Parsons Brinckerhoff Associates

TRANSPOWER GRID UPGRADE PLAN APPLICATIONS:

INFORMATION REQUIRED TO ASSESS CAPITAL EXPENDITURE REQUIREMENTS

A report prepared for

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SECTIONS

1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE

As part of its responsibilities in applying the Grid Investment Test (GIT)[1] to transmission system augmentation or upgrade proposals, the Electricity Commission (Commission) has to review the capital expenditure forecasts for these proposals. To date these reviews have proved somewhat problematic, since no agreed guidelines exist for the format and level of detail of the technical and cost estimation information that has to be submitted as part of Grid Upgrade Plan (GUP) applications.

As a result, the level of detail provided in various GUP applications has varied considerably. In some cases this also extended to the level of details provided for the main and alternative project options[2]. It has therefore been necessary to make substantial assumptions when reviewing the cost estimates, sometimes resulting in significant differences between Transpower's estimates and those prepared by the Commission's consultants. In many cases these differences arose more as a result of different interpretations and assumptions with regard to the proposed construction projects, rather than an underlying disagreement about actual construction costs.

To address this problem, the Commission has requested PB Associates to prepare high-level guidelines for the capital cost estimate information required from Transpower to accompany GUP applications. The guidelines are intended to assist Transpower by indicating the level and extent of information required by the Commission to allow it to meet its capital cost review obligations in terms of the GIT. This in turn will provide the Commission's reviewers with a more effective understanding of the assumptions and allowances made by Transpower in preparing the cost estimates, thus avoiding unnecessary and unproductive interpretational differences. Overall this should contribute to more streamlined reviews and a quicker project approval process.

This report presents the guidelines for the capital cost information to be submitted with GUP applications.

1.2 GENERAL NOTES

In applying these guidelines a number of factors should be noted.

- The guidelines are intended to assist with the efficient provision of cost estimate information and the review of this information. In preparing the guidelines, PB Associates was guided in part by discussions held with Transpower representatives on 1 June 2007 at the Commission's offices.
- The overall intention of the guidelines is to achieve a high degree of shared understanding between Transpower and the Commission on the basis of the cost estimates submitted with GUP applications. This includes the scope of work included in an application, the proposed work program, the unit rates used for equipment, the alternatives considered and the assumptions made in preparing the cost estimates.

[1] As described in Part F, Section III of the Electricity Governance Rules (2003)

[2] It is a requirement of the GIT that various feasible project alternatives are considered.

- To achieve the required level of understanding, information is required not only on the actual cost estimates, but also on the technical details of the proposed projects on which the estimates are based.
- It is not the intention of the guidelines to add substantially to the information that Transpower has to prepare for the GUP applications. Most of the information discussed below has already been provided by Transpower in some form or other for earlier GUP applications, even if this did not form part of the original applications. It is also understood that Transpower is already developing the bulk of this information in order to prepare the cost estimates for the GUP applications.
- It is also not the intention of these guidelines to be too prescriptive on the format that the cost estimates and supporting information submitted with GUP applications should take - this would be counter-productive and would interfere unnecessarily with Transpower's planning and estimation processes. Our basic presumption is that Transpower, the Commission and its reviewers fully understand the engineering principles underpinning transmission augmentation projects and the cost estimation principles applied and would not require very detailed (and limiting) prescriptions on how to effectively share information to allow effective cost reviews.
- At the time of preparing GUP applications, it is unlikely that detailed project designs or surveys would be available. The Transpower cost estimates are therefore based on significant assumptions and simplifications. This is understood and accepted as long as the assumptions and their impact on the accuracy of the estimates are adequately described.
- Much of the information requested in terms of the guidelines is likely to already be included in the main GUP application. It is not the intention to duplicate information – where additional information is requested, this can be added to the main application as further appendices, or can be separately provided with the application.
- Some of the information requested to support the cost estimates may be confidential or commercially sensitive. This information can be provided in confidence and will be treated as such. The Commission has procedures in place to protect confidential information, with the obligation for this also extending to their review consultants.
- The cost of easements or obtaining environmental consents is not addressed in these guidelines. The Commission is investigating these as a separate activity.

