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TransCo
National Transmission Corporation

TransCo
ASSET REVALUATION PROJECT

DISCUSSION PAPER - MODERN EQUIVALENT ASSET BUILDING BLOCKS (MEA)

- Final
- 6 July 2005

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1. Overview of Asset Valuation, and MEA Building Block Approach.

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

This will be the first revaluation 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 allowed revenue, the effective transmission power delivery charge, and other regulated charges for future years.

Optimised Depreciated 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 Business 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.

Clause 2.4 of TransCo's Terms of Reference specifies that:

2.4 In the absence of any other requirement from the ERC prior to the start of the revaluation, the following methods of revaluation may be used for TransCo's assets:

2.4.1 *Indexation* **-** This method is appropriate for assets where there has been little technological change and most, if not all, direct cost that have been incurred and capitalized in respect of those assets that would have to be incurred if they were replaced. This method has the feature that the valuation is directly linked to the historical value of the relevant assets, thereby ensuring that all relevant costs are included in the valuation.

2.4.2 *Absolute valuation by replacement cost analysis* **-** This method of valuation involves valuing the relevant assets at their current unit prices multiplied by their volumes. Such prices may be verified by reference to the purchase price of like assets within the last twelve (12) months or by reference to recent documented arm's length quotations for the purchase of those (or similar) assets. Such price should include the discounts available from purchasing in the volumes which have been used in the normal course of business and must be increased to cover relevant costs arising from design, procurement, mobilization, construction and commissioning. This approach may be used in valuing an asset where there has not been significant technological change and where it has not been possible to develop an appropriate index for the valuation of that asset for the purposes of the revaluation method referred to in clause (2.4.1).

2.4.3 *Absolute valuation using modern equivalent asset analysis* - this method of valuation involves valuing the relevant assets at the cost of modern equivalent asset with similar service potential (for example, an asset which replicates at least their current capacity and functionality). It may be used when it is not possible to determine the current replacement cost for an asset, e.g. because that asset is no longer manufactured.

SKM proposes to use a combination of all three asset valuation approaches, applied logically and sensibly to the various categories of assets that need to be re-valued. The primary methodology that we will be applying to the majority of fixed network assets (transmission lines, substations, etc) will be the Modern Equivalent Asset (MEA) approach.

The "indexation" and "absolute valuation by replacement cost analysis" approaches may be adopted for other asset groups where the MEA approach is inappropriate.

2. Valuation Guidelines & Modern Equivalent Assets (MEA's)

2.1 ODRC Guidelines

The Optimised Depreciated Replacement Cost (ODRC) revaluation of the network assets owned by TransCo will be carried out in accordance with the methodology set out in the Philippines Transmission Wheeling Rate Guidelines issued by the ERC, the TransCo Terms of Reference, and the principles and practices adopted by SKM in carrying out similar valuations of transmission utility assets in Australia, New Zealand, Singapore and Canada.

2.2 ODRC Values Groups of Assets

An ODRC valuation does not value the replacement cost of every individual asset or piece of equipment that exists on the network, but rather it values groups of similar assets, of a similar physical description, with similar service potential, and having a similar expected economic life.

2.3 Definition of a MEA.

Transmission network valuations, based on the ODRC methodology, adopt, as a key part of the valuation process, the concept of the Modern Equivalent Asset (MEA). A MEA is the asset which, in the normal course of business, the transmission entity would use to replace the existing asset if it were to be replaced today. The MEA may differ from an existing asset as a result of one or more of the following situations:

(a) An unnecessarily small and immaterial graduation between asset by types/sizes. (eg. conductor sizes that are no longer in use and/or are close in size and capacity to a currently used standard);

(b) Changes in technology and/or product development. (eg the MEA for an old bulk oil circuit breaker would be a modern SF_6 or vacuum circuit breaker, depending on the system voltage concerned);

(c) Changes in the life-cycle cost of alternative assets. (eg. The MEA for an old wood pole transmission line may be considered to be a modern spun concrete, or lattice tower line, where it has been clearly demonstrated on a "whole of life" costing basis, that the concrete or steel option is cheaper than wood); and

(d) The asset is no longer available. (this is similar to (b) above, and usually arises where technical obsolescence results in a particular type or style of asset no longer being available).

MEA assets are assets with the same service capability as the existing assets that would be selected if they had been replaced on the references date of the valuation (in this case, 31 December, 2004). MEAs should be commercially available technology and proven to the extent that a prudent network owner would use them on its network.

3. Specification of the MEA's

3.1 General

This discussion paper describes and specifies the MEA's proposed to be used by SKM for the revaluation of TransCo's network assets (as distinct from non-network assets), together with adjustment factors that SKM may apply where terrain and environmental conditions in the field may differ from the conditions assumed when estimating the MEA unit rates.

This discussion paper also addresses the question of the asset class lives in the Philippines and describes the experience and findings of SKM in arriving at suitable asset class lives in other regulatory jurisdictions.

