2023-27
POWERLINK QUEENSLAND REVENUE PROPOSAL

Appendix 7.03 – PUBLIC

Cost Estimating Methodology

1. Purpose

This appendix describes the cost estimating methodologies we have applied in the development of the capital expenditure forecast in our Revenue Proposal, particularly:

- our general estimating process;
- our approach to the development of project specific estimates; and
- the basis on which we have developed unit rates applied in our Capital Expenditure Replacement (Repex) Forecasting Model.

2. Organisational structure

We maintain a dedicated in-house cost estimating team that manages all cost data and develops estimates required for network capital and operational projects. The team is complemented with commercial estimating and quantity surveying contractors as necessary to manage work load.

This approach ensures consistency in the estimating process and continuity in the maintenance and review of cost data from projects delivered over time. The retention of an in-house cost estimating function enables us to effectively monitor and benchmark the cost performance of our projects and the contractors engaged to provide project and construction services. In addition, the periodic engagement of commercial estimating and quantity surveying contractors provides connection to current market data and construction, practices and methodologies

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.

3. Estimating framework and process

We develop project cost estimates based on a defined scope of work to address an identified investment need. Identified investment needs may be triggered, for example, by growth in customer demand exceeding existing network capacity, the condition or obsolescence of existing network assets or the need to maintain network performance standards.

We produce our project estimates using a first principles approach, where the estimate is calculated based upon the specific resources and quantities required to complete the defined scope of works (e.g. labour, equipment, materials and subcontracts). We also identify and cost items particular to the project site to account for project-specific site conditions.

Project estimates provide the basis for economic analysis, management decisions, budgets and cost control. Estimates of increasing accuracy may be produced to support these activities as a project progresses.

3.1 Estimate types

We adopt two formal estimating methodologies for network capital 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, with a wider cost accuracy range these are typically developed for future investment needs or to support the detailed investigation of a confirmed investment need.
- Project Proposals: developed in response to a detailed project scope for a single option, which enables a narrower cost accuracy range, to support the full financial approval of a project consistent with Powerlink's corporate governance framework.

For the purpose of establishing the capital expenditure forecast in our Revenue Proposal, we have scoped and estimated a single option using the Concept Estimate approach. All projects will undergo full option analysis as part of business as usual processes, which also includes application of the Regulatory Investment Test for Transmission where appropriate and related public consultation. This will require a new Concept Estimate to compare option costs on a like basis before the preferred option is selected and a Project Proposal completed to provide a more detailed scope and estimate.

3.2 Estimate classes and accuracy

We produce five classes of estimate in line with international recommended practice[1] that are informed by the level of specific project information available at the time of the estimate being prepared. The most common class of estimate for Concept Estimates and Project Proposals are class 5 and class 3 respectively. Table 3.1 provides the typical level of detail required and accuracy of each class of estimate produced.

Table 3.1: Estimate classes and accuracy

Estimate Class	Maturity of Project Definition	Typical Accuracy Range	Typical Estimate Type
Class 5	0% to 2%	-50% to +100%	Concept Estimate
Class 4	1% to 15%	-30% to +50%	
Class 3	10% to 40%	-20% to +30%	Project Proposal
Class 2	30% to 75%	-15% to +20%	
Class 1	65% to 100%	-10% to +15%	

Source: AACE International, Powerlink

The estimate classification is derived from the maturity of the data that makes up the project definition, such as the specific items of equipment required, quantities of construction materials, and construction staging. Each project estimate is based upon known quantities where available, but will also include assumed quantities based upon recent project examples where necessary.

3.2.1 Cost estimating process

We apply a standard business process to develop project cost estimates.

