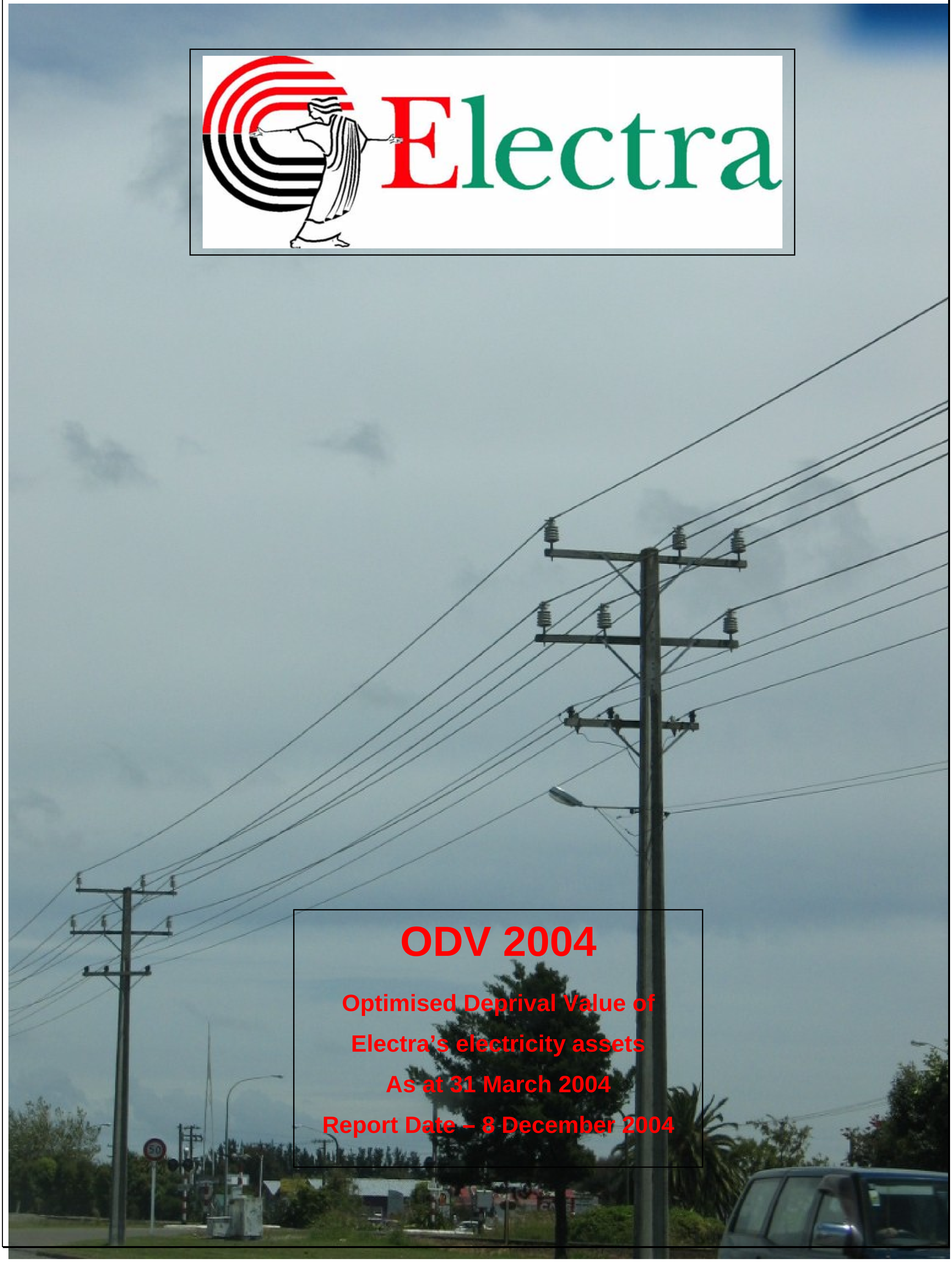
Electra



ODV 2004

Optimised Deprival Value of Electra's electricity assets

As at 31 March 2004

Report Date – 8 December 2004

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I: Background

Who is Electra?

Electra is the lines company that owns and manages the electricity assets within the Kapiti Coast and Horowhenua districts from Foxton/Tokomaru to Paekakariki. Electra supplies 40,297 connected consumers, with a maximum combined peak winter demand of 82MW in the year ending 31 March 2004.

Electra supplies few major industrial consumers; most commercial consumers are small to medium sized. Most consumers are residential - either rural or urban in the broad categories below.

- Traditional farming – including dairy and horticulture;
- Non-traditional horticulture;
- Rural residential;
- Rural lifestyle;
- Urban residential;
- Commercial;
- Industrial

Network Overview

Electra's network can be summarised as:

- Two closed 33kV rings – Kapiti and Horowhenua – connected through Otaki zone substation
- 10 zone substations – generally located at major population centres;
- 42 radial 11kV feeders from the zone substations;
- 2,327 distribution transformers with a total installed capacity of 282,753kVA – mainly small pole mounted units with 1,259 50kVA or smaller;
- Installed in a coastal marine environment

Electra, in designing its network, makes no distinction between industrial, commercial or residential consumers in the standards used for construction, maintenance or operation of the electricity assets. All consumers should have access to the same quality of service as others in the same locality.

What is an ODV?

An ODV is the optimised deprival value (ODV) of the electricity assets belonging to a lines company that is valued based on the "Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses" published by the Commerce Commission on 30 August 2004 (the ODV Handbook).

It is the lesser of the:

- Optimised Depreciated Replacement Cost of the electricity assets, and
- Economic Value assessment for the network.

The Commerce Commission's Information Disclosure Requirements requires a fully audited update of the ODV to be completed by all lines companies for the year ending 31 March 2004. Annual adjustments for additions and deletions are required as part of this disclosure regime which should follow the ODV methodology but are not required to be audited externally.

What is the ODV2004?

The ODV2004 is the valuation of all electricity assets connected and in-service at 31 March 2004.

This is the 3-yearly full audited update using a complete new cut of source information.

ODV2004 report

This report outlines the application of this ODV manual to the electricity assets of Electra. This is based on the ODV Handbook issued by the Commerce Commission in August 2004.

This report does not include details of the individual models that support this ODV summary table. A copy of this table is included in Appendix 4.

Assumptions

The assumptions underlying the ODV2004 are as below.

- All consumers connected to the electricity network require connection at the same capacity and location as they have at 31 March 2004.
- Assets are depreciated on a straight line basis.
- Location of GXPs and zone substations are fixed.
- For the purposes of this valuation, there are no assets where the valuation rules included in the Handbook are insufficiently prescriptive to require an alternative approach to be applied.

Included assets

The assets included are only those that either reticulate electricity or monitor the flow of electricity to consumers. These are generally in the categories below.

- Sub-transmission (33kV) circuits/networks;
- Zone substations;
- Distribution (11kV) circuits/network;
- Distribution transformers and switchgear;
- Reticulation (400V) circuits/network;
- Protection;
- Ripple signal generators
- Radio communications networks;
- Associated land;
- Network Emergency spares, and
- SCADA

Only those assets that are owned by Electra are included in this valuation. As such, all models do not report on the asset classes below.

- All 22kV assets,
- 11kV/400V transformers over 750kVA,
- 11kV SWER lines,
- Overhead 400V 2-wire circuits, including underbuilt,
- Kiosk (masonry or block enclosures),
- 11kV voltage regulators

Please note that, at the zone substations, the ODV Handbook defines outdoor switchgear as including the disconnectors, earth switches and bus work required to connect the equipment together, but excluding the circuit breaker (Table A1, note k). All of these assets, excluding the circuit breaker, are included in our site development and buildings.

Excluded assets

Electricity assets excluded from the ODV2004 are as outlined below.

- Network Information Management System (NIMS)
- Vehicles
- Test equipment

- Streetlighting circuits laid with 400V circuits as the 400V circuit is deemed to be able to supply the streetlighting as well.

Information source

The information necessary to complete this ODV2004 update is as outlined below.

- NIMS - geographic and associated electronic data tables
- NIMS - outage tables
- 33kV and 11kV schematics

- NIMBUS - financial data
- SCADA - for historical load
- Demand forecasts (prepared by Electra)
- Field surveys.

Where appropriate, the source of various data used in this ODV2004 review will be noted.

Who completed this ODV2004?

This ODV2004 report was completed by Electra, with assistance from its contractors Linework and UnitedGooder.

- ODRC: Electra
- Economic Value: Electra

This ODV2004 report was then audited by PricewaterhouseCoopers (economic and financial audit) and Gerry Pallo (engineering audit).

Electra

II: Optimised Depreciated Replacement Cost - issues

Optimised Depreciated Replacement Cost

The Optimised Depreciated Replacement Cost (ODRC) has several issues associated with the application of the ODV Handbook to the valuation of the network.

These are outlined in general below and in more detail in latter sections.

Optimisation

Optimisation, under the ODV Handbook, allows for the existing network to be used as the starting point in any valuation. However, a series of optimisation tests to determine that the most cost-efficient design that will provide the necessary security of supply are applied to that network to determine the optimised network. These optimisation questions revolve around those outlined below.

- Is the asset needed?
- If so, at what capacity?
- Why?

The application for this differs for different voltage classes and quality requirements.

Modern Equivalent assets

Modern equivalent assets are what would be used today if re-building the network. The ODV Handbook outlines reasonably specific rules for these; however, others may be used where there is a legal or similar requirement.

For example, in the Kapiti Coast, the local council requires all new reticulation to be underground regardless of where it is installed. Therefore, all underground cables laid in rural areas in the Kapiti Coast will be valued as the equivalent optimised underground circuits and not as overhead lines.

Costs

The ODV Handbook has a table of standard values. These are used to determine the replacement cost for the optimised assets.

These can be modified by several allowed multiplication factors that may affect the replacement cost of assets.

Multiplication factors

This Handbook also outlines several multipliers that can be used in valuation. The questions used in assessing whether multiplication factors are to be used are as below.

- Is the area CBD, urban, rural or remote rural?
- Is it rock or similar hard going?
- Is traffic management required?
- Are there any known site specifics that would indicate a "special" rate is required? For example, swampy ground in Kopuatora (north of Levin) or along the Foxton-Shannon Highway?

Ages

The ageing of the network is needed to determine the ODRC.

III: Information Systems

Background

The ODV2004 is based on six sources of information.

- NIMS reports on asset types, ages and locations;
- SCADA historical load data;
- Meteorological and geological records;
- Fault histories
- Local, regional and national government requirements and
- Staff and contractor memories.

The last are included only where there is either no or little information available from the other sources. Where this is used, it is outlined as appropriate in this report.

NIMS system

NIMS, the asset information and network maintenance database, is based on the ESRI ARC FM system.

This is the second of the GIS systems, installed in December 2001, used by Electra. Although the data set was that used in the original GIS system (Intergraph Framme) and in the ODV2001, Electra has also completed further data quality checks as part of the replacement of the GIS system

Electra maintains operational flexibility and currency of its NIMS system through incremental upgrades of hardware and software versions as required and released.

Electra continues to improve the quality of the data stored in NIMS through site checks and completion of as-built drawings.

A key plank in an ODRC is quality relevant data. Electra captures information on the physical location and condition of all electricity assets as below.

- Connections to the national grid at Mangahao and Paraparaumu;
- Sub-transmission (33kV) circuits/networks;
- Zone substations;
- Distribution (11kV) circuits/network;
- Distribution transformers and switchgear;
- Reticulation (400V) circuits/network;
- Radio communications networks; and
- SCADA and Network Information Management Systems (NIMS)

Further data, electronically and hard copy, is gathered from regional and national bodies with regards to population profiles, weather patterns, flood plains and similar to ensure that assets are correctly designed, sited and relatively easy to maintain.

All new asset information – physical location and asset details – are provided by the relevant contractor as part of the works pre-payment requirements. This information is up-loaded into ARC-FM electronically, and Olympic (finance) database manually, by Electra staff. (This will be changing in 2004/05 with the introduction of versioning in ESRI ArcFM. This is being trialled at present.)

Condition based information – including photographs where appropriate – are provided by the relevant contractor as part of the works pre-payment requirements. These are also up-loaded into ARC-FM by Electra. Electra audits this information as part of the general contract audit of physical work and general auditing of the network assets.

SCADA

SCADA is the central hub of information gathering and control of the network and has been based on its most recent LogicaCMG platform since 1999. Minor upgrades to software and hardware are completed as required.

LogicaCMG, Electra's SCADA support, undertakes routine inspections of the SCADA database remotely, as part of the SCADA support agreement.

Each month, Electra extracts ½ hourly load data from SCADA for each 11kV feeder. This data is used as the factual basis for the demand forecasts in the annual review of the AMP. Electra's has records for each substation from January 1996 to March 2004, except for Waikanae and Paraparaumu West. These substations were built after January 1996 and data is held from 1998 and 2003 respectively.

Fault histories Electra maintains an outages database on the NIMS database. This allows data on outages to be reviewed as required.

Consumer Numbers Electra's ODV includes all network connections as consumer numbers. As at 31 March 2004, Electra had 40,297 connections to its 400V network in NIMS.

At any one time, a number of these connections will not be "live" due to either temporary vacancy or disconnection for debt. As at 31 March 2004, Electra had 39,500 live connections according to MARIA – the national reconciliation database.

Permanent physical disconnections are made in NIMS and are not, therefore, included in the connection count. All connections are valued as they may be energised at any time.

Estimated Quantities Some data is estimated for this ODV2004. This is generally because the information has not been required in the past and has not been captured separately.

Asset quantities that have been estimated in the ODV models are:

- 3 phase and 1 phase connections: Estimates are based on load and connection requirements in rural and urban areas. Generally, most consumers in rural areas are assumed three phase and in urban areas are assumed single phase. This is the same basis as used in ODV2001. Please note that the total number of overhead and underground connections is not estimated.
- Shared and own fuse pillars for underground connections: Estimates are based on the separation between rural lots in most standard rural subdivisions, but makes some allowance for smaller lots in subdivisions (such as rural residential around Nikau Valley). ¾ of pillars are estimated as being for single consumers in these rural areas. In urban areas, the converse is true and most fuse pillars are joint. However, some of the smaller pillars and subdivisions indicate that there are around ¼ of the fuse pillars that are for single consumers. Please note that the total number of fuse pillars is not estimated.
- The age of the streetlighting underground cables is the average age of the underground circuits connected to the zone substation.
- The GIS model does not differentiate the section of a consumer service that crosses public road and is the responsibility of Electra. As in the ODV2001, a multiplication factor has been added to the urban 400V circuits of 1.4 to account for these assets. This is applied through an LV overhead cost multiplier in the tables.

