TransCo (Philippines) Asset Valuation and the Optimisation Process

DISCUSSION PAPER

- Draft
- 18 July 2005

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1. Overview of Asset Valuation and Optimisation Philosophy

Sinclair Knight Merz (SKM), in conjunction with Cuervo Appraisers Inc (Phil) and PricewaterhouseCoopers Inc (Phil), has been engaged by TransCo (Phil) to conduct an Optimised Depreciated Replacement Cost valuation (ODRC) of all of its network assets , in accordance with the Transmission Wheeling Rate Guidelines (TWRG).

This will be the first valuation that TransCo will have undertaken since the transmission function was separated from the National Power Corporation (NPC). The results of the valuation will be used by the Energy Regulatory Commission (ERC) to determine TransCo's annual revenue requirement, maximum allowable revenue and the effective transmission power delivery charge, and other regulated charges for future years.

Optimised Depreciation Replacement Cost (ODRC) of assets is the cornerstone methodology for the determination of the Optimised Deprival Valuation (ODV) of System Fixed Assets of Electricity Transmission and Distribution Businesses operating in a regulatory environment. The ODRC methodology is widely used in other countries and regulatory jurisdictions, including the UK, Australia, New Zealand, Singapore, Canada, etc.

Optimised Deprival Valuations (ODV) is defined as the lesser of Optimised Depreciated Replacement Cost (ODRC), and Economic Value (EV).

Economic Value (EV) may be used to value portions of a network where it is not possible to make a normally accepted rate of return on the assets under ODRC methodology. The underlying philosophy of the ODV methodology is to "value the assets at the level at which they can be commercially sustained in the long term, and no more. The resulting value should be equal to the loss to the owner if they were deprived of the assets and they took action to minimise their loss "

Another way of describing the ODV methodology is:

"ODV measures the minimum cost of replacing or restoring the service potential embodied in the network with modern equivalent assets in the most efficient way possible from an engineering perspective, given the service requirements, the age and condition of the existing assets, and replacement in the normal course of business."

2. Policy Guidelines for Valuation of Network Assets

2.1 TransCo Terms of Reference

The TransCo Terms of Reference require the valuation consultant:

"To undertake the Initial Revaluation using an optimised replacement cost approach using the principles of indexation, absolute valuation by replacement cost analysis, or absolute valuation using modern equivalent asset analysis provided under the Transmission Wheeling Rates Guidelines (TWRG) in addition to the criteria that the ERC may set with respect to their regulatory requirements."

"To state the fair market value of the entire transmission network, including the land buildings and all assets in other categories, needed to establish the identify of TransCo and allow its operation as a separate entity."

"The final product of the undertaking will be the recommendation of the replacement cost[1] of all fixed assets used in the operation which have been optimised from an engineering perspective and depreciated according to the assets' respective age."

2.2 Transmission Wheeling Rate Guidelines

The TransCo Terms of Reference make reference in several places to the "Guidelines on the Methodology for Setting Transmission Wheeling Rates for 2003 to around 2027" – ERC Case No 2003-34, dated 29 May 2003 (TWRG). The Transmission Wheeling Rate Guidelines (TWRG) make specific reference to the optimisation process as follows:

Clause 4.6.6. "In undertaking the optimisation of the revaluation of the assets based on replacement cost, at least the following optimisation principles must be employed:

(a) assets which are assessed to have an unreasonable degree of over capacity or excess redundancy (ie. assets which are unreasonably over-designed or have unreasonably excessive installed capacity) will have their split between the value of that capacity or redundancy which is reasonably necessary to meet Customer requirements for Regulated Transmission Services within the electricity transmission network planning horizon (see paragraph (b)) and the value of that capacity or redundancy which is in excess of this requirement – for these purposes, what is

[1] Replacement cost shall also refer to replacement cost new (RCN) and replacement cost based on modern equivalent assets (RC-MEA)

reasonable must be assessed having regard to the need to ensure reliability in the provision of Regulated Transmission Services into the future, and investment that is reasonably undertaken to meet the target levels of performance determined by the ERC pursuant to Article VIII will be deemed to be reasonable;