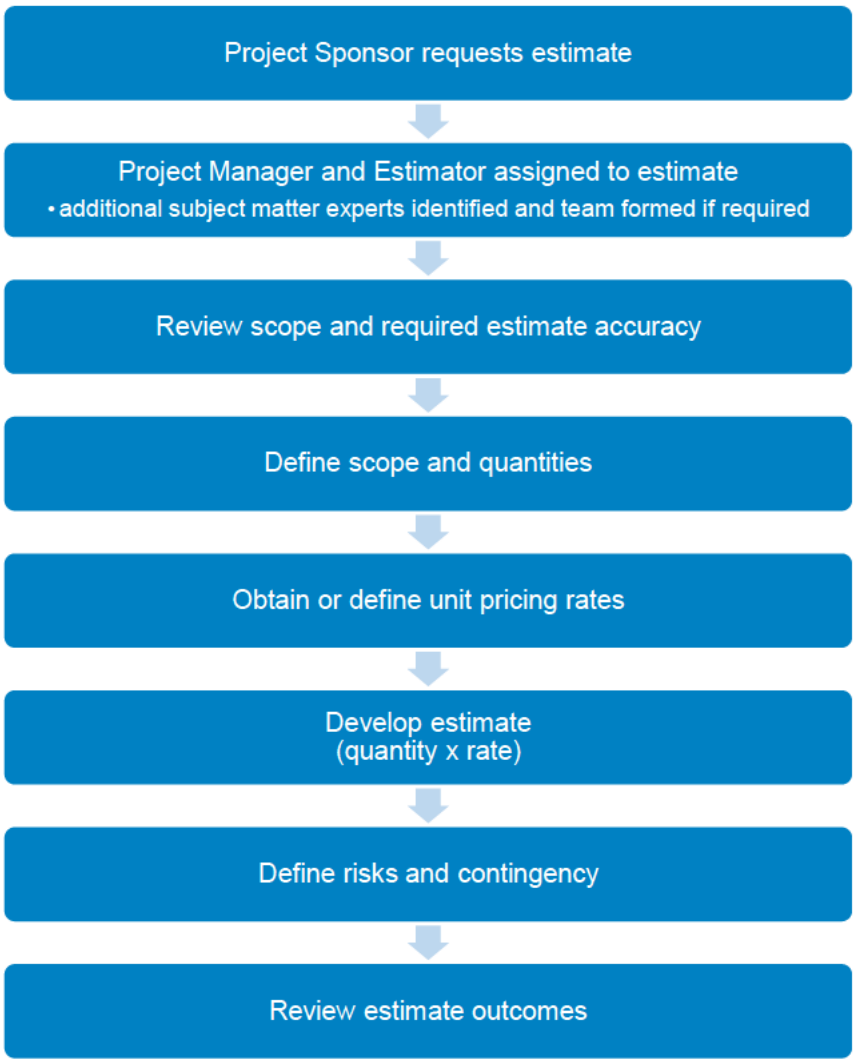
A Project Sponsor is allocated to each project to coordinate and define the project scope, request project estimates and manage project governance throughout subsequent phases of project development and execution.

After receiving a project estimate request which also defines the project scope requirements, 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.

[1] Association for the Advancement of Cost Estimating (AACE International), Recommended Practice No. 18R-97

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

Figure 3.1: Network project cost estimating process



Each project estimate is subject to peer and line manager review to ensure the quality and consistency of delivered project estimates, including a formal review meeting attended by senior project delivery managers. Project estimates are approved by the relevant Manager Projects, with post notification to the General Manager Infrastructure Delivery.

3.3 Estimating risk and allowances

The Project Manager and Estimator, with appropriate advice and input from subject matter experts and design teams, develop project specific allowances and risks based upon the particular attributes of a project scope.

Project specific allowances are made for those events that are almost certain to occur on a project of similar scope under similar conditions. 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) that cannot be avoided or mitigated. 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. Identified risks are captured in a deterministic risk model together with an appropriate

mitigation strategy. A first principles approach is used to cost the potential impact of the risk both before and after mitigation, including the cost of the mitigation strategy.

The cost of the mitigation strategy is included in the base cost of the project estimate, but the potential cost impacts are excluded. However, the cost impacts of the identified risks are considered by the Project Sponsor in the approved project budget.

4. Powerlink's Unit Rates for the Repex Model

4.1 Background

We have adopted a Hybrid+ approach to forecasting our capital expenditure for the 2023-27 regulatory period[2]. This consists of a combination of bottom-up forecasts for specific significant investments and top-down modelling of other expenditure requirements. We have used a calibrated version of the AER's Repex Model for the top-down modelling of our non-load driven network capital expenditure.

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 unit rates for use in the Repex Model.

4.2 Methodology

We identified a range of asset categories for use in the Repex Model, categorised in a manner similar to that reported in our annual Regulatory Information Notice (RIN) data. We then leveraged the standard estimating process to develop cost estimates for the unit rates for each asset category.