3.2 Overall Number of MEA Building Blocks

After reviewing a range of TransCo. systems and documents, and by grouping and classifying similar assets, SKM has arrived at the following approximate number of MEA Building Blocks.

Table 3.1 Overall Number of MEA Building Blocks.

Asset Category	Approximate Number of MEAs
AC Transmission Lines (13.8kV to 500kV)	25
DC Transmission Lines (+/-350kV)	3
AC Submarine Cables (69kV to 230kV)	4
DC Submarine Cables (+/-350kV)	1
Substation Switch bays	56
Capacitor Banks	12
Reactors	14
Ancillaries	5
Power Transformers	55

These MEA numbers should be considered as only approximate as it often becomes necessary to develop new MEA unit rates for assets identified during the course of the valuation. In addition to the above, MEA unit rates are also established for "one - off", or unique assets for which a standard MEA unit rate may not have been previously developed (eg. TransCo's HVDC. link).

4. Transmission Lines.

4.1 MEA Building Blocks

The MEA building Blocks proposed to be used to value TransCo's transmission lines are shown in the following tables.

Table 4.1 Overhead Transmission Lines - AC Network.

Capacity	No. Circuits	Conductor Description	Reference Structure Type
500	DC	Quad Condor	ST
230	DC	Quad Condor	ST
230	DC	Double Condor	ST
230	DC	Single Condor	ST
230	SC	Quad Condor	ST
230	SC	Double Condor	ST
230	SC	Single Condor	ST
138	DC	Double Condor	ST
138	DC	Single Condor	ST
138	DC	Single Linnet	ST
138	SC	Double Condor	ST
138	SC	Single Condor	ST
138	SC	Single Linnet	ST
115	DC	Double Condor	ST
115	DC	Single Condor	ST
115	DC	Single Linnet	ST
115	SC	Double Condor	ST
115	SC	Single Condor	ST
115	SC	Single Linnet or smaller	ST
69	DC	Single Condor	ST
69	DC	Single Linnet or smaller	ST
69	SC	Single Condor	ST
69	SC	Single Linnet or smaller	ST
34.5	SC	Any size	CP
13.8	SC	Any size	CP

Table 4.2 Submarine Cables - AC Network

Voltage (kV)	Structure Type	Conductor Size (mm^2)	Single Circuit
230	Submarine Cable	800	✓
138	Submarine Cable	300	✓
	Submarine Cable	104	✓
69	Submarine Cable	300	✓

Table 4.3 Overhead Transmission Lines-HVDC Network

Voltage (kV)	Structure Type	Conductor Size (mm^2)	Single Circuit	Double Circuit
+/-350	Steel Tower	3x772		✓
	Steel Tower	2x772	✓	-
	Steel Tower	1x772	✓	-

Table 4.4 Submarine Cables - DC Network

Voltage (kV)	Structure Type	Conductor Size (mm^2)	Single Circuit
+/-350	Submarine Cable	1000	✓

4.2 MEA Reference Assets - Line Design Parameters.

In arriving at the MEA unit rates for transmission lines the following basic line design parameters have been used.

Table 4.8 basic line design parameters

Length	100km
Location:	Rural area with access to normal line services within about 100 km.
Terrain:	Plain – flat to undulating. No steep slopes or river crossings.
Average span – steel towers	500kV and 230kV – 450 metres 138kV, 115kV – 400 metres
Structure – steel towers	Self supporting galvanised lattice steel
Ultimate wind velocity	270km/hr
Conductor Maximum Temperature	90 degrees C
Minimum Ground Clearance:	8 metres
Everyday Conductor Tension:	22% of CBL

4.3 Inclusions

Cost items that will be included in the determination of the transmission line MEA unit rates are;

- Survey - Engineering survey, profile, tower spotting and pegging;
- Terrain/Clearing - Plain Light timber on flat to undulating ground. No special requirements for land clearing. Access tracks suitable for light 4WD vehicles and normal construction vehicles. No bridges or cutting required;
- Wind - The standard transmission line MEA unit rates are based on an ultimate wind velocity of 270 km/hr. A wind factor to be applied in the Luzon area will be developed;
- Foundations - Pad and chimney for towers;
- Structures - Galvanised lattice steel self-supporting towers;
- Conductor - ACSR/GZ;
- Overhead ground wire - Where there is one ground wire OPGW; where there are two ground wires, one OPGW and one SC/GZ; and
- Insulators/Fittings - all insulators and line hardware including compression joints, suspension clamps and vibration dampers.

4.4 Exclusions

Cost items that will not be included in the determination of the transmission line MEA unit rates are;

- Route selection, easement survey, acquisition, planning and regulatory approvals;
- Tower design, prototyping, and testing;
- Interest during construction (this is calculated separately to the transmission line valuation); and
- Easement cost (these are valued separately).

