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Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses

DRAFT

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COMMERCE COMMISSION

CONTENTS

ABBREVIATIONS USED IN THE HANDBOOK

Abbreviation	**Term**
a	Stranded aluminium conductor
Al	Aluminium
c	Stranded copper conductor
Cu	Copper
Distribution ELBs	ELBs other than Transpower
DRC	Depreciated Replacement Cost
DV	Depreciated Value
ELB	Large Electricity Lines Business
EV	Economic Value
h	HDPE sheath
hc	Helically wound copper screen
HV	High Voltage
kV	kiloVolt
kVA	kiloVoltAmpere
LV	Low Voltage
MEA	Modern Equivalent Assets
MW	MegaWatt
NRV	Net Realisable Value
ODRC	Optimised Depreciated Replacement Cost
ODV	Optimised Deprival Value
ORC	Optimised Replacement Cost
PV	Present Value
RC	Replacement Cost
RL	Remaining Life
SWER	Single Wire Earth Return
TL	Total Life
UDV	Undepreciated Value
x	XLPE insulation

PART ONE: INTRODUCTION

The Optimised Deprival Valuation Methodology

1.1 This handbook details the optimised deprival valuation (ODV) methodology that large electricity lines businesses (ELBs), comprising distribution ELBs and Transpower, are required to use when valuing their system fixed assets on an ODV basis for the purposes of Part 4A of the Commerce Act 1986.

1.2 The ODV method of valuation measures the value of assets to a business. To this end the method assumes that the value of assets to a business is equal to the cost the business would incur if it were deprived of the use of its assets and then took action to restore its operating position to the pre-deprival situation by replacing its old asset base, at the lowest possible cost, with an asset base providing an equivalent service potential[1].

1.3 When applied to the valuation of system fixed assets of ELBs, the ODV method recognises that in a hypothetical deprival situation, the like for like replacement of an existing asset with one of similar design may be neither the least cost nor the most appropriate option. Given that it is the service potential of an asset, rather than its design, that is important, the ODV method requires the replacement cost of any asset to be the cost of the lowest cost modern equivalent asset (MEA) that provides the same service potential. In applying the deprival valuation method to an ELB's system fixed assets, it is necessary to first determine the replacement cost (RC) of each individual asset, assuming each asset is replaced with its lowest cost MEA.

1.4 The individual system assets of an ELB are connected together to form a network capable of providing a level of service to network customers. The service potential provided by the network as a whole (the asset base) is of more interest than the sum of the service potential of each asset[2]. In a deprival situation envisaged in clause 1.2, an ELB may be able to reduce the replacement cost of its asset base by reconfiguration and redesign of its network, without reducing the service potential of its network below that which is provided by the existing asset base. Optimisation of the existing asset base, which is an integral component of the ODV method, is intended to capture such cost saving opportunities.

1.5 However, the service potential of the optimised asset base on which the ODV valuation is calculated should be no higher than the actual service potential of the existing asset base ~~if the service potential of the optimised asset base would result in a higher replacement cost for the asset base~~. That is, the purpose of the ODV method is not to increase asset value by way of a superior service potential that currently does not exist. This principle applies, for example, where the existing asset base does not meet current technical, safety,

1 In this context, the service potential of an asset has both a functional and time component. Functionality relates to the asset's capability of providing a useful engineering function while the time component or remaining life of the asset relates to the remaining period over which the asset can be expected to economically perform its designed engineering service.
2 For clarity, in this handbook the term "asset" is taken to refer to an individual fixed asset, whereas the term "asset base" refers to the set of fixed assets that taken together comprise an ELB's transmission or distribution network.

environmental or other legal requirements[3]. While it is acknowledged that an ELB would need to meet these requirements when replacing assets following a deprival situation, the overriding purpose of the ODV valuation framework is to value the service potential provided by the existing asset base only.

1.6 An optimised asset base should only have the service potential that an ELB reasonably requires. If the existing asset base contains a service potential that an ELB no longer requires, the incremental value of this surplus service potential should be excluded from the ODV asset valuation. This is consistent with the deprival valuation philosophy in that, in a hypothetical deprival situation, an ELB would not replace existing assets to the extent that they provide a service potential that is no longer required. In undertaking an ODV asset valuation, it is therefore necessary to adjust for any service potential in the unoptimised asset base no longer required. This adjustment requires judgement on the part of the valuer undertaking the ODV valuation.

1.7 The optimised asset base will thus comprise a notional set of assets, which would provide at the lowest possible cost, a service potential that (i) is no greater than provided by the existing asset base and (ii) is no greater than an ELB reasonably requires. The replacement cost of these notional assets is termed the "optimised replacement cost (ORC)".

1.8 This handbook requires the RC and the ORC of lines business system fixed assets to be depreciated to reflect the remaining service potential of the existing and optimised system fixed assets, respectively. The service potential of an existing system fixed asset, in economic terms, will depend on the length of time it is expected to remain in service and will generally be less than that of a brand new asset. Depreciation therefore reflects the service potential that has already been expended by an asset that is part way through its expected economic life. The replacement cost of the assets in the existing real asset base after accounting for depreciation is termed the "depreciated replacement cost (DRC)" and the replacement cost of the optimised notional asset base after accounting for depreciation is the "optimised depreciated replacement cost (ODRC)".

1.9 As normally applied, the ODV method requires an economic valuation to be undertaken on the basis that the deprival value of an asset should be no higher than its economic value (EV). This requirement is based on the premise that, faced with a hypothetical deprival situation, a rational business would not replace an asset if the replacement cost of that asset were greater than its economic value. The loss to the business would therefore be limited to the economic loss arising from being deprived of the use of the asset. Therefore, the deprival value of an asset in this situation is the lower of its ODRC and EV.

1.10 This handbook sets out the mandatory rules to be applied to determine the valuation of system fixed assets of ELBs using the ODV method for the purposes of Part 4A of the Commerce Act 1986. The valuation rules in this handbook are intended to reflect a

3 For example, if an ELB were replacing an existing zone substation it would be required to include an oil interceptor system and an earth system that protected against hazardous voltages under fault conditions in order to meet current environmental and safety standards. However, the ODV of an existing zone substation would not permit these environment- and safety-related assets to be included in the ODV if the assets did not currently exist in the zone substation.

practical application of the ODV method based on the design and construction of an ELB asset base as is typically found in the New Zealand context.

1.11 In certain situations, it may be found that a strict application of the rules in this handbook may not be possible or appropriate. In such situations the ODV valuation is to be undertaken in a manner that is consistent with the philosophy behind the ODV valuation methodology as set out in this section.

Steps in the ODV Method

1.12 The valuation of an ELB's system fixed assets using the ODV methodology is to include the following steps:

1. preparation of an asset database;

2. determination of the RC of the individual assets that make up the existing asset base;

3. optimisation of the existing asset base to determine the ORC;

4. depreciation of the optimised asset base to determine the ODRC;

5. application of the EV test, where appropriate;

6. determination of the ODV; and

7. preparation of an asset valuation report.

PART TWO: PRACTICAL VALUATION AND MANDATORY PROCEDURES

Preparation of an Asset Database

2.1 An ELB shall maintain a comprehensive and accurate database of its system fixed assets. The asset database shall provide the basis for undertaking the valuation of the ELB's system fixed assets using the ODV methodology. The database shall record the individual system fixed assets and shall be constructed in such a way that it is possible to verify the completeness and accuracy of the database by field surveys of the physical assets actually installed. Individual assets shall be classified into asset categories in accordance with the asset categories provided in the relevant tables contained in Appendix A.

2.2 The asset database shall be subdivided ~~decompose the asset base~~ into individual assets to the extent that (i) the accuracy of the information on an individual asset can be verified by field surveys; (ii) each individual asset can be classified into asset categories in accordance with clause 2.1; (iii) ~~the age of~~ the individual asset for valuation purposes has only one use~~is unique~~; and (iv) there is only one multiplier or other factor relevant to the determination of the replacement cost of the asset~~ is unique~~.

2.3 The following information shall be recorded for each individual asset within an asset category:

- Quantity.
- Age or commissioning date.
- ~~Mulitpliers~~Multipliers or other factors that affect the replacement cost of the asset.

2.4 The asset database must be updated on an ongoing basis to reflect changes in the makeup of the asset base and thus to ensure that the database is complete and accurate. The asset database should be in a form that facilitates scrutiny and a ready understanding of how it is composed.

2.5 It is recognised that some system fixed assets currently may not be individually recorded in the asset database and that therefore estimations of asset quantities and ages ~~will be~~ may be necessary to prepare a valuation of the assets. It is not required that such assets be retrospectively recorded in the asset database. However, all new system fixed assets are to be recorded in the asset database as they are commissioned. In this way the completeness and accuracy of the asset database can be expected to improve over time.

Assets to be Included in the Valuation

2.6 Only system fixed assets owned by the ELB or subject to a finance lease are to be included in the reported ODV valuation. System fixed assets are tangible in nature, have relatively long useful lives, and are used, or intended to be used, for the conveyancing or supply of electricity. Furthermore, stores and spares held in stock that can be ~~connected~~ used in ~~to~~ the network in place of existing network assets may be included in the valuation to the extent that the quantities of items included in the valuation are ~~consistent with~~ appropriate considering the historical reliability of the equipment and the number of items installed on the network. Stores and spares included in the ODV valuation must be separately categorised.

2.7 The following assets are not to be included in the ODV valuation:

- office buildings, except where the office building is required for the real time operation and control of the distribution or transmission network;
- depots and workshops;
- office furniture, and equipment;
- motor vehicles;
- tools, plant and machinery;
- works under construction;
- consumer-based meters and load control relays;
- non-network land, stores and spares;
- computer systems, except those computer systems that are used for real time network operation and control;
- asset management systems, including geographic information systems;
- street lights, and poles or other structures used exclusively for the support of streetlights;
- street light control relays and circuits or other equipment used exclusively for street light control;
- mobile substations and generators; and
- assets whose ownership is disputed or unclear.

2.8 Assets owned by the ELB which, in accordance with clause 2.7, must not be included in the ODV valuation may be valued in accordance with the Commission's current requirements.

Asset Quantities

2.9 Where the quantities and ages of certain categories of system fixed assets installed before a certain date are not known, ELB~~'~~s must estimate the quantities and the ~~weighted-average~~ ages of such assets using a statistically robust methodology. The valuation report shall identify assets where the quantities and ages have been estimated and include details of the methodology used to derive the estimate.

2.10 Estimates of asset quantities and weighted-average ages shall be reviewed regularly to account for the removal of assets from the network.

Determination of Replacement Cost

2.11 Individual system fixed assets are to be valued using the replacement costs (RCs) of modern equivalent assets (MEAs) that would be installed today in order to provide the same engineering service potential as the existing asset. The MEA shall not reflect a service potential required by legislative or regulatory changes made since the assets were first built or installed, ~~if such inclusion results in a higher replacement cost and~~ if the existing assets have not yet had to comply with the additional requirements, e.g. where grandfathering provisions apply. The maximum values for MEAs for standard system fixed assets which are not to be exceeded are set out in tables in Appendix A. Appendix A also contains other details regarding the valuation of particular types of assets.