Unit rates were derived by our internal estimating resource based upon a first principles approach to delivery of each asset category. To do this, we:

- Prepared a cost estimate for each asset type based on that single asset being delivered as a stand-alone project.
- Considered the opportunities to coordinate reinvestment works to form larger projects to extract economies of scale, which reduces the per unit project management, design and commissioning costs and reflects our standard delivery approach.
- Applied an efficiency factor based upon a standard package of works for each individual type of asset and the opportunity to realise efficiencies during delivery, such as reinvestment in four primary plant bays at a substation of similar condition.

No locality or site specific allowances were included in the unit rate cost estimates. We also did not include any risk or contingency within the unit rates. The resulting estimates were compared against current contract and outturn costs for similar works to validate that the unit rates produced were reflective of our costs, excluding such factors.

The specific bundling approach for each asset category, together with specific inclusions and exclusions, is detailed within the following sections.

[2] Our capital expenditure forecasting approach is described in more detail in Chapter 5 of our Revenue Proposal (Forecast Capital Expenditure) and our Expenditure Forecasting Methodology (included as Appendix 5.03 to the Revenue Proposal).

4.3 Asset group and asset category data unit rates

We have collected the unit rates for specific asset categories into the following asset groups:

- substation switch bays;
- secondary systems;
- telecommunications;
- buildings and infrastructure; and
- transmission lines.

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, while the unit rates are included in Attachment A.

4.3.1 Substation switch bays

We have developed the unit rates for substation switch bays based on bundling works in line with the following reference scopes:

- for voltages of 132kV and below – all assets form part of a bundled scope to replace four complete air insulated switchgear bays, in-situ within an existing Powerlink substation; and
- for voltages over 132kV – all assets form part of a bundled scope to replace four complete air insulated switchgear bays within a 1.5 circuit breaker diameter configuration, in-situ within an 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 switch bay unit rates are inclusive of civil, primary equipment and associated switch bay common works. The following cost items have been included or excluded, as indicated, in the switch bay assets unit rates.

Table 4.1: Switch bay assets unit rates inclusions and exclusions

Inclusions	Exclusions
Decommissioning and removal of existing equipment	Planning and building permit applications
Supply, installation, testing and commissioning of equipment (including other equipment as required, e.g. surge arrestors, and procurement on-cost)	Land acquisitions and easement acquisition
Foundations and structures (where applicable)	Secondary systems replacement (included in secondary systems unit rates)
Cabling between the field marshalling kiosk and primary equipment	Bulk earthworks and roadworks (works assumed to be within existing substation footprint)
Interplant connections	Replacement of switchyard lighting
Landing beams and associated strung bus replacement (where applicable)	Alterations to landing spans and/or first structure away from the beam
Supply and installation of support insulators	Asset disposal written-down values
Fixed bus modifications	Spares
Earthing modifications	Operating and maintenance costs
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)	
Contractor indirect costs	

4.3.2 Substation secondary systems

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

Secondary system bay unit rate

A secondary systems bay asset includes the protection relays, control system, panel and wiring associated with a primary plant switch bay. We developed the unit rate for secondary systems bays based on bundling works in line with a reference project to replace four complete secondary systems bays. The unit rate has 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 systems were comparable irrespective of the voltage at which the relevant primary plant switch bay operates.

Secondary systems non-bay unit rate

At each substation, Powerlink has a non-bay secondary systems asset which includes control and monitoring assets not associated with a specific primary plant switch bay, 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.

We developed the secondary systems non-bay unit rate by considering the proportion of equipment required to effect the bundled works in line with the reference project to replace four complete secondary systems bays, with delivery assumed to coincide with the replacement of the four secondary systems bays.

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. We developed the unit rate for metering based on bundling works in line with a reference project to replace four complete secondary systems bays, which included Type 2 metring. The unit rate reflects the incremental costs above the secondary systems bay cost. The following cost items have been included or excluded, as indicated, in the secondary systems assets unit rates.