2. TECHNICAL INFORMATION SUPPORTING COST ESTIMATES

2.1 GENERAL TECHNICAL INFORMATION

The following general information is required for all GUP applications, for the preferred option as well as for the alternatives considered.

2.1 a) A technical description that describes the overall intended project, the sub-projects on which it will be based, the stages into which the project will be broken and the location of the intended project components.

Comment : This information already forms part of GUP applications.

2.1 b) A description of the proposed construction program, that highlights the:

- proposed commissioning dates for key components or project phases; and
- anticipated construction program for these project phases (percentage of main activities completed each year prior to commissioning).

Comment : This information is required to calculate the net present value of projects, as well as interest during construction. Transpower already provided this information for some of its applications, for example as illustrated in table 2.1 below.

Table 2.1 : Example of construction program information

		Applying Proportions to Stream Costs						
			T-4	T-3	T-2	T-1	T0	T+1
Streaming of Costs Proportions	1	2	3	4	5	6	7
Transmission Line -new	A	0.04	0.08	0.33	0.32	0.18	0.05
Transmission Line -thermal upgrade	B	0.00	0.00	0.10	0.50	0.35	0.05
Transmission Line -duplexing	C	0.04	0.05	0.30	0.33	0.22	0.05
Cable 400 kV/ 220 kV /HVDC	D	0.00	0.00	0.15	0.35	0.45	0.05
Substation	E	0.00	0.00	0.05	0.20	0.70	0.05
Capacitor bank - shunt or series	F	0.00	0.00	0.00	0.20	0.75	0.05
Transformer PST or Interconnector	G	0.00	0.00	0.00	0.20	0.75	0.05
SVC	H	0.00	0.00	0.00	0.20	0.75	0.05
Syn Condenser	I	0.00	0.00	0.00	0.20	0.75	0.05
Easements	J	0.40	0.40	0.20	0.00	0.00	0.00
Consents	K	0.50	0.30	0.20	0.00	0.00	0.00
Dismantling costs	L	0.00	0.00	0.00	0.30	0.70	0.00
Investigation. Design, Project Management	M	0.20	0.20	0.20	0.20	0.20	0.00

2.1 c) Installations or components not existing at the time of the application, but deemed to be present at the time of commissioning of new installations (or project components) should be identified.

Comment : For some applications, there may be equipment already planned (approved or under serious consideration) that will be in place by the time a current application is implemented. This planned equipment may have a significant impact on future installations and thus the capital expenditure estimates, and any assumptions made in this regard therefore have to be clearly identified. Any such equipment also has to be clearly identified in future project information, such as single line diagrams, layout drawings and route drawings.

2.1 d) Information is to be provided in generally accessible electronic format, such as MS Word, MS Excel, PDF, AutoCAD or PLS CAD. Where this is not practical, such as for historical drawings too large to easily scan, hard copies of information can be provided.

2.2 INFORMATION REQUIRED FOR SUBSTATION PROJECTS

For substation projects, or where substations make up components of a larger project application, the following technical information is required. Substation projects are deemed to include projects covering related installations, such as switching stations and installations for phase-shifting transformers or VAR compensation.

2.2 a) For new substations, a single line diagram is required for the proposed project, indicating:
- the final intended configuration of the substation; and
- if construction will occur in stages, the staged single line diagram of the substation after completion of each major interim milestone.

2.2 b) For existing substations to be modified or expanded, a single line diagram is required for the proposed project, indicating:
- the current configuration of the substation;
- the final intended configuration of the substation; and
- if construction will occur in stages, the staged single line diagram of the substation after completion of each major interim milestone.

2.2 c) Single line diagrams are to include all major substation components (with ratings and voltage levels where applicable) and all circuits must be clearly identified. The type of circuit breaker configuration intended is to be clearly identified.