(b) the electricity transmission network planning horizon will be taken to be 15 years or as otherwise determined by the ERC based on reasonable planning policies in the context of an electricity transmission network in the Philippines; and

(c) the analysis of over capacity or excess redundancy will be based on there being no changes to the location of supply and demand (ie. take-off points for generators and loads), transmission line or cable routes, easements or substation locations, but existing network elements can be re-rated or re-designed in a notional sense to assess their optimised value. If, during the course of conducting optimisation studies, load flow programs fail to produce meaningful results (non-convergence), then additional feeders or network re-configuration may be added to reflect future planned capital works that exists in the 10 year works program.

Other optimisation principles may be used as approved by the ERC following advice from an independent expert or experts referred to in Section 4.6.2. Such principles must include the manner in which windfall gains and losses arising from the Initial Re-valuation are to be treated."

3. Optimisation Process

3.1 Scope of Optimisation Process

Optimisation is a national exercise. The objective is to determine the value of those assets on which the business could earn a normal rate of return commensurate with the risk that the business faces.

The objective of optimisation is to:

- Eliminate redundant assets.
- Eliminate overdesign of assets.
- Eliminate overcapacity in the network.

Optimisation principles provided can be summarised as follows:

- An "incremental Optimisation" approach is to be followed – ie. it is not intended that a full system redesign of the network be undertaken.
- Optimisation cannot improve the system or increase asset values.
- Individual network elements cannot be considered in isolation from each other.
- Utilities are expected to perform their own optimisation studies (the valuer reviews the studies).
- Optimisation should be based on the reasonably expected level of use of the asset.
- Optimisation should take account of future demand forecast in the planning period, together with strategic development plans for the area. The planning period is to be defined for each voltage level in the system. The planning period is considered to start at the beginning of the next regulatory period.
- Optimisation should take account of whole of life costs.
- Optimisation should take account of required quality, reliability, planning criteria and security of supply.
- Assets installed for specific customers under terms of a supply agreement would generally not be optimised.

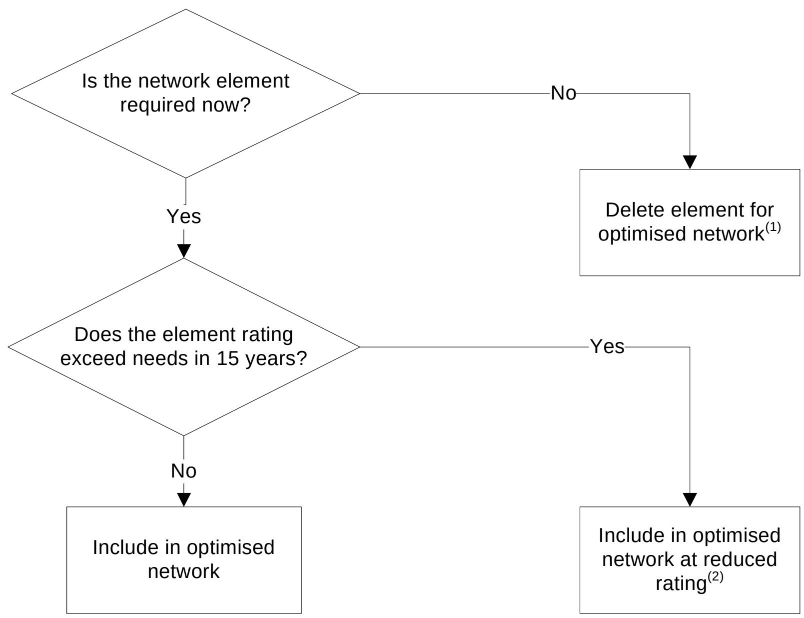
The optimisation process assumes:

- Location of generation and bulk supply substations are fixed.
- Location of customers is fixed.
- Network boundaries with other DNSPs and TNSP are fixed.
- Existing lines and cable routes remain unchanged.

- Optimised network to have similar import/export capacity to the real network.
- Optimised system shall be stable within acceptable voltage limits and fault levels.

Figure 1 shows the decision paths for the optimisation process. It equally applies whether one "starts from scratch" or considers assets that were optimised out in previous valuations.