Table 4.2: Secondary systems assets unit rates inclusions and exclusions

Inclusions	Exclusions
Decommissioning and removal of existing equipment	Building modification or extension works
Supply, installation, testing and commissioning of equipment (including procurement on-cost)	Removal of asbestos
Protection and control associated with the equipment, including interface works	Communication systems between the remote ends
Cabling between the cubicle and field marshalling kiosk	Asset disposal written-down values
Inter-cubicle wiring	Spares
Cubicle earthing	Operating and maintenance costs
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)	
Contractor indirect costs	

4.3.3 Telecommunications

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.

The following cost items have been included or excluded, as indicated, in the telecommunications assets unit rates.

Table 4.3: Secondary systems assets unit rates inclusions and exclusions

Inclusions	Exclusions
Decommissioning and removal of existing equipment	Communications building modification or extension works
Supply, installation, testing and commissioning of equipment (including procurement on-cost)	Communication systems external to the substation
Inter-cubicle wiring	Cost escalations
Design cost (internal/external where applicable)	Asset disposal written-down values
Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs)	Spares
Contractor indirect costs	Operating and maintenance costs

4.3.4 Buildings and infrastructure

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). The works for each unit rate are assumed to be delivered in conjunction with the replacement of substation switch bays or secondary systems bays as appropriate.

The following cost items have been included or excluded, as indicated, in the building and infrastructure assets unit rates.

Table 4.4: Buildings and infrastructure assets unit rates inclusions and exclusions

Inclusions	Exclusions
Decommissioning, repair and/or removal of existing infrastructure	Asbestos removals
Supply, installation, testing and commissioning of infrastructure(including procurement on-cost)	Major earthworks
Design cost (internal/external where applicable)	Asset disposal written-down values
Internal labour costs (i.e. project management, associated construction facilitation/inspection costs and project development costs)	Spares
Contractor indirect costs	Operating and maintenance costs

4.3.5 Transmission lines

The unit rates derived for transmission lines allow for replacement or refit of the structures, hardware and conductors associated with existing Powerlink transmission lines. Unit rates are inclusive of site access, civil, structural and associated conductor works (where applicable).

We have developed the unit rates based on bundling works in line with a reference project to replace or refit 10km of contiguous transmission line section. There are several different unit rates for refit of transmission lines that allow for the various quantum of works typically undertaken to extend the life of a transmission line asset.

Powerlink does not anticipate replacing any conductors due to condition in the 2023-27 regulatory period. Minor works to conductors are possible due to cut-in of feeders at substations where the related switch bay is being replaced.

The following cost items have been included or excluded, as indicated, in the transmission lines assets unit rates.

Table 4.5: Transmission lines assets unit rates inclusions and exclusions

Inclusions	Exclusions
Decommissioning and removal of existing equipment (for replacement only)	Planning and building permit applications
Supply, installation and commissioning of equipment (including procurement on-cost)	Land acquisitions, easement acquisition and landowner compensation
Foundations and structures (where applicable)	Asset disposal written-down values
Earthing modifications	Spares
Site surveys, geotechnical investigations and reports (where applicable)	Operating and maintenance costs
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)	
Contractor indirect costs	

4.4 Verification of unit rates used in Repex Model

4.4.1 Internal benchmarking of unit rates

Our updated unit rates have increased by an average nominal rate of 2.5% per annum from the unit rates applied in our Revenue Proposal for the 2018-22 regulatory period.

We compared the unit rates in aggregate to the outturn costs of recent projects and contracted costs of current projects. We found that the unit rates are consistent with the costs of recent and current projects, and in many cases understate the total project cost due to the absence of locality and site specific factors.

We consider this approach appropriate given that these costs are inputs to a model rather than specific project estimates.

4.4.2 Independent benchmarking of unit rates

We engaged GHD to provide an independent expert opinion of an industry benchmark cost for each of the unit rates used in the Repex Model.

GHD generated building-block definitions for each asset category to identify all direct and indirect costs to be included, as well as other assumptions necessary to develop the benchmark unit costs. They then independently estimated the benchmark unit costs for the nominated capital works from their own data sources, including:

- market cost data available through recent operational and capital expenditure reviews for electricity transmission and distribution utilities – in Australia and New Zealand;
- contract and procurement costs available for recent projects completed by electricity utilities;
- material cost data that may be obtained from suppliers;
- recent asset valuations by GHD;

- cost data available in the public domain, including standard labour costs; and
- Category Analysis RIN data submitted by Australian electricity transmission and distribution utilities.