2.12 Where a standard replacement cost for a system fixed asset is not provided in Appendix A, the MEA would normally be the asset that: (i) can be purchased or constructed using current technology at the time of valuation; and (ii) has an equivalent service potential to that of the existing asset; and (iii) has the lowest lifetime cost. Indicators that can be used to determine the service potential of an MEA include:

(a) number of faults/100km of line/year
(b) voltage complaints/100km of line/year
(c) proven reliability of the technology
(d) functional compliance with modern operating requirements
(e) meeting statutory and industry safety requirements.

2.13 Replacement costs should be determined on a "brownfields" basis. This assumes that construction occurs around all existing infrastructure and development (other than the asset being valued). Furthermore, replacement costs must also be commensurate with a significant scale of construction rather than with piecemeal additions. As a guide, replacement costs for zone substations, subtransmission circuits and distribution feeders should be determined on the basis that each complete substation, circuit or feeder is constructed as a single project.

2.14 Equipment purchase costs should be based on costs ~~quoted~~ charged by manufacturers or suppliers in a competitive environment. Construction cost estimates should be based on knowledge of the work involved and efficient industry practice with competitive costs, such as would be charged by efficient private contractors. Alternatively, costs may be based on competitive quotes by turnkey private contractors.

2.15 The valuation report shall identify each class of assets that is included in the valuation but that does not have a standard replacement cost or asset life scheduled in Appendix A. The valuation report shall describe the basis for the determination of the MEAs, and the replacement costs and asset lives of such assets. Details of any analysis used to determine the appropriate MEA, including details of relevant indicators and life cycle cost analysis, and the basis for estimating the replacement cost and asset life used for valuation purposes must also be provided.

2.16 Any grants or contributions that have been received should be ignored, as it is the deprival value of the assets that is required, not the actual investment.

2.17 Aggregation of the RCs for all the individual system fixed assets will produce the network RC.

OPTIMISATION

Introduction

2.18 Under the deprival approach to asset valuation an optimised network would use the most cost efficient design that would provide the required service potential. Such a design could conceptually be undertaken using a "greenfields" approach that disregards completely the design and configuration of the existing asset base. This approach, which is cost intensive and likely to result in variable and inconsistent outcomes, is not required by the valuation rules in this handbook. Instead, these rules allow the existing network to be used as a starting point. A series of optimisation tests must be systematically applied to the whole network to identify stranded assets, over engineering and excess capacity. Required optimisation tests are included in Appendix B. Where required, the network is notionally redesigned to provide an optimised network. The ORC is the undepreciated replacement cost of the optimised network.

2.19 Optimisation should be undertaken after the RC of the existing network asset base has been calculated.

2.20 The optimised network should:

(a) provide a quality of supply similar to that which currently exists and which does not exceed the ELB's standard quality of supply criteria; and

(b) have a capacity similar to that of the existing network, except where this exceeds allowed future load growth.

2.21 Optimisation consists of five stages:

(a) exclusion of stranded assets;

(b) optimising the configuration of the network;

(c) optimising the capacity of elements in the network;

(d) optimising network engineering; and

(e) optimising stores and spares.

2.22 The determination of the MEA that would replace existing individual network components is NOT part of the optimisation process. This must be done prior to calculating the RC and, for most network components, has already been reflected in the maximum standard replacement costs given in Appendix A.

Constraints on Optimisation

2.23 The optimisation must be carried out subject to the following constraints:

(a) the performance of the optimised network must not exceed the existing quality of supply or service potential and ~~no~~ the performance of any part of the network may not exceed the ELB's disclosed quality of supply criteria, unless non-standard contracts with customers exist that guarantee an enhanced quality of supply;

(b) the location of points of connection to other networks should be assumed to be fixed. However, where a point of connection can be by-passed and this allows a reduction in the replacement value of an ELB's assets, then that point of connection must be deleted for valuation purposes;

(c) the location, number and current demand of existing ~~customers~~ connections to consumers should be assumed fixed;

(d) the optimised network should use only the voltage levels used on the existing network[4]; and

(e) the existing boundaries of the ELB should be assumed to be fixed.

The Process of Optimisation

2.24 Optimisation of the network should be undertaken on a systematic basis. The optimisation process must ensure that all excess capacity that will materially affect the replacement value of the network is optimised out. Optimisation must be undertaken systematically on the following parts of the network including:

(a) points of connection to other networks;

(b) zone substations and primary distribution switching stations;

(c) subtransmission lines and primary distribution circuits[5];

(d) each individual high voltage distribution feeder. For the purposes of the valuation rules in this handbook, a feeder includes any circuit of the distribution network, excluding a low voltage circuit, used to directly supply customers or to supply one or more distribution substations feeding the ELB's own low voltage network; and

(e) the low voltage distribution system.

Future Load Growth

2.25 The maximum capacity of any part of the optimised network shall be determined by the allowed load growth, which is the maximum forecast load under contingency operating conditions at the end of the relevant planning period. However, in no case shall optimised capacity exceed existing capacity.

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4 This does not preclude existing equipment being optimised down to a lower standard network voltage. However, there is no requirement to optimise down to a non-standard voltage level.

5 A primary distribution circuit is a distribution voltage circuit that is used for the transport of electricity but not for the supply of electricity to customers or the supply of distribution substations that feed an ELB's low voltage network.

2.26 In order to assure compliance with clause 2.24, ELBs must disclose, in the valuation report, both existing loads and the load growth forecast used as a basis for optimisation. As a minimum, existing and forecast loads must be provided for each point of connection, each zone substation and each high voltage distribution feeder. Clear justification and a detailed derivation of the load growth forecasts are required. Both the existing maximum demand, and the forecast maximum demand at the end of the planning period, must be provided. Allowances should be made, where possible, for different growth rates in different parts of the network. Existing loads may be estimated where metering is not available.

2.27 The demand forecast shall include only future electricity loads that can reasonably be expected to be supplied from the ELB's network. A load outside the existing boundaries of an ELB's area of supply shall not be included in the forecast unless a written customer contract to supply the load exists at the time of the valuation.

2.28 The planning periods over which future load growth can be allowed for shall not exceed the following:

(a) for transmission networks, (being networks with a voltage above 33 kV), sub-transmission lines, primary distribution circuits ~~(being networks with a voltage above 33 kV),~~ and points of connection to a transmission network, 15 years;

(b) zone substations, 10 years;

(c) for HV and LV distribution, and other network assets, 5 years; and

(d) for distribution transformers, no future load growth is permitted. Distribution transformers must be optimised in terms of capacity utilisation, based on current network loadings.

Quality of Supply

2.29 The optimised network must be designed to supply the existing load, and allowed load growth, with a quality of supply that matches the level that currently exists for each part of the network except where this is greater than the disclosed quality of supply criteria.

2.30 An ELB is required to disclose, in its valuation report, the quality of supply criteria that it currently uses as a basis for network design. This should be based on the ELB's analysis of customer requirements and its assessment of network maintenance requirements and costs.

2.31 Relevant quality of supply standards include:

(a) the degree of security (redundancy) in different circumstances or localities;

(b) target reliability indices for different areas of the network (CBD, urban, rural);

(c) voltage regulation criteria; and

(d) levels of electrical losses.

2.32 The degree of security may be disclosed by reference to the level of in-built redundancy, i.e. as (n) or (n-1) or (n-2) or greater component redundancy. (An (n) security level implies no component redundancy so that if a component fails, then customer supply is lost. An (n-1) security level is one in which customer supply is not interrupted in the event of any single component outage etc.) It is recognised that some ELBs are now analysing the degree of security on a probabilistic, rather than a deterministic basis. It is necessary for an ELB to express its degree of security criteria in such a way that the optimisation process is transparent and can be shown to have been applied consistently across all parts of the network.

2.33 In the case of Transpower, account should be taken of prudent standards and practices followed in overseas countries, such as those adopted in Australia and the United Kingdom, relevant decisions of the Electricity Commission and the contractual relationship between Transpower and its connected customers.

2.34 Existing assets that provide a quality of supply greater than that disclosed by the ELB must be optimised out, except where the assets are required in order to meet the ELB's contractual obligations to provide an improved level of security to specific customers.

Excluding Stranded Assets

2.35 Any system fixed assets that are not required to supply line services to customers, and which could therefore be disconnected, should be identified and excluded from the optimised network. Such assets are known as stranded assets.

Optimising the System Configuration

2.36 Optimisation of system configuration must be carried out by considering alternative configurations subject to the constraints on optimisation and in accordance with the relevant criteria relating to the quality of supply declared by the ELB. The optimised configuration is the one that satisfies the relevant optimisation criteria at minimum overall replacement cost.

2.37 In the process of optimising the system configuration, certain assets or groups of assets may become excess to requirements and should be valued at nil, while other new assets may need to be notionally brought in. Required tests for the optimisation of the system configuration are set out in Appendix B.

Optimising Network Capacity

2.38 After the configuration of the system has been optimised, the elements within it must be optimised by considering whether lower capacity elements with a lower replacement cost would be adequate. When optimising the elements within the system, the ELB must individually consider all high voltage distribution feeders and the material assets within them. Required tests for the optimisation of the network capacity for ELBs are set out in Appendix B.

2.39 Civil engineering works such as spare ducts and switchyard bays that are not currently used shall be optimised out unless they are required to meet the forecast load growth by the end of the planning period. If such assets are only required to provide an improved quality of supply, they shall be optimised out since the optimised system must not provide a quality of supply greater than that which currently exists.

Optimising Network Engineering

2.40 After the optimisation of network capacity, the engineering of the network must be examined to confirm that the asset base is valued in a manner that minimises the replacement cost to meet the required quality of supply criteria. Consistent with the philosophy behind a deprival approach to asset valuation, this must be done by comparing the engineering inherent in existing network assets with the design and construction practices that the ELB would use if it were replacing the existing asset base. The ELB's documented design and construction standards, and standard of engineering applied to its most recent projects should be used as the benchmark for this test. Where the replacement cost of the existing network exceeds the replacement cost using existing engineering standards then the existing assets must be replaced by a notional asset arrangement that reflects current practice. Required tests for the optimisation of the network engineering for ELBs are set out in Appendix B.

Optimising Network Equipment Spares

2.41 Network equipment spares may be included in the ODV as long as the spares are ~~the same as~~ suitable replacements for the assets installed in the network. Further, the quantity of the spares to be valued in the ODV must not exceed a reasonable quantity required to meet the ELB's disclosed quality of supply criteria.

2.42 Stranded assets may be valued as network spares, subject to the criteria set out in clause 2.40.

Determining the Optimised Replacement Cost (ORC)

2.43 Once the optimised system has been determined, those parts of the optimised network that are different from the existing network must be re-evaluated. This entails applying the cost of the MEAs to the optimised notional network.

2.44 Stranded assets that are not required as network equipment spares, shall be assigned zero value for the purposes of the ODV. It is permissible to assign the NRV of such stranded assets to the incremental business owned by the ELB. This is consistent with the avoidable cost allocation methodology (ACAM) rules as set out in the ~~Commission's~~ Ministry of Economic Development's current requirements in the Handbook, clauses 3.54, 3.78, 3.79 and B.27. Since stranded assets are avoidable by the ELB, NRVs associated with their disposal should not be assigned to the system fixed assets.

2.45 When assets are notionally brought into the system through optimisation they should be valued at their replacement cost in accordance with the relevant requirements of this handbook for the determination of the replacement cost of system fixed assets.