- **Figure 1 Decision Paths for Optimisation Process (also applies to elements of the network previously optimised out)**



Note (1) : Deletion of an element may involve reinforcing or amending other parts of the network. The reduction in value of the optimised network should be net of any additional works required for other parts of the network.

(2) : Where the rating of the asset is inadequate the optimisation methodology does not provide for uprating in the optimised network.

3.2 Basic Steps

The basic steps in the optimisation process are:

a) Review the network planning criteria to determine if they are in accordance with "good electricity industry practice". Any optimisation carried out on the network configuration or assets must meet current good practice planning criteria.

b) Review the design criteria for network assets to determine if they are in accordance with good practice for the location and application of those assets. If the design criteria result in the assets being over-designed compared to good practice they would be optimised down.

c) Review operating criteria, practices and performance as required to ensure that operating constraints are considered as part of the optimisation process.

d) Review the forecast load, generation and interconnector flows for the nominated planning horizon. The period must also take into consideration that most transmission assets can only be installed in relatively large blocks.

e) Review asset ratings.

f) Carry out steady state network studies to ensure that the optimised network and its configuration meets required levels of service and quality standards, and the requirements of the Philippine Grid Code.

3.3 Greenfield vs Brownfield Approach to Optimisation

"Brownfield" optimisation follows an incremental approach and not a "Greenfields" approach. With incremental optimisation the existing network is reviewed and configurations, ratings and designs assessed to identify excess redundancy, over-capacity and over-design. It is based on there being no changes to points of supply (generating stations), location of loads, transmission line or cable routes, easements or substation sites. However, existing substations or lines can be amended in layout, or rating, or design, or deleted as appropriate. With greenfields optimisation the entire network would be completely redesigned and all lines and substations re-engineered and potentially relocated.

Incremental optimisation places a limiting constraint on the extent of optimisation. It recognises that there will always be some degree of sub-optimality and reflects to some extent the historical development of the network. It takes a position between a pure economic (greenfield) approach that would lead to significant optimisation and an historical approach (and acceptance of staged construction of assets where economically justified) that would result in virtually no optimisation.

An incremental optimisation methodology has in general been followed for previous electricity asset valuations, thus establishing precedence for this methodology. Incremental optimisation is considered pragmatic, and has been adopted for this optimisation assessment.

4. Planning Criteria Issues

4.1 Network Security and Planning Criteria

4.1.1 Current Practice for Optimisation

The transmission network provides bulk supply of energy between major generation and load centres. While transmission networks are normally very reliable the consequences of any outages may be very severe both in terms of the amount of load that is lost and the duration of the interruption.

Consequently the transmission network must be designed with some redundancy. Generally this requires that there is sufficient capability built in to the network to allow for the unexpected outage of any plant item under extreme conditions, without resulting in immediate overloads on other elements. The consequences of such overloads could be very severe since they may ultimately lead to cascade tripping of transmission elements and loss of system integrity.

Generally speaking, transmission networks are planned so that there is no loss of supply and normal service levels and quality of supply are maintained for any single contingency event (n-1 security). A single contingency event is the unplanned disconnection of an element of the network from the network. Following a single contingency, load shedding is not required to bring flows within plant ratings, but some rescheduling of generation, interconnection flows or system configuration may be necessary within a short period of time, during which short term plant ratings may be relied upon. Some load shedding may however be required to secure the power system from a subsequent (second) contingency event.

Current optimisation practice is to use deterministic network security criteria for establishing the configuration of the optimised network and cyclic or overload ratings for the assessment of asset utilisation.

For large or critical loads or parts of the network where load flows are high, higher levels of redundancy may be appropriate (n-1 secure or possibly n-2). For smaller loads located some distance from the main transmission network it may not be economic to provide n-1 security.

4.1.2 Approaches in Other Jurisdictions

While deterministic (n-1, n-1 secure, n-2) planning criteria are commonly used for the planning and operation of most transmission systems, some utilities apply a probabilistic approach. A probabilistic planning approach is now applied in the assessment of augmentations for the Victorian (Aust) transmission network, with transmission investment decisions based on a probabilistic analysis of energy at risk. That analysis includes consideration of the probability weighted impacts on supply reliability of unlikely, high cost events such as single and multiple outages of generation or rotating reactive compensation plant, and unexpectedly high levels of demand.