In addition to incorporating knowledge of market-tested comparable rates from its recent similar project engagements, GHD were also able to identify potential cost impacts from proposed large transmission projects in Australia, particularly in New South Wales and Victoria. Hence, they were able to weight their building-block rates to more recent pricing being offered in the market.

GHD provided costs in real 2020/21 dollars and state that the quality of the data provided by Powerlink, and the market data available to GHD, supports class 4 estimates (±30%) for all benchmark unit costs provided.

GHD's report is provided in Appendix 7.02, while the comparison of our unit rates to GHD's benchmark unit costs are included in Attachment A to this Appendix. Note that all unit rates provided to the AER are commercial in confidence.

We have compared our unit rates to those provided by GHD and have found our rates to be prudent and efficient, with our unit rates on average 10% less than the equivalent GHD rate. We therefore consider the unit rates that we have applied in the Repex Model are realistic and generate a reasonable estimate of forecast costs.

Some variances arise in specific unit rates, but these can largely be explained by the underlying assumptions adopted when developing the unit rates. An overview of these comparisons is provided below by asset group, while the detailed unit rate comparisons are included in Attachment A to this Appendix.

Substation switch bays

Our unit rates are 3% lower on average than the benchmark unit costs provided by GHD.

There are some significant differences in the unit rates to replace specific asset categories. These differences arise from an alternative approach to how costs of the full-bay replacement are assigned to each individual unit. When the individual unit rates are combined to form a full switch bay cost, the resulting costs from GHD are within the stated estimating accuracy range of our unit rates.

Substation secondary systems

On average, our unit rates are 6% higher than the benchmark unit costs provided by GHD. This is driven primarily by the difference in unit rate for metering installation. When this low value category is excluded, our unit rates are approximately 9% less than the benchmark costs.

Telecommunications

We have not used this unit rate in our capital expenditure forecast for the 2023-27 regulatory period due to the specificity of works proposed within the period. All telecommunication asset reinvestments are included in the bottom-up forecast, as we consider that this more appropriately allows for the variance in scale and types of investments.

Buildings and infrastructure

We have not used this unit rate in our capital expenditure forecast for the 2023-27 regulatory period due to our underlying assumption that reinvestment works will be within the existing buildings and/or substation footprint. This largely eliminates the need for new buildings and substation infrastructure from inclusion in our forecast of reinvestment capital expenditure.

Transmission lines

Our unit rates are 23% lower on average than the benchmark unit costs provided by GHD.

These differences arise in part due to the assumptions that underpin the cost estimates. The current refit works are focussed on towers designed and constructed in the 1970s to the prevailing standards at that time, or later using a value engineering approach. Although GHD have moderated their quantities that underpin their estimates, they have developed their refit unit costs based upon what they know of modern structural tower design. As a result, the GHD assumptions typically represent increased quantities of steel members and nuts and bolts than our assumptions.

The differences in design and construction over time has resulted in an average increase in the number and size of structural members, and hence nuts and bolts. Together with assumptions on actual replacement rates of members, nuts and bolts, contractors' establishment and running costs and Powerlink costs in delivering refit works, this contributes to some significant variations between GHD rates and our unit rates. Irrespective of this, taken as an average, we believe that the comparative review demonstrates out unit rates used in the Repex Model are efficient.