2.46 Aggregation of the ORCs of the system fixed assets in the optimised system will produce the network ORC.

DEPRECIATION

Approach to Depreciation

2.47 Asset replacement costs shall be depreciated when the existing asset's remaining service life is less than the total life (TL) that would normally be expected from a new asset. The depreciation effectively recognises the limited remaining life (RL). The MEA replacement cost shall be depreciated according to the RLs of the existing assets.

2.48 The straight-line method of depreciation shall be used such that the Depreciated Replacement Cost (DRC) of an asset is determined as:

DRC = RC x RL/TL

where: RC = Undepreciated replacement cost
RL = Remaining life
TL = Total Life.

It is clear from the above that both the total life and the remaining life need to be established for all system fixed assets.

Determining Asset Total Lives

2.49 The maximum TLs of the MEA for different asset classes are set out in the tables in Appendix A. These maxima are not to be exceeded except as provided for in Appendix A. The appendix also contains other details regarding the TLs to be used for particular types of assets.

2.50 TLs lower than the specified maxima may be used and may be appropriate in certain circumstances, such as specified in Appendix A.

Determining Asset Remaining Lives

2.51 The life of each asset commences when the equipment is commissioned. The basic procedure for determining RLs is to subtract the age of assets from their TLs. The age of assets should be determined either from records establishing the age, or where necessary from engineering assessments of the age.

2.52 Where the date of commissioning of an asset is not known, the age of the asset must be based on the age used for the previous ODV valuation. Reassessment of the date of installation of an asset is allowable only if clearly documented objective evidence is provided in the valuation report to justify the reassessment. Evidence of a purely subjective nature, even when provided by a technical expert, is insufficient to satisfy the requirements of this clause. The valuation report shall include details of any assets for which the date of installation has changed from that used in the previous valuation and shall also describe the evidence on which this change is based.

2.53 When an asset may be retired early from service because it may become redundant as part of a development of the system, this should not be taken into account in assessing the RL of that asset. However, when a class of assets is routinely replaced as part of the evolution of the system before its technical life expires, this should be taken into account in assessing the TL for that class of assets.

Refurbishment

2.54 Appendix A provides procedures for assigning RLs in cases where assets have been refurbished.

Fully Depreciated Assets

2.55 At any revaluation, assets whose standard economic life is less than three years shall be deemed to have a residual life of three years. However, in cases where an asset is expected to fail or be decommissioned within three years, its remaining life for valuation purposes shall be set at its actual expected remaining life. The DRC of such assets shall be determined using the formula in clause 2.47.

Determining the Depreciated Replacement Cost (DRC)

2.56 Aggregation of the DRCs for all the system fixed assets will produce the network DRC.

Determining the Optimised Depreciated Replacement Cost (ODRC)

2.57 When optimisation leads to existing assets being notionally replaced, the replacement asset shall be depreciated for the same proportion of its TL as the existing asset was depreciated. When the optimisation involves groups of assets being reconfigured, the replacement assets shall be depreciated as a group to reflect the RL of the existing group as a proportion of that group's TL, this being calculated on a weighted-average basis.

2.58 Aggregation of the ODRCs of the fixed assets in the optimised system will produce the network ODRC.

ECONOMIC VALUATION

2.59 As discussed in Part 1 of this handbook, economic valuation is an integral part of the ODV valuation method. The Commission reserves the right to require an EV test to be applied in situations where it considers that a valuation prepared in accordance with this handbook may materially exceed the economic value. It further reserves the right, after consultation with the ELB concerned, to determine how an EV test shall be applied in a particular situation.

2.60 EV tests are not required to be undertaken on rural distribution spurs, except where required under clause 2.5859.

ODV

2.61 The ODV value of an asset is the lower of its EV or ODRC. If an EV test on an asset is not required the ODV of the asset is equal to its ODRC. Aggregation of the ODV values, whether ODRC or EV, of the network assets will produce the value of the network system fixed assets at ODV.

VALUATION REPORTS

2.62 It is important to the integrity of the information disclosure requirements under subpart 3 of Part 4A of the Commerce Act 1986 that valuation reports be transparent. As a general principle, sufficient information should be included in valuation reports to allow stakeholders to independently assess the validity and robustness of the reported ODV valuation.

2.63 As a minimum, valuation reports must contain the following information:

1. the asset quantities for the existing asset base, excluding stores and spares. This information should be broken down into asset classes consistent with the asset classes included in the tables in Appendix A;

2. the replacement cost, optimised replacement cost, depreciated replacement cost, and optimised depreciated replacement cost for each asset class and for the asset base as a whole. This information should be shown separately for stores and spares, which need not be disaggregated into asset classes;

3. a schedule of asset classes where asset quantities and asset ages have been estimated. For each such asset class, the valuation report should shall describe the methodology used to derive the estimates. Refer to section 2.9;

4. a schedule of replacement costs and asset lives used as the basis for valuing assets where a standard replacement cost or asset life is not provided in Appendix A, or where the asset replacement cost or asset life used in the valuation is different from the maximum values given in Appendix A (before the application of multipliers or other adjustments). Refer to section 2.15;

5. a schedule of asset classes and asset quantities to which multipliers or other adjustments have been made to the standard costs given in the tables in Appendix A. Refer to section 2.?;

6. a description of the basis for determining the replacement cost of assets where standard replacement costs are not provided in Appendix A. This information should include, where appropriate, the basis for the selection of MEA and the methodology used to determine the current replacement cost of the MEA. Refer to section 2.15;

7. a description of the methodology used in undertaking optimisation. Refer to section 2.?;

8. the existing loads and the load growth forecast used as a basis for optimisation. This information should be disaggregated by point of connection, zone substation and high voltage distribution feeder. Refer to section 2.26;

9. a description of the quality of supply criteria used as the basis for optimisation. Refer to section 2.30;

10. a schedule of all network optimisations and details of the valuation impact of each individual optimisation, including details of the assets removed as stranded assets. Refer to section 2.?;

11. details of any assets, including transmission and distribution lines, for which the date of installation has changed from that used in the previous valuation and a description of the evidence on which this change is based. Refer to sections 2.52 and A.9;

12. details of any assets for which the remaining life has been extended as a result of refurbishment. Refer to sections 2.54?, A.36? and A.37?; and

13. a description of the methodology used for economic valuations (if any) undertaken as part of the ODV valuation process and a comparison of the EV and ODRC for each economic valuation undertaken. Refer to sections 2.59? and 2.60?

APPENDIX A: VALUING ASSETS AND MAXIMUM ASSET COSTS AND LIVES

A.1 This appendix gives the methodology that should be applied in determining replacement costs to value the system fixed assets of ELBs. The appendix also contains Table A.1 (for local ELBs), and Tables A.2–A.8 (for Transpower), which specify the maximum replacement costs and the maximum asset lives that are not to be exceeded for the purpose of assessing the depreciated replacement costs of ELB system fixed assets.

ELB Maximum Costs

A.2 Maximum replacement costs are shown in Table A.1 (for distribution ELBs), and Tables A.2–A.8 (for Transpower). These values are maxima and, for valuation purposes, are not to be exceeded except for the application of multipliers and other adjustments as provided for in this appendix.

A.3 The values in the tables are based on installed costs for Modern Equivalent Assets (MEA). They have been based on industry best practice and competitive pricing. The ~~rates~~ values reflect the savings from achieving the lowest labour and material costs through bulk or term purchasing. This can be summarised as the costs paid by an efficient ELB using the most cost effective methods to establish the optimised design of network, purchasing all items (equipment and services) at the best possible rates. The per unit replacement costs ~~rates~~ include the following elements:

(i) costs of materials delivered to store;

(ii) direct installation labour including indirect costs (ACC, holiday pay, sick leave, training, supervision, etc);

(iii) transport and plant costs for delivery and erection; and

(iv) on-cost incorporating business administration, design, construction supervision, and project management costs.

The costs of land use consents, easements, and compensation are excluded. Goods & Services Tax (GST) is excluded but other taxes and duties incurred in the construction of the assets are included.

A.4 For equipment used in adverse conditions, multipliers or per kilometre allowances can be applied to the values as specified in the tables, but only subject to conditions as specified in A.10, A.15, A.16 and A.20. To ensure appropriate application of the cost multipliers, a record of their application ~~should~~ shall be retained for audit purposes. This information must include:

(i) multiplier used;

(ii) quantity of item to which it is applied; and

(iii) the specific conditions justifying the use of the multiplier.

Furthermore, a schedule of asset quantities and asset classes to which multipliers and other adjustments have been applied shall be included in the valuation report.

A.5 Where more than one multiplier is applicable to a particular asset the effect of the multipliers is to be summated, not multiplied. (e.g. if multipliers of both 1.25 and 1.3 apply to a given work to adjust for specific conditions then the combined multiplier is 1.55).

A.6 Where the nature of an asset in service differs from any in the tables, an engineering assessment of the replacement cost can be made. Before such an assessment is made, the ELB must be satisfied that there is justification for not selecting an MEA listed in the tables. This assessment must be recorded in the valuation report, and calculations and other relevant records to justify the assessment must be retained for audit purposes.

A.7 In assessing costs for assets not listed in the tables, or where the ELB's assessed value is less than the maximum listed cost, the cost elements set out in clause A.3 should be recorded and retained for audit purposes.

ELB Asset Types

A.8 In the following sections additional information is given in relation to the valuation of certain types of assets used by ELBs.

Overhead lines

A.9 The economic life of pole type lines shall be based on the weighted-average number of wooden and concrete poles on the line. Similarly, the age of the line for valuation purposes should be equal to the average age of the poles on the line. To comply with this provision, and notwithstanding the requirements of clause 2.51, the economic life and age of such lines may be adjusted at each valuation. Consistent with requirements of clause 2.51, ELBs must retain for audit purposes documentary objective evidence supporting such adjustments. Furthermore, details of such adjustments shall be included in the valuation report.

A.10 **Distribution ELBs:** The maximum overhead 33kV, 22kV and 11kV line costs in Table A.1 have been based on three-phase construction in a rural environment utilising 70-80m spans. For lines of these voltages in other environments, maximum costs can be established by applying the following multipliers:

overhead line urban	:	1.5 to 1.8 times A.1 cost
overhead line remote area	:	1.0 to 1.25 times A.1 cost
overhead line rugged terrain	:	1.2 to 1.3 times A.1 cost,

where remote areas are those which are situated more than 75 km from the nearest works depot of either the ELB or a line construction contractor; and rugged terrain includes those areas where normal line operating vehicles and plant cannot be used and where it is necessary to use helicopters, tracked vehicles or other specialised plant.

A.11 **Transpower:** The maximum overhead line costs for AC transmission lines in Table A.8 have been based on nominal average span lengths of 165m and 375m for pole and tower lines respectively, in flat rural land with an assumption that the work is carried out 50km from the nearest urban area. There is no adjustment for further remoteness. Costs for overhead lines in Table A.8 in other terrain can be established by applying the following multipliers:

overhead line hilly terrain	:	1.07 times A.7 cost
overhead line mountainous terrain	:	1.23 times A.7 cost
overhead line urban terrain	:	1.20 times A.7 cost.

A.12 The maximum costs in Table A.1 for circuits of lower voltage erected on higher voltage lines (i.e. underbuilt) have been based on the marginal cost of additional materials and installation.

A.13 Costs for special configurations (e.g. composite 33kV/11kV/LV lines and aerial bundled conductor construction) and for construction at other voltages (e.g. 110kV, 66kV or 22kV) should be determined in accordance with clause A.7.