IV: Urban Rural split

Background

The ODV Handbook outline, in Table A1, the maximum costs and assets lives to be used in the calculation of the ODRC for the electricity assets.

The ODV Handbook acknowledges that various situations where these costs would be different from those stated in Table A1. The ODV Handbook outlines a range of multiplication factors that are available.

This section outlines the derivation of the urban/rural split for the 33kV and 11kV circuits for the application of multiplication factors for the Electra electricity assets.

Source of data

The urban/rural split was based on the planning maps provided by Kapiti Coast District Council and Horowhenua District Council as part of their respective district plans. These plans are available in the public domain.

These plans were overlain on our network maps to produce the split, if any.

11kV feeder rural areas

The table below illustrates the boundary of the rural areas on each 11kV feeder.

Please note that "south" is electrically below the plant item referenced and away from the relevant zone substation. Electrically "north" is closer to the relevant zone substation than the referenced plant item.

Please note that these boundaries indicate that all spurs electrically south of the referenced plant item, unless specifically noted otherwise, are included within the rural areas.

11kV feeder rural area

11kV feeder	Rural area boundary points
A2	(Shannon) A121, A37, A232, A127, A203
A3	(Shannon) A156, A35, and spur to A91 et al
A4	(Tokomaru) A147, A83, A202
C97	(Foxton south) C10, C156, C29, C172, C259
C98	(Foxton, Foxton Beach) C29, C24, C119, C93 and south C222
C100	(Foxton north) C77, C156, C30, C250
E148	All rural
E150	(Waitarere Beach) south of F26
E151	(Levin) E145, D123
E153	(Levin) E128, H38, H203, H198
E156	(Levin) E172, E89, H13
G306	(Levin) All urban
G308	(Levin) H238, H58, H203, H135
G310	(Levin) All urban
G311	(Levin) All urban
G313	All rural
L348	(Otaki, Otaki Beach) M138 south
L349	(Otaki, Waikawa Beach) L206, L43, L56, L267, L85, M184 south
L350	(Otaki, Otaki Beach) M126, M174, M124, M135, M171
L351	(Otaki) L267, L248
L352	All rural, except Q31 south (Te Horo Beach)
622	(Waikanae) T176 south
632	(Waikanae, Pekapeka), S242, Q38
652	(Waikanae) S191south
662	(Waikanae) S150 south
672	(Waikanae, Waikanae Beach) All urban
V101	(Paraparaumu) All urban
V103	(Paraparaumu) All urban
V104	(Paraparaumu) Y75 south
V106	(Paraparaumu) All urban
V107	(Paraparaumu) All urban
V109	(Paraparaumu) V62, W12, W381
Z209	(Raumati) All urban
Z210	(Raumati) All urban
Z211	(Raumati South) Z291, Z203, Z11
Z165	(Paekakariki) All urban

Z166	(Paekakariki) All urban
Z167	All rural
402	All urban
403	All urban
404	All urban

33kV urban/rural split (overhead circuits)

Most 33kV overhead circuits may be considered as rural, often through swamps, over rugged terrain or with difficult or restricted access.

The exceptions are as outlined below.

- Levin West to Levin East – all contained within the urban area of Levin.
- Paraparaumu GXP to Paraparaumu – all contained within the suburban area of Valley Road/Ruapehu Street area of Paraparaumu.
- Paraparaumu to Raumati – generally contained within the urban area of Paraparaumu and Raumati.
- Small sections (often less than 1 kilometre) to the various substations.

V: Base Costs

Background

The ODV Handbook outline, in Table A1, the maximum costs and assets lives to be used in the calculation of the ODRC for the electricity assets.

The ODV Handbook acknowledges that various situations where these costs would be different from those stated in Table A1. The ODV Handbook outlines a range of multiplication factors that are available.

This section outlines the application of these cost tables and multiplication factors for the Electra electricity assets.

33kV substation equipment costs derivation

Electra has derived these costs as below.

- All costs include installation – which are generally based on that used for the new Paraparaumu West substation and the Foxton substation upgrade projects.
- All zone transformers were derived from the last 11.5/23MVA transformer purchased in 2003 for Foxton, and includes the cost of installation. The replacement of these transformers was a package provided by United Gooder and is inclusive of labour .
- All 33kV switchgear costs were taken from the ODV Handbook. (Please note that these Handbook costs are considerably lower than actual costs for recent switchgear purchases.)
- All 11kV switchgear costs were taken from the ODV Handbook.
- Tap changer controllers are eBerle, with the Transformer differential protection provided by the SEL531 range of relays. (These are Electra's standard equipment and provide efficient control of zone transformers, particularly in minimisation of circulating currents when transformers are operated in parallel.) Costs include the cost of installation and is based on the equipment purchased in 2002 and 2003 for Foxton.

- All protection costs were sourced from SEL and includes earth fault, overcurrent, auto-reclosing and fault data functions.
- Communication and SCADA equipment were derived from the last installation and reviewed by Facilities Management (our communications provider) and Linework. Please note that communication around each substation is via a SEL2020 hub.
- Building and structures includes all site works (including site establishment and project management) as well as earth mats, oil containment, 400V AC and DC wiring, local service transformer (or alternative), protection cables, transformer pads, seismic bracing, smoke alarm systems, neutral CTs (as required), VTs (outdoor 33kV switch yards), security fences, buildings, driveways (as necessary) and commissioning. The replacement cost for these has been assessed by United Gooder based on three prototypes – Paraparaumu West, Levin East and Foxton.
- All radio communication hubs were derived from the equipment installed in 2003 at Moutere by Alstom (now Facilities Management).
- Lives of indoor switchgear – using vacuum or SF6 – are set to 55 years (refer clause A.42). This will affect Levin West (feeders only), Otaki, Waikanae, Paraparaumu West, Levin East and Raumati.

33kV cable costs

Electra has derived these costs from the standard costs outlined in Table A1. The maximum capacity in Table A1 for underground circuits is 240mm^2 – which has a 325A capacity. This is insufficient for the underground circuits both for capacity required and fault duty rating. As such, a multiplication factor of 1.7 was added to the standard cost of the 33kV circuits. This multiplication factor was based on the use of two 240mm^2 circuits being used for each of Electra's single 33kV circuit with a reduction in cost allowing for the joint trenching that would be used with two such cables.

Traffic management at the ODV Handbook rate is calculated on individual segments of lines and cables and is apportioned on a pro-rata basis. The routes taken are generally along either State Highway 1 or through heavily trafficked local roads where significant amount of traffic management would be required by the local District Council.

No traffic management is included for those 33kV cables installed within the substation compound.

Non-Specified costs derivation

The ODV Handbook has not provided cost derivations for all assets – particularly at the zone substation level.

The non-specified costs below were used in the ODRC valuation.

Item	Description	$ value
Zone transformers	11.5/23	$461,523
	5/10	$329,023
Zone transformer protection	SEL 531 EBerle tap changer controller	$70,000
33kV circuit protection	SEL351 MEA	$17,500
11kV circuit protection	SEL351 MEA	$17,500
SCADA and radio	at zone substation – includes RTU and programming	$128,987
Building and Structures	Incl security fences, oil containment, bus structures, buildings, transformer pads, etc	Based on one of: Levin East (Paraparaumu, Levin East, Levin West) Paraparaumu West (Otaki, Waikanae, Paraparaumu West) Foxton (Foxton, Shannon, Paekakariki, Raumati)
Land		District Valuation roll
Fibre Optic	No traffic management	$63,180 per kilometre

	included	
33kV auto-recloser	Includes installation and is based on a Nulec N36 (as used on network)	$35,000

Residual Value

Electra has assets that are beyond the maximum life as determined by the ODV Handbook. These assets still have an economic value to Electra and should be valued at their residual value.

The residual value is set such that all assets have a minimum of 3 years remaining life as allowed by the ODV Handbook (clause 2.55)..

Other Unit prices

The table below outlines the base unit prices used in Electra's ODV2004 valuation of 11kV where a combination of assets is required. This table only includes assets used by Electra.

Where necessary, these values will be increased by the approved multiplication factors outlined below.

Item	Components Included ($ 000)	Replacement Cost ($ 000)
Up to 15kVA Single Phase Pole Transformer	*Transformer 2.6 *Mounting 1.0	3.6
30kVA Single Phase Pole Transformer	*Transformer 3.3 *Mounting 1.0	4.3
Up to and including 30kVA Three Phase Pole Transformer	*Transformer 5.0 Mounting 1.0	6.0
50kVA Three Phase Pole Transformer	*Transformer 7.0 *Mounting 1.0 *	8.0
100kVA Three Phase Pole Transformer	*Transformer 9.0 *Mounting 2.0 *	11.0
200kVA Three Phase Pole Transformer	*Transformer 13.0 *Mounting 2.0	15.0
300kVA Three Phase Pole Transformer	*Transformer 16.0 *Mounting 2.0	18.0
100kVA Three Phase Ground Transformer	*Transformer 9.0 *Cover 4.0	13.0
200kVA Three Phase Ground Transformer	*Transformer 14.0 *Cover 4.0	18.0
300kVA Three Phase Ground Transformer	*Transformer 16.0 *Cover 4.0	20.0
500kVA Three Phase Ground Transformer	*Transformer 22.0 *Cover 4.0	26.0
750kVA Three Phase Ground Transformer (located in customer premises)	*Transformer 26.0 *Cover 4.0	30.0

3 phase 11kV Disconnector (ABS)	3.5
3 phase 11kV Load Break Switch	6.5
11kV 3 phase DO fuse	2.5
11kV recloser	27.0
3 way RMU	16.0
Extra oil switch	6.0
Extra Fuse Switch	8.0

VI: Multiplication Factors

Background

The ODV Handbook allows a range of multiplication factors to be included to recognise the varying terrain and other constraints that exist in reality.

This section outlines the application of these multiplication factors for the Electra electricity assets.

Multiple multiplication factors

Where an asset is subject to many multiplication factors, these factors are summed.

However, multiplication factors are not applied to any plant or equipment such as a transformer, disconnector or DO fuse. This is because, although the routes that the overhead and underground circuits take may be rugged or be difficult to access, plant is installed so that access can generally be relatively easy to obtain.

Multiplication factors – 33kV overhead

Urban areas

Multiplication factors allowed are 1.5 to 1.8 times Table A1 costs.

Electra has adopted 1.7 for the urban areas multiplication factors for 33kV circuits. This is for the reasons below.

- Urban areas are generally flat with wide streets;
- Span lengths are shorter, typically around 40 metres, because of an increased use of joint poles with 400V and 11kV lines with associated pole mounted equipment such as transformers;
- Increased strength of construction due to urban environment.

Rugged terrain

Multiplication factors allowed are 1.2 to 1.3 times Table A1 costs and are used where normal line operating vehicles and plant cannot be used and where it is necessary to use helicopters, tracked vehicles or other special plant.

Electra has adopted two "rugged terrain" multipliers. The first of these is specific to two sections of 33kV circuits. These are the 13.5 kilometres of the Mangahao – Levin East and 1.4 kilometres of the Raumati T – Paekakariki section. These sections are in areas that are not easily accessible for routine line vehicles. The routes are also very difficult and very expensive to maintain clear of gorse and other scrub.

Electra has adopted 1.3 for the multiplication factor for these 33kV circuits.

The other "rugged terrain" multiplier relates to the remainder of Electra's 33kV "rural" circuits.

In general, Electra's 33kV overhead circuits are installed cross country that lends some difficulty to access and construct the overhead circuits for a variety of reasons, including land use, winter boggy land, fence installation and similar. These circuits are defined as being more than 10 metres from the constructed road, but not built using 2-pole structures or similar.

For these circuits, Electra has adopted a terrain multiplier of 1.2 to reflect the additional labour, plant and equipment used to access as well as construct these overhead lines. These are referred to as "difficult access" to distinguish them from the other "rugged terrain" areas.

Multiple factors

Generally, for 33kV overhead circuits, no circuit will have multiple multiplication factors applied in this ODV. This comment does not apply to the addition of traffic management.

Traffic Management

Transit New Zealand has a Code of Practice requirement for Traffic Management. This code outlines various classes of road – Low Volume, Level 1 (500-10,000 vpd), Level 2 (>10,000vpd) and Level 3 (High Volume, multi-lane roads and motorways). Transit New Zealand sets the road level for state highways and local and regional councils set the various road levels for regional highways and local roads.

Transit New Zealand have defined that there are no Level 3 roads in Electra's area.

Transit New Zealand (Palmerston North office) has defined State Highway 1 through Electra's area as Level 2 from Paekakariki to Levin (15,000 vpd). State Highway 1 is classified as level 1 from Levin north to Foxton (9,000 vpd).

Transit New Zealand (Palmerston North office) has defined State Highway 57 (from Levin to Palmerston North through Shannon) as level 1.

KCDC have classified all main urban roads as Level 1, except Kapiti Road and State Highway 1 which are classified as Level 2. (Examples are, Rimu Road, Golf Road, Matai Road, Raumati Road, Valley Road and Mazengarb Road.)

HDC, except for State Highway 1, have classified all main urban roads as Level 1. (Examples are Hokio Beach Road, Foxton-Shannon Road, and Tararua Road.)

Where Electra has been able to construct its 33kV overhead circuits adjacent to the road, Electra has applied the appropriate traffic management allowance. This will not be applied in conjunction with either the "rugged" or "difficult access" multipliers.

This additional sum is accounted for separately within the 33kV circuits model but is included within the 33kV circuits in the overall ODRC summary table.

Non-standard cost multiplier– swampy ground -33kV overhead

Although not specifically stated in the handbook, Electra has several areas of "swamp" that masquerades as ground for supporting pole lines.