Attachment A: Powerlink Unit Rates and Comparison to Independent Benchmarks

Table A1 - Substation switch bays asset group unit rates

Asset category	Basis of unit rate derivation	Reference scope	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
< = 33kV; air insulated circuit breaker	1 x 3 phase dead tank SF6 insulated circuit breaker, incl. foundations	Installation as part of bundled scope to deliver four complete 33kV air insulated switchgear bays.	[redacted]	[redacted]	-13%
< = 33kV; air insulated isolator/earth switch	2 x isolator / 1 x earth switch, incl. foundations		[redacted]	[redacted]	-41%
< = 33kV; voltage transformer	3 x 1 phase free standing capacitor voltage transformers (CVT), incl. foundations.		[redacted]	[redacted]	-27%
< = 33kV; current transformer	3 x 1 phase free standing CTs, incl. foundations.		[redacted]	[redacted]	-15%
> 33kV & < = 66kV; air insulated circuit breaker	1 x 3 phase dead tank SF6 insulated circuit breaker, incl. foundations	Installation as part of bundled scope to deliver four complete 66kV air insulated switchgear bays.	[redacted]	[redacted]	10%
> 33kV & < = 66kV; air insulated isolator/earth switch	2 x isolator / 1 x earth switch, incl. foundations		[redacted]	[redacted]	-45%
> 33kV & < = 66kV; voltage transformer	3 x 1 phase free standing capacitor voltage transformers (CVT), incl. foundations.		[redacted]	[redacted]	-8%
> 33kV & < = 66kV; current transformer	3 x 1 phase free standing CTs, incl. foundations.		[redacted]	[redacted]	-13%
> 66kV & < = 132kV; air insulated circuit breaker	1 x 3 phase dead tank SF6 insulated circuit breaker, incl. foundations	Installation as part of bundled scope to deliver four complete 132kV air insulated switchgear bays.	[redacted]	[redacted]	97%
> 66kV & < = 132kV; air insulated isolator/earth switch	2 x isolator / 1 x earth switch, incl. foundations		[redacted]	[redacted]	-46%
> 66kV & < = 132kV; voltage transformer	3 x 1 phase free standing capacitor voltage transformers (CVT), incl. foundations.		[redacted]	[redacted]	-8%
> 66kV & < = 132kV; current transformer	3 x 1 phase free standing CTs, incl. foundations.		[redacted]	[redacted]	2%

Asset category	Basis of unit rate derivation	Reference scope	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
> 132kV & < = 275kV; air insulated circuit breaker	1 x 3 phase dead tank SF6 insulated circuit breaker, incl. foundations	Installation as part of bundled scope to deliver four complete 275kV air insulated switchgear bays within 1.5 circuit breaker diameter configuration.	[redacted]	[redacted]	101%
> 132kV & < = 275kV; air insulated isolator/earth switch	2 x isolator / 1 x earth switch, incl. foundations		[redacted]	[redacted]	-27%
> 132kV & < = 275kV; voltage transformer	3 x 1 phase free standing capacitor voltage transformers (CVT), incl. foundations.		[redacted]	[redacted]	-15%
> 132kV & < = 275kV; current transformer	3 x 1 phase free standing CTs, incl. foundations.		[redacted]	[redacted]	-29%
> 275kV & < = 330kV; air insulated circuit breaker	1 x 3 phase dead tank SF6 insulated circuit breaker, incl. foundations	Installation as part of bundled scope to deliver four complete 330kV air insulated switchgear bays within 1.5 circuit breaker diameter configuration.	[redacted]	[redacted]	98%
> 275kV & < = 330kV; air insulated isolator/earth switch	2 x isolator / 1 x earth switch, incl. foundations		[redacted]	[redacted]	-28%
> 275kV & < = 330kV; voltage transformer	3 x 1 phase free standing capacitor voltage transformers (CVT), incl. foundations.		[redacted]	[redacted]	-19%
> 275kV & < = 330kV; current transformer	3 x 1 phase free standing CTs, incl. foundations.		[redacted]	[redacted]	-22%

Source: GHD, Powerlink

Table A2 – Secondary systems asset group unit rates

Asset category	Basis of unit rate derivation	Reference scope	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
Secondary systems bay	All protection relays, control system, panel and wiring associated with a primary plant switch bay	Installation as part of bundled scope to deliver four complete secondary systems bays.	[redacted]	[redacted]	-14%
Secondary systems non-bay	Control and monitoring assets not associated with a specific bay (e.g. substation HMI, remote monitoring equipment)	Installation as part of bundled scope to deliver four complete secondary systems bays.	[redacted]	[redacted]	-4%
Metering	Duplicate Type 2 metering	Installation as part of bundled scope to deliver four complete secondary systems bays.	[redacted]	[redacted]	35%

Source: GHD, Powerlink

Table A3 – Telecommunication assets group unit rates

Asset category	Basis of unit rate derivation	Reference scope	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
Communication network assets	Includes a single multiplexer, communications rack, fibre driver or digital microwave radio replacement	Installation as part of bundled scope to deliver four complete secondary systems bays and associated telecoms for small substation site.	[redacted]	[redacted]	-57%

