Report on the reliability performance of Eastland Networks Limited

Produced for

The Commerce Commission

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Preface

Strata Energy Consulting Limited specialises in providing services relating to the energy industry and energy utilisation. The Company, which was established in 2003, provides advice to clients through its own resources and through a network of Associate organisations. Strata Energy Consulting has completed work on a wide range of topics for clients in the energy sector both in New Zealand and overseas.

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This report has been prepared to assist the Commerce Commission with its assessment of the quality performance of the Eastland Networks Limited electricity distribution network.

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In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as an interpretation of the application of the Commerce Act or other legal instruments. Strata Energy Consulting's opinions in this report include considerations of materiality to the requirements of the Commerce Commission and opinions stated or inferred in this report should be read in relation to this over-arching purpose.

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1 Introduction and background

1.1 Purpose of this review

1 The Commerce Commission (the Commission) engaged Strata Energy Consulting (Strata) to review the network performance of ENL Networks Limited's (ENL) electricity distribution network over the period 1 April 2010 to 31 March 2012. During this period ENL has exceeded the regulatory quality standard and the Commission required Strata to provide expert advice as to whether this performance trend is indicative of a sustained deterioration of the network.

1.2 Scope and objectives

2 This review is intended to inform the Commission of the underlying causes of ENL's under-performance and to identify whether or not exceeding the regulatory quality standard was the result of a sustained deterioration of the network.

3 In particular, the Commission has asked Strata to provide its advice on the following matters:

(a) whether current management practices are leading to, or likely to lead to deterioration in network reliability;

(b) the reasons for the non-compliance with the Electricity Distribution Services Default Price-Quality Path Determination 2010 Quality standard;

(c) any issues with regard to organisational practices, individually or collectively, and whether or not those issues are likely to be successfully addressed by ENL; and

(d) any recommendations for the Commission's consideration in response to any concerns raised.

1.2.1 Review approach

4 The Commission set out the following two-stage approach for this review:

	Task
Stage 1	**Desk-top review** Objective: Establish an understanding of and assess ENL's asset management framework. Inform the onsite review. Carry out a desk-top review of ENL's electricity distribution

	Task
	network giving consideration to the following: – examine quality and reliability performance management and reporting; – consider the extent of asset planning and operational management (e.g. fault response planning) and its impact on annual reliability performance; – assess asset management principles and practices, as well as procedures and processes; – assess asset management plans and methodologies; – examine asset condition, assessment monitoring, and reporting; – examine the extent of proactive and reactive asset management planning and practice; – consider organisational capability (management, technical and operational) to deliver asset management objectives; – examine system loadings, demand forecasting, asset capacity planning and asset condition information (e.g. asset age profiles); – consider capital expenditure and maintenance budgets and plans at an aggregate level; and – assess historical performance against budgets and plans for relevant capital expenditure and maintenance.
	Initial report Strata provided the Commission with a briefing on initial issues and observations from the desktop review.
Stage 2	**On-site assessment** Objectives: Assess the extent to which ENL applies its asset management framework in practice. Establish compliance with and the appropriateness of the regulatory standards. Inform the assessment of likely future reliability performance. Establish a view of the reliability and accuracy of the information used by ENL to manage its assets. Complete an onsite assessment of ENL's electricity distribution network and asset management practices, based on the following: – examine compliance with policies, procedures and

	Task
	processes; – examine systems outage management processes including the appropriateness of both the process and the system controls for recording SAIDI and SAIFI; – review the implementation of annual asset management plans; – examine how performance against budgets and plans is monitored; – review organisation and contractor management practices; – review the accuracy and reliability of asset data and information systems; – review asset age, condition monitoring and reliability assessment practice; and – review system loadings, demand forecasting and asset capacity measurement and reporting.
	Final report Objective: Provide the review findings and justification for conclusions and recommendations.

5 In the Eastland Network's office, we spent most of our time in discussions with Sector General Manager – Energy Brent Stewart (GM) and Asset and Planning Manager Murray Carman.

6 Our onsite visit included drive-by and from-the-air inspection of a wide range of network assets, escorted by Murray Carman. While this was clearly a relatively quick, high-level inspection, it provided a good overview of assets across the network and allowed us to form some overall impressions.

7 We looked at line assets in the vicinity of Gisborne and Wairoa and in the remote/rugged terrain inland from Wairoa. We discussed asset management practices with the experienced senior manager that provided transport and guidance. We focused on some of the worst performing feeders to assess the conditions in which these assets operate and gain a view of maintenance intensity and issues.

8 We also visited a number of zone substations in the vicinity of Gisborne and looked at the subtransmission feeders that interconnect them.

1.3 Structure of this report

9 The sections of this report are structured to provide the reader with a high-level overview of the information gathered in the review and to provide the key points relevant to the review objectives.

10 A summary of the following sections of the report is set out in the following table.

Section	Content
Headlines	Provides a summary of the main observations and findings of the review.
Key findings	Provides the key findings, observations and recommendations.
Overview of ENL	Provides a brief overview of ENL, its governance structure and key statistics.
The remaining sections provide supporting analysis for the headlines and key findings	
Assessment of Reliability Performance	Provides the historical performance against the regulatory standards. Provides an assessment of ENL's explanations for the network's reliability performance. Sets out Strata's views on ENL's explanations for historical reliability performance and provides an assessment of future performance based on the findings of the review.
ENL's network assets	Provides information on the age and condition of assets. Discusses historical levels of expenditure (capex and opex) in the network and provides an assessment of the implications for future compliance. Provides an assessment of ENL's forecast capex and opex.
Assessment of asset management framework	Gives an assessment of ENL's asset-related management framework including policies, strategies and operational procedures. The assessment identifies areas of concern and/or deficiencies in the framework. In particular, the assessment considers the extent to which consistency is seen between the various components of the framework and the extent to which they are implemented in practice.