4.5 Adjustment Factors

For the TransCo revaluation exercise, it is proposed to apply adjustment factors to the MEA unit rates to provide for additional costs associated with design requirements or site conditions that are not reflected in the MEA unit rates. Adjustment factors will cover the following:

- **Line location**. Two categories are proposed, Plain and Rough. Transmission line sections have been classified into these categories by TransCo and are available as part of their transmission line records;
- **Strain ratio**. The strain ratio is the ratio of the number of strain structures to the total number of structures on a transmission line. The transmission line MEA unit rates assume a ratio of 1/10;
- **Steel pole**. The transmission line MEA unit rates will be factored to account for the additional costs of structures and foundations and the shorter spans associated with steel pole lines;
- **Wood pole**. The transmission line MEA unit rates will be factored to account for the lower costs of wood pole lines;
- **Concrete Pole**. The transmission line MEA unit rates will be factored to account for the specific costs of concrete pole lines;
- **Wind**. A wind factor will be provided for the additional costs of transmission line construction in Luzon where the ultimate wind velocity is 270km/hr;
- **Establishment**. This covers cost associated with mobilisation and demobilisation of the construction work force.
- **Miscellaneous**. This provides for additional costs that are not covered by the reference asset costs or by the above mentioned adjustment factors such as the need for piling or buoyancy foundations.

5. Substations

5.1 MEA Building Blocks

In undertaking this re-valuation, SKM has available, from its extensive asset valuation database, standard substation reference assets that will be adapted to the voltage levels and substation configurations used on the TransCo network. The following table indicates the range of different substation busbar configurations proposed for the revaluation.

Table 5.1 - Substation busbar Configurations.

Asset Type Unit Rates
Name
SwBay 500kV GIS single ring bus bay with 1 breaker, feeder
SwBay 500kV GIS single ring bus bay with 1 breaker, transf
SwBay 500kV 1 & ½ bay with 3 breaker
SwBay 500kV 1 & ½ bay with 2 breaker
SwBay 500kV 1 & ½ bay with 1 breaker
SwBay 230kV 1 & ½ bay with 0 breaker
SwBay 230kV 1 & ½ bay with 1 breaker
SwBay 230kV 1 & ½ bay with 2 breaker
SwBay 230kV 1 & ½ bay with 3 breaker
SwBay 230kV double bus bay with 0 breaker, feeder
SwBay 230kV double bus bay with 1 breaker, feeder
SwBay 230kV double bus bay with 1 breaker, b coupler
SwBay 230kV double bus bay with 1 breaker, transf
SwBay 230kV double bus bay with 2 breaker, transf
SwBay 230kV GIS double bus bay with 1 breaker, transf
SwBay 230kV GIS double bus bay with 1 breaker, b coupler
SwBay 230kV GIS double bus bay with 1 breaker, feeder
SwBay 230kV single CB bay with 1 breaker, b coupler
SwBay 230kV single CB bay with 1 breaker, b section
SwBay 230kV single CB bay with 1 breaker, feeder
SwBay 230kV single CB bay with 1 breaker, transf
SwBay 115kV GIS double bus bay with 1 breaker, transf
SwBay 115kV GIS double bus bay with 1 breaker, b coupler
SwBay 115kV GIS double bus bay with 1 breaker, feeder
SwBay 138kV 1 & ½ bay with 0 breaker
SwBay 138kV 1 & ½ bay with 1 breaker
SwBay 138kV 1 & ½ bay with 2 breaker
SwBay 138kV 1 & ½ bay with 3 breaker
SwBay 138kV 1 & ½ bay, spare bay
SwBay 138kV double bus bay with 1 breaker, feeder
SwBay 138kV double bus bay with 2 breaker, transf

Asset Type Unit Rates
Name
SwBay 138kV single CB bay with 0 breaker, feeder
SwBay 138kV single CB bay with 1 breaker, b coupler
SwBay 138kV single CB bay with 1 breaker, feeder
SwBay 138kV single CB bay with 1 breaker, transf
SwBay 69kV double bus bay with 0 breaker, feeder
SwBay 69kV double bus bay with 0 breaker, transf
SwBay 69kV double bus bay with 1 breaker, feeder
SwBay 69kV double bus bay with 2 breaker, transf
SwBay 69kV single CB bay with 0 breaker, b coupler
SwBay 69kV single CB bay with 0 breaker, feeder
SwBay 69kV single CB bay with 1 breaker, b coupler
SwBay 69kV single CB bay with 1 breaker, b section
SwBay 69kV single CB bay with 1 breaker, feeder
SwBay 69kV single CB bay with 1 breaker, transf
SwBay 69kV 1 & ½ bay with 1 breaker
SwBay 69kV 1 & ½ bay with 2 breaker
SwBay 69kV 1 & ½ bay with 3 breaker
SwBay 34.5kV single CB bay with 1 breaker, b section
SwBay 34.5kV single CB bay with 1 breaker, feeder
SwBay 13.8kV indoor CB bay with 1 breaker, feeder
SwBay 13.8kV indoor CB bay with 1 breaker, transf
SwBay 13.8kV single CB bay with 0 breaker, feeder
SwBay 13.8kV single CB bay with 1 breaker, b coupler
SwBay 13.8kV single CB bay with 1 breaker, feeder
SwBay 13.8kV double bus bay with 2 breaker, feeder

Table 5.2 indicates the range of standard transformer MEA building blocks proposed for the revaluation.