These areas, such as along the Foxton-Shannon Road, are renown for sound poles moving or completely falling over. Generally, these poles are re-stood by:

- installing culverts to the rear if near a drain;
- using 4 cubic metres of gravel to provide increased support for the pole;
- using additional ground and aerial stays; or
- all of the above.

This is also how new lines are built in these areas with project costs generally at 30% above the cost of installing a standard pole line. The non-standard cost has been derived from the "rugged ground" multiplier factors and will be applied at 1.3. This will be applied **ONLY** where swampy ground is known from experience. For 33kV overhead circuits, this will apply only to the 33kV circuits between Foxton and Shannon along the Foxton-Shannon Road.

Table: Multiplication factors and non-standard costs – 33kV overhead

The table below illustrates the multiplication factors to be used for 33kV overhead circuits. (Note: model uses "rugged" for rugged and swamp as the multiplication factor is the same. Difficult access is accounted for separately.)

Circuit	Multiplication factor and non-standard costs	% of circuit	Total to be applied
MHO - SHN #1	Urban, Rural, Traffic Management	50% 50% 50% (level 1)	1 for rural 1.7 for urban $800/km for TM
MHO-LVE1	Rugged, Urban, Traffic Management	75% rugged 25% urban 25% traffic management (level 1)	1.3 for rugged 1.7 for urban $800/km for TM
LVE-OTK	Urban, Difficult access	7% urban 93% access	1.7 urban 1.2 access
LVW-SHN	Difficult access	100%	1.2 access
SHN-FXT	Swamp, Difficult access	70% 30%	1.3 swamp 1.2 access
FXT-LVW	Urban Difficult access Traffic Management	10% 90% 10% (level 1)	1.7 urban 1.2 access $800/km
LVW-LVE	Urban, Traffic Management	100% (Level 1)	1.7 urban $800/km
VLR-WKN1	Ürban Rural Traffic Management	50% urban 50% rural 100% (50% Level 2, 50% level 1)	1.7 urban $800/km (Level 1) $1,500/km (Level 2)
VLR-PAK (from Tee to Raumati)	Rugged Urban Traffic Management	40% 60% 60% (Level 1)	1.3 for rugged 1.7 for urban $800/km for TM
OTK-WKN	Difficult access	100%	1.3 access
VLR-PAK (to Raumati/PAE Tee	Urban Difficult access Traffic Management	50% 50% 50% (Level 1)	1.7 urban 1.2 access $800/km
VLR-PRM	Urban Traffic Management	100% 100% (Level 1)	1.7 urban $800/km
VLR-PAK (from Tee to PAE)	Rugged Urban	55% 45%	1.2 for rugged 1.7 for urban

	Traffic Management	35% (Level 2 SH1)	$1,500/km for TM

Multiplication factors and non-standard costs – 33kV underground

Non-standard cost: 33kV cables:

Electra's 33kV underground cables are set at a minimum of 630mm^2, 1 core, aluminium conductor, XLPE insulation. This cable has a minimum rating of 600A at 33kV.

The ODV handbook sets the standard 33kV cable as a 240 mm^2, 1 core, aluminium conductor, XLPE insulation. This cable has a rating of 250A at 33kV.

Electra has adopted 1.7 for the multiplication factors for 33kV underground circuits. This is for the reasons below.

- Local ground conditions – including swamps, sand and rock, requiring additional shoring or excavation techniques.
- Local road reconstruction requirements (including state highway and major regional roads)
- The cables used are 2.5x the size noted in Table A1 of the ODV Handbook. This capacity is required to effectively meet the load requirements on the 33kV closed ring circuits in the Kapiti Coast.
- Allowance is made for joint trenching in the "equivalent" cable assessment.

These apply to all 33kV underground circuits.

Traffic Management

Electra has only installed underground cables outside of zone substations in the Kapiti Coast. These circuits are laid in as direct routes as possible to minimise expenditure as far as possible. In most cases, these circuits do traverse State Highway 1 and major roads requiring additional traffic management for at least part of their length.

As outlined above, these circuits are classed as Level 2 (Transit and KCDC) and Level 1 (KCDC). Electra has applied the appropriate traffic management allowance as outlined in the section below.

This additional sum is accounted for separately within the 33kV circuits model.

Table: Multiplication factors and non-standard costs – 33kV underground

The table below illustrates the multiplication factors to be used for 33kV underground circuits.

Circuit	Multiplication factor	% of circuit	Total to be applied
PRM-RMT (*)	Urban Traffic Management	100% 30% (Level 1)	1.7 $6,000/km
VLR - RMT	Urban Traffic Management	100% 100% (Level 1)	1.7 $6,000/km
VLR - PRW	Urban Traffic Management	100% 100% Level 1	1.7 TM $6,000/km
VLR – WKN1	Urban Traffic Management	100% 100%	1.7 TM $6,000/km (DCCT urban)
VLR - WKN2	Urban (DCCT) State Highway 1 Cross country Traffic Management	10% 20% 70% 30% (Level 2 and Level 1)	1.7 TM $40,000/km SH1 TM $6,000/km (DCCT urban)
PRM-PRW	Urban Traffic Management	100% (Level 1)	1.7 $6,000/km

*: Although PMR-RMT is noted as urban, it is installed in part along the railway corridor that has similar reinstatement costs to urban roads. Traffic management is only applied to the section along Raumati and

Matai Roads.

**: VLR – WKN 2 is, in part, constructed along the carriage way of State Highway 1 and then in parallel with the underground portion of VLR-WKN1 through Waikanae. Traffic management at the appropriate rate is applied only to these sections. Construction cost of the section through Nikau Valley was similar (according to contract staff who installed it due to being mainly swamp or through DOC land).

Multiplication factors– 11kV overhead lines

Urban areas

Multiplication factors allowed are 1.5 to 1.8 times Table A1 costs.

Electra has adopted 1.5 to 1.7 for the urban areas multiplication factors for 11kV circuits. This is for the reasons below.

- Urban areas are generally flat with wide streets;
- Increased strength of construction due to urban environment.
- Span lengths are shorter because of smaller property boundaries and an increase use of joint poles with 400V and 33kV lines.
- 1.7 will be used for light lines, 1.6 for medium, and 1.5 for heavy.

Rugged terrain

Electra has adopted two "rugged terrain" multipliers for areas where normal line operating vehicles and plant cannot be used and where it is necessary to use helicopters, tracked vehicles or other special plant.

The first of these "rugged terrain" multiplication factors are for those sections of 11kV circuits that are in very rugged terrain – generally around the roads heading back into the Tararuas from the Tokomaru/Shannon area. These sections are in areas that are not easily accessible and are also very difficult and very expensive to maintain clear of gorse, other scrub and trees.

Electra has adopted 1.3 for the multiplication factor for these 11kV circuits. The extent of these is determined by reference to our contractors, long -serving Electra engineering staff and site visits.

The other "rugged terrain" multiplier relates to the remainder of Electra's 33kV "rural" circuits. Electra's 11kV overhead circuits are often installed cross country which lends difficulty to access for a variety of reasons, including land use, winter boggy land, fence installation and similar. These circuits are defined as being more than 10 metres from the constructed road, but not built using 2-pole structures or similar.

For these circuits, Electra has adopted a "difficult access" terrain multiplier of 1.2 to reflect the additional labour, plant and equipment used to access as well as construct and maintain these overhead lines. . These are referred to as "difficult access" to distinguish them from the other "rugged terrain" areas.

Multiple factors

Generally, for 11kV overhead circuits, no circuit will have multiple multiplication factors applied to the same length in this ODV. This comment does not apply to the addition of traffic management.

Traffic Management

Transit New Zealand has a Code of Practice requirement for Traffic Management. This code outlines various classes of road – Low Volume, Level 1 (500-10,000 vpd), Level 2 (>10,000vpd) and Level 3 (High Volume, multi-lane roads and motorways). Transit New Zealand sets the road level for state highways and local and regional councils set the various road levels for regional highways and local roads.

Transit New Zealand have defined that there are no Level 3 roads in Electra's area.

Transit New Zealand (Palmerston North office) has defined State

Highway 1 through Electra's area as Level 2 from Paekakariki to Levin (15,000 vpd). State Highway 1 is classified as level 1 from Levin north to Foxton (9,000 vpd).

Transit New Zealand (Palmerston North office) has defined State Highway 57 (from Levin to Palmerston North through Shannon) as level 1.

KCDC have classified all main urban roads as Level 1, except Kapiti Road and State Highway 1, which are classified as Level 2. (Examples are, Rimu Road, Golf Road, Matai Road, Raumati Road, Valley Road and Mazengarb Road.) KCDC also prefers to have minor roads, although technically low volume, managed as if they are Level 1, but this is not applied in the derivation of the Traffic Management.

HDC, except for State Highway 1, have classified all main urban roads as Level 1. (Examples are Hokio Beach Road, Foxton-Shannon Road, and Tararua Road.)

Where Electra has been able to construct its 11kV overhead circuits adjacent to a State Highway, regional highway or major local road, Electra has applied the appropriate traffic management allowance. This will not be applied in conjunction with either the "rugged" or "difficult access" multipliers or applied to under built lines

This additional sum is accounted for separately within the 11kV circuits model.

Traffic Management will not, on predominately rural circuits, be applied to "light" lines as these are normally spur lines along low volume (LV) roads that do not require additional traffic management apart from cones and some signs.

Non-standard cost multiplier– swampy ground -11kV overhead

Although not specifically stated in the handbook, Electra has several areas of "swamp" that masquerades as ground for supporting pole lines.

These areas, such as along the Foxton-Shannon Road, are renown for sound poles moving or completely falling over. Generally, these poles are re-stood by:

- installing culverts to the rear if near a drain;
- using 4 cubic metres of gravel to provide increased support for the pole;
- using additional ground and aerial stays; or
- all of the above.

This is also how new lines are built in these areas with project costs generally at 30% above the cost of installing a standard pole line. The non-standard cost has been derived from the "rugged ground" multiplier factors and will be applied at 1.3.

This multiplication factor will be applied ONLY where swampy ground is known from experience. Some specific areas are outlined below.

- Opiki Road, Okuku Road (Tokomaru)
- Whirokino Road, Foxton
- Koputaroa Road, Levin
- McKay's Crossing (Paekakariki) and along State Highway 1 to Raumati.

Table: Multiplication factors and non-standard costs – 11kV overhead

The table below illustrates the multiplication factors to be used for 11kV overhead circuits. (Note: model uses "rugged" for rugged and swamp as the multiplication factor is the same. Difficult access is separately accounted for.)

Circuit	Multiplication factor	% of circuit	Total to be applied
A2	Urban Rugged Difficult access	10% 30% 60%	1.7, 1.6, 1.5 1.3 1.2
A3	Urban Swamp Traffic Management	10% 90% 20% (Level 1)	1.7, 1.6, 1.5 1.3 $800/km
A4	Rugged Swamp Difficult Access Traffic Management	60% 20% 20% 20% (Level 1)	1.3 1.3 1.2 $800/km
C97	Difficult access Rural Traffic Management	50% 50% 10% (Level 1)	1.2 1 $800/km
C98	Urban Traffic Management	100% 80% (Level 1)	1.7, 1.6, 1.5 $800/km
C100	Urban Rural Traffic Management	60% 40% 70% (Level 1)	1.7, 1.6, 1.5 1 $800/km
E148	Difficult access Rural Traffic Management	20% 80% 50% (Level 1)	1.2 1 $800/km
E150	Urban Rural Difficult access Traffic Management	33% 34% 33% 40% (Level 1)	1.7, 1.6, 1.5 1 1.2 $800/km
E151	Urban Traffic Management	100% 70% (Level 1)	1.7, 1.6, 1.5 $800/km
E153	Urban Rural Traffic	50% 50% 70% (Level 1)	1.7, 1.6, 1.5 1 $800/km

	Management		
E156	Urban Rural Traffic Management	90% 10% 70% (Level 1)	1.7, 1.6, 1.5 1 $800/km
G306	Urban	100%	1.7, 1.6, 1.5
G308	Urban Rural Difficult access Traffic Management	30% 35% 35% 20% (Level 1)	1.7, 1.6, 1.5 1 1.2 $800/km
G310	Urban	100%	1.7, 1.6, 1.5
G311	Urban	100%	1.7, 1.6, 1.5
G313	Rural Difficult access Traffic Management	70% 30% 70%(Level 1)	1 1.2 $800/km
L348	Urban Traffic Management	100% 60% Level 1	1.7, 1.6, 1.5 $800/km
L349	Urban Rural Difficult access Traffic Management	10% 80% 10% 40% Level 1 40% Level 2 (SH1)	1.7, 1.6, 1.5 1 1.2 $800/km $1,500/km
L350	Urban	100%	1.7, 1.6, 1.5
L351	Difficult access Traffic Management	100% 20% (level 1)	1.2 $800/km
L352	Urban Rural Difficult access Traffic Management	10% 60% 30% 15% (Level 1)	1.7, 1.6, 1.5 1 1.2 $800/km
622	Urban	100%	1.7, 1.6, 1.5
632	Urban Rural Traffic Management	30% 70% 10% (Level 2 SH1)	1.7, 1.6, 1.5 1 $1,500/km
652	Urban	20%	1.7, 1.6, 1.5

	Rugged Difficult access	40% 40%	1.3 1.2
662	Urban Traffic Management	100% 10% (Level 1)	1.7, 1.6, 1.5 $800/km
672	Urban Traffic Management	100% 10% (Level 1)	1.7, 1.6, 1.5 $800/km
V101	Urban Traffic Management	100% 100% (Level 1)	1.7, 1.6, 1.5 $800/km
V103	Urban Traffic Management	100% 100% (Level 1)	1.7, 1.6, 1.5 $800/km
V104	Urban Difficult access Traffic Management	10% 90% 10% (Level 1)	1.7, 1.6, 1.5 1.2 $800/km
V106	Urban Traffic Management	100% 30% (Level 1)	1.7, 1.6, 1.5 $800/km
	Urban Traffic Management	100% 30% (Level 1)	1.7, 1.6, 1.5 $800/km
V109	Urban Rural Traffic Management	50% 50% 50% (Level 2 SH1)	1.7, 1.6, 1.5 1 $1,500/km
402	Urban	100%	1.7, 1.6, 1.5
403	Urban	100%	1.7, 1.6, 1.5
404	Urban	100%	1.7, 1.6, 1.5
Z209	Urban Traffic Management	100% 20% (Level 1)	1.7, 1.6, 1.5 $800/km
Z210	Urban Traffic Management	100% 20% (Level 2 SH1 and Raumati Road)	1.7, 1.6, 1.5 $1,500/km
Z211	Urban Traffic Management	100% 20% (Level 1)	1.7, 1.6, 1.5 $800/km

Z165	Urban Traffic Management	100% 10% (Level 1)	1.7, 1.6, 1.5 $800/km
Z166	No overhead 11kV lines		
Z167	Urban Rugged Difficult access Traffic Management	10% 20% 70% 10% (Level 1)	1.7, 1.6, 1.5 1.3 1.2 $800/km

Multiplication factors – 11kV underground cables

Urban/Rocky land

The costs in the ODV Handbook Table A1 for underground circuits are based on laying in a suburban area with developed infrastructure. Multiplication factors allowed are 1.15 to 2.0 for CBDs, and 1.5 to 2.0 for rocky ground.