Comment : We understand that Transpower already prepares staged single line diagrams for its own internal cost estimation purposes.

2.2 d) For new substations, a lay-out drawing is required that indicates:
- the intended geographical location of the substation;
- the intended layout of the substation; and
- if construction will occur in stages and the position of key equipment is expected to change over time, the interim substation layout after each major milestone.

2.2 e) For existing substations to be modified or expanded, a lay-out drawing is required that indicates:
- the current layout of the substation;
- the final intended layout of the substation (this can be part of the current layout drawing, provided that new equipment and structures are clearly identified); and
- if construction will occur in stages and the position of key equipment is expected to change over time, the interim substation layout after each major milestone.

2.2 f) Layout drawings should:
- indicate the typical major civil or site works required (including site levelling, access routes, drainage works, etc.);
- indicate the position of key equipment (with identification);
- indicate the proposed cable routes within the substation and the proposed method of installation (e.g. ducted or direct buried);
- indicate the location of external connection points such as line or cable terminals and details of the proposed connection to these points;
- identify major circuits;
- be drawn to scale (for A3 prints, or as indicated by Transpower); and
- be provided in PDF or AutoCAD format, preferably to an A3 format (but if this is insufficient to provide sufficient clarity, on a larger format).

Comment : We understand that Transpower already prepares lay-out drawings for its own cost estimation purposes – these would be acceptable. Since the estimates are prepared before detailed surveys or designs are executed, it is understood that these drawings will be for preliminary layouts only and would not include substantial levels of technical detail, site or geological information.

2.3 INFORMATION FOR CABLE NETWORKS

For cable projects, or where these make up components of a larger project application, the following technical information is required.

2.3 a) Preliminary route drawings, to scale, are required:
- in PDF or AutoCAD format;
- scaled to an A3 size, or as deemed appropriate by Transpower; and
- indicating the position of cable termination points.

Comment : Sufficient information should be made available to allow proposed routes to be assessed and route-lengths to be estimated to a reasonable degree of accuracy. We understand that surveys are unlikely to have been conducted at the estimation stage and that route decisions are therefore generally only based on desk-top identification of suitable corridors from available maps.

It is also noted that this information may in some cases be considered environmentally or socially sensitive and that exact cable routes or termination

stations may therefore not be specified well in advance of more detailed surveys having been done. In such instances drawings can be provided in confidence, or sufficient information must be made available to allow the Commission to understand Transpower's cost estimate assumptions for the cable installations.

2.3 b) Preliminary circuit details are required, highlighting the intended:
- voltage levels;
- cable type, size and conductor material;
- circuit design capacity;
- circuit configuration (e.g. flat formation, trefoil, etc.);
- cross-bonding arrangements; and
- measures planned to limit induced voltages.

Comment : It is appreciated that at the cost estimation stage, designs would be of a preliminary nature only.

It is also understood that Transpower may in some instances specify non-standard, or more expensive cable to achieve certain specific requirements, rather than accept the lowest cost cable to achieve circuit ratings. This should be highlighted.

2.3 c) The assumed cable installation details should be highlighted, including the:
- typical trench size;
- allowance made for ground conditions, especially hard rock;
- installation position (e.g. proportion of the route in the carriageway, in footpaths, un-finished surface, etc.);
- number of joints (or average cable drum length);
- number of circuits per trench; and
- backfill and protective material to be used.

Comment : Since no detailed route or geotechnical survey would have been conducted at the estimation stage, it is accepted that the allowance for surface finishes and soil conditions will be preliminary only, based on the best available information at the time.

2.3 d) Details of other factors influencing the cost of cable installations are required, including:
- special cooling installations;
- allowance for special road, river or bridge crossings;
- temperature sensing fibre-optic cable installations and associated monitoring equipment; and
- additional cable ducts.

Comment : In general it is noted that Transpower has provided cable cost estimates to a high degree of detail with its GUP applications and that these meet all the requirements stated above, including the circuit information and construction assumptions. In some instances the details of the proposed cable routes were however not sufficiently clear.