Table 5.2A- Power Transformer MEA's (By Highest Voltage & Rating) – Auto Transformers

Asset Type Unit Rates
Name
Tx-Auto-500/230/13.8-600
Tx-Auto-230/69/13.8-100
Tx-Auto-230/69/13.8-75
Tx-Auto-230/69/13.8-50
Tx-Auto-230/69/13.8-20
Tx-Auto-230/69/13.8-10
Tx-Auto-230/138/13.8-50
Tx-Auto-230/138/13.8-150
Tx-Auto-230/115/69/13.8-300
Tx-Auto-230/115/13.8-62.5
Tx-Auto-230/115/13.8-50
Tx-Auto-230/115/13.8-300
Tx-Auto-230/115/13.8-100
Tx-Auto-138/69/13.8-75
Tx-Auto-138/69/13.8-50
Tx-Auto-138/69/13.8-30
Tx-Auto-138/69/13.8-100
Tx-Auto-138/69/13.8-150
Tx-Auto-115/69/13.8-50
Tx-Auto-115/69/13.8-20
Tx-Auto-69/34.5/13.8-10

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Table 5.2B - Power Transformer MEA's (By Highest Voltage & Rating) – Non-Auto Transformers

Asset Type Unit Rates
Name
Tx--500/230/13.8-600
Tx--230/69-50
Tx--230/69-150
Tx--230/115/69/13.8-50
Tx--230/115/13.8-50
Tx--230/69/13.8-50
Tx--230/69/13.8-40
Tx--230/69/13.8-100
Tx--230/13.8-69
Tx--230/115-75
Tx--230/115/13.8-300
Tx--138/69-50
Tx--115/69-50
Tx--138/69-10
Tx--115/69-10
Tx--138/69/13.8-30
Tx--138/69/13.8-50
Tx--138/13.8-15
Tx--138/115-67.7
Tx--115/34.5-83
Tx--115/34.5-50
Tx--115/34.5/13.8-50
Tx--115/34.5-25
Tx--69/13.8-7.5
Tx--69/34.5-2
Tx--69/13.8-2
Tx--69/13.8-5
Tx--69/13.8-32.2
Tx--69/13.8-30
Tx--69/13.8-20
Tx--69/13.8-15
Tx--69/13.8-10
Tx--69/23-20
Tx--34.5/13.8-2.5

MEA building blocks and unit rates for other substation equipment are listed in Appendix B of this paper.

5.2 Inclusions

Cost items that will be included in the determination of the transformer MEA unit rates are;

- Delivery to site;
- Foundations and oil containment; and
- Transformer controls (temperature, OLTC, Buckholz, DGA).

5.3 Exclusions

Cost items that will not be included in the determination of the transformer MEA unit rates are;

- Protection (differential relays, cabling and panels);

5.4 MEA Reference Assets –Substation Design Parameters

In arriving at the MEA unit rates for substations and substation equipment, the following basic substation design parameters have been used;

Table 5.3 Basic substation design parameters

Type:	Outdoor, air insulated – or GIS as appropriate				
Location:	Rural or semi rural				
Terrain:	Reasonably flat ground, no extensive benching required				
Structures:	Galvanised lattice				
Wind:	185km/hr				
Busbar	Strung bus				
Equipment Rating:		500kV	230kV	138 kV	69kV
	Current A	3,000	3,000, 1,600	1,600, 1,200	
	Fault Current (kA)	40	50	23	23
	BIL - Plant (kV)	1,050	950	650	325
	- Transformer (kV)	1,050	950	650	325

5.5 Substation Bays.

It should be noted that the SKM valuation methodology does not value every item of equipment in a substation, but instead values the substation on a " bay by bay" basis. This is done by evaluating the actual switch bay configuration (from single line diagrams) against the SKM reference asset configuration in the database. In this way, the valuation can be done on a "bay by bay" basis, thereby recognising the staged development that is generally associated with the growth and development of the network.

5.6 Substation Equipment

It is often the case that major items of substation equipment may be installed, or relocated in substations well after the substation is built (eg transformer upgrades, circuit breaker replacements, etc). Subject to the detailed information being available from TransCo's asset database, SKM will extract from the bay, and value separately the following major items of plant and equipment:

- Site Establishment
- Power transformers

- Circuit breakers
- Capacitor banks
- CTs (to be discussed)
- VTs (to be discussed)
- Reactors

5.7 Inclusions

Cost items that will be included in the determination of the substation MEA unit rates are:

5.7.1 Site Establishment

Site establishment is applied to each individual voltage and is dependent on the number of bay diameters associated within the yard and includes the following;

- Earthworks, gravel surfacing, roads, drainage, landscaping, fencing
- Cable ducts not specific to a bay
- Earth grid
- Oil Containment

Note that all substation land and buildings are valued separately.