It was assumed that no 11kV circuits were laid in rocky ground such that significant cost multipliers were required.

However, there are several town centre that have CBD type areas where road reconstruction costs are higher than allowed in the base cost of the ODV Handbook Table A1. Electra has adopted a multiplier of 1.15 for CBDs in the Levin (HDC) and 1.25 for Paraparaumu, Waikanae, Otaki and Raumati (KCDC) due to the different road reconstruction requirements for each of our local Councils.

Traffic Management

Transit New Zealand has a Code of Practice requirement for Traffic Management. This code outlines various classes of road – Low Volume, Level 1 (500-10,000 vpd), Level 2 (>10,000vpd) and Level 3 (High Volume, multi-lane roads and motorways). Transit New Zealand sets the road level for state highways and local and regional councils set the various road levels for regional highways and local roads.

Transit New Zealand have defined that there are no Level 3 roads in Electra's area.

Transit New Zealand (Palmerston North office) has defined State Highway 1 through Electra's area as Level 2 from Paekakariki to Levin (15,000 vpd). State Highway 1 is classified as level 1 from Levin north to Foxton (9,000 vpd).

Transit New Zealand (Palmerston North office) has defined State Highway 57 (from Levin to Palmerston North through Shannon) as level 1.

KCDC have classified all main urban roads as Level 1, except Kapiti Road and State Highway 1, which are classified as Level 2. (Examples are, Rimu Road, Golf Road, Matai Road, Raumati Road, Valley Road and Mazengarb Road.) KCDC also prefers to have minor roads, although technically low volume, managed as if they are Level 1, but this is not applied in the derivation of the Traffic Management.

HDC, except for State Highway 1, have classified all main urban roads as Level 1. (Examples are Hokio Beach Road, Foxton-Shannon Road, and Tararua Road.)

Many of Electra's 11kV underground circuits are installed along significant regional/local roads. These roads have significant traffic management requirements and Electra has applied the $6,000/kilometre traffic management allowance for Level 1 roads unless otherwise indicated in the models.

This additional sum is accounted for separately within the 11kV circuits model.

Table: The table below illustrates the multiplication factors to be used for 11kV

Multiplication factors – 11kV underground

underground circuits. Electra's 11kV schematics were reviewed for CBD areas, extent of 11kV inside these areas as well as local road controlling authority requirements for traffic management. Only those 11kV circuits that have multipliers are included.

Circuit	Multiplication factor	% of circuit	Total to be applied
E156	CBD Traffic Management	100% 100% (Level 1)	1.15 $6,000/km
G311	CBD Traffic Management	100% 100% (Level 1)	1.15 $6,000/km
L350	CBD	100%	1.25
L351	CBD Traffic Management	100% 100% (Level 2 SH1)	1.25 $15,000/km
662	CBD Traffic Management	30% 50% (Level 1)	1.25 $6,000/km
672	Traffic Management	70% (Level 1)	$6,000/km
V101	CBD Traffic Management	100% 100% (Level 1)	1.25 $6,000/km
V103	CBD Traffic Management	100% 100% (Level 1)	1.25 $6,000/km
V106	CBD Traffic Management	60% 60% (Level 2 Kapiti Road)	1.25 $15,000/km
402	CBD Traffic Management	60% 60% (Level 1)	1.25 $6,000/km
403	Traffic Management	100% (Level 1)	$6,000/km
404	Traffic Management	100% (Level 1)	$6,000/km
Z210	CBD	60%	1.25

	Traffic Management	60% (Level 1)	$6,000/km
Z166	CBD	100%	1.25

Multiplication factors – 400V

Electra has applied the multiplication factors below to the 400V.

- Underground: 1.15 and 1.25 for CBD areas (as for 11kV underground circuits).

Joint use poles

The ODV Handbook outlines the cost for "Double Circuit" lines at 33kV and 11kV. Electra has termed these "joint use" and the extent was determined through the NIMS reporting. All asset costs for these "Double Circuit" areas were re-calculated using the above multiplication factors before applying them to the ODRC model. Where necessary, eg traffic management, the additional costs were divided over the two circuits.

Shared trenching

The ODV Handbook outlines the cost for "Double Circuit" underground cables at 33kV, 11kV and 400V. Electra has determined the extent of shared trenches within the network. All asset costs for these "Double Circuit" areas were re-calculated using the above multiplication factors before applying them to the ODRC model. Where necessary, eg traffic management, the additional costs were divided over the two circuits.

VII: Ages and Standard Lives

Background

An essential element of completing the ODV is the assessment of age of various assets.

This section outlines how Electra aged its assets in ODV2004. Please note that there has been no alteration in determining asset lives since the ODV2001.

Zone substations

Zone substations are significant in value but small in quantity.

Accurate age records of equipment installed, and when the structures were built at these sites, has been maintained and were available.

Where equipment has been retrofitted, such as 11kV vacuum CBs at Levin West, a weighted average age will be used for the affected equipment.

33kV circuits

33kV circuits are significant in value. These are also installed as one complete project, as the zone substation is essentially valueless without a connection to the relevant GXP.

However, these circuits are not refurbished at the same time due to the significant cost involved. Individual poles and fittings are replaced as required through inspections, but the conductor is not.

If no accurate records have been maintained, then the age of the relevant circuit will be assessed as below.

- Local knowledge;
- Age of zone substations at each end of the circuits;
- Condition monitoring and

- Weighting of ages where some lengths have been refurbished and others not, based on the circuit lengths concerned.

Please note that the copper 33kV circuits between Levin East and Mangahao (MHO-LVNE) have been extensively studied by Industrial Research Limited. These circuits were installed in 1952 and have an actual life of 52 years. IRL's studies of 2 spans of these circuits, taken from the area with the most faults and exposed to the highest wind loading, indicated that there had been very little ageing of the copper. They indicated that these circuits had a further effective life of 40 years. As Electra completes an annual inspection of all 33kV lines, and bases its pole/crossarm replacement programme on these inspections, Electra has set the age of this 33kV circuit at ½ of the maximum life – ie 30 years with an enhanced installation date of 1974. (A copy of this IRL report is available on request.)

All circuits installed or replaced since 1 April 2001 are separated out and aged based on their known installation date.

Distribution transformers and ground mounted switchgear

Age of this equipment was sourced from the relevant database.

This information comes from the name plate of the asset itself and is considered accurate.

11kV and 400V circuits

Unless specific local knowledge is available, then the age of these circuits will be taken as the median of the age of the associated transformers. This will, if possible, be divided into two components – one for overhead and one for underground circuits. (Please note that this is the same basis as used for the ODV2001 valuation).

This is not as accurate as transformers and circuits are installed and replaced independently of each other. However, it is the best approximation with the information available. The values obtained are reasonable given the age of the urban areas concerned.

All circuits installed or replaced since 1 April 2001 are separated out and aged based on their known installation date.

Calculation of ages of 11kV and 400V circuits

11kV feeder	Median Overhead	Median Underground
A2	1977	1978
A3	1975	1974
A4	1978	1971
C97	1975	1977
C98	1979	1978
C100	1975	1977
E148	1976	1977
E150	1979	1981
E151	1972	1975
E153	1969	1978
E156	1974	1982
G306	1978	1978
G308	1977	1982
G310	1966	1976
G311	1973	1977
G313	1976	1974
L348	1982	1978
L349	1978	1979
L350	1983	1983
L351	1979	1980
L352	1984	1984
622	1979	1980
632	1977	1984
652	1980	1988
662	1973	1984
672	1982	1979
V101	1980	1983
V103	1970	1984

V104	1978	1974
V106	1978	1987
V107	1984	1982
V109	1983	1993
402	1978	1987
403	1978	1987
404	1970	1984
Z209	1972	1988
Z210	1978	1988
Z211	1967	1984
Z165	1971	1979
Z166	Nil	1983
Z167	1979	1984

Ageing of 400V consumer connections

Unless specific information is known, then the age of these connections will be taken as the median of the age of the associated overhead and underground circuits. (Please note that this is the same basis as used for the ODV2001 valuation).

Standard lives

Electra has generally used the standard lives allowed in Table A1 of the ODV Handbook. This is because Electra has well established effective maintenance programmes that accommodate the various climates within its electricity supply areas – particularly in the coastal marine environments.

Electra has adopted the enhanced life of 55 years for indoor vacuum or SF6 insulated switchgear. This will include all 33kV indoor switchgear (Otaki, Waikanae, Paraparaumu West) as well as the appropriate 11kV switchgear at zone substations (Levin West, Levin East, Waikanae, Otaki, Raumati, Paraparaumu West).

- The indoor switchrooms are pressurised to minimise ingress of moisture, dust and other particles for 33kV switchgear where installed indoors.
- Lower degradation of the insulant under planned and emergency

switching increasing times between maintenance.

Lower fault duty than switchgear specification.

Electra has also adopted the enhanced life for all zone transformers of 55 years (as allowed in clauses A35, A40, A41). This is because of the very comprehensive inspection and testing programme undertaken each year on these assets, as outlined below and in our Asset Management Plan.

- Visual inspection for oil leaks, rust prevention requirements, operation of tap changer and similar: every two months at a minimum.
- DGA, Furans and particle analysis: completed by external contractors once a year at a minimum since 2001.
- DGA analysis: completed by external contractors once a year at a minimum since 1996 and records are available.
- All remedial repairs completed as required by the above inspection regimes.
- Copies of the most recent inspection records are available on request.

Overhead lines are constructed on both concrete and wooden poles. These have different lives, but 96.2% of lines, by circuit kilometre, are constructed on concrete poles. The variation in average age is less than 1% and is not material to the ODRC value. As such, concrete poles are assumed for all overhead circuits.

Where an asset type – for example, PVC/PVC cable insulation – is not defined, then the maximum life selected is for the nearest equivalent asset type. For PVC/PVC, this type is XLPE and a maximum life of 45 years was selected.

Schedule of non-standard lives

The table below outlines what assets and/or asset classes have had extended lives in accordance with the provisions of clauses A32-A40.

Asset/Asset Class	Standard life	Enhanced Life
SF6/Vacuum switchgear at zone substations	45 years	55 years
Zone transformers	45 years	55 years

No assets have been refurbished, as defined in the ODV Handbook, and returned to service since 2001.

Reduction in standard lives

There has been no reduction in standard lives specified in Table A1.

VIII: Demand Forecasts

Background

Demand forecasts are an assessment of future capacity requirements and are based on historical load growth and regional development.

Electricity usage growth will continue through the fifteen years of this forecast as the Kapiti Coast and the Horowhenua continue to develop both as regional economies and as dormitory towns for Wellington and Palmerston North. This will, however, be off-set by issues underlying development within New Zealand as a whole – particularly the impact of the Kyoto protocol, the Maui gas field depletion, the difficulties being experienced in obtaining suitable generation resource consents, and the associated increase in electricity prices.

This section outlines the demand forecasts used for calculating the required capacity for GXPs, zone substations and 11kV feeders used in the optimisation of the electricity assets in Electra.

These forecasts are the median increases and are reviewed annually. The full demand forecasts include a low and high projection.

Assumptions

Electra uses the base assumptions below for all demand forecasts.

- There will be no significant alteration to the distribution of electricity in the next 5-15 years;
- Embedded or standby generation will not become a significant factor in the near future in either the Kapiti Coast or Horowhenua;
- No major transportations corridors will be established prior to 2010 to accelerate any increases in electricity use;
- Network extensions and development continue at a reasonably similar rate;
- Forecasts will continue to be conservative and use the sustained

underlying summer load growth particularly in the Kapiti Coast;

- The residential characteristics of load, particularly in the Kapiti Coast will not change markedly in the next 10-15 years;
- There will be no single new load equal to or greater than 4MW.
- All loads included in forecasts are based within the existing supply areas of the Kapiti Coast and Horowhenua.

Data

Electra has developed the demand forecasts based on the data below.

- Historical ½ hour demands recorded by SCADA and Transpower (April 1997 to March 2004);
- Population growth and projections produced by Department of Statistics;
- Known future load changes
- Network extensions and development.

Variations evident in the historic trends are used to estimate a likely range (between the expected and conservative view) for these forecasts. The overall demand on the network is still winter peaking.

Demand Forecasts - GXPs

The table below summarise the peak load projections for 2004 – 2019 for GXPs.

GXP (MW)	Annual average % increase	2003 (actual)	2004 (forecast)	2013 (forecast)	2019 (forecast)
Mangahao	1%	31.49MW	31.81MW	34.78MW	36.9MW
Paraparaumu	2.0%	53.85MW	54.92MW	65.64MW	73.92MW
Total	1.5%	82.02MW	83.25MW	95.18MW	104.1MW

*: Only 5% of Paraparaumu and Mangahao load is above 44MVA and 27MVA respectively. This discrepancy between peak load and the median load is expected to decrease through the next 15 years as, for each GXP, the median load is increasing faster than the peak load.