2.4 INFORMATION FOR OVERHEAD LINE PROJECTS

For transmission line projects, or where these make up components of a larger project application, the following technical information is required.

2.4 a) Preliminary costing corridors, to scale, in PLS CAD format and with circuit identification. Total circuit lengths are also to be indicated, as well as the location and routes of line diversions or T-offs, terminal and connection points.

Comment : Transpower has provided this information for previous applications.

2.4 b) Proposed circuit and construction details are to be provided, including:

- typical tower structures proposed (PLS CAD format);
- typical foundation details;
- intended conductor type and configuration;
- average span length assumed;
- estimated number of strain and tension towers;
- earth wire arrangements ;
- assumptions made with regard to the crossing of major obstacles; and
- key design factors assumed, including
  - intended circuit capacity
  - maximum magnetic and electric field density allowed at ground level
  - maximum noise levels assumed (at easement edge).

Comment : Transpower has provided most of this information for previous applications.

2.5 NON-STANDARD PROJECT COMPONENTS

The above categories should cover the bulk of the components included in transmission augmentation projects. However, in special cases there may be project components that do not comfortably fit into the project categories described above. For these instances the following should apply.

2.5 a) Non-standard project components should be described in sufficient detail to allow an effective assessment of the cost estimates for these. This should include:

- a description of the component;
- the intended location of the equipment;
- the rating and specification of the component (e.g. size, voltage levels, capacity, etc.);
- where appropriate, a description of the technology on which the component is based (e.g. for an ac/dc rectifier station, the type of switches and pole configuration should be identified);
- a description of how the component will be connected to the transmission grid; and
- a description of any associated construction works required for the non-standard component, including site and building works, access routes, etc..

Comment : Sufficient information should be provided to allow the cost estimates for non-standard construction components to be effectively reviewed without having to second-guess Transpower's intentions or to force the Commission to prepare its own preliminary designs for cost estimation purposes.

3. COST ESTIMATES

3.1 GENERAL COSTING INFORMATION

The following general guidelines for capital cost estimates should apply to all GUP applications, (as appropriate) for the preferred option as well as for the alternatives considered.

3.1 a) Cost estimates should be broken down per major construction component and should be supported with the following information:

- exchange rate assumptions;
- contingencies allowed;
- allowance made for surveying, planning and design;
- allowance made for Transpower's testing & commissioning (as distinct from the suppliers' or contractors' testing & commission costs); and
- allowance for Transpower's own project management and supervision costs (as distinct from the suppliers' or contractors' project management and supervision costs).

3.1 b) All cost estimates should include:

- cost of all material, equipment and associated consumables, delivered and downloaded on site;
- full construction costs;
- contractors' testing and commissioning costs;
- contractors' project management costs; and
- costs for site access, rehabilitation and compensation.

3.1 c) Estimates should be based on the current estimated cost (at a fixed date prior to the GUP application) of the project components.

3.1 d) An overall cash-flow program for the GUP application is to be provided indicating the expected capital expenditure for each year of the application period for the project considered. The cash-flow for each major project component should be indicated for the year in which that component will be commissioned, in real terms (as at the date of the project application).

3.1 e) Items not included in the estimates, provisions not made or possible contingencies and risks excluded from the estimates, should be clearly identified.

3.1 f) The allowance made for interest during construction should be separately indicated for each major project component (in real terms).

3.1 g) The basic cost estimate (based on a building block model using periodically updated supplier data) and cash-flow information should be provided in MS Excel format, with the underlying formulas activated. Other information is to b provided in generally accessible electronic formats such as MS Word, PDF, MS Excel or MS Project.

Comment : This information already forms part of the GUP applications, but may not always have been separately indicated.

To facilitate the expenditure reviews, it is important to provide cost estimate spreadsheets with the underlying formulas activated – this allows better understanding, easier tracking and more effective verification of information.