Underground Cables

A.14 The maximum underground cable costs in Table A.1 have been based on laying underground cables in an urban area with developed infrastructure.

A.15 Cables laid in business districts require special consideration, and a multiplier of 1.15 ~~or~~ to 1.25 times the costs in Table A.1 can be applied. Business districts include arterial r~~em~~outes carrying 10,000 vehicles or more per day. This multiplier takes into account, restricted access times, special reticulation requirements and areas requiring substantial reinstatement and /or special backfilling.

A.16 For cables laid in rocky ground a multiplier of 1.5 to 2.0 times the costs of Table A.1 can be applied.

A.17 The Table A.1 cost of double circuit (viz two) cables, including cables of differing voltages laid together, incorporates the marginal cost of the extra cable and laying in a joint trench. Where more than two cables of the same voltage are laid together the replacement cost should be determined in accordance with this principle and clause A.7.

A.18 The cost of cables intended to operate at voltages other than 33kV, 22kV, 11kV, LV and submarine cables should be determined in accordance with clause A.7.

A.19 The standard replacement cost of all 33kV, 22kV and distribution cables should be based on unarmoured XLPE cables being the deemed MEA. The replacement cost of LV cables should be based on PVC or XLPE unarmoured construction.

Traffic Management

A.20 The standard replacement costs for overhead lines and cables include normal traffic management costs. However, where extensive traffic management provisions (e.g. the provision of dedicated staff to direct/control traffic) are required by the National Road Code, or where specifically required by territorial authorities, a fixed monetary "per kilometre" allowance may be added to the maximum allowable replacement cost after any allowable ~~mutipliers~~ multipliers have first been applied. The per km allowance is $800 per km of overhead line and $4,000 per km of underground cable trench.

Zone Substations

A.21 The replacement costs should be compiled in accordance with clause A.7 and should be presented in the categories set out in Table A.1 (for distribution ELBs) and Tables A.2 and A.3 (for Transpower).

A.22 The replacement cost of substation buildings should be included in the zone substation valuation, but the land value should be treated separately.

Distribution Substations

A.23 Distribution substations should be valued without distribution transformers, and the land value should also be treated separately. Standard replacement costs for overhead and underground distribution substations are given in Table A.1.

Distribution Transformers

A.24 Replacement costs for distribution transformers are given in Table A.1 (for distribution ELBs) for currently available distribution transformer sizes. Replacement costs for distribution transformers for Transpower are given in Table A.4. Where other sizes are in service, the cost of the next largest available size should be used for valuation purposes.

Streetlighting

A.25 Streetlights and field equipment for streetlight control are not to be included in the valuation. Where LV reticulation is not available, streetlighting mains owned by the ELB can be valued as a stand-alone 2-core cable.

System Control Facilities

A.26 All system control facilities associated with a system control centre should be valued together as a master station. The value of remote units should be incorporated in the value of the appropriate substation.

Communication Facilities

A.27 Terminal facilities should be valued as a master station. The value of remote units should be incorporated in the value of the appropriate substation.

Easements

A.28 The "existing works" provisions in the Electricity Act 1992 protect the ownership of lines (both distribution ELBs and Transpower) constructed or commenced prior to January 1993. They also provide for line owner access to the land the works are on, to inspect, maintain and operate them. Under previous legislation the Crown and ESAs had virtually unlimited rights of access to land to build works. Easements were not required. Easements are not explicitly required by the Electricity Act 1992, but are expected to be the normal means of registering rights.

A.29 Easement rights obtained and registered against a land title after 1 January 1993, (or in the case of Transpower, additionally between 1 January 1988 and 1 January 1993), may be valued at the purchase cost, provided that the sum paid has not already been expensed.

ELB Maximum Lives

A.30 Maximum total lives for standard ELB assets are given in Table A.1 (for distribution ELBs) and Tables A.2-A.8 (for Transpower). These lives are maxima and are not to be exceeded for the purpose of determining TLs of assets, except as provided for in A.33.

A.31 Total lives of assets not listed in Table A.1 (for distribution ELBs) and Tables A.2-A.8 (for Transpower) should be established on a comparable basis with those in the tables. Such lives should not exceed the total lives included in the tables for comparable assets. Assessment of the TL of such assets must include:

(i) examination of asset service records;

(ii) discussion with maintenance personnel; and

(iii) physical inspection.

A.32 TLs less than the maxima of Table A.1 (for distribution ELBs) and Tables A.2-A8 (for Transpower) should be assigned when the Valuer considers this appropriate. Circumstances when this could be appropriate include:

(i) assets in coastal environments;

(ii) assets subject to particularly high use or high fault levels or showing systematic premature retirement due to failure;

(iii) assets which have been poorly maintained.

TLs so assigned should, however, never be less than 50 percent of the relevant maximum given in the tables.

A.33 The TL of certain assets, as specified below, may be extended by the Valuer where specified conditions have been satisfactorily met. These are:

zone substation transformers	(clause A.40)
indoor MV or indoor 33kV switchgear	(clause A.41)
distribution transformers	(clause A.42)
transmission lines	(clause A.43).

A.34 In order to justify the extension of TLs as provided in A.33, the following information, as applicable, shall be documented for audit purposes:

(i) an age profile of the assets in the category concerned, showing the original population, survival population in each year and number of failures in each year, sufficient to demonstrate that the asset category concerned warrants on average the application of life extension; and/or

(ii) information on the standard or specification used in the purchase of the asset or that class of asset sufficient to demonstrate modern or special technology that would warrant the application of a longer life.

A.35 In addition the following documented information shall be available:

(i) a maintenance policy statement indicating the nature, scope and regularity of maintenance work carried out on the asset or class of asset since its installation, sufficient to support the claim for a longer life;

(ii) maintenance and test records of the asset (or, where the life extension relates to a class of asset, representative records for that class of asset) sufficient to demonstrate that the agreed maintenance policies have been applied over the life of the asset; and

(iii) where relevant (e.g. for transformers), information on the loading applied to the asset or class of asset over time, demonstrating circumstances that would warrant a life extension.

Refurbishment

A.36 Refurbishment is classed as work done on the asset (or set of assets) that results in a material extension of its service life beyond its normal TL. This is distinct from maintenance work, which is done to ensure that an asset is able to perform its designated function for its normal TL.

A.37 When an asset has been refurbished, the ELB should assign an RL, effective from the time of refurbishment, but this RL should not be greater than the maximum TL as specified in Table A.1 (for distribution ELBs) and Tables A.2-A8 (for Transpower). The ODV value of the asset after refurbishment shall be the new optimised replacement cost of an MEA with an equivalent engineering service ~~fee~~ potential, depreciated to reflect the assigned remaining life. Where an asset is assigned a new RL in accordance with the provisions of this clause, the ELB shall prepare an engineering report detailing the refurbishment work undertaken and the basis for determining the new remaining life. This engineering report should be retained for audit purposes.

Lives for Particular Asset Types

A.38 In the following sections, additional information is given in relation to the assessment of lives of certain types of asset.

Overhead Lines

A.39 Two different sets of life maxima are given in Table A.1 – one for concrete poles, and the other for wooden poles. This is notwithstanding the fact that a single set of maximum replacement costs has been given reflecting the MEA asset replacement type.

Zone Substation Transformers

A.40 The maximum TL of zone substation transformers is to be taken as 45 years, as shown in Table A.1. However, in accordance with clauses A.33-A.35, where sound maintenance programmes have been in place over the life of the asset, the TL for such transformers may be extended, but to not more than 60 years. Such an extension assumes a typical urban and commercial load curve and cyclic loading in accordance with IEC 354 and should cover most situations in New Zealand. For such extensions, the ELB should retain supporting information for audit purposes.

Indoor Distribution Switchgear

A.41 The maximum TL of indoor distribution switchgear is to be taken as 45 years, as shown in Table A.1. However, in accordance with clauses A.33-A.35, where indoor distribution switchgear is of modern, sealed design and specified to operate without maintenance for an extended number of operations, the TL may be extended, but to not more than 55 years. In such cases, the ELB should retain for audit purposes documentary evidence of the type of switchgear installed and the Standard (IEC) to which it has been constructed. The TLs in this clause are also applicable to indoor zone substation incoming (33kV) switchgear.

Distribution Transformers

A.42 The maximum TL of distribution transformers is to be taken as 45 years, as shown in Table A.1. However, in accordance with clauses A.33-A.35, distribution transformer lives may be extended, but to not more than 55 years, providing that general maintenance, including tank replacement during the life of the transformer, is expensed and not capitalised. The major factor in determining the ultimate life of the transformer is then the life of the core and windings. For the application of an extension to the TL, the ELB must have a documented maintenance policy and must retain, for audit purposes, documented maintenance records consistent with the requirements of clause A35.

Transmission Lines

A.43 The maximum TL of transmission lines is to be taken as 55 years, as shown in Table A.8. This is the TL allowed for transmission lines constructed in areas with normal environmental conditions. Transmission lines in coastal (hostile corrosive environment) is to be accorded an asset TL of only 35 years, and, in accordance with clauses A.33 and A.35, transmission lines lives may be extended, but to not more than 70 years, where those transmission lines are in lower than normal corrosive conditions (dry inland).

Distribution ELB Maximum Costs and Lives

A.44 The following table gives maximum replacement costs and lives that should be applied in valuing distribution ELB system fixed assets.

TABLE A.1: DISTRIBUTION ELB MAXIMUM ASSET VALUES AND LIVES

Asset Description	Unit	Notes	Maximum Value ($000) a	Maximum Life (Years)	
SUBTRANSMISSION					
				Pole Type	
				Concrete	**Wood**
33 kV Lines – Heavy (≥ 150 mm^2, ≤ 300 mm^2 Al)	Km	b	56	60	45
33 kV Lines – Light (< 150 mm^2 Al)	Km	b	40	60	45
33 kV Lines – DCct Heavy	Km	b	90	60	45
33 kV Lines – DCct Light	Km	b	70	60	45
				Cable Type	
				XLPE	**PILC**
33 kV - Cables (≤ 240 mm^2 Al)	Km	c	175	45	70
33 kV - Cables DCct (≤ 240 mm^2 Al)	Km	c	280	45	70
Pilot/Communications Ccts O/H	Km	b	**	45	
Pilot/Communications Ccts U/G	Km	c	**	45	
33 kV Isolation	No.	l, s	9	35	
33 kV Outdoor Circuit Breakers	No.	d, s	35	40	
33 kV Surge Arresters (3 phase set)	No.		8	35	
ZONE SUBSTATIONS					
Land	No.		-	-	
Site Development and Buildings	No.		**	50	
Transformers	No.	e	**	45	
33 kV Indoor Switchgear Cubicle	No.	d, m	40	45	
33 kV Bus Section/Coupler Indoor Switchgear	No.	d, m	45	45	
33 kV Outdoor Circuit Breakers	No.	d	35	40	
Incoming Outdoor Switchgear	No.	d, n	**	40	
Transformer Outdoor Switchgear	No.	d, n	**	40	
Feeder Outdoor Switchgear	No.	d, n	**	40	
Bus Section/Coupler Outdoor Switchgear	No.	d, n	**	40	
Incoming Circuit Protection & Controls	No.		**	40	
Transformer Protection and Controls	No.		**	40	
Feeder Protection and Controls	No.		**	40	
Bus Section/Coupler Protection and Controls	No.		**	40	
				Pole Type	
				Concrete	**Wood**
Outdoor Structure if not included above	Lot		**	60	45
SCADA and Communications Equipment	Lot.		**	15	
Ripple Injection Plant	Lot		**	20	
LV supplies (excluding local service transformer)	Lot		**	20	
DC supplies, batteries and inverters	Lot		**	20	
Other Items			**	40	