	500kV	230kV	138/115kV	69/13.5kv
Type 1	6 diameters or greater than 17 circuit breakers	8/9 diameters or greater than 23 circuit breakers	More than 6 diameters or greater than17 circuit breakers	More than 6 diameters or grater than 17 circuit breakers
Type 2	4 or 5 diameters or greater than 11 circuit breakers	6/7 diameters or greater than 17 circuit breakers	More than 4 diameters or greater than 11 circuit breakers	More than 4 diameters or greater than 11 circuit breakers
Type 3	3 diameters or greater than 8 circuit breakers	4/5 diameters or greater than 11 circuit breakers	More than 2 diameter or greater than 5 circuit breakers	More than 2 diameters or greater than 5 circuit breakers
Type 4	2 diameters or greater than 5 circuit breakers	2/3 diameters or greater than 5 circuit breakers	More than 1 diameter or greater than 2 circuit breakers	More than 1 diameters or greater than 2 circuit breakers
GIS Indoor	8 Circuit Breakers	7 Circuit Breakers		

5.7.2 Switch Bays

A range of switch bays will be included depending on busbar arrangement, the number of circuit breakers associated with the bay and the type of circuit.

The bay costs cover all equipment, structures, foundations, protection (relays, cabling and panels), erection, testing and commissioning in the bay with the exception of certain major plant items, eg transformers and other equipment listed in 5.6.

5.7.3 Ancillaries

- Fault recording equipment;
- Remote terminal unit;
- Overall substation control, protection and communication but excluding communication bearers;
- AC and DC auxiliary supplies, duplicate batteries;
- Stand by diesel generator (above 110 V);
- Cable ducts not specific to a bay; and
- Cabling not specific to a bay.

5.8 Exclusions

Cost items not included in the substation valuation are:

- Interest during construction (this is calculated separately to the substation valuation);
- Substation land and buildings(valued separately); and
- Site selection, planning and regulatory approval costs.

6. Asset Lives

6.1 General

In conducting the revaluation of the TransCo network assets, SKM will need to establish, in association with TransCo, appropriate asset class lives which represent the typical or average, economic life expectancy of these assets in the Philippine situation and environment.

Asset class lives should reflect the "average" economic service life that may be expected from each set of assets. The economic service life is considered to be at an end when the capitalized value of future operating maintenance and failure costs exceed the replacement cost of the asset.

The assessment of asset class lives should take account of a range of overall asset management policies and procedures, including:

- design standards;
- construction standards;
- loading criteria;
- maintenance policies, procedure & practices;
- operating practices; and
- the general environment in which the assets are operated.

6.2 Typical Asset Class Lives

It is SKM 's experience that worldwide, there is not universal consistency in the adoption of a standard set of asset class lives, either for accountancy or regulatory purposes.

SKM has however conducted transmission asset valuations in a number of countries over at least 15 years, and has developed a detailed understanding of the factors affecting the economic life of transmission assets. Based on this experience, we would expect, subject to further investigation during the course of the revaluation exercise, that the asset class lives will fall within the following ranges.

Table 6.1 – Typical Ranges of Asset Class Lives

Asset Class	Range of Class Lives (yrs)
Transmission Lines - Steel Tower	55 - 60
- Steel Pole	55
- Concrete Pole	55
- Wood Pole	45
Transmission Cables	40 - 45
Substation Switch bays	45-50

Asset Class	Range of Class Lives (yrs)
Substation Establishment	50 - 60
Power Transformers	45 - 50
Capacitors	40
Circuit Breakers	45
Current Transformers	45
Voltage Transformers	45
Control & Protection Schemes	15 - 30
SCADA Systems	15
Communications Equipment	10 -12.5

SKM understand that an asset life of 30 years has been adopted in the TransCo financial asset registers for the calculation of sound value. While this may be appropriate for accounting purposes, we do not, at this stage consider that a 30 year life for all asset classes is appropriate for regulatory purposes. SKM will during the course of the revaluation project, make an assessment of asset class lives taking into account conditions in the Philippines.

6.3 Remaining Asset Life/Residual Life

As part of the revaluation process, SKM will assign a remaining life to each of the assets on the network. SKM will follow the normal practice of calculating the remaining life as the difference between the asset class life and the age of the asset as at 31 December 2004. In addition, SKM will make an engineering judgement of the condition of the assets to confirm that the lives assigned to assets are appropriate. This will be based on a review of TransCo's operations and maintenance standards and practices, discussions with TransCo maintenance staff and inspections of a sample of the assets.

SKM anticipates, as with most asset valuations, that we will find assets which are older than the standard class life for that group of assets.

Adequate and effective maintenance over the life of an asset contributes to the overall extension of power system asset lives, and for assets that exceed the average class life a reasonable residual life must be assigned to the asset to reflect its continued serviceability. Taking into account the period required to implement planning and project works to affect the replacement of ageing assets, a residential life of five (5) years is normally adopted.

SKM will make an assessment of the conditions in the Philippines and in conjunction with TransCo, establish an appropriate residual life for assets approaching or exceeding the asset class life.

