to Category Analysis RIN unit rates which are developed by disaggregating projects costs to an asset level (top-down) to meet the AER's annual RIN requirements. The assumptions applied in the disaggregation of the Category Analysis RIN unit rates do not align with requirements for forecast unit rates applied in the Repex Model.

The impact of these differences is that the unit rates reported in the Category Analysis and Reset RINs are lower than Powerlink's observed project costs and also vary as a result of the differing methodologies used to capture the unit rates.

For the purpose of forecasting reinvestment capital expenditure in the 2018-22 regulatory period using the Repex Model, Powerlink considers that it is appropriate to capture the costs identified above in the unit cost input module of the model. In particular, Powerlink considers that this is required to provide transparency in the total costs that are expected to be incurred in the 2018-22 regulatory period.

3.3.2 Potential for double counting in unit rates

Unit rates were derived by disaggregating the total out-turn cost of indicative projects into each applicable unit rates. This approach, in conjunction with the allocation of direct costs from relevant BPOs to each unit rate has mitigated the possibility of double counting between estimates of unit rates. In addition, the scope of each unit rate has been defined and clearly articulates those items included with the rate or excluded and the subject of another unit rate.

3.3.3 Variability in unit rates

Variability between unit rates for individual asset replacements is expected to occur due to differences in geographic location, site specific conditions (e.g. physical access, brownfield conditions) and network outage requirements.

In developing unit rates for use in the Repex Model, Powerlink has sought to ensure that they reflect the average cost of replacement for that asset category when considered at a program and portfolio level, across the population of Powerlink's assets. Powerlink has developed each unit rate using BPOs informed by actual average historical project costs and estimated the total cost of the unit rate within the scope of an indicative project. Powerlink also compared a series of 'bottom up' project estimates against a separate estimate of each project cost derived from unit rates applied in the Repex Model. This assessment confirmed that variability exists between unit rates when applied to individual asset replacement projects however across a population of sample projects the difference between the total estimated expenditure using unit rates or bottom-up projects estimates was within ±5%.

3.3.4 Independent benchmarking of Repex Model unit rates

Powerlink engaged Jacobs to provide its own independent set of estimates for 52 nominated asset building-blocks across a number of different categories and voltages, namely: conductors; tower replacement and refit/refurbishment; substation switch bays, including selected power transformers; SCADA, network control and protection systems; and reactive plant including Static VAR Compensators (SVCs), capacitors and shunt reactors. Jacobs' report is provided as Appendix 7.04 to the Revenue Proposal.

Jacobs' estimates were based on market data drawn from multiple sources, which included:

- Recent expenditure reviews for electricity transmission and distribution utilities to support regulatory proposals to the AER;
- Procurement studies of transmission and distribution asset costs;
- Jacobs market price surveys of materials costs and construction and maintenance activities;
- Contract and procurement costs incurred by utilities on recent projects;
- Recent asset valuations and comparative Jacobs estimates; and
- Jacobs valuation database.

Powerlink used Jacobs' estimates to compare against the unit rates developed from Powerlink's own estimating systems and delivered projects used as input to the Repex Model. Powerlink found that while some of its individual unit rates differed from those developed by Jacobs, the application of both sets of unit rates in the Repex Model at a portfolio level resulted in Jacobs rates being marginally higher than Powerlink (by 2%). The reason for the variation in some individual unit rates could be attributed to the different approach that Powerlink and Jacobs has taken to apportion common costs to each unit rate. Overall, Powerlink is satisfied that the unit rates used as input to the Repex Model provide for a reasonable estimate of forecast costs.