Asset Description	Unit	Notes	Maximum Value ($000) a	Maximum Life (Years)	
DISTRIBUTION LINES & CABLES				**Pole Type**	
				Concrete	**Wood**
Lines					
22 kV O/H Heavy (≥ 150 mm², ≤ 240 mm² Al)	km	b	32	60	45
22 kV O/H Medium (> 50 mm², < 150 mm² Al)	km	b	29	60	45
22 kV O/H Light (≤ 50 mm² Al)	km	b	27	60	45
22 kV single phase or SWER lines	km	b	23	60	45
22 kV O/H DCct Heavy	km	b	50	60	45
22 kV O/H DCct Medium	km	b	46	60	45
22 kV O/H DCct Light	km	b	42	60	45
22 kV O/H Underbuilt Heavy	km	b	17	60	45
22 kV O/H Underbuilt Medium	km	b	16	60	45
22 kV O/H Underbuilt Light	km	b	14	60	45
11 kV O/H Heavy (≥ 150 mm², ≤ 240 mm² Al)	km	b	30	60	45
11 kV O/H Medium (> 50 mm², < 150 mm² Al)	km	b	27	60	45
11 kV O/H Light (≤ 50 mm² Al)	km	b	25	60	45
11 kV single phase or SWER lines	km	b	21	60	45
11 kV O/H DCct Heavy	km	b	46	60	45
11 kV O/H DCct Medium	km	b	42	60	45
11 kV O/H DCct Light	km	b	38	60	45
11 kV O/H Underbuilt Heavy	km	b	15	60	45
11 kV O/H Underbuilt Medium	km	b	14	60	45
11 kV O/H Underbuilt Light	km	b	12	60	45
Cables				**Cable Type**	
				XLPE	**PILC**
22 kV U/G Heavy (> 240 mm², ≤ 300 mm² Al)	km	c	155	45	70
22 kV U/G Medium(> 50 mm², ≤ 240 mm² Al)	km	c	118	45	70
22 kV U/G Light (≤ 50 mm² Al)	km	c	94	45	70
22 kV U/G DCct Heavy	km	c	210	45	70
22 kV U/G DCct Medium	km	c	140	45	70
11 kV U/G Heavy (> 240 mm², ≤ 300 mm² Al)	km	c	125	45	70
11 kV U/G Medium(> 50 mm², ≤ 240 mm² Al)	km	c	97	45	70
11 kV U/G Light (≤ 50 mm² Al)	km	c	77	45	70
11 kV U/G DCct Heavy	km	c	170	45	70
11 kV U/G DCct Medium	km	c	135	45	70
DISTRIBUTION SWITCHGEAR					
22/11 kV Disconnector (Excl Pole)	No.	s	3.5	35	
22/11 kV Load Break Switch (Excl Pole)	No.	s	6.5	35	
22/11 kV Dropout Fuse 3 Ph (Excl Pole)	No.		2.5	35	
22/11 kV Sectionaliser (Excl Pole)	No.	s	18	40	
22/11 kV Recloser (Excl Pole)	No.	s	26	40	
22/11 kV Circuit Breaker	No.	s	30	40	
Voltage Regulator	No.		**	55	
Ring Main Unit - 3 Way	No.	s	16	40	
Extra Oil Switch	No.	s	6	40	
Extra Fuse Switch	No.	s	8	40	

DISTRIBUTION TRANSFORMER (kVA)				
22/0.4 and 11/0.4 kV Single/Two Phase Units				
Up to and including 15 kVA	No.	f, g	2.6	45
30	No.	f, g	3.3	45
50	No.	f, g	4	45
75	No.	f, g	5	45
100	No.	f, g	7	45
Three Phase Units (Pole Mounted - Bushing Terminations)				
22/0.4 kV				
Up to and including 30 kVA	No.	f, g	6	45
50	No.	f, g	8	45
100	No.	f, g	11	45
200	No.	f, g	14	45
300	No.	f, g	17	45
500	No.	f, g	20	45
11/0.4 kV				
Up to and including 30 kVA	No.	f, g	4	45
50	No.	f, g	6	45
100	No.	f, g	8	45
200	No.	f, g	12	45
300	No.	f, g	15	45
500	No.	f, g	18	45
Three Phase Units (Cable entry, one or both voltages)				
22/0.4 kV				
100	No.	f, g	11	45
200	No.	f, g	15	45
300	No.	f, g	18	45
500	No.	f, g	22	45
750	No.	f, g	26	45
1,000	No.	f, g	31	45
1,250	No.	f, g	40	45
1,500	No.	f, g	49	45
11/0.4 kV				
100	No.	f, g	9	45
200	No.	f, g	13	45
300	No.	f, g	16	45
500	No.	f, g	20	45
750	No.	f, g	23	45
1,000	No.	f, g	26	45
1,250	No.	f, g	34	45
1,500	No.	f, g	42	45
DISTRIBUTION SUBSTATIONS				
Pole Mounted (50 kVA or less)	No.	h, o,g	1	45
Pole Mounted (100 kVA or more)	No.	h, o,g	2	45
Ground Mounted (Covered)	No.	I,g	4	45
Kiosk (Masonry or block enclosure)	No.	I,g	9	45
On Customer's Premises with Feedout	No.		2	45

LV LINES					
				Pole Type	
				Concrete	**Wood**
Overhead Heavy - LV only (>150 mm^2)	km	j	45	60	45
Overhead Medium - LV only (≤ 150 mm^2)	km	j	42	60	45
Overhead Heavy Underbuilt (>150 mm^2)	km	j	24	60	45
Overhead Medium Underbuilt (≤ 150 mm^2)	km	j	21	60	45
				Cable Type	
				XLPE or PVC	**PILC**
Underground Heavy - LV Only (>240 mm^2)	km	J, k	72	45	70
Underground Medium - LV Only (≤ 240 mm^2)	km	J, k	63	45	70
Underground Heavy - with MV (>240 mm^2)	km	J, k	40	45	70
Underground Medium - with MV (≤ 240 mm^2)	km	J, k	32	45	70
Underground 2 core street lighting circuit	km	u	16	45	70
2 way Link Pillar	No.		2	45	
4 way Link Pillar	No.		4	45	
CUSTOMER SERVICE CONNECTIONS EXCLUDING METERS AND RELAYS					
LV overhead - 1 ph	No.	p	0.07	45	
LV overhead - 3 ph	No.	p	0.18	45	
LV underground - 1 ph	No.	q	0.5	45	
LV underground - 3 ph	No.	q	0.8	45	
OTHER SYSTEM FIXED ASSETS					
SCADA and Comms (Central Facilities)	Lot	r	**	15	

a All values are based on installed costs (excluding GST) for an MEA.

b Values relate to costs for rural construction.

c Values are based on costs of underground reticulation for suburban areas in average ground conditions.

d In accordance with clause A.41 (and the requirements of clause A.33), the lives for indoor distribution (or indoor 33kV) switchgear may be extended, but to no more than 55 years, if it is of modern, sealed design and specified to operate without maintenance for an extended number of operations.

e In accordance with clause A.40 (and the requirements of clause A.33), the lives of zone substation transformers may be extended, but to no more than 60 years, provided that evidence of a sound maintenance programme is presented to the Valuer.

f Values based on replacement costs are for currently available sizes. For intermediate sizes value at next size up. (Optimisation factor should take account of any resulting enhancement.)

g In accordance with clause A.42 (and the requirements of clause A.33), the lives of distribution transformers may be extended, but to no more than 55 years, provided that evidence of a sound historical maintenance programme over the life of the asset is presented to the Valuer. The associated distribution substation life may be extended in line with the transformer, subject to appropriate maintenance provisions.

h Excludes dropout fuses.

i Includes enclosure and LV frame. Use kiosk only where additional LV frames required.

j If detailed records of LV quantities are not available, the quantities used in the valuation should be based on an average length of LV for each size of transformer.

k Values are based on costs for suburban subdivisions.

l 33 kV Isolation equipment includes load break switches, air break switches and links/isolators.

m Standard 33 kV circuit breaker complete with one set of protection CTs, disconnectors and earth switches. Excludes protection.

n This includes disconnectors, earth switches, and buswork required to connect the equipment together. Excludes the circuit breaker costs.

o This cost includes the conductor from both the HV and LV lines to the transformer terminals, all HV and LV transformer and line connections, the fuse on the LV side of the transformer, transformer earthing and the transformer platform.

p Connection includes conductor from the LV line to the property boundary, connection from the line to the LV service and all pole top fuses and fuse holders.

q Connection includes cable from the LV line to the property boundary, connections from the line to the LV cable, a boundary service pillar, all pillar terminations, fuses and fuse holders. This also covers connection to underground cables.

r Any communications equipment required to communicate with remote control switches should be included with this item. This includes transmitters, repeaters and receiving stations.

s Any actuator or motor units required to enable a switch to be remotely operated shall have a maximum value at $3,000/unit. This value shall only be included if the switch can be operated remotely at the time of the valuation.

t The cost of all cable terminations 11 kV or greater have been included in the cost allowed for switchgear or transformer, as appropriate.

u Includes ~~10~~all terminations to streetlight poles.

** No maximum value assigned.

Transpower Maximum Costs And Lives

A.45 The following tables give maximum replacement costs and lives that should be applied in valuing Transpower's system fixed assets.

A.46 The maximum replacement costs included in the tables are subject to adjustment for seismic factors (for substations) and interest incurred during construction. The adjustment factors are shown in tables A.9 and A.10.

Substations by Standard Size

A.47 For valuing establishment and buildings, substations are split into facilities of four standard sizes - Major, Medium, Small and Rural.

Table A.2: Establishment Building Block Costs

Type	Description	Maximum Value ($000)	Maximum Life (years)
Major	accommodating on average 14x220kV, 19x110kV and 15x33kV or 15x11kV bays, roadways, etc	3,184.75	55
Medium	accommodating on average 8x220kV, or 8x110kV and 10x33kV or 10x11kV bays, roadways, etc.	1,203.07	55
Small	accommodating on average 6x110kV and 15x33kV or 15x11kV bays, roadways, etc	1,072.82	55
Rural	accommodating on average 2x66kV, 6x33kV or 6x11 bays, roadways, etc	973.34	55

Substations (Standard sizes) by Indoor/Outdoor

A.48 For costing buildings at substations, the four standard sizes are further broken down to differentiate between indoor or outdoor facilities.