7. Derivation of MEA unit Rates.

7.1 Transmission Wheeling Rate Guidelines.

The Transmission Wheeling Rates Guidelines (TWRG) specifies (clause 4.6.4) that "For the purposes of the Initial Re-valuation, and in the circumstances specified below in connection with them, the following methods of re-valuation may be used for different Asset Categories (as defined in, or otherwise approved by the ERC pursuant to, Section 4.6.5):

(a) Indexation - this method is appropriate for assets where there has been little technological change and most, if not all, direct coasts that have been incurred and capitalised in respect of those assets would have to be incurred if they were replaced. This method has the feature that the valuation is directly linked to the historical value of the relevant assets, thereby ensuring that all relevant cost are included in the valuation.

(b) Absolute valuation by replacement cost analysis - this method of valuation involves valuing the relevant assets at their current unit prices multiplied by their volumes. Such prices may be verified by reference to the purchase price of like assets within the last twelve (12) months or by reference to recent documented arm's length quotations for the sale of those (or similar) assets. Such prices should include the discounts available from purchasing in the volumes which have been used in the normal course of business and must be increased to cover relevant cost arising for design, procurement, mobilisation, construction and commissioning. This approach may be used in valuing an asset where there has not been significant technological change and where it has not been possible to develop an appropriate index for the valuation of that asset for the purposes of the re-valuation method referred to in paragraph (a).

(c) Absolute valuation using modern equivalent asset analysis – this method of valuation involves valuing the relevant assets at the cost of a modern equivalent asset with similar service potential (for example, an asset which replicates at least their current capacity and functionality). It may be used when it is not possible to determine the current replacement cost for an asset, e.g. because that asset is no longer manufactured.

7.2 TransCo Terms of Reference (TOR)

Similarly, the TransCo terms of Reference specifies that the revaluation may be undertaken using the same methods:

(1) Indexation (Clause 2.4.1)

(2) Absolute Valuation by Replacement Cost Analysis (Clause 2.4.2)

(3) Absolute Valuation by using Modern Equivalent Asset Analysis (clause 2.4.3)

7.3 SKM Database of MEA Unit Rates

As a result of having concluded many transmission/distribution asset valuations over a 10-15 year period, SKM has established an extensive MEA database of asset costs which it has successfully applied in valuations conducted in Australia, New Zealand, Canada, and Singapore. In developing the MEA unit rates for the TransCo revaluation of network assets, we are using predominantly methods (2) and (3) specified in the TransCo terms of reference.

SKM has established a set of asset descriptors to match the vast majority of assets that exist on the TransCo power system (transmission lines and substations) – Refer Appendix A and B. For each of these asset descriptors, SKM will establish an MEA unit cost rate, which is reflective of the replacement cost of these assets in the Philippines as at 31 December, 2004.

7.4 Calibration of SKM Database to Philippines Prices for Capital Works.

As the cost structure for labour, materials and plant/equipment is different from country to country, it is necessary to calibrate the SKM database of costs to the local Philippine market for capital works. This is done by comparing the SKM database of prices with the cost of recent capital works projects undertaken by TransCo.

Generally speaking, we have reviewed project costs over the period 1999 to 2004 and made exchange rate adjustments for the cost of imported assets, and CPI adjustments on the cost of local Philippine input, to generate the MEA unit rate costs effective at 31 December 2004.

Where recent Philippine costs for some assets have not been available, SKM has exercised its judgement in arriving at the MEA unit rate, based on relativities with other similar assets, and relativities between different system voltages and capacities.

As a final calibration check, we have compared the MEA unit rate prices with similar schedules of unit prices used for preliminary planning and estimating of future projects, provided by TransCo.

Appendix A MEA Descriptions and Unit Rates – Transmission Lines

MEA Descriptions and Unit Rates – Transmission Lines

Transmission Line Unit Rates

Capacity	No. Circuits	Conductor Description	Reference Structure Type	Unit Rate (Php)k / km
500	DC	Quad Condor	ST	21,190
230	DC	Quad Condor	ST	14,060
230	DC	Double Condor	ST	8,910
230	DC	Single Condor	ST	6,700
230	SC	Quad Condor	ST	8,740
230	SC	Double Condor	ST	6,060
230	SC	Single Condor	ST	4,500
138	DC	Double Condor	ST	7,790
138	DC	Single Condor	ST	5,410
138	DC	Single Linnet	ST	4,330
138	SC	Double Condor	ST	5,230
138	SC	Single Condor	ST	3,550
138	SC	Single Linnet	ST	2,900
115	DC	Double Condor	ST	7,790
115	DC	Single Condor	ST	5,410
115	DC	Single Linnet	ST	4,330
115	SC	Double Condor	ST	5,230
115	SC	Single Condor	ST	3,550
115	SC	Single Linnet or smaller	ST	2,900
69	DC	Single Condor	ST	5,190
69	DC	Single Linnet or smaller	ST	4,150
69	SC	Single Condor	ST	3,420
69	SC	Single Linnet or smaller	ST	2,770
34.5	SC	Any size	CP	1,600
13.8	SC	Any size	CP	1,080