This approach takes into account the fact that the level of supply reliability is uncertain because it is subject to variations in load (due to forecasting inaccuracies and weather impacts), and performance and availability of generating plant. A pool simulation model is used to determine the hourly generation dispatch for a large number of scenarios to capture the range of variation. Critical transmission line loadings are then determined on an hour by hour basis and compared with the ten minute network capability. This allows the risks associated with the transmission system to be identified.

4.1.3 Conclusions

The deterministic approach for network planning is simpler, facilitates independent assessment of the network, and is current practice for optimisation.

Thus, it is concluded that for the purposes of optimisation the deterministic approach is satisfactory. In general, the n-1 security criteria should be applied. For very large loads, critical loads or segments of the transmission network where load flows are high, the security of the network post the first contingency event should be taken into account. In some cases, particularly if the proposed optimisation is material, it may be necessary to carry out a more detailed assessment of the optimisation. We would expect that, in general, this would be a subjective assessment, based on discussions with network planners and a review of the appropriate network planning studies.

4.2 Planning Horizons

4.2.1 Network Configuration

Optimisation of the network configuration ensures that the network does not have excessive redundancy and that the network configuration is the most efficient given present and projected load, generation and interconnection flow patterns.

System planning must consider the time lag in the planning, design and construction of assets. However for optimisation, this is irrelevant. Plant should only be considered part of the regulatory asset base (and thus a candidate for optimisation out or down) once it has been introduced into service. Correspondingly, asset values should include an allowance for interest during construction.

4.2.2 Asset Utilisation

Transmission assets can only be installed in relatively large blocks. Their ratings therefore generally provide for load growth over the medium to long term, say 10-15 years. This must be recognised in the assessment of asset utilisation by using load data that reflects long term forecasts.

The TWRG specifies (clause 4.6.6(b)) that for optimisation purposes, "the electricity transmission network planning horizon will be taken to be 15 years or as otherwise determined by the ERC …".

This is considered by SKM to be a reasonable period, and is consistent with asset valuations that we have conducted elsewhere.

4.3 Reinstatement of Assets Optimised out in Previous Valuations

Previous optimisations could have resulted in an asset either being deleted from the optimised network or having its rating/capacity reduced in the optimised network.

In deciding whether assets optimised out previously should now be included in the optimised network or its rating/capacity restored, the decision path set out in Section 3.1 is appropriate. It is noted that the decision process is the same regardless of whether optimisation is considered to be "undertaken from scratch" or whether assets previously optimised out or down should now be included or "optimised back or up".

The replacement value of the reinstated asset will be calculated at the current Modern Equivalent Asset (MEA) rate. The current MEA rate should be based on the original MEA rate adjusted for inflation on the same basis used to roll forward the value of the asset base.

The written down value should be calculated by the normal method. No allowance in the remaining life should be made for the period the asset was 'optimised out' of the network.

5. Optimisation Principles

5.1 General Principles

The underlying principle for developing the optimised network is:

> How would the network be configured today by a Transmission Network Service Provider (TNSP) following modern 'good practice' network design or what would a competitor do if the competitor replicated the service provided?

This principle requires that future loads be taken into account when assessing utilisation of assets. It also means that where two single circuit transmission lines connect two nodes on the network a double circuit transmission line in the optimised network should generally replace them. This would not necessarily apply for supply to major or critical loads or for primary parts of the network where there are large load transfers between generators and major load centres.