Table A. 3: Buildings Building Block Costs

Type	Description summary	Maximum Value ($000)	Maximum Life (years)
Major OD	Facilities associated with outdoor switchyard with on average 14x220kV, 19x110kV and 15x33kV or 15x11kV bays, 155.5msq control room.	175.91	55
Major ID	Facilities associated with outdoor ~~switchyardr~~switchyard with on average 14x220kV, 19x110kV bays and indoor switchgear and control facilities with on average 15x33kV or 15x11kV bays with 155.5sqm control room and 201.6sqm switchgear room	365.81	55

Type	Description summary	Maximum Value ($000)	Maximum Life (years)
Medium OD	Facilities associated with outdoor switchyard with on average 8x220kV or 8x110kV and 10x33kV or 10x11kV bays, 103.7msq control room	143.30	55
Medium ID	Facilities associated with outdoor switchyard with on average 8x220kV or 8x110kV bays and indoor switchgear and control facilities with on average 10x33kV or 10x11kV bays with 103.7sqm control room and 159.6sqm switchgear room	143.30	55
Small OD	Facilities associated with outdoor switchyard with on average 6x110kV and 10x33kV or 10x11kV bays, 86.4msq control room	121.65	55
Small ID	Facilities associated with outdoor switchyard with on average 6x110kV bays and indoor switchgear and control facilities with on average 10x33kV or 10x11kV bays with 86.4sqm control room and 159.6sqm switchgear room	286.87	55
Rural OD	Facilities associated with a rural outdoor switchyard with on average 2x66kV and 6x33kV or 6x11kV bays, 69.1sqm control room	112.95	55
Rural ID	Facilities associated with outdoor switchyard with on average 2x66kV bays and indoor switchgear and control facilities with on average 6x33kV or 6x11kV bays with 69.1sqm control room and 109.2sqm switchgear room	244.86	55

Transformers

A.49 Replacement costs for a large number of power transformer options have been provided to cover the range of power transformer sizes and configurations used by Transpower. Generally, costs are provided for power transformers with On-load Tap Changers, except where identified.

Table A. 4: Power Transformer Building Block Costs

HV	LV	TV/ MVA	Vector	Phase	MVA 3ph	OLTC	Maximum Value ($000)	Maximum Life (years)
220	110	11/60	A	3	200	No	2,842.58	55
220	110		A	3	200	Yes	2,535.81	55
220	110	11/60	A	1	200	Yes	1,541.83	55
220	110		A	3	180	Yes	2,372.31	55
220	110	14.5/ 141.5	A	3	141.5	Yes	2,300.44	55
220	110		A	3	120	Yes	2,062.22	55
220	110	11/60	A	3	100	Yes	1,958.86	55
220	110		A	3	100	Yes	1,852.42	55
220	110	11/60	A	1	100	No	1,056.57	55
220	110		A	3	90	Yes	1,907.18	55

HV	LV	TV/ MVA	Vector	Phase	MVA 3ph	OLTC	Maximum Value ($000)	Maximum Life (years)
220	110	33/30	A	3	70	Yes	1,803.81	55
220	110	11/30	A	1	65	No	902.01	55
220	110	11/30	A	3	60	Yes	1,752.13	55
220	110	11/30	A	3	50	No	1,489.46	55
220	110	11/30	A	1	50	No	836.11	55
220	66	11/60	S-S	3	200	Yes	3,047.37	55
220	66	11/60	S-S	1	200	Yes	1,643.80	55
220	66	11/60	S-S	3	100	No	2,151.45	55
220	66	11/60	S-S	1	100	No	1,126.35	55
220	66	33/30	S-S	3	70	Yes	1,930.09	55
220	66	11/30	S-S	1	50	No	917.92	55
220	55		TR	1	18	Yes	820.79	55
220	55		TR	1	15	Yes	778.87	55
220	33		S-D	3	200	Yes	3,278.42	55
220	33		S-D	1	200	Yes	1,315.29	55
220	33		S-D	3	150	Yes	2,715.32	55
220	33		S-D	3	120	Yes	2,366.39	55
220	33		S-D	3	100	Yes	2,273.37	55
220	33		S-D	1	100	Yes	1,000.29	55
220	33		S-D	1	63	No	793.15	55
220	33		S-D	3	60	Yes	1,668.55	55
220	33		S-D	3	50	Yes	1,639.87	55
220	33		S-D	1	50	No	723.70	55
220	33		S-D	1	30	No	616.84	55
220	33		S-D	3	30	Yes	1,319.64	55
220	33		S-D	3	25	Yes	1,261.48	55
220	33		S-D	3	20	No	1,155.49	55
220	33		S-D	3	18	Yes	1,180.06	55
220	33		S-D	3	15	Yes	1,145.17	55
220	33		S-D	3	10	Yes	1,017.85	55
220	33		S-D	3	5	No	925.47	55
220	22		S-D	3	50	Yes	1,632.54	55
220	22		S-D	1	50	Yes	744.47	55
220	16	33/60	S-D	1	240	Yes	1,383.60	55
220	11		S-D	3	100	Yes	2,415.16	55
220	11		S-D	3	70	Yes	1,955.02	55
220	11		S-D	3	60	Yes	1,801.64	55
220	11		S-D	3	12	Yes	1,065.42	55
220	11		S-D	3	10	Yes	1,034.75	55
110	66		D-S	3	60	Yes	1,184.96	55
110	66		D-S	3	55	Yes	1,119.64	55
110	66	11/10	A	1	30	No	498.89	55
110	66	11/10	A	1	20	No	456.02	55
110	66	11/10	A	1	15	No	434.58	55
110	50		D-S	3	30	No	835.05	55
110	50		D-S	1	30	No	451.61	55
110	50		D-S	1	20	No	400.28	55
110	50		D-S	1	15	No	374.61	55
110	50		D-S	1	14.1	No	369.99	55

HV	LV	TV/ MVA	Vector	Phase	MVA 3ph	OLTC	Maximum Value ($000)	Maximum Life (years)
110	50		D-S	3	10	No	663.97	55
110	50		D-S	1	10	No	348.94	55
110	33		D-S	3	120	Yes	1,803.28	55
110	33		D-S	3	100	Yes	1,628.28	55
110	33		D-S	1	100	Yes	797.40	55
110	33		D-S	3	75	Yes	1,403.33	55
110	33		D-S	3	70	Yes	1,358.33	55
110	33		D-S	3	60	Yes	1,268.35	55
110	33		D-S	3	60	Yes	1,268.35	55
110	33		D-S	1	50	No	555.42	55
110	33		D-S	3	50	No	1,084.92	55
110	33		D-S	3	40	Yes	1,088.38	55
110	33		D-S	1	40	No	512.97	55
110	33		D-S	3	38	No	968.60	55
110	33		D-S	3	35	Yes	1,043.38	55
110	33		D-S	1	30	Yes	477.53	55
110	33	11/10	D-S	1	30	No	487.33	55
110	33		D-S	3	30	Yes	1,033.22	55
110	33	11/10	D-S	3	30	No	1,067.96	55
110	33		D-S	3	28	No	871.67	55
110	33		D-S	1	27.5	No	459.92	55
110	33		D-S	3	25	Yes	953.41	55
110	33		D-S	1	20	No	428.08	55
110	33		D-S	3	20	No	859.65	55
110	33		D-S	3	20	Yes	908.41	55
110	33		D-S	3	18	Yes	890.41	55
110	33		D-S	3	15	Yes	833.57	55
110	33		D-S	1	10	No	389.00	55
110	22		D-S	3	50	Yes	1,193.51	55
110	22		D-S	1	50	Yes	604.07	55
110	22		D-S	3	30	Yes	945.94	55
110	22		D-S	1	30	Yes	449.90	55
110	11		D-S	3	60	Yes	1,322.73	55
110	11		D-S	3	50	Yes	1,201.15	55
110	11	33/20	S-D	3	50	Yes	1,253.74	55
110	11		D-S	3	40	Yes	1,078.51	55
110	11		D-S	1	30	No	449.01	55
110	11		D-S	3	30	Yes	955.85	55
110	11		D-S	1	30	Yes	483.78	55
110	11		D-S	3	28	No	884.29	55
110	11		D-S	1	28	No	441.09	55
110	11		D-S	3	27	Yes	919.07	55
110	11		D-S	1	27	Yes	472.31	55
110	11		D-S	3	25	Yes	894.53	55
110	11		D-S	1	25	Yes	461.26	55
110	11		D-S	3	20	Yes	836.52	55
110	11		D-S	1	20	Yes	433.65	55
110	11		D-S	3	15	Yes	771.89	55
110	11		D-S	3	10	Yes	710.56	55

HV	LV	TV/ MVA	Vector	Phase	MVA 3ph	OLTC	Maximum Value ($000)	Maximum Life (years)
110	11		D-S	1	10	Yes	396.65	55
110	11		D-S	1	8	Yes	367.36	55
110	11		D-S	3	7.5	Yes	679.90	55
110	11		D-S	1	7.5	Yes	364.60	55
110	11		D-S	3	5	Yes	649.24	55
110	11		D-S	1	5	Yes	350.79	55
110	11		D-S	1	4.5	No	349.28	55
110	11		D-S	3	4	No	636.19	55
110	11		D-S	3	3	Yes	624.72	55
110	11		D-S	1	2.25	Yes	322.44	55
110	11		D-S	3	1	Yes	597.94	55
66	33		D-S	3	60	Yes	1,113.53	55
66	33		D-S	3	45	Yes	958.40	55
66	33		D-S	3	40	Yes	906.68	55
66	33		D-S	3	20	Yes	699.83	55
66	33		D-S	1	20	Yes	377.70	55
66	33		D-S	3	16	Yes	658.46	55
66	33	11/7.5	A	1	15	No	429.14	55
66	33		D-S	3	15	Yes	648.12	55
66	33		D-S	3	10	Yes	596.41	55
66	33		D-S	3	9	No	537.82	55
66	33		D-S	3	5	Yes	544.69	55
66	33		D-S	1	5	No	260.90	55
66	11		D-S	3	45	Yes	999.11	55
66	11		D-S	3	40	Yes	946.53	55
66	11		D-S	3	30	Yes	841.35	55
66	11		D-S	1	30	Yes	433.23	55
66	11		D-S	3	20	Yes	736.17	55
66	11		D-S	1	20	Yes	366.69	55
66	11		D-S	3	16.5	Yes	699.35	55
66	11		D-S	3	10	Yes	630.99	55
66	11		D-S	1	10	Yes	300.15	55
66	11		D-S	3	5	Yes	578.40	55
66	11		D-S	1	5	Yes	266.88	55
66	11		D-S	1	3.75	No	217.70	55
66	11		D-S	3	3	Yes	557.36	55
66	11		D-S	1	3	Yes	253.57	55
66	11		D-S	3	1	No	361.75	55
66	11		D-S	3	0.5	Yes	531.07	55
50	33		S-S	3	5	No	477.81	55
50	33		S-S	1	5	No	260.90	55
50	11		D-S	1	15	Yes	350.09	55
50	11		D-S	3	7.5	Yes	558.83	55
50	11		D-S	1	7.5	Yes	288.76	55
50	11		D-S	1	5	Yes	268.32	55
50	11		D-S	1	3	No	189.88	55
50	11		D-S	1	2.25	No	219.93	55
50	11		D-S	3	2	Yes	438.30	55
33	11		D-S	3	20	Yes	562.58	55

HV	LV	TV/ MVA	Vector	Phase	MVA 3ph	OLTC	Maximum Value ($000)	Maximum Life (years)
33	11		D-S	3	15	Yes	540.10	55
33	11		D-S	3	13	Yes	531.12	55
33	11		D-S	3	10	No	524.19	55
33	11		D-S	1	10	No	286.45	55
33	11		D-S	3	7.5	Yes	506.39	55
33	11		D-S	3	5	Yes	495.15	55
33	11		D-S	3	2.25	No	357.38	55
33	11		D-S	3	2	No	352.00	55
11	11		A	3	4.5	Yes	494.52	55

Oil Containment

Oil containment is costed based upon the capacity of the facility.