Submarine cables – AC Network

Voltage (kV)	Structure Type	Conductor Size (mm2)	Single Circuit	Double Circuit
230		800	✓	-
138		300	✓	-
		104	✓	-
69		300	✓	-

Overhead Transmission Lines – HVDC Network (Bi-polar)

Voltage	Structure Type	Conductor Size		

(kV)		(MCM)	Single Circuit	Double Circuit
+/-350	Steel Tower	3x772		✓
20kV		2x772	✓	-

Submarine Cables – HVDC Network

Voltage (kV)	Structure Type	Conductor Size (mm2)	Single Circuit	Double Circuit
+/-350	Submarine Cable	1000	✓	

Appendix B MEA Descriptions and Unit Rates – Substations

Switch Bays

Asset Type Unit Rates	
Name	**RC (Php k)**
SwBay 500kV GIS single ring bus bay with 1 breaker, feeder	180,000
SwBay 500kV GIS single ring bus bay with 1 breaker, transf	180,000
SwBay 500kV 1 & ½ bay with 3 breaker	183,627
SwBay 500kV 1 & ½ bay with 2 breaker	116,897
SwBay 500kV 1 & ½ bay with 1 breaker	85,506
SwBay 230kV 1 & ½ bay with 0 breaker	16,593
SwBay 230kV 1 & ½ bay with 1 breaker	40,544
SwBay 230kV 1 & ½ bay with 2 breaker	52,288
SwBay 230kV 1 & ½ bay with 3 breaker	82,368
SwBay 230kV double bus bay with 0 breaker, feeder	28,365
SwBay 230kV double bus bay with 1 breaker, feeder	34,812
SwBay 230kV double bus bay with 1 breaker, b coupler	30,276
SwBay 230kV double bus bay with 1 breaker, transf	26,584
SwBay 230kV double bus bay with 2 breaker, transf	52,288
SwBay 230kV GIS double bus bay with 1 breaker, transf	100,000
SwBay 230kV GIS double bus bay with 1 breaker, b coupler	100,000
SwBay 230kV GIS double bus bay with 1 breaker, feeder	100,000
SwBay 230kV single CB bay with 1 breaker, b coupler	25,092
SwBay 230kV single CB bay with 1 breaker, b section	19,680
SwBay 230kV single CB bay with 1 breaker, feeder	28,937
SwBay 230kV single CB bay with 1 breaker, transf	21,254
SwBay 115kV GIS double bus bay with 1 breaker, transf	42,000
SwBay 115kV GIS double bus bay with 1 breaker, b coupler	42,000
SwBay 115kV GIS double bus bay with 1 breaker, feeder	42,000
SwBay 138kV 1 & ½ bay with 0 breaker	11,934
SwBay 138kV 1 & ½ bay with 1 breaker	30,990
SwBay 138kV 1 & ½ bay with 2 breaker	38,849
SwBay 138kV 1 & ½ bay with 3 breaker	61,716
SwBay 138kV 1 & ½ bay, spare bay	4,119
SwBay 138kV double bus bay with 1 breaker, feeder	26,662
SwBay 138kV double bus bay with 2 breaker, transf	38,849
SwBay 138kV single CB bay with 0 breaker, feeder	18,977
SwBay 138kV single CB bay with 1 breaker, b coupler	18,150
SwBay 138kV single CB bay with 1 breaker, feeder	22,403
SwBay 138kV single CB bay with 1 breaker, transf	15,867

Asset Type Unit Rates	
Name	**RC (Php k)**
SwBay 69kV double bus bay with 0 breaker, feeder	19,787
SwBay 69kV double bus bay with 0 breaker, transf	13,480
SwBay 69kV double bus bay with 1 breaker, feeder	21,674
SwBay 69kV double bus bay with 2 breaker, transf	21,836
SwBay 69kV single CB bay with 0 breaker, b coupler	7,759
SwBay 69kV single CB bay with 0 breaker, feeder	11,946
SwBay 69kV single CB bay with 1 breaker, b coupler	13,726
SwBay 69kV single CB bay with 1 breaker, b section	9,976
SwBay 69kV single CB bay with 1 breaker, feeder	13,833
SwBay 69kV single CB bay with 1 breaker, transf	10,801
SwBay 69kV 1 & ½ bay with 1 breaker	17,300
SwBay 69kV 1 & ½ bay with 2 breaker	21,836
SwBay 69kV 1 & ½ bay with 3 breaker	35,958
SwBay 34.5kV single CB bay with 1 breaker, b section	7,301
SwBay 34.5kV single CB bay with 1 breaker, feeder	9,187
SwBay 13.8kV indoor CB bay with 1 breaker, feeder	2,210
SwBay 13.8kV indoor CB bay with 1 breaker, transf	3,179
SwBay 13.8kV single CB bay with 0 breaker, feeder	1,199
SwBay 13.8kV single CB bay with 1 breaker, b coupler	2,725
SwBay 13.8kV single CB bay with 1 breaker, feeder	1,362
SwBay 13.8kV double bus bay with 2 breaker, feeder	3,179