Please note that Electra undertakes conservative forecasts so as not to overstate the capacity required and the financial return required by Transpower for these loads. Mangahao and Paraparaumu have both exceeded the forecast peak in winter 2004 due to very cold July and August. These forecasts have not been amended for the ODV2004.

Demand Forecasts – Zone substations

The table below summarise the peak load projections for 2004 – 2019 for the zone substations and are in MVA.

Zone	Annual average % increase	2003 (actual)	2004 (forecast)	2013[4] (forecast)	2019 (forecast)
Shannon	1.00%	4.12	4.16	4.55	4.83
Foxton (1)	3.00%	8.18	8.43	11.0	13.14
Levin West	1.00%	7.60	7.68	8.40	8.93
Levin East (2)	2.50%	17.44	17.87	22.32	25.92
Otaki	1.00%	11.39	11.50	12.58	13.37
Waikanae	2.00%	12.11	12.35	14.76	16.64
Paraparaumu (2)	2.00%	20.81	21.23	25.37	28.60
Raumati	3.00%	11.96	12.20	14.58	19.21
Paekakariki	1.00%	4.94	5.09	5.40	5.80

(1): Two new 11.5/23 33kV/11kV transformers, a 4th 11kV feeder and new bus switch installed/commissioned May 2004. New assets will be included in next revision of ODV.
(2): Load transfers are under review.
(3): Includes Paraparaumu and Paraparaumu West as there has been insufficient historical data yet developed for Paraparaumu West. Paraparaumu West off-loaded Paraparaumu from some of its residential load.
(4) The 2013 forecast is provided for optimisation of individual transformers at zone substations.

Electra expects the load to continue to grow at the above average rates beyond this forecast.

Essentially, this load growth has been constant over the last few years and is in accordance with the increase in residential and lifestyle developments in the Kapiti Coast and Horowhenua.

There are only a few major industrial plants in this region (Carter Holt Harvey box making plant in Levin, Richmonds Fellmongery near Shannon, Feltex Carpet Mills). All of these have indicated their commitment to this region for at least the next ten years. Feltex have recently purchased the site of their Foxton mills. Richmonds have completely refurbished their Fellmongery after the February 2004 floods that saw water up to 3 metres deep through their site.

Demand Forecasts – 11kV feeders

The table below summarise the peak load forecasts for 2004 – 2009 for the 11kV feeders and are in 11kV amps. Please note that a 5 year period was used for these as the definition of "primary distribution feeder" excludes any 11kV feeder that is actually supplying load.

Zone	Annual average % increase	2003 (2) (actual)	2004 (forecast)	2009 (forecast)
A2	1%	86.4	87	92
A3	1%	100	101	106
A4	1%	111	112	118
C97	3%	110	113	131
C98	3%	248	255	230 (4)
C100	3%	156	161	200 (4)
E148	1%	70	71	74
E150	1%	70	71	74
E151	1%	95	96	101
E153	1%	140	141	149
E156	1%	153	155	162
G306 (5)	2.5%	169	173	196
G308(5)	2.5%	111	114	129
G310 (5)	2.5%	178	182	206
G311 (5)	2.5%	234	240	271
G313 (5)	2.5%	69	72	80
L348	1%	191	193	203
L349 (6)	1%	175	177	186
L350	1%	125	126	133

L351	1%	82	83	90
L352	1%	74	75	80
622	2%	120	122	135
632	2%	120	122	135
652	2%	48	49	54
662	2%	147	150	166
672	2%	173	176	195
V101 (1)	2%	210	214	236
V103 (1)	2%	150	153	169
V104 (1)	2%	100	102	113
V106 (1)	2%	212	216	240
V107 (1)	2%	337	344	380
V109 (1)	2%	150	153	170
402 (1)	2%	251	256	283
403 (1)	2%	81	85	91
404 (1)	2%	78	80	88
Z209	3%	189	195	226
Z210	3%	242	249	290
Z211	3%	196	202	234
Z165	1%	96	97	102
Z166	100% dedicated to TollRail			
Z167	1%	214	216	227

Notes:

(1) All 11kV feeders starting with either "V" or "4" are not considered as reliable as other primary 11kV feeders due to the recent commissioning of Paraparaumu West and the load transfer from the Paraparaumu substation through, mainly, V106 and V107 to 402, 403 and 404. A 4th 11kV feeder out of Paraparaumu West is also due for commissioning 2004/05 which will have an impact on the Paraparaumu, Paraparaumu West and Raumati zone substations.

(2) Peak loads maybe a little distorted by the transfer of load between adjacent 11kV feeders during emergency and planned work. All circuits are sized to bear the combined load of their own supply areas and adjacent emergency support areas.

(3) All load growths in excess of 2% are adjusted to 2% after 5 years.

(4) 4th 11kV feeder is due to be commissioned in 2004/05 to reduce load on C98 and C100.

(5) 6th 11kV feeder being planned for Levin East and is due to be commissioned in 2007/08. Alternatives are being reviewed with a possibility of transfer of load to Levin West.

(6) Large subdivision commissioned in 2003 in Waikawa Beach Road, Subdivision is not completely built/occupied and is not expected to be so until 2006/7.

Electra expects the load to continue to grow at the above average rates beyond this forecast. Essentially, this load growth has been constant over the last few years and is in accordance with the increase in residential and lifestyle developments in the Kapiti Coast and Horowhenua.

Accuracy of demand forecast

These forecasts should be considered as trend profiles for demand growth. There are a number of distorting factors that may have influenced the historical data used.

- Seasonal effects may affect the load patterns, e.g. wet/dry summer, cold/warm winter
- System reconfiguration for an interruption or fault event, altering the normal load pattern
- Load control can distort the load, both on switching off and restoration of the controlled load.
- Any electricity generation shortages experienced during the winter will produce abnormal loads

Effect of inaccuracy of demand forecast

As the load growth per annum is typically low (2% average) and areas of higher growth are no more than 5%; it is unlikely that large parts of the network will reach their operational limits without sufficient time to react. If necessary, development projects are brought forward by a year or two. Slower than expected load growth can be accommodated by the deferral of works.

The accuracy of the projections underlying the forecast is considered adequate for sub-transmission planning purposes. Planning data from the 1996/2003 planning period has show a consistent projected 2.5% peak growth when compared to an actual of approximately 2.7% pa overall.

IX: Optimisation

Background

This section outlines the background to the optimisation of the electricity assets in Electra. It is based on the questions outlined in the ODV Guidelines for optimisation.

When and why should optimisation be carried out?

All optimisation methods outlined below should be carried out only when the Replacement Cost (RC) and the Depreciated Replacement Cost (DRC) calculations have been completed. This provides a comparison between what has been installed and what would be installed today.

Optimisation of the electricity assets must be carried out to ensure that only assets (or elements thereof) that would be required and fully used in an optimised design of the network are valued. There were no instances where life cycle cost analysis was applied during the optimisation process to avoid the use of an asset with a lower replacement cost than the optimised network. The resulting ODRC valuation should be based on an optimal, modern efficient design that:

a) Provide a quality of supply similar to that which currently exists and which does not exceed our stated standard quality of supply criteria; and
b) Has sufficient capacity to meet existing demand and, where appropriate, allowed future load growth; and
c) Is depreciated to the same degree as the existing assets.

Optimisation consists of three stages.

a) Identifying stranded assets; and
b) Optimising the system configuration; and
c) Optimising elements of the system.

Optimisation must be carried out subject to the constraints below.

a) Optimised network must not exceed the existing level of supply security and no part of the network may exceed our disclosed quality of supply criteria unless non-standard contract with customers exist that guarantee an enhanced quality of supply; and
b) Location of GXPs 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 our electricity assets, then that point of connection must be deleted for valuation purposes; and
c) The location and number of existing customers should be assumed fixed; and
d) Our existing boundaries should be assumed fixed.

Consumer types

Consumers are generally within the classes below.

- Urban Residential;
- Rural residential;
- Residential support facilities – including schools and hospitals
- Non-dairy traditional farming;
- Dairy Farming;
- Alternative farming (eg horticulture, viticulture and similar);
- Beach settlements – including permanent residents and holiday homes;
- Commercial activities – including traditional shopping precincts and trade supplies;
- Industrial activities – including sawmills and abattoirs.

Generally, Electra does not distinguish, in planning criteria, between these consumer classes. Priorities in interruptions may differ.

Although the majority of consumers have alternative supplies available, generally through switching of the 11kV network, this is not the case for all consumers. Electra is in line with good New Zealand industry practice for the general consumer classes listed above.

Quality of supply standards (including n, n-1, etc)	Electra asset planning allows for (n-1) security of supply generally throughout the 11kV and 33kV network. This is based on the EEA Guidelines for System Security as issued by the New Zealand Electricity Engineers Association. Electra notes that this is a deterministic method of assessing security of supply. However, the more probabilistic methods are not yet robust enough to provide the same level of comfort in the assessment. This is published in more detail in our Asset Management Plan (AMP) and is reproduced below for ease of reference. The security levels have been added in accordance with the ODV guidelines on optimisation. *Under normal operating and (n-1) contingency conditions, each electricity asset should be able to:* ➢ *Each dual banked 33kV/11kV substation should not lose supply if one transformer is out. Security level (n-1). Examples include Levin East and Waikanae.* ➢ *Each single bank 33kV/11kV substation should be supported, through switching or load shedding, from adjacent substations. Security level (n-1) with switching or (n) without switching.* ➢ *All urban 11kV feeders should be supported, through switching, from at least one adjacent 11kV feeder. Security level (n-1).* ➢ *All rural 11kV feeders will be supported, through switching and fault isolation, in 75% of cases either through restoration of the original 11kV feeder or through adjacent 11kV feeders. Security level is (n-1) for main 11kV feeders, and (n) for 11kV spur lines.*

- *All 11kV spur feeders should be no more than 1MVA between isolation points. Security is (n); this improves reliability by reducing the area that requires components to be repaired before service is restored.*
- *All 11kV spur feeders should be isolatable for rapid restoration on the primary 11kV feeder. Security is (n); this improves reliability by reducing the area that requires components to be repaired before service is restored.*
- *An alternative 11kV source will not be provided until a minimum MD load of 2MVA is required. Security is (n); investment is made when load required additional reliability.*

These quality standards are generic in statement and similar standards have been the basis for planning by Electra for a number of years. Minimal over-investment has been made in the electricity network.

Reliability and voltage regulation

Electra' reliability and voltage regulation statements, published in the AMP are as below.

	Statement
Voltage regulation (steady state voltage)	33kV:+ 2.5% to –5% 11kV: +2.0% to –2.5% 400V: ± 5.5% (excluding service)
Reliability targets	SAIDI: 100 minutes SAIFI: 2.2 interruptions CAIDI: 45.46 minutes Rural customers: 4 unplanned interruptions per annum Urban customers: 1 unplanned interruptions per annum
Losses	Losses: 6.7%

Stranded assets

This is where capacity has been installed that is no longer required for whatever reason.

An analysis of the Electra network would indicate that there are no stranded assets.

As such, there will be no optimisation of electricity assets due to those assets being stranded.

Non-standard consumer contract

Electra has no non-standard consumer contracts in place at this time. As such, there will be no optimisation of electricity assets due to non-standard consumer contracts.

With the rise of modified farming methods – including hydroponics and other alternative horticulture – there will be a perceived requirement from consumers of increased security of supply even in what are traditional rural areas. This may impact, in future years, on the optimisation of the electricity assets in valuation exercises.

Optimising the system configuration

Assumptions

- location of consumers;
- Location of Grid Exit Points (GXPs).
- AMP2004

Grid Exit Points

Electra has two GXPs – Mangahao (near Shannon) and Paraparaumu – where connection is made to the national grid. Mangahao supports the Horowhenua 33kV ring and Paraparaumu the Kapiti 33kV ring.

Neither of these two GXPs could support the entire network on their own. This is for the reasons outlined below.

- Voltage regulation at 33kV and 11kV over the considerable distances between Shannon and Paekakariki;
- Capacity of existing 33kV and 11kV circuits; and
- Especially for Paraparaumu, the existing loads already supported

by these stations.

As such, there will be no optimisation of GXPs.

Electra only owns the 33kV connection assets at these GXPs. These will be valued as part of the 33kV circuits.

33kV/11kV (zone) substations

Electra's load is generally concentrated around the townships of Shannon, Foxton, Levin, Otaki, Waikanae, Paraparaumu, Raumati and Paekakariki. The ten zone substations are each generally sited within these townships and supports that town and adjacent rural areas. These zone substations are separated by some distance.

Each zone substation could be supported from adjacent zone substations under off-normal operating conditions. This is dependent on the loading on 11kV circuits, and is not sustainable into the long term without serious consequences to the condition of these 11kV circuits and voltage regulation of the network as a whole.

This support is also not available at all times - particularly Foxton and Paekakariki, the two extremes of the network – due to the load on other circuits. Construction of Paraparaumu West and the refurbishment of Foxton will relieve some of these known constraints.

With the location of consumers and GXPs a given, none of the existing ten zone substations could be optimised out of the network.

The capacity of each zone substation will be considered elsewhere.

33kV circuits

Electra operates its 33kV circuits mainly in closed rings. There are two major rings – the Horowhenua and Kapiti. Each of these has minor open

33kV rings supplying more recent zone substations.

All bar Paekakariki have dual 33kV supply from these 33kV rings. This complies with the stated quality of supply standards. (Paekakariki is supported, through an automatic changeover scheme, by an 11kV feeder from Raumati.)

These 33kV circuits are mainly overhead and are constructed on the most direct route possible. This generally coincides with formed roads and each is easily accessible. The two main exceptions are the Mangahao – Levin East and Raumati T – Paekakariki 33kV circuits.

As such, there will be no optimisation of 33kV circuits.

The capacity of each 33kV circuit will be considered elsewhere.

<u>11kV feeders</u>

The 11kV feeders radiate out from the zone substation and on different routes as far as possible.

An analysis of the Electra network would indicate that each of the 11kV feeders is required in its existing location, for the reasons outlined below.