Source: GHD, Powerlink

Table A4 – Buildings and infrastructure asset group unit rates

Asset category	Basis of unit rate derivation	Reference scope	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
Substation buildings, excluding amenities	Replacement of a demountable control room building	Installation as part of bundled scope to deliver four complete secondary systems bays.	[redacted]	[redacted]	0%
Communication buildings	Replacement of a demountable communications building	Installation as part of bundled scope to deliver four complete secondary systems bays and associated telecoms for small substation site.	[redacted]	[redacted]	48%
Site infrastructure, substations	Replacement of substation site infrastructure, not included within other unit rates, e.g. earthworks, earth grid, perimeter fences, etc.	Installation as part of bundled scope to deliver four complete 132kV air insulated switchgear bays.	[redacted]	[redacted]	9%
Site infrastructure, communications	Replacement of telecommunications site infrastructure, not included within other unit rates.	Installation as part of bundled scope to deliver four complete secondary systems bays and associated telecoms for small substation site.	[redacted]	[redacted]	N/A

Source: GHD, Powerlink

Table A5 – Transmission lines asset group unit rates

Asset category	Reference scope and basis of unit rate derivation	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
> 66kV & < = 132kV; Single Circuit	Replacement Assumes whole section of line to be replaced for approx. 10km, and includes: • decommissioning and disposal of old towers • new tower costs: materials, construction, etc. with a typical span length of approx. 400m • conductors, OPGW and OHEW, insulators and hardware	[redacted]	[redacted]	-56%
> 132kV & < = 275kV; Single Circuit		[redacted]	[redacted]	-44%
> 275kV & < = 330kV; Single Circuit		[redacted]	[redacted]	-18%
> 66kV & < = 132kV; Multiple Circuit		[redacted]	[redacted]	-48%
> 132kV & < = 275kV; Multiple Circuit		[redacted]	[redacted]	-36%
> 275kV & < = 330kV; Multiple Circuit		[redacted]	[redacted]	-5%
> 66kV & < = 132kV; Single Circuit	Refit & paint (no insulators) For each structure on a contiguous section of approx. 10km includes: • 1% of members • 5% of bolts replaced • surface preparation and painting • insulators retained • OHEW & OPGW retained	[redacted]	[redacted]	-36%
> 132kV & < = 275kV; Single Circuit		[redacted]	[redacted]	-26%
> 275kV & < = 330kV; Single Circuit		[redacted]	[redacted]	-4%
> 66kV & < = 132kV; Multiple Circuit		[redacted]	[redacted]	-39%
> 132kV & < = 275kV; Multiple Circuit		[redacted]	[redacted]	-32%
> 275kV & < = 330kV; Multiple Circuit		[redacted]	[redacted]	-3%
> 66kV & < = 132kV; Single Circuit	Refit & paint For each structure on a contiguous section of approx. 10km includes: • 1% of members • 5% of bolts replaced • surface preparation and painting • insulators replaced • OHEW & OPGW retained	[redacted]	[redacted]	-21%
> 132kV & < = 275kV; Single Circuit		[redacted]	[redacted]	-10%
> 275kV & < = 330kV; Single Circuit		[redacted]	[redacted]	12%
> 66kV & < = 132kV; Multiple Circuit		[redacted]	[redacted]	-31%
> 132kV & < = 275kV; Multiple Circuit		[redacted]	[redacted]	-23%
> 275kV & < = 330kV; Multiple Circuit		[redacted]	[redacted]	0%

Asset category	Reference scope and basis of unit rate derivation	2020 Benchmark unit cost (GHD)	2020 Unit rate (PQ)	Variance to GHD Benchmark
> 66kV & < = 132kV; Single Circuit	Refit For each structure on a contiguous section of approx. 10km includes: • 5% of members replaced • 20% of bolts replaced • insulators replaced • OHEW & OPGW retained	[redacted]	[redacted]	N/A
> 132kV & < = 275kV; Single Circuit		[redacted]	[redacted]	N/A
> 275kV & < = 330kV; Single Circuit		[redacted]	[redacted]	N/A
> 66kV & < = 132kV; Multiple Circuit		[redacted]	[redacted]	N/A
> 132kV & < = 275kV; Multiple Circuit		[redacted]	[redacted]	N/A
> 275kV & < = 330kV; Multiple Circuit		[redacted]	[redacted]	N/A

Source: GHD, Powerlink