Table A. 5: Oil Containment Building Block Costs

Capacity (m^3)	Description	Maximum Value ($000)	Maximum Life (years)
10	Oil Containment System	68.78	45
15	Oil Containment System	75.24	45
18	Oil Containment System	76.83	45
25	Oil Containment System	80.52	45
30	Oil Containment System	83.16	45
35	Oil Containment System	85.79	45
40	Oil Containment System	88.43	45
45	Oil Containment System	91.07	45
50	Oil Containment System	93.60	45
55	Oil Containment System	96.34	45
60	Oil Containment System	98.98	45
65	Oil Containment System	101.62	45
70	Oil Containment System	104.26	45
75	Oil Containment System	106.90	45
80	Oil Containment System	109.53	45
85	Oil Containment System	112.17	45
90	Oil Containment System	118.46	45
115	Oil Containment System	128.00	45
160	Oil Containment System	149.02	45

Switchgear

Table A. 6: Switchgear Building Block Costs

kV	Description	CB qty	Bus Type	Out/ In	Maximum Value ($000)	Maximum Life (years)6
220	1.5 Line Breaker	1	SB	O	947.20	45
220	1.5 Half Breaker	1	-	O	763.64	45
220	1.5 Transformer Breaker	1	SB	O	631.59	45
220	Transmission Line - No Bus	1	-	O	754.35	45
220	Transmission Line - Single Bus	1	SB	O	835.37	45
220	Transmission Line - Double Bus	1	DB	O	985.22	45
220	Transmission Line - Triple Bus	1	TB	O	1,183.52	45
220	Connection Circuit - No Bus	1	-	O	361.78	45
220	Connection Circuit - Single Bus	1	SB	O	442.80	45
220	Connection Circuit - Double Bus	1	DB	O	592.65	45
220	Connection Circuit - Triple Bus	1	TB	O	790.95	45
220	Generator - No Bus	0	-	O	68.23	45
220	Generator - Single Bus	0	SB	O	149.24	45
220	Generator - Double Bus	0	DB	O	299.09	45
220	Generator - Triple Bus	0	TB	O	497.40	45
220	Bus Section	1	SB	O	418.20	45
220	Bus Coupler – Dual Bus	1	DB	O	980.02	45
220	Bus Coupler - Triple Bus	1	TB	O	1,057.88	45
110	Transmission Line - No Bus	1	-	O	403.29	45

6 Some components of switchgear, in particular infrastructure, currently has a life of 55 years

kV	Description	CB qty	Bus Type	Out/ In	Maximum Value ($000)	Maximum Life (years)6
110	Transmission Line - Single Bus	1	SB	O	476.75	45
110	Transmission Line - Double Bus	1	DB	O	668.04	45
110	Connection Circuit - No Bus	1	-	O	251.62	45
110	Connection Circuit - Single Bus	1	SB	O	325.08	45
110	Connection Circuit - Double Bus	1	DB	O	516.37	45
110	Incomer - No Bus	1	-	O	251.62	45
110	Incomer - Single Bus	1	SB	O	325.08	45
110	Incomer - Double Bus	1	DB	O	516.37	45
110	Generator - No Bus	0	-	O	50.55	45
110	Generator - Single Bus	0	SB	O	124.01	45
110	Generator - Double Bus	0	DB	O	315.31	45
110	Bus Section	1	SB	O	283.42	45
110	Bus Coupler	1	DB	O	836.95	45
110	Bus VT		-	-	46.11	45
66	Transmission Line - No Bus	1	-	O	389.79	45
66	Transmission Line - Single Bus	1	SB	O	454.11	45
66	Transmission Line - Double Bus	1	DB	O	630.83	45
66	Connection Circuit - No Bus	1	-	O	245.48	45
66	Connection Circuit - Single Bus	1	SB	O	309.80	45
66	Connection Circuit - Double Bus	1	DB	O	486.52	45
66	Incomer – No Bus	1	-	O	245.48	45
66	Incomer –	1	DB	O	309.80	45

kV	Description	CB qty	Bus Type	Out/ In	Maximum Value ($000)	Maximum Life (years)6
	Single Bus					
66	Incomer – Dual Bus	1	DB	O	486.52	45
66	Generator – No Bus	0	-	O	48.00	45
66	Generator – Single Bus	0	SB	O	112.32	45
66	Generator – Double Bus	0	DB	O	289.04	45
66	Bus Section	1	SB	O	275.89	45
66	Bus Coupler	1	DB	O	791.92	45
66	Bus VT		-	-	38.96	45
50	Transmission Line – No Bus	1	-	O	386.53	45
50	Transmission Line – Single Bus	1	SB	O	446.23	45
50	Connection Circuit - No Bus	1	-	O	244.78	45
50	Connection Circuit - Single Bus	1	SB	O	304.48	45
50	Incomer – No Bus	1	-	O	244.78	45
50	Incomer – Single Bus	1	SB	O	304.48	45
50	Bus Section	1	SB	O	275.13	45
50	Bus Coupler	1	DB	O	0.00	45
50	Bus VT		-	-	38.96	45
33	OD Feeder – No Bus	1	-	O	221.22	45
33	OD Feeder – Single Bus	1	SB	O	245.40	45
33	OD Feeder – Dual Bus	1	DB	O	283.55	45
33	OD Incomer – No Bus	1	-	O	202.74	45
33	OD Incomer – Single Bus	1	SB	O	223.62	45
33	OD Incomer – Dual Bus	1	DB	O	261.77	45
33	OD Bus Section	1	SB	O	194.96	45
33	OD Bus Coupler	1	DB	O	243.33	45
33	OD Bus VT		-	-	0.00	45
33	Recloser	1	ACR	O	45.21	45

11	OD Feeder - Single Bus	1	SB	O	81.44	45
11	OD Feeder - Dual Bus	1	DB	O	98.66	45
11	OD Incomer - Single Bus	1	SB	O	94.24	45
11	OD Incomer - Dual Bus	1	DB	O	110.51	45
11	OD Bus Section	1	SB	O	90.05	45
11	OD Bus Coupler	1	DB	O	102.54	45
11	Recloser	1	ACR	O	36.43	45
33	Circuit Breaker - Indoor Bus Coupler	1	DB	I	128.80	45
33	Circuit Breaker - Indoor Bus Section	1	SB	I	99.57	45
33	Circuit Breaker - Indoor Feeder	1	SB	I	86.77	45
33	Circuit Breaker - Indoor Feeder - Double Bus	1	DB	I	127.40	45
33	Circuit Breaker - Indoor Incomer	1	SB	I	92.77	45
33	Circuit Breaker - Indoor Incomer - Double Bus	1	DB	I	131.50	45
22	Circuit Breaker - Indoor Bus Coupler	1	DB	I	120.70	45
22	Circuit Breaker - Indoor Bus Section	1	SB	I	87.65	45
22	Circuit Breaker - Indoor Feeder	1	SB	I	83.25	45
22	Circuit Breaker - Indoor Feeder - Double Bus	1	DB	I	119.90	45
22	Circuit Breaker - Indoor Incomer	1	SB	I	84.45	45
22	Circuit Breaker - Indoor Incomer - Double Bus	1	DB	I	124.20	45

11	Circuit Breaker 500MVA - Indoor Bus Coupler	1	DB	I	107.77	45
11	Circuit Breaker 500MVA - Indoor Bus Section	1	SB	I	71.07	45
11	Circuit Breaker 500MVA - Indoor Feeder	1	SB	I	69.47	45
11	Circuit Breaker 500MVA - Indoor Feeder - Double Bus	1	DB	I	107.37	45
11	Circuit Breaker 500MVA - Indoor Incomer	1	SB	I	73.47	45
11	Circuit Breaker 500MVA - Indoor Incomer - Double Bus	1	DB	I	110.67	45
11	Circuit Breaker 750MVA - Indoor Bus Coupler	1	DB	I	232.96	45
11	Circuit Breaker 750MVA - Indoor Bus Section	1	SB	I	98.57	45
11	Circuit Breaker 750MVA - Indoor Feeder	1	SB	I	95.57	45
11	Circuit Breaker 750MVA - Indoor Feeder - Double Bus	1	DB	I	195.16	45
11	Circuit Breaker 750MVA - Indoor Incomer	1	SB	I	145.57	45
11	Circuit Breaker 750MVA - Indoor Incomer - Double Bus	1	DB	I	274.96	45

Reactive Power Plant

Table A. 7: Reactive Power Plant Building Block Costs

Description	Maximum Value ($000)	Maximum Life (years)7
110 kV Two Zone Bus Protection	130.51	15
220 kV Two Zone Bus Protection	130.51	15
66 kV Two Zone Bus Protection	130.51	15
Neutral Earthing Resistor 11kV 12.5 ohms 500A	66.00	45
Neutral Earthing Resistor 22kV 25 ohms 500A	71.00	45
Neutral Earthing Resistor 33kV 37.5 ohms 500A	76.00	45
Neutral Earthing Resistor 17.5kV 2 ohms 300A	66.00	45
Neutral Earthing Resistor 17.5kV 2 ohms 1500A	76.00	45
Neutral Earthing Resistor 17.5kV 2 ohms 3000A	86.00	45
Neutral Earthing Resistor 17.5kV 2 ohms 6400A	96.00	45

Transmission Line

Table A. 8: Transmission Line Building Block Costs

kV	Config	Rating	Conductor	Temp.	Maximum Value ($000)	Maximum Life (years)8
11	Scp	220	1/mink	50	36.64	55
33	Dcp	315	1/hyena	50	61.98	55
33	Dcp	360	1/coyote	50	66.21	55
33	Dcp	525	1/wolf	75	74.40	55
33	Scp	220	1/mink	50	37.29	55
33	Scp	315	1/hyena	50	41.09	55
33	Scp	360	1/coyote	50	43.21	55
33	Scp	410	1/hyena	75	41.03	55
33	Scp	525	1/wolf	75	47.36	55
50	Scp	220	1/mink	50	40.00	55
50	Scp	315	1/hyena	50	43.80	55
66	Dcst	315	1/hyena	50	112.14	55

7 Life of Neutral Earthing Resistors to be confirmed
8 Transmission lines are assigned lives according to environmental factors (see A.43).