Transformers

Asset Type Unit Rates	
Name	**RC (PHP k)**
Tx-Auto-500/230/13.8-600	379,524
Tx-Auto-230/69/13.8-100	71,880
Tx-Auto-230/69/13.8-75	66,704
Tx-Auto-230/69/13.8-50	52,616
Tx-Auto-230/69/13.8-20	36,227
Tx-Auto-230/69/13.8-10	30,764
Tx-Auto-230/138/13.8-50	52,616
Tx-Auto-230/138/13.8-150	87,981
Tx-Auto-230/115/69/13.8-300	126,508
Tx-Auto-230/115/13.8-62.5	59,804
Tx-Auto-230/115/13.8-50	52,616
Tx-Auto-230/115/13.8-300	126,508
Tx-Auto-230/115/13.8-100	71,880
Tx-Auto-138/69/13.8-75	50,891
Tx-Auto-138/69/13.8-50	41,978
Tx-Auto-138/69/13.8-30	33,640
Tx-Auto-138/69/13.8-100	58,079
Tx-Auto-138/69/13.8-150	71,305
Tx-Auto-115/69/13.8-50	41,978
Tx-Auto-115/69/13.8-20	28,177
Tx-Auto-69/34.5/13.8-10	17,826
Tx--500/230/13.8-600	398,500
Tx--230/69-50	55,204
Tx--230/69-150	92,293
Tx--230/115/69/13.8-50	55,204
Tx--230/115/13.8-50	55,204
Tx--230/69/13.8-50	55,204
Tx--230/69/13.8-40	48,303
Tx--230/69/13.8-100	75,330
Tx--230/13.8-69	64,692
Tx--230/115-75	70,154
Tx--230/115/13.8-300	132,833
Tx--138/69-50	46,003
Tx--115/69-50	46,003
Tx--138/69-10	22,832
Tx--115/69-10	22,832
Tx--138/69/13.8-30	36,644
Tx--138/69/13.8-50	46,003
Tx--138/13.8-15	27,061
Tx--138/115-67.7	52,994
Tx--115/34.5-83	58,067
Tx--115/34.5-50	46,003
Tx--115/34.5/13.8-50	46,003
Tx--115/34.5-25	33,826
Tx--69/13.8-7.5	11,557
Tx--69/34.5-2	5,919
Tx--69/13.8-2	5,919
Tx--69/13.8-5	9,358
Tx--69/13.8-32.2	23,678
Tx--69/13.8-30	23,114
Tx--69/13.8-20	18,773
Tx--69/13.8-15	16,349
Tx--69/13.8-10	13,248
Tx--69/23-20	18,773
Tx--34.5/13.8-2.5	7,044

SKM

Capacitor Banks

Asset Type Unit Rates	
Name	**RC (PHP k)**
Capacitor Bank-13.8-2.5	1,674
Capacitor Bank-13.8-7.5	3,616
Capacitor Bank-69-2.75	1,771
Capacitor Bank-69-5	2,645
Capacitor Bank-69-5.4	2,800
Capacitor Bank-69-5.5	2,839
Capacitor Bank-69-7.5	3,616
Capacitor Bank-69-10	4,587
Capacitor Bank-69-15	6,528
Capacitor Bank-69-18	7,693
Capacitor Bank-230-50	20,118
Capacitor Bank-230-100	39,533

Reactors

Asset Type Unit Rates	
Name	**RC (PHP k)**
Reactor-500-15	57,501
Reactor-500-30	77,049
Reactor-500-90	122,520
Reactor-230-25	43,237
Reactor-230-30	37,357
Reactor-230-50	46,349
Reactor-138-15	22,652
Reactor-138-30	30,353
Reactor-138-40	34,272
Reactor-69-7.5	12,613
Reactor-69-10	14,242
Reactor-69-15	16,902
Reactor-69-30	22,648
Reactor-69-70	32,388

Ancillaries

Asset Type Unit Rates	
Name	**RC (PHP k)**
Ancillaries-500	73,289
Ancillaries-230	49,611
Ancillaries-138	38,900
Ancillaries-115	38,900
Ancillaries-69	38,900
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Site Establishment

Asset Type Unit Rates	
Name	**RC (PHP k)**
Type 1 - 500	45,101
Type 2 - 500	32,416
Type 3 - 500	25,651
Type 4 - 500	18,040
Type 1 - 230	27,624
Type 2 - 230	23,114
Type 3 - 230	18,322
Type 4 - 230	13,248
Type 1 - 138	9,584
Type 2 - 138	7,893
Type 3 - 138	5,919
Type 4 - 138	4,792
Type 1 - 69	8,175
Type 2 - 69	6,765
Type 3 - 69	5,074
Type 4 - 69	4,228
Indoor - 500	175,894
Indoor - <500	87,947