3.2 COST ESTIMATE INFORMATION FOR SUBSTATION PROJECTS

For substation projects, or where substations make up a component of a larger project application, the cost estimates should take into account the following guidelines. Substation projects are deemed to include projects covering related installations, such as switching stations and installations for phase-shifting transformers or VAR compensation.

3.2 a) All major equipment or components included in the cost estimates should be identified. These identifications should correspond to that provided in the technical project descriptions.

3.2 b) Transpower is currently using a schedule of standard substation component cost information. The continued use and further expansion of this schedule is encouraged.

- Where components from the standard schedule are used, these should be identified as being drawn from the schedule.
- The schedule should be updated for each new application with new cost information (when appropriate) or by including new standard components. The version of the schedule used in a GUP application should be identified.

3.2 c) For the cost estimation of substation installations:

- in general all major components identified as part of the technical project information provided are to be separately priced ;
- where equipment can be logically grouped together into stand-alone units (e.g. a typical bay configuration), this can be priced per group; and
- the costs for land, site preparation and building works are to be separately estimated.

3.2 d) The estimates for all major components are to be provided in real terms (as at a fixed date prior to the GUP application).

Comment : Transpower has on occasion provided fairly detailed spreadsheets to the Commission with breakdowns of their cost estimates on a per component and per commissioning year basis, indicating the unit numbers and unit costs assumed. (An example of such a spreadsheet provided by Transpower is “NIGUP_Option 3_Duplex_CostReport(v3)1.xls”.) These spreadsheets contained the required information noted above.

3.3 COST ESTIMATE INFORMATION FOR UNDERGROUND CABLE PROJECTS

For underground cable projects, or where these make up components of a larger project application, the cost estimation information set out below is required.

3.3 a) All equipment included in the cost estimates should be identified. These identifications should correspond to that provided in the technical project descriptions.

3.3 b) The cost estimates for the cable installations are to be made in accordance with the technical project details provided and the assumptions stated.

3.3 c) The unit rates and number of units assumed for all the key components identified as part of the technical description should be separately indicated.

3.3 d) Estimates are to be provided in real terms (as at a fixed date prior to the GUP application).

Comment : As noted before, Transpower has provided this level of detail for previous GUP applications.

3.4 COST ESTIMATE INFORMATION FOR TRANSMISSION LINE PROJECTS

For transmission line projects, or where these make up components of a larger project application, the cost estimation information set out below is required.

3.4 a) All equipment included in the cost estimates should be identified. These identifications should correspond to that provided in the technical project descriptions.

3.4 b) The cost estimates for the transmission line installations are to be made in accordance with the technical project details provided and the assumptions stated.

3.4 c) The unit rates and number of units assumed for all the key components identified as part of the technical description should be separately indicated. This should include the assumption made for steel costs.

3.4 d) Estimates are to be provided in real terms (as at a fixed date prior to the GUP application).

3.5 COST ESTIMATE INFORMATION FOR NON-STANDARD PROJECT COMPONENTS

Where components are planned that do not logically fit into the project categories described above, the cost estimation information set out below is required.

3.5 a) All non-standard equipment included in the cost estimates should be identified. These identifications should correspond to that provided in the technical project descriptions.

3.5 b) The cost estimates for the non-standard installations are to be made in accordance with the technical project details provided and the assumptions stated.

3.5 c) The unit rates and number of units assumed for all the key components identified as part of the technical description should be separately indicated.

3.5 d) Estimates are to be provided in real terms (as at a fixed date prior to the GUP application).

3.5 e) Information on where cost estimates were obtained and the basis of the estimates are to be provided. This may include details of tenders or quotations received.

Comment : By their nature, non-standard components are likely to be tailored for specific situations. This makes the preparation of review estimates more problematic than for standard components. To assist the Commission in this regard, the basis on which Transpower has prepared its cost estimates for non-standard estimates should therefore be communicated in some detail, which could include tenders or quotations from suppliers/contractors. Since this information may be commercially sensitive, it can be disclosed in confidence.