kV	Config	Rating	Conductor	Temp.	Maximum Value ($000)	Maximum Life (years)8
66	Dcst	410	1/hyena	75	114.37	55
66	Dcst	525	1/wolf	75	137.48	55
66	Dcst	640	1/goat	50	170.65	55
66	Dcst	1960	2/zebra	75	318.88	55
66	Dcp	290	1/mink	75	65.92	55
66	Dcp	525	1/wolf	75	90.07	55
66	Dcp	640	1/goat	50	115.38	55
66	Scst	315	1/hyena	50	91.61	55
66	Scp	220	1/mink	50	40.84	55
66	Scp	315	1/hyena	50	44.64	55
66	Scp	360	1/coyote	50	46.77	55
66	Scp	410	1/hyena	75	44.28	55
110	dcst	315	1/hyena	50	123.14	55
110	dcst	360	1/coyote	50	128.81	55
110	dcst	410	1/hyena	75	125.92	55
110	dcst	525	1/wolf	75	141.18	55
110	dcst	640	1/goat	50	176.57	55
110	dcst	750	1/zebra	50	194.99	55
110	dcst	840	1/goat	75	180.55	55
110	dcst	980	1/zebra	75	195.41	55
110	dcst	1050	2/wolf	75	223.74	55
110	dcst	1280	2/goat	50	295.26	55
110	dcst	1500	2/zebra	50	321.20	55
110	dcst	1640	1/chukar	75	273.37	55
110	dcst	1680	2/goat	75	296.05	55
110	dcst	1960	2/zebra	75	324.84	55
110	Dcp	400	1/wolf	50	97.00	55
110	Dcp	525	1/wolf	75	100.14	55
110	Scst	315	1/hyena	50	91.57	55
110	Scst	360	1/coyote	50	96.61	55
110	Scst	410	1/hyena	75	92.98	55
110	Scst	525	1/wolf	75	104.48	55
110	Scst	640	1/goat	50	128.46	55
110	Scp	315	1/hyena	50	51.41	55
110	Scp	360	1/coyote	50	53.48	55
110	Scp	410	1/hyena	75	53.91	55
110	Scp	525	1/wolf	75	57.02	55
110	Scp	640	1/goat	50	66.05	55
220	dcst	750	1/zebra	50	210.54	55
220	dcst	980	1/zebra	75	212.97	55
220	dcst	1280	2/goat	50	319.92	55
220	dcst	1500	2/zebra	50	353.41	55
220	dcst	1640	1/chukar	75	307.03	55
220	dcst	1680	2/goat	75	324.31	55
220	dcst	1960	2/zebra	75	362.80	55
220	dcst	3280	2/chukar	75	538.91	55
220	Scst	640	1/goat	50	132.34	55
220	Scst	750	1/zebra	50	146.96	55

kV	Config	Rating	Conductor	Temp.	Maximum Value ($000)	Maximum Life (years)8
220	Scst	980	1/zebra	75	149.87	55
220	Scst	1280	2/goat	50	210.85	55

Table A. 9: Seismic adjustment factors (for substations)

Equipment Type	Zone A *(high risk)*	Zone B *(medium risk)*	Zone C *(low risk)*
Establishment	1.14	1.06	1.00
Buildings	1.02	1.01	1.00
Oil Containment	1.14	1.06	1.00
Transformers	1.04	1.02	1.00
Switchgear	1.02	1.01	1.00
Other Plant	1.02	1.01	1.00

Table A.10: Interest during construction factors

Asset Type	Factor (Annualised Rate)
Substation assets	4.0%
Transmission line assets	4.8%

APPENDIX B: OPTIMISATION FOR ELECTRICITY LINES BUSINESSES

Optimisation of Network Configuration

(a) Connection/Supply Points (including embedded generation connections)

Issue: Whether all existing points of supply are required, given the ELB's disclosed quality of supply criteria.

Approach: Location and supply voltage should be considered fixed. All points of supply must be tested to determine whether a lower value network would result if the point of supply were eliminated and the load supplied from adjacent points of supply. If possible, the point of supply should be optimised out and replaced with a notional lower value network.

(b) Transmission/Subtransmission/Primary Distribution Circuits

Issue: Whether the number of transmission/subtransmission lines exceeds the number required given the ELB's disclosed quality of supply criteria and allowed future load growth.

Approach: The route of the line should be considered fixed. Assess the number of transmission/subtransmission lines in relation to the ELB's disclosed quality of supply criteria and allowed future load growth. Optimise out those that are not required. Furthermore, assess whether the existing voltage is still required or the lines could be replaced with a lower voltage network. If possible the lines should be optimised out and replaced by a notional lower voltage network.

(c) Substations/Zone Substations/Primary Distribution Substations

Issue: Whether the number of and voltage of substations exceeds that which is required to meet the ELB's disclosed quality of supply criteria and allowed future load growth.

Approach: The location of all substations should be considered to be fixed. Each substation must be tested to determine whether a lower value network would result if the substation were eliminated or reduced in voltage. Optimise out assets not required and replace with a notional lower voltage network.

Issue: Whether substation configuration exceeds ELB's requirements.

Approach: Review the configuration of each substation, including the need for more than a single busbar. Where the ELB's quality of supply requirements can be met by a lower value configuration replace existing configuration with a lower value notional configuration.

Issue — Whether substation engineering exceeds ELB requirements.

Approach — Review the standard of engineering of each substation. If possible, recent projects undertaken by the ELB should be used as a benchmark for this test. If it is found that the standard of engineering exceeds the ELB's quality of supply requirements, the existing assets should be notionally reengineered and the replacement costs reduced accordingly.

(d) High Voltage Distribution Network

Issue: — Whether the configuration and engineering of the high voltage distribution network exceeds the standard required to meet the ELB's quality of supply criteria.

Approach: — Assuming that the routes of existing distribution lines are fixed, review the standard of engineering of all parts of the high voltage distribution network, using recent projects undertaken by the ELB as a benchmark for this test. If it is found that the standard of engineering exceeds the ELB's quality of supply requirements, the network should be notionally reconfigured so that it does not exceed the required standard. Assets that are not required should be optimised out.

Issue: — Use of very low capacity or less than three phase distribution lines.

Approach: — Where the existing distribution line or a part of it is of less than three phase construction, the line must be valued accordingly. Three phase distribution spur lines in rural areas shall be optimised to single phase two wire lines where there are no existing three phase customers and it is possible to meet the ELB's quality of supply criteria with a two phase arrangement.

Issue — Valuation of single wire earth return circuits

Approach — No standard costs are provided for single wire earth return circuits. These systems may be valued as if they were constructed using a light single phase two wire distribution circuit with the isolating transformer optimised out. ELB's may use non-standard replacement costs for single wire systems provided the total replacement cost of the system is less than the standard replacement cost of the equivalent two wire design.

Transpower

Security Guidelines for Transmission Planning				
Load (MW)	**Basic Securit y**	**Transmission Circuits**	**Busbars**	**Transformers**
Less than 10	n	One circuit	One bus or bus section	1 x 3-phase units.
(10 to 40, if more than 40km remote and local generation can limit load shed to 25%)	n	One circuit	One bus or bus section	4 x 1-phase or 1 x 3-phase unit, if backed up from alternative supply point.
From 10 to 300	n-1	Two circuits	Two busbars or bus sections	7 x 1-phase units or 2 x 3-phase units. Firms supply of peak demand using any short term overload capability.
More than 300	n-2	Three circuits on at least two routes	One redundant bus or bus section, such that supply is not lost after a single contingency while one bus is out of service for maintenance	7 x 1-phase units or 2 x 3 phase units. Firms supply of peak demand using any short term overload capacity
More than 600	Loss of station	Supply into region should be diversified across more than one major terminal substation.		

Optimisation of Network and Engineering

(a) Transmission/subtransmission/primary distribution lines and cables

Issue: Conductor and cable size.

Approach: Determine the required capacity, being the maximum demand and load cycle the line or cable will be exposed to during the planning period, given the disclosed quality of supply criteria and allowed future load growth.

Optimise down the size of the conductor or cable to the smallest standard size that meets the required capacity utilising the short term ratings of the conductors or cables and the disclosed quality of supply as appropriate.

Issue: Underground cable trenching

Approach: If more than one underground cable is laid in a trench only the cost of the additional cable(s) may be valued for those additional cables i.e. the trenching may only be valued for one cable.

(b) Substations/zone/primary distribution substations

Issue: Under-utilised equipment is often installed at substations.

Approach Optimise the size of the equipment used, including transformers, to nearest standard rating to not exceed the allowed future load growth.

Issue: Land and buildings.

Approach: Optimise indoor substations to outdoor where land is available and this will result in a lower replacement value network unless there are clear technical reasons or local authority requirements that prevent this.

Optimise out any unutilised, or under utilised land so that the value of the land allowed reflects only the area of land required to meet the ELB's disclosed quality of supply criteria and allowed future load growth.

Reduce the replacement cost of buildings to that of a simple standard modern structure using pre-fabricated or other low cost designs. A higher standard of construction is allowed only where the ELB can provide objective evidence to show that a low cost design will not meet local authority planning requirements. The size of the optimised design should not exceed that required to meet the essential functionality of the building.

Issue: Ancillary equipment.

Approach: Optimise out if not required to meet the ELB's disclosed quality of supply criteria.

Issue: Fire protection and oil retention facilities.

Approach: Include equipment currently installed unless not required for MEA.

Issue: Cable or circuit breaker or other equipment constraints.

Approach: Derate transformers to the lowest rating of any piece of equipment associated with the transformer.

(d) High Voltage Distribution

Issue: Conductor and cable size.

Approach: Examine thermal ratings, faults and current levels to determine ~~minimum~~ the standard conductor size for each feeder, given the disclosed quality of supply criteria and allowed future load during the allowed planning period. Optimise down where necessary.

Issue: Underground cable trenching

Approach: Optimise the trenching arrangement of existing underground cables. Cables running close together, or on the same side of any road or street must be optimised to a single trench except where this would not meet the ELB's quality of supply requirements. If more than one underground cable is laid in a trench only the cost of the additional cable(s) may be valued for those additional cables i.e. the trenching may only be valued for one cable.

Issue: Achievement of satisfactory customer voltage.

Approach: The optimisation of each feeder must include consideration as to whether the existing customer service standard (in particular the voltage) is being achieved in the most cost-effective manner. A more cost-effective network may result from reducing the conductor size and utilising other means such as voltage regulators, and reactive compensators to maintain the disclosed quality of supply criteria throughout the length of the feeder.

(e) Voltage Control Devices

Issues: Degree of control.
Manual and on load tap changes.
Line regulators and line drop compensation.

Reactive compensation.

Approach: Test requirements for all existing voltage control devices and optimise out where there is no clear justification for the equipment.

(f) Distribution Transformers (pole, kiosk, ground types)

Issue: Transformer rating.

Approach: Optimise out excess distribution transformer capacity so that the capacity utilisation (ratio of current peak load, converted to MVA at an assumed power factor of 0.95, to total distribution transformer capacity) for the network is not less than 30% unless a lower utilisation is provided for in a specific customer non-standard contract. Transformer capacity optimised out shall be valued at the average DRC per kVA of the ELB's transformer equipment. ELB's may apply this test globally to the network as a whole or to disaggregated parts of the network such as zone substations or individual feeders.

(g) Low Voltage Distribution

Issue: Underground Distribution Trenching

Approach: Optimise the trenching arrangement of existing underground cables. Cables running close together, or on the same side of any road or street must be optimised to a single trench except where this would not meet the ELB's quality of supply requirements. If more than one underground cable is laid in a trench only the cost of the additional cable(s) may be valued for those additional cables i.e. the trenching may only be valued for one cable.

Issue: Whether the configuration and engineering of the high voltage distribution network exceeds the standard required to meet the ELB's quality of supply criteria.

Approach: Review the standard of engineering of all parts of the low voltage distribution network, using recent projects undertaken by the ELB as a benchmark for this test. If it is found that the standard of engineering exceeds the ELB's quality of supply requirements, the network should be notionally reconfigured so that it does not exceed the required standard. Assets that are not required should be optimised out.

(h) System Control

Issue: Degree of sophistication of SCADA equipment.

Approach: Determine whether equipment is appropriate on the basis of disclosed quality of supply criteria. Reduce replacement cost to that of a modern equivalent asset of the required sophistication.

Issue: Need for load control system and degree of sophistication.

Approach: Determine whether equipment is appropriate on the basis of customer requirements and disclosed quality of supply criteria. If necessary, reduce replacement cost to that of a modern equivalent asset of the required sophistication.