Optimisation of a transmission network will be carried out in accordance with the following principles.

a) The optimised network will be based on the location of existing generators, loads, interconnectors and existing transmission line routes.

b) The optimised network will be specified to meet existing loads and expected future patterns of load growth and generation.

c) The optimised network should have import / export capacities for interconnectors increased in proportion to load growth (where incremental upgrade is feasible). Where practical, interconnector capacity shall be assessed on a scenario basis using credible interconnector upgrades and additions.

d) The requirements of the Philippine Grid Code shall be met by the optimised network in relation to security, reliability and quality of supply.

e) Optimisations must not result in improvements in the network from the existing service levels and quality standards. If a network or an asset is not adequate to meet good practice levels of service it cannot be optimised up to that level.

f) Present voltage levels utilised in the network will be assessed. It is expected that only voltage levels that are used at present in a particular network will be used in the optimisation, unless it is considered the introduction of the highest voltage would have been more appropriate at a reduced voltage.

g) All TNSPs for reasons for economy in design, construction, maintenance and spares have adopted a standard range of conductor sizes for lines and cables and ratings for substation equipment. The optimisation of the network will recognise the TNSP's existing standards.

h) The determination of normal, cyclic and emergency ratings of conductors and plant must be in accordance with standards or codes or practices applicable to the asset concerned.

i) Optimisation should focus on aspects that are likely to materially affect the ODRC valuation; some aspects might require considerable effort for little effect on the valuation. It should be recognised that optimisation need not be all encompassing, but should cover only those aspects that have or are likely to have a material affect on the valuation.

j) Optimisation is constrained by the principle that any optimisation should be practical from a technical, operational, environmental and community acceptance point of view. It in no way infers that the network owner should make the change to the network or assets although in some circumstances it may do so.

k) Shared network assets and land which are required to be held by for statutory reasons should not be the subject of optimisation.

l) Optimisation is applied only to the network elements of a transmission system (eg. transformers, lines, cables, etc). It is not applied to non-network assets (eg. computers, plant and equipment, etc), and nor is it applied to the manner in which the network business is staffed, structured, or functions operationally.

6. Optimisation Record

The load forecasting and system studies required under the optimisation process will be prepared by the transmission entity, and will be reviewed by the SKM optimisation specialist (Keith Frearson). The transmission entity may also prepare an "optimisation report" which summarizes it's view on the specific assets that may require optimisation.

It is of importance that a clear audit trail exists of optimisations that affect the final ODV of fixed assets, and in this respect, Sinclair Knight Merz had adopted a formal process for recording the agreed optimisations, and the basis for the optimisation. Attached Appendix A is to be used to record agreed optimisations. SKM will prepare these records after completion of the optimisation analysis.

Appendix A Asset Valuation – Optimisation Record

Asset Valuation – Optimisation Record

Company ________________________________ **Job No** ______________________

Valuation Year ____________________________ **Optimisation No** ______________

1. Description of Optimisation

____
____
____
____
____
____

2. Category of Optimisation (tick one)

☐ Remove stranded/redundant assets ☐ Optimise configuration ☐ Optimise elements

3. Basis of Optimisation
Describe briefly the load/generation scenarios which lead to the optimisation outcome.

____
____
____
____
____
____

4. Are there any related optimisations (either up or down) required to enable this optimisation to be practical? If so, describe below:

____
____
____
____
____
____

5. What is the estimated net effect of this optimisation on the DRC?
- ☐ Increase
- ☐ Decrease

Value $__________________

6. Does the optimised network deliver the appropriate standard of security, reliability and quality of supply defined in the "Philippine Grid Code"?

☐ Yes ☐ No

7. Are the constraints on optimisation met?

		Yes	No
(a)	only existing easements, line and cable routes should be used?	☐	☐
(b)	location of connection points fixed?	☐	☐
(c)	location and number of existing customers assumed fixed?	☐	☐
(d)	existing Network Business boundaries assumed fixed?	☐	☐

8. What exceptions to the optimisation provisions are being invoked in this case on the basis of a "fair and reasonable practicality" test (eg. fixed line routes, fixed connection points, etc).

____

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____

____

9. Optimisation endorsed

____________	____________	____________
(Name)	(Sign)	(Company)
____________	____________	Sinclair Knight Merz
(Name)	(Sign)	(Company)

Asset Valuation – Optimisation Record

Company ________________________________ **Job No** ______________________

Valuation Year ____________________________ **Optimisation No** ______________

Actual System Configuration

Optimised System Configuration

Signed ________________________________ Signed ________________________________
(Sinclair Knight Merz)