- There is little overlap of supply areas from each individual 11kV feeder, even where individual 11kV circuits are on common poles for some part of their route.
- Each 11kV feeder, including spurs, has only been extended as far as is required to service consumers.
- Each 11kV feeder provides support for at least one other 11kV feeder, either from the same zone substation or from an adjacent zone substation.
- Each rural 11kV feeder is considerably isolated from adjacent feeders or spurs. It would be difficult to support these from other 11kV feeders or spurs due to the distance across private land and

the increase in the length of 11kV feeders.

- All switching equipment on each 11kV feeder, and between adjacent 11kV feeders, has been installed with the quality of supply statements in mind. These are used to minimise the impact of interruptions and increase the reliability of the overall 11kV network.
- There are no very low capacity or non-3 phase 11kV lines within Electra' network.
- 11kV voltage regulators would not be useful as below.
    - the load on 11kV feeders is generally evenly spread down the length of each feeder;
    - load on adjacent 11kV feeders is usually significant;
    - more complicated devices would add to maintenance costs, and hence life cycle costs of the 11kV feeder.

As such, there will be no optimisation of 11kV circuit breakers at zone substations if an 11kV feeder is connected to it. There will also be no optimisation of 11kV feeders as to number.

The capacity of each 11kV circuit will be considered elsewhere.

<u>Distribution transformers</u>

The distribution transformers are installed on the 11kV feeders to provide electrical supply to consumers.

An analysis of the Electra network would indicate that each of the distribution transformers is required in its existing location, for the reasons outlined below.

- The location of each transformer is determined by the consumer requirements. These are generally sited as close to the load centre as possible.
- Most urban transformers can provide support for adjacent transformers to minimise the impact of interruptions on

consumers. Transformers on rural 11kV feeders generally only supply a few consumers and provide minimal support for other consumers.

- Transformers are installed only when there is a recognised and proven consumer need for one – this could be for load support, voltage regulation, and isolation of one consumer's effects from other consumers.
- Sizes of transformers are based on 3.5kVA/consumer, and using standard size transformers commonly available in New Zealand and as outlined in the ODV Handbook.
- All transformers are reviewed for size/location/need as part of replacement programmes.

As such, there will be no optimisation of the number of distribution transformers. The capacity of each transformer will be considered elsewhere.

<u>400V circuits</u>

These are provided to connect consumers to distribution transformers. These are sized to provide voltage regulation to all connected consumers under normal operation.

An analysis of the Electra network would indicate that the 400V circuits are required in its existing location and size, for the reasons outlined below.

- The location of each 400V circuit is determined by the consumer requirements.
- The size of 400V circuits is based on 3.5kVA/consumer and providing stated standard of voltage regulation.
- 400V circuits are enhanced only when there is a recognised and proven consumer need for one – this could be for load support, voltage regulation, and isolation of one consumer's effects from other consumers.

As such, there will be no optimisation of the number of 400V circuits.

System control

Electra has one system control. This is based at Levin. System control represents the issues below.

- Centralised monitoring and control of 11kV and 33kV assets;
- Recording of data relating to system assets for use in asset planning and contingency analysis;
- Interruption data;
- Improved reliability of the electricity assets through enhanced monitoring and speed of response for planned and unplanned work;
- Safety co-ordination service for work on the electricity assets.

This valuation does not include the human elements of this system control. However, the SCADA system is a complement to these and should be valued as the asset that they are.

There will be no optimisation of the SCADA master station or any of the necessary radio communications centres.

Non-coincident segments

No segment of Electra's network was optimised separately from the remainder of the network.

Optimising asset size – Grid Exit Points

Electra does not own any significant assets at Mangahao and Paraparaumu.

As such, there will be no optimisation affecting Electra' assets at GXPs. Transpower will review and value these assets.

Optimising asset size – 33kV/11kV (zone) transformer capacity

Optimisation of the capacity of zone transformers would be as illustrated in the table below with the capacity of the individual zone substations and the load projections for the next ten to fifteen years. If only one transformer is installed in reality, this optimised size will be contained within one transformer; all other dual bank substations will be reviewed to determine the optimum number of transformers given the location, consumer base and the stated quality of supply standards.

As transformers can be purchased in virtually any size and configuration, Electra has assumed that the standard size transformers in use on the Electra network are appropriate. These are 11.5/23 ONAN/OFAF and 5/10 ONAN/OFAF 33kV/11kV star/delta.

Zone substation	Existing transformers		2003 peak load	2013 forecast load	2019 forecast load	Optimised unit	
	Number	Size (MVA) (**)				Number	Size
Paekakariki	1	5	4.8	5.40	5.80	1	5
Raumati	1	11.5	11.7	14.58	19.21	1	11.5
Paraparaumu (1)	2	11.5	14.22	25.37	28.60	2	11.5
Waikanae	2	11.5	11.80	14.76	16.64	2	11.5
Otaki	2	11.5	11.1	12.58	13.37	2	11.5
Levin East	2	11.5	17.1	22.32	22.32	2	11.5
Levin West (2)	1	11.5	7.6	8.4	8.93	1	11.5
Foxton (2) (4)	1	5	8.03	11.0	13.14	1	5
Shannon	2	5	4.1	4.55	4.83	2	5

Notes:

(1) Includes Paraparaumu and Paraparaumu West substations due to load transfers underway between these two zone substations.

(2) Each of these zone substations has a second transformer as support. These are removed from consideration in this exercise.

(3) All transformers are ONAN/ONAF rated. Emergency ratings are not stated as these are not sustained overload capacities.

(4) Foxton is presently being re-built with two 11.5/23MVA transformers. These are required for capacity and voltage regulation but will not be fully commissioned until 31 May 2004. As such, they are not included in this ODV2004.

(5) Where increased capacity for a zone transformer is indicated by load projections, the existing transformer is considered the optimal size. The AMP2004 outlines where alterations will be made to the network to remove or minimise technical constraints on the network.

Optimising asset size – zone substation buildings and circuit breakers

Buildings and structures

In general, the only buildings within the zone substations are those for the indoor switchgear and to house the protection equipment. These are concrete block and suitably reinforced for the seismic zone of the Kapiti Coast and Horowhenua districts.

The remainder of the equipment is the necessary bus structure and fences required for legislation requirements.

As such, there will be no optimisation of land or buildings at zone substations.

11kV circuit breakers

Optimisation of the number of 11kV circuit breakers is illustrated in the table below. These are all considered indoor 11kV circuit breakers as, in most cases, there is insufficient land available for establishing an effective outdoor board.

Any circuit breakers that are not connected to an 11kV feeder will be optimised out of the valuation.

Zone substation	No installed	Optimised No	Comments
Paekakariki	4	4	1 incomer, 3 11kV feeders, no circuit breaker unused
Raumati	5	5	1 incomer, 3 11kV feeders, 1 circuit breaker used as part of emergency backup for loss of transformer at Raumati or at Paraparaumu
Paraparaumu	6	5	2 incomer, 4 11kV feeders, 1

West			bus section, 1 circuit breaker unused
Paraparaumu	9	9	2 incomer, 6 11kV feeders, 1 bus section, no circuit breaker unused
Waikanae	8	8	2 incomer, 5 11kV feeders, 1 bus section, no circuit breaker unused
Otaki	8	8	2 incomer, 5 11kV feeders, 1 bus section, no circuit breaker unused
Levin East	8	7	2 incomer, 5 11kV feeders, 1 circuit breaker unused and removed from consideration
Levin West	9	8	2 incomer, 5 11kV feeders, 1 bus section, 1 circuit breaker unused and removed from consideration
Foxton	5	5	2 incomer, 3 11kV feeders,
Shannon	5	4	2 incomer, 3 11kV feeders

<u>33kV circuit breakers</u>

All 33kV circuit breakers installed at the zone substations are required for either effective operation of the 33kV closed ring circuits or for control of power transformers.

The operation of the 33kV in closed rings has reduced the number of interruptions affecting consumers. This is in line with the stated reliability and voltage regulation indices.

However, this operation does eliminate the possibility of operating the power transformers at zone substations as “transformer feeders” from the relevant GXP. Such an operation would also be sub-optimal with the distances between the relevant GXP and the zone substations.

Waikanae and Otaki do not have sufficient space available to create an outdoor bus and 33kV circuit breakers. Each of these sites was specifically designed with indoor switchgear.

Optimisation of the number of 33kV circuit breakers is illustrated in the table below. There is no alteration from existing units.

Zone substation	No installed	Optimised No	Comments
Paekakariki	1	1	1 transformer incomer only
Raumati	3	3	1 incomer, 2 33kV ring circuits
Paraparaumu	4	4	2 incomer, 2 33kV ring circuits
Waikanae	6	6	2 incomer, 3 33kV ring circuits, 1 bus section – required for effective connection of Otaki
Otaki	4	4	2 incomer, 2 33kV ring circuits, 1 bus section
Levin East	6	6	2 incomer, 3 33kV ring circuits, 1 bus section
Levin West	5	5	2 incomer, 3 33kV ring circuits
Foxton	4	4	2 transformer incomers, 2 33kV ring circuits
Shannon	4	4	2 incomer, 2 33kV ring circuits

Optimising asset size and type – 33kV circuits

Optimisation of the capacity of the 33kV circuits is illustrated in the table below, as well as the capacity of the individual 33kV circuits and the load projections for the next ten years. All optimisation has acknowledged that each circuit must be sized to contain the load of the 33kV ring as appropriate.

Overhead circuits

These are assessed as part of the 33kV ring or separate as required and can be represented by the standard types listed in the ODV Handbook Table A1.

33kV circuit	2003 load	2019 Forecast load	Capacity	Max Optimised Capacity	Comments
MHO-Levin	644A	861A	600A each	Heavy	Combined ring load

East – Levin West – Shannon (1), (2)			leg except Levin West to Levin East		includes Foxton as it is sourced from this ring.
Levin West to Foxton	0A	0A	150A	Light	Back up supply to Foxton
Shannon - Foxton	140A	230A	600A	Heavy	Principal supply to Foxton
Levin East - Otaki	0A	0A	600A	Heavy	Back up supply to Otaki
Otaki - Waikanae	194A	234A	600A	Heavy	Principal supply to Otaki
Paraparaumu GXP – Waikanae – Paraparaumu GXP	206A	291A	600A	Heavy	A back up to Paraparaumu ring. Most underground
Paraparaumu GXP – Paraparaumu West – Paraparaumu - Raumati - Paraparaumu GXP	537A	938A	600A each leg	Heavy	A back up to Waikanae ring. Most underground
Paekakariki	84A	101A	600A	Heavy	Support, through 11kV, to Raumati (205A in 2003)

(1) ODV Model pre-optimises MHO – Levin East #1 and #2 into a single 600A circuit.

A significant length of these assets do use joint poles – both with other 33kV circuits and with 11kV circuits. This is predominant around Levin, especially where multiple line routes are not available.

Underground circuits

These are assessed as part of the 33kV ring or separate as required and cannot be represented by the standard types listed in the ODV Handbook Table A1.

33kV circuit	2003 load	2019 Forecast load	Capacity	Max Optimised Capacity	Comments
Paraparaumu GXP – Waikanae – Paraparaumu GXP	206A	291A	600A	Heavy	A back up to Paraparaumu ring. Most underground
Paraparaumu GXP – Paraparaumu West – Paraparaumu - Raumati - Paraparaumu GXP	537A	938A	600A each leg	Heavy	A back up to Waikanae ring. Most underground

The maximum capacity in Table A1 for underground circuits is 240mm2 – which has a 325A capacity. This is insufficient for the underground circuits both for capacity required and fault duty rating. As such, a multiplication factor of 1.7 was added to the standard cost of the 33kV circuits. As all of these circuits are required at their present capacity, there is no optimisation of circuit size.

All underground 33kV circuits are located in the Kapiti Coast 33kV rings and all but one are laid solely within urban areas. The exception is part of PMR-WKN2 which is laid through Nikau Valley and State Highway 1 to Waikanae.

Since the early 1990's, Kapiti Coast has required all new circuits to be installed underground in the Kapiti Coast as part of their District Plan. This is not a new stance on the part of Kapiti Coast District Council and it's predecessors. Since the early 1970s, when the large developments started in the Kapiti Coast, Kapiti Coast District Council have preferred all new electricity circuits to be installed underground. This was encouraged through their subdivision rules.

All but one of the 33kV cables was laid since 1995. As these were new assets and not replacing previous circuits, these were subject to the requirement of Kapiti Coast District Council to be installed as underground circuits. A resource consent would not have been issued for overhead lines – particularly not of the capacity required for the major 33kV rings in this area.

The one 33kV circuit laid earlier, in 1988, was the circuit to Raumati. This underground cable is laid, in part, along the railway line and through private property. Each of these areas required underground cables to be used for safety and access reasons. These land owners were supported by the Kapiti Coast District Council.

Optimising asset size and type- 11kV feeders

The table below illustrates the three standard sizes given in the handbook with their maximum current ratings.

Description	Equivalent current rating	Maximum current rating	Optimised rating (67% of nominal)
11kV o/h Heavy	≥150mm^2, ≤ 240mm^2 Al	≥ 360A	≥ 240A
11kV o/h Medium	>50mm^2, <150mm^2 Al	150A to 360A	100A to 240A
11kV o/h Light	≤ 50mm^2 Al	≤ 150A	≤ 100A
11kV UG Heavy	>240mm^2 Al	≥ 325A	≥ 220A
11kV UG Medium	>50mm^2, ≤ 240mm^2 Al	200A to 325A	130A to 220A
11kV UG Light	≤ 50mm^2 Al	≤ 200A	≤ 130A

No 11kV feeder is completely underground. However, local authorities require new circuits to be placed underground within urban areas, as part of their District Plans. Kapiti Coast District Council also requires this in rural areas. Horowhenua District Council do not specify any requirements in the District Plan for rural feeders. However, in most cases new developments are reticulated using underground circuits as the developer generally requires this. Electra does not contribute to the difference between overhead and underground circuits but has ownership transferred to itself using a Network Transfer Agreement. As such, all underground circuits in rural areas are valued as underground circuits and no optimisation from underground to overhead is required.

Optimisation allows for the circuit to be loaded to a maximum of 67% of the optimised feeder rating. As spur lines are often lighter in construction than the principal 11kV feeder, all line assets will be valued as a maximum of what is installed.

Optimisation of the capacity of individual 11kV feeders is illustrated in the table below, as well as the capacity of the individual 11kV circuits, based on the demand forecasts outlined in section VIII above. A few of these 11kV feeders do use joint poles – both with other 33kV circuits and with 11kV circuits. This is predominant around Levin, especially where multiple line routes are not available. The optimised replacement cost of the 11kV circuits will assume that all poles are part of the most significant circuit on the pole.

11kV feeder	Actual Capacity (A)	Forecast Capacity utilisation % (2009)	Max optimised capacity	Comments
A2	300	31	M	Back up for Levin East as well as within Shannon. Voltage concerns if 11kV backbone feeder is decreased.
A3	235	45	M	Back up for Foxton as well as within Shannon. Voltage concerns if 11kV backbone feeder

				is decreased.
A4	235	50	M	Back up for Foxton as well as within Shannon. Voltage concerns if 11kV backbone feeder is decreased.
C97	235	56	M	In excess of 67%. Back up for Shannon as well as within Foxton.
C98	300	77	M	In excess of 67%. Back up for Shannon as well as within Foxton
C100	300	77	M	In excess of 67%. Back up for Shannon as well as within Foxton.
E148	300	27	M	Back up for Foxton and Shannon. Voltage concerns if 11kV backbone feeder is decreased.
E150	300	27	M	Back up for Foxton as well as within Levin West. Voltage concerns if 11kV backbone feeder is decreased.
E151	300	37	M	Back up for Levin East as well as within Levin West. Voltage concerns if 11kV backbone feeder is decreased.
E153	180	92	M	In excess of 67%. Back up for Levin East as well as within Levin West.
E156	300	60	M	Back up for Levin East as well as within Levin West. Voltage concerns if 11kV backbone feeder is decreased
G306	300	84	M	In excess of 67%
G308	300	55	M	Back up for Otaki

				(Manakau area) as well as within Levin East. Voltage concerns if 11kV backbone feeder is decreased
G310	300	88	M	In excess of 67%
G311	300	116	M	In excess of 67%
G313	300	35	M	Back up for Shannon) as well as within Levin East. Voltage concerns if 11kV backbone feeder is decreased
L348	300	75	M	In excess of 67%
L349	300	68	M	In excess of 67%. Principal supply to north Otaki and back up to Levin East.
L350	300	49	M	Principal supply to Otaki Beach. Voltage concerns if 11kV backbone feeder is decreased
L351	300	32	M	Principal supply to Otaki Gorge. Support for Te Horo and parts of north Waikanae. Voltage concerns if 11kV backbone feeder is decreased
L352	300	29	M	Principal supply to Te Horo. Support for Otaki Gorge and parts of north Waikanae. Voltage concerns if 11kV backbone feeder is decreased
622	200	82.5	M	In excess of 67%. Back up supply to Waikanae Beach.
632	200	82.5	M	In excess of 67%.

				Principal supply to Peka peka. Support for Otaki Gorge and Te Horo.
652	300	22	M	Only rural feeder into Reikorangi area. Also supplies Waikanae water and sewerage plant.
662	300	67	M	In excess of 67%. Back up supply to Waikanae Beach and north Paraparaumu.
672	300	79	M	In excess of 67%. Main supply to Waikanae Beach and back up for north Paraparaumu.
V101	300	96	M	Refer to Demand forecasts for caveat on demand forecasts. Please also note that fault duty in this area also dictated size of 11kV feeder cables from Paraparaumu West substation.
V103	300	69	M	
V104	235	59	M	
V106	300	97	M	
V107	300	154	M	
V109	300	69	M	
402)	400	86	H	
403	200	58	H	
404	400	27	H	
Z209	300	101	M	In excess of 67%. Please note that this substation is being reviewed for reinforcement from Paraparaumu West and through installation of a 4th 11kV feeder and a 2nd transformer from Raumati.
Z210	300	129	M	
Z211	300	105	M	
Z165	300	38	M	Main Paekakariki supply.
Z166	300	100	M	Capacity requirements from Toll Rail
Z167	300	84	M	In excess of 67% and

				also principal 11kV support for Paekakariki 33kV through an automated changeover scheme.

Please note that capacity of the 11kV feeder is taken as the capacity of the 11kV feeder cable from the zone substation.

Further optimisation of 11kV circuits will be as illustrated in the table below. These were derived from analysis of the 11kV schematics, and are short lengths totalling 800 metres. As any optimisation would be immaterial, it has not been not been undertaken for this valuation.

11kV feeder	Asset ID	Optimised asset	Comment
A2	Beyond A126	Remove	11kV line not used
C97	B44 and beyond	Remove	11kV DO fuse and line not used
G313	Beyond D116	Remove	11kV line not used
E156	Beyond E199	Remove	11kV line not used
E150	Beyond F75 (Spur)	Remove	11kV cable not used
G313	G363 and beyond	Remove	11kV DO fuse and line not used
G308	Beyond G150	Remove	11kV line not used
G308	Beyond H53	Remove	11kV line not used
L349	L331 and beyond	Remove	11kV line not used
L352	Beyond P253	Remove	11kV line not used

Optimisation of 11kV isolation devices

Electra uses 11kV isolation devices to provide disconnection points for planned and unplanned works. These may be DO fuses, 11kV links, air break switches and auto-reclosers; these devices provide the visible breaks required for safe isolation.

- Links and DO fuses are generally used on spur lines;
- Links are used at the start of underground segments of 11kV feeders;

- DO fuses are used to provide fault indication on overhead lines;
- DO fuses are used to provide fault indication on underground segments of 11kV feeders;
- ABSs are used to provide interconnection between adjacent 11kV feeders where three phase operation is essential;
- ABSs are used to provide separation points along long overhead 11kV feeders to minimise the number of consumers materially affected by an interruption where three phase operation is essential;
- ABSs are used to provide isolation between underground and overhead segments of 11kV feeders;
- Auto-reclosers are used to isolate rural areas away from the more concentrated urban areas. Analysis of the number of interruptions, their causes and the number of consumers affected by these interruptions was carried out prior to siting these assets. A 2002 analysis indicated that these were correctly sited to contribute to the stated quality of supply standard.

Without these various devices, serious issues would arise within the effective operation of the electricity network.

- Interruptions would affect significantly more consumers;
- Faulty segments would be difficult to isolate in a safe manner;
- Maintenance costs, especially with the use of live line techniques, would increase;
- Life cycle costs of assets would increase.

There will be no optimisation of the location or number of 11kV in-line DO fuses, Links or Auto-Reclosers.

Optimisation of the ABSs will be as illustrates in the table below. All other ABSs have been reviewed; these are all necessary for effectiveness of operation as well as safety of staff, plant and the general public.

11kV feeder	Asset ID	Optimised asset	Comment
Z167 North	Z185	Remove	Two ABSs adjacent in feeder; no asset connected between
Z210	Z16	Remove	Adjacent to in-line DO fuse and 2 other ABSs
Z210	Z191	Remove	Duplication
622	T89	Links	Present construction standards
662	T62	DO Fuse	Present construction standards
662	T61	DO Fuse	Present construction standards
672	T84	Links	Present construction standards
L349	L81	Remove	Two ABSs adjacent in feeder, no asset connected between
G313	G96	Remove	Consumer has changes. CT metering is no longer required.
A2	D50	Links	Present construction standards
G313	D72	Links	Present construction standards
A2	D45	Links	Present construction standards
A4	B117	Links	Present construction standards
A4	A145	Links	Present construction standards
A4	A50	Links	Present construction standards
C97	B39	Links	Present construction standards

Optimisation of asset size - Distribution transformers

The distribution transformers are installed on the 11kV feeders to provide electrical supply to consumers.

The ODV Guidelines require excess distribution transformer capacity to be optimised out so that the capacity utilisation (ratio of current peak load to total distribution transformer capacity) of the network is not less that 30%.

The network as a whole had, in winter 2003, a system peak of 82MW. This would give a capacity utilisation of 29.53%. Optimising distribution transformer capacity would not be, however, considered a fair and equitable representation of the distribution transformer capacity required by consumers.

Winter 2003 was an "energy crisis year" and the peak loads were artificially decreased due to national, government funded, publicity campaigns. In comparison, winter 2002 showed, on a system wide basis, a capacity utilisation of 30.2% and winter 2004 a capacity utilisation of 32%. Neither of these years was deemed to be winter "energy crisis year" and reflect a more accurate distribution transformer capacity requirement.

This is reflected in the total units transported through the network each year. Overall, there has been a steady increase of 2.75% a year in units transported, except for the two winter crisis years of winter 2001 and winter 2003.

Optimising asset size and type - 400V feeders

These 400V circuits provide the connection between the distribution transformers and the consumer. These circuits are sized on 3.5kVA/consumer with a maximum allowed voltage drop of 5% to the terminal consumer.

As such, there will be no optimisation of asset size in the 400V circuits.

No underground 400V feeder has been optimised to overhead in this ODV. Local authorities require new circuits to be placed underground within urban areas, as part of their District Plans. Kapiti Coast District Council also requires this in rural areas. Horowhenua District Council do not specify any requirements in the District Plan for rural feeders. However, in most cases new developments are reticulated using underground circuits as the developer generally requires this. Electra does not contribute to the difference between overhead and underground circuits but has ownership transferred to itself using a Network Transfer Agreement. As such, all underground circuits in rural areas are valued as underground circuits and no optimisation from underground to overhead is required.

Circuit lengths

The data was sourced as below.

- NIMS information through ESRI ARCFM derived reports; and
- Local knowledge;
- Circuit drive bys; and
- schematic plans where appropriate.

X: Network Emergency Spares

Background

Electra's electricity assets generally take more than 24 hours to source. As such, Electra maintains a minimum holding of certain assets to meet emergency requirements that may arise during the course of incidents and outages on the network.

How are Emergency spares held?

Network emergency spares are maintained by Linework on behalf of Electra. Electra has provided a comprehensive list of the equipment to be maintained as these spares.

For materials used routinely, such as cross arms, conductors and similar, this requirement is set as the minimum re-order level. Electra does not pay for these materials until used. The sole exception is the 33kV spare cables, generally purchased as part of a 33kV cable project, which are owned by Electra.

All discrete items, such as transformers and switchgear, specific assets need to be at either the Levin or Paraparaumu depots. Electra has set a minimum level for these. When one discrete spare is used, then a similar one must be ordered immediately unless more than the minimum level was available. Electra pays for these items and are, therefore, its assets to be included in the ODV.

Often, spare transformers are returned from the network for a variety of reasons. These are tested, repaired and upgraded as required. If suitable, they are included within the network spares.

Emergency Spares List	The list below includes the network spares to be kept by Electra. These are minimum levels and, for discrete assets, there may be more available at any one time.
Emergency spares at 31 March 2004	A stock-take was completed on the 2nd working day of April 2004 for the transformers, switchgear and 33kV cable that was in the emergency spares at Linework's Levin and Paraparaumu depots. This is the basis for the valuation of the network spares for ODV2004. Emergency spares are valued at book value.

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XI: Economic Value Assessment

Introduction

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The ODV of an asset is the lesser of its ODRC and Economic Value ("EV"). The EV of an asset is lower than the ODRC where it is possible to provide the same service, at lower cost to users of the network, by an alternative means.

Valuation of system fixed assets at EV

System fixed assets are valued at their EV when it is possible to supply users by alternative means at a lower cost than the existing network.

The strict application of the above approach would require EV testing for each part of the system. This would be time consuming and impractical in many instances. The Handbook states in paragraph 2.59 however, that a comprehensive EV test need only be applied if it is considered that the write-down in asset value as a result of the EV analysis on all potentially uneconomic assets would be greater than 1% of the ODRC of all system fixed assets. In accordance with clause 2.59 of the Handbook, the EV analysis undertaken for the 2001 ODV has been considered as a guide to determine whether a comprehensive EV test is required.

In 2001, 8 segments were selected for EV testing using the segmentation criteria prescribed in paragraph 3.70 of the Ministry of Economic Development's ODV Handbook (4th edition). Together these segments comprised a total ODRC of $5.277 million or 7.3% of the total 2001 ODRC. The EV testing applied to these segments in 2001 resulted in an EV write-down of $96,946 or 0.13% of the ODRC.

Since 2001, there have been no significant changes to the configurations or supply requirements of these spurs and feeders. Increases in the replacement cost of the assets due to revised Handbook values have been partially offset by additional depreciation on the assets since 2001. As a result, there is no reason to consider that the results of the EV testing undertaken in 2001 would be materially different in 2004. In addition, there are no other segments of the network that are believed to be less economic than the segments noted above. Therefore, as the EV write-down in 2001 was considerably less than 1% of the ODRC, it is not necessary to undertake a comprehensive EV analysis for the purposes of the 2004 ODV valuation.

Further support for this conclusion is provided by the cost of the alternative supply options for the relevant feeders and spurs. In 2001, the ODV Handbook prescribed that EV tests must be undertaken using a cost for the alternative supply option (excluding energy, but including transmission) of no more than 30 cents per kWh (or 35 - 40c/kWh including energy). Based on analysis undertaken by PricewaterhouseCoopers in 2001 and again in 2004, for those customers connected to the least economic segments, the least cost alternative use able to provide the same service, is local diesel generation. In 2001, PricewaterhouseCoopers assessed the total costs of supply for remote segments as being greater than the maximum alternative cost allowed in the 2001 Handbook. In 2001 however, in accordance with the Handbook, the EV tests were calculated using the maximum allowable tariff of 30 c/kWh. The EV write-downs calculated in 2001 were therefore potentially overstated due to the Handbook's requirement to use 30 c/kWh as the cost of the alternative.

The 2004 Handbook does not prescribe a maximum value to be used for alternative supply options. The current cost of the fuel itself is in excess of 30c/kWh (for remote locations) and forecasts of diesel prices are not expected to result in prices any lower than 2001 prices. In addition, neither we nor PricewaterhouseCoopers has evidence that the capital costs for diesel generation are lower in 2004 than in 2001, or will become less than 2001 costs in the medium term. These factors support our conclusion that the EV analysis undertaken in 2001 was potentially overstated. Therefore for the purposes of this valuation, and given the 2001 EV results, we conclude that the potential EV write-down in 2004, if any, will be less than 1% of ODRC.

In addition, the potential for by-pass of existing customers by alternative suppliers was considered in order to determine if additional EV analysis was required. Following discussions with PricewaterhouseCoopers, it was concluded that no additional analysis was required as there are no instances where large customers (that is those who are likely to be of most interest to alternative suppliers), could be supplied by another network or the transmission system with costs of supply less than existing costs of supply. Thus the EV of these assets will be greater than their ODRC, based on the higher alternative costs, and the ODV equals the ODRC.

For the reasons outlined above therefore, and in accordance with Clause 2.59 of the Handbook, we have reviewed the system fixed asset base and have identified assets that are potentially uneconomic. As a result, and based on analysis previously undertaken, with consideration of changes in circumstances relevant to these assets, we conclude that an EV of these assets will not result in a material (or > 1%) reduction in the ODV of the total system fixed assets. This conclusion was discussed and confirmed with PricewaterhouseCoopers.

Appendix 1: Zone Substation non standard costs

Non Standard costs

The zone substation building and site works costs were developed by UnitedGooder. The breakdown of these costs is including in the tables below.

33kV substation costs							
Substation	**Total**	**To be excluded**			**For**		
Paraparaumu We:	$2,864,120.34	$451,215.04	Transformer Installation #1		Paraparaumu West		
		$450,225.04	Transformer Installation #2		Otaki		
		$323,766.39	33kV switchboard		Waikanae		
		$271,984.94	11kV switchboard				
		$101,200.00	protection relays				
		$125,499.35	scada and comms				
		$1,723,890.76	Total exclusions				
	$1,140,229.58	**Substation total**					
Substation	**Total**	**To be excluded**			**For**		
Foxton	$2,956,862.59	$450,466.92	Transformer Installation #1		Foxton		
		$450,730.92	Transformer Installation #2		Shannon		
		$152,360.78	33kV switchboard		Raumati		
		$274,138.06	11kV switchboard		Paekakariki		
		$101,200.00	protection relays				
		$128,971.63	scada and comms				
		$1,557,868.31	Total exclusions				
	$1,398,994.28	**Substation total**					
Substation	**Total**	**To be excluded**					
Levin East	$3,292,770.93	$450,466.92	Transformer Installation #1		**For**		
		$451,676.92	Transformer Installation #2		Paraparaumu		
		$397,388.92	33kV switchboard		Levin East		
		$272,334.06	11kV switchboard		Levin West		
		$101,200.00	protection relays				
		$128,971.63	scada and comms				
		$1,802,038.45	Total exclusions				
	$1,490,732.48	**Substation total**					

Appendix 2: Multiplication factor and non-standard cost application

Overall Multiplication factors

The overall multiplication factor application for the assets as a whole are as shown in the table below.

33kV overhead circuits

Multiplier	# of kilometres	% of total kilometres
Urban – 1.7	25.8km	18.94%
Rugged terrain 1.3 1.2	 15kms 38kms	 11% 28%
Traffic Management – Level 2 Level 1	 4kms 19kms	 3% 14%
"Swamp" – non standard cost	32kms	23. %

33kV underground circuits

Multiplier	# of kilometres	% of total
Non-standard cost – 1.7	19.75kms	100%
Traffic Management – Level 2A Level 2 Level 1	 1.4kms 0kms 10.7kms	 7% 0% 54%

11kV overhead circuits

Multiplier	# of kilometres	% of total 11kV overhead kilometres
Urban 1.7	 122km	 15%

1.6 1.5	84km 0km	11% 0%
Rugged terrain 1.3 1.2	 81kms 183kms	 10% 23%
Traffic Management – Level 2A Level 2 Level 1	 0 kms 17kms 92kms	 0% 2% 12%
"Swamp" – non standard cost	39kms	5%

11kV underground circuits

Multiplier	# of kilometres	% of total 11kV underground circuits
CBD 1.25 1.15	 20kms 13kms	 12% 8%
Traffic Management – Level 2A Level 2 Level 1	 0kms 7kms 40kms	 0% 4% 23%

Pre-optimisation

The areas noted below were pre-optimised in setting up the ODV models.

- Double trenches on the same side of the street.
- Asset and circuits that were noted as optimised out in this report.

Appendix 3: ODV Valuation Report Cross-reference

Comment This appendix is provided as a guideline for reading this ODV Valuation report. It does not provide any further information.

2.65 (a) The breakdown of asset quantities is included at Appendix 4.

Please note that the transformer structures are included within the quantity value of the associated transformer.

2.65 (b) The breakdown of asset RC, ORC, DRC, ODRC is included at Appendix 4.

Please note that, as with asset quantities, the transformer structures are included within the value of the associated transformer.

2.65 (c) Non-standard costs are included within sections V and VI. For the purposes of this valuation, there are no assets where the valuation rules included in the Handbook are insufficiently prescriptive to require an alternative approach to be applied

2.65 (d) An assessment of asset ages for circuits is included in sections III, IV, IV and VII.

2.65 (e) The breakdown of asset multipliers and their application is included the ODV Valuation Report Volume 1 in section V, VI and Appendix 2.

2.66 (f) The breakdown of non standard costs, their basis and their application is included the ODV Valuation Report Volume 1 in section V, VI and Appendix 1.

2.66 (g) A schedule of where asset lives have been extended is included in section VII of the ODV Valuation Report Volume 1.

2.66 (h) Please refer to section VII of Volume 1 of this ODV Valuation Report.

2.66 (i) No assets were reduced in age from the standard lives outlined in Table A. Refer section VII of Volume 1 of this ODV Valuation Report

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2.66 (j) Please refer to section IX of Volume 1 of this ODV Valuation Report.

2.66 (k) Not applicable to ODV2004. Refer section IX of Volume 1 of this ODV Valuation Report.

2.66 (l) Please refer to section VIII of Volume 1 of this ODV Valuation Report.

2.66 (m) Please refer to section VIII of Volume 1 of this ODV Valuation Report.

2.66 (n) Please refer to section IX of Volume 1 of this ODV Valuation Report.

2.66 (o)

Asset	RC	DRC	ORC	ODRC
Levin East 1 11kV CB feeder	$180,000	$130,909	$150,000	$109,091

Levin East 1 11kV CB feeder protection	$105,000	$65,625	$87,500	$54,688
Levin West 1 11kV CB feeder protection	$105,000	$68,250	$87,500	$56,875
Paraparaumu West 1 11kV CB feeder	$120,000	$117,818	$90,000	$88,364
Paraparaumu West 1 11kV CB feeder protection	$70,000	$68,250	$52,500	$51,188

2.66 (p) Please refer to section IX of Volume 1 of this ODV Valuation Report.

2.66 (q) Not applicable to this ODV2004. Please refer to section IX of Volume 1 of this ODV Valuation Report

2.66 (r) Please refer to section XI of Volume 1 of this ODV Valuation Report.

2.66 (s) Not applicable to this ODV2004. Please refer to section XI of Volume 1 of this ODV Valuation Report.

Appendix 4: ODV Summary Table

		Units	Replacement Cost ($)	Depreciated RC ($)	Optimised RC ($)	ODRC ($)	ODV ($)
Subtransmission							
33kV lines - Heavy	km	93.40	7,289,090	4,086,778	7,289,090	4,086,778	4,086,778
33kV lines - Light	km	25.18	1,353,794	961,483	1,353,794	961,483	961,483
33kV lines DCCT Heavy	km	17.64	1,284,353	513,312	1,284,353	513,312	513,312
33kV Cables	km	13.02	3,945,932	3,314,966	3,945,932	3,314,966	3,314,966
33kV Cables - DCCT	km	7.95	1,915,950	1,794,647	1,915,950	1,794,647	1,794,647
33kV Isolation	No	14	152,000	99,686	152,000	99,686	99,686
33kV Surge Arrestors	No	21	168,000	139,200	168,000	139,200	139,200
Total - 33kV circuits			16,109,118	10,910,072	16,109,118	10,910,072	10,910,072
Zone Substations							
Land	Lot		544,000	544,000	544,000	544,000	544,000
Site Development and Buildings	Lot		13,488,859	6,730,612	13,488,859	6,730,612	6,730,612
Zone transformers	No	18	7,512,414	4,484,248	7,512,414	4,484,248	4,484,248
33kV circuit breakers - line	No	23	1,070,000	743,125	1,070,000	743,125	743,125
33kV circuit breakers - transformers	No	18	840,000	587,898	840,000	587,898	587,898
33kV circuit breakers - bus coupler	No	3	165,000	156,000	165,000	156,000	156,000
33kV circuit breakers - line protection	No	23	402,500	278,011	402,500	278,011	278,011
Transformer protection and controls	No	18	1,260,000	936,886	1,260,000	936,886	936,886
11kV indoor circuit breakers - feeders	No	43	1,290,000	798,000	1,230,000	750,545	750,545
11kV indoor circuit breakers - incomers	No	18	540,000	317,318	540,000	317,318	317,318
11kV indoor circuit breakers - bus coupler	No	5	150,000	106,462	150,000	106,462	106,462
11kV indoor circuit breakers - feeder protection	No	45	787,500	490,000	735,000	450,625	450,625
SCADA and Comms equipment	Lot		1,289,710	561,024	1,289,710	561,024	561,024
Ripple Injection Items	No	2	600,000	330,000	600,000	330,000	330,000
Total - zone substations			29,939,983	17,063,585	29,827,483	16,976,755	16,976,755
Distribution - Lines							
11kV oh medium	km	262.38	8,171,570	4,610,946	8,171,570	4,610,946	4,610,946
11kV oh light	km	448.85	14,236,032	7,965,969	14,236,032	7,965,969	7,965,969
11kV oh underbuilt heavy	km	12.49	190,083	98,244	190,083	98,244	98,244
11kV oh underbuilt medium	km	62.16	984,146	561,376	984,146	561,376	561,376
11kV oh underbuilt light	km	4.36	60,931	30,739	60,931	30,739	30,739
Totals			23,642,762	13,267,275	23,642,762	13,267,275	13,267,275
Distribution - Cables							
11kV ug heavy	km	7.57	1,024,904	785,438	1,024,904	785,438	785,438
11kV ug medium	km	154.13	17,242,388	12,870,108	17,242,388	12,870,108	12,870,108
11kV ug light	km	13.02	1,129,141	855,048	1,129,141	855,048	855,048
Total - Distribution Cables			19,396,434	14,510,594	19,396,434	14,510,594	14,510,594

			Replacement Cost ($)	Depreciated RC ($)	Optimised RC ($)	ODRC ($)	ODV ($)
	Units						
Distribution transformer							
10kVA - 1 phase	No	14	50,400	35,640	50,400	35,640	35,640
15kVA - 1 phase	No	12	43,200	35,200	43,200	35,200	35,200
30kVA - 1 phase	No	4	17,200	10,416	17,200	10,416	10,416
15 kVA - 3 phase - pole	No	98	588,000	339,533	588,000	339,533	339,533
30 kVA - 3 phase - pole	No	818	4,908,000	2,514,533	4,908,000	2,514,533	2,514,533
50 kVA - 3 phase - pole	No	313	2,504,000	1,182,667	2,504,000	1,182,667	1,182,667
100 kVA - 3 phase - pole	No	135	1,485,000	785,644	1,485,000	785,644	785,644
200 kVA - 3 phase - pole	No	43	645,000	132,167	645,000	132,167	132,167
300 kVA - 3 phase - pole	No	15	270,000	65,600	270,000	65,600	65,600
100 kVA - 3 phase - ground	No	116	1,508,000	1,028,878	1,508,000	1,028,878	1,028,878
200 kVA - 3 phase - ground	No	122	2,196,000	1,345,000	2,196,000	1,345,000	1,345,000
300 kVA - 3 phase - ground	No	453	9,060,000	4,276,444	9,060,000	4,276,444	4,276,444
500 kVA - 3 phase - ground	No	65	1,690,000	860,889	1,690,000	860,889	860,889
750 kVA - 3 phase - ground	No	11	330,000	165,333	330,000	165,333	165,333
Total - Distribution Transformers		2,219	25,294,800	12,777,944	25,294,800	12,777,944	12,777,944
LV Lines							
Overhead - LV Only	km	114.14	5,998,600	3,183,435	5,998,600	3,183,435	3,183,435
Overhead - Underbuilt	km	345.94	7,881,756	4,286,860	7,881,756	4,286,860	4,286,860
Underground - LV only	km	278.95	19,135,601	10,431,376	19,135,601	10,431,376	10,431,376
Underground - with 11kV	km	135.96	3,768,578	2,059,044	3,768,578	2,059,044	2,059,044
Total - 400V			36,784,535	19,960,715	36,784,535	19,960,715	19,960,715
Customer service connections							
LV - 1 phase - overhead	No	7,636	534,553	219,706	534,553	219,706	219,706
LV - 3 phase - overhead	No	2,577	463,822	194,120	463,822	194,120	194,120
LV - 1 phase - underground	No	26,319	8,224,538	3,568,990	8,224,538	3,568,990	3,568,990
LV - 3 phase - underground	No	3,765	2,635,649	1,146,598	2,635,649	1,146,598	1,146,598
Total - Customer Service		40,297	11,858,563	5,129,415	11,858,563	5,129,415	5,129,415
Other system Fixed Assets							
SCADA and Comms (Central Facilities)	Lot		1,176,000	699,200	1,176,000	699,200	699,200
Radio Communication hubs	No	3	330,350	279,423	330,350	279,423	279,423
Fibre Optic	km	3.67	231,744	226,594	231,744	226,594	226,594
Link Pillars	No	755	2,178,000	1,064,800	2,178,000	1,064,800	1,064,800
Streetlighting	km	42.70	1,281,000	597,800	1,281,000	597,800	597,800
Emergency Spares			345,500	338,000	345,500	338,000	338,000
Total - other system Fixed Assets			5,542,594	3,205,817	5,542,594	3,205,817	3,205,817
Totals			177,475,288	101,266,158	177,362,788	101,173,264	101,173,264

Note – Pages 93 and 94 are blank and have been omitted from this report