Section	Content
Assessment of organisational capabilities	Provides a high level assessment of the capabilities of ENL and its contractors. A view is presented on how management is identifying and addressing maintenance and development of ENL's capabilities.

1.4 Data and information sources

11 The key data and information that this review has relied upon are set out in the following table.

Information/data	Source
SAIDI and SAIFI values	ENL annual compliance statements for 2011 and 2012. ENL analysis of worst performing feeders. Commerce Commission Outage Data Financial 1998-99 to 2011-12 Excel workbook
Historical and forecast capex and opex	ENL responses to Strata information requests. ENL draft 2013 Asset Management Plan (AMP). Capex and opex data provided by ENL by email and included in the Excel workbook ENL Performance by Category.
Asset age and condition	ENL responses to Strata information requests. ENL information obtained at the on-site visit and responses to email requests for further information. ENL 2013 AMP.
Asset management framework and practices	ENL responses to Strata information requests. Information obtained from ENL management during the onsite visit. AMP Policy ENL Draft 2013 AMP. ENL annual reports. Various procedures and manuals provided by ENL to the Commission.
References for good industry asset management	PAS 55-1: 2009 and PAS 55-2: 2009 Asset Management Standard and Guidelines.

Information/data	Source
practice	International Infrastructure Management Manual – International Edition 2006. AS/NZS ISO 31000: 2009 Risk Management Principles and Guidelines.

2 Summary of findings

12 On the basis of the information and data we have obtained during the course of this review, we have formed the view that the reasons provided to the Commission by ENL as to why it breached the SAIDI boundary levels in 2010/11 and 2011/12 do not fully reflect the underlying causes because:

(a) while events due to trees have increased during the period, failures due to equipment defects have also increased;

(b) the significant investment made during the past decade in renewal of the urban networks will have delivered improved reliability to the urban (high consumer density) areas. Therefore the SAIDI boundary breaches represent a greater fall in the rural network performance than the SAIDI figures, on their own, suggest;

(c) it is likely that historical low levels of spending on both replacement capex and maintenance opex have contributed to deterioration in asset condition and performance; and

(d) since the introduction of price-quality regulation, ENL has been actively managing quality outcomes to the regulatory thresholds and this will have had some bearing on the breaches of the SAIDI limit.

13 Strata has observed that the network assets are being required to perform within defined SAIDI limits and a constrained expenditure budget. This has led to increasing asset ages and a trend of increasing incidence of equipment failure. These factors, combined with ENL's historical underspend of its forecast capex, suggest that remaining within SAIDI and SAIFI limits in future years will be challenging.

14 In our opinion, ENL is likely to continue to breach the SAIDI and SAIFI limits in some years unless:

(a) a strategic review is undertaken to establish an appropriate approach to manage the aging overhead distribution network in challenging physical environmental conditions;

(b) the currently planned levels of replacement capex are reviewed;

(c) the currently planned maintenance opex is reviewed on a bottom-up basis, to reveal what an appropriate level of expenditure should be;

(d) the revised level of planned replacement capex and opex is delivered on an on-going basis by the business;

(e) the current level of vegetation control expenditure is at least maintained and, where economically justified, extended;

(f) the underlying causes for the upward trend in defective equipment-related faults is fully understood and addressed; and

(g) appropriate network performance targets are set by the business and consideration is given to removing the threshold levels as a target (instead considering them as limits not to be exceeded).

15 The above conclusion is valid if the current limits for SAIDI and SAIFI are to apply for future years. If higher SAIDI and SAIFI limits were to apply, it may be possible to achieve the required performance within the currently planned replacement capex and opex levels. The cost reliability trade-off should be made explicit if this path is taken.

2.1 Recommendations

16 While the Commission has not asked Strata to provide advice or recommendations with respect to its enforcement authority or options with regard to regulatory action or intervention, Strata considers that the Commission may find the following points useful.

17 Strata considers that ENL should undertake a strategic review to establish an appropriate approach for management of the aging overhead distribution network. This should include:

(a) consideration of the context and respective needs of both urban and rural consumers;

(b) a review of the forecast capex and opex to ensure that the planned expenditure is optimised and targeted at maintaining asset condition and performance at appropriate levels; and

(c) an assessment of the appropriateness of outcomes resulting from current price/reliability trade-offs, which are implicit in the planned capex and opex profiles.

18 Given the specific economic issues in the Gisborne region, ENL may consider it appropriate to constrain expenditure below the level needed to ensure network performance achieves the current SAIDI and SAIFI limits in some parts of their network. If ENL considers that the current SAIDI and SAIFI limits are overly stringent, it could apply to the Commission for a customised price-quality path. Alternatively, ENL may decide to lift expenditure above levels that can be sustained under its Default Price Path (DPP). Consumer consultation will be essential.

19 ENL should address the following strategic decisions in its review:

(a) develop and implement a strategy to address the increasing incidence of equipment failure;

(b) ensure that the business delivers budgeted capex and maintenance opex, unless it can be demonstrated that any material underspend is prudent;

(c) develop and document a comprehensive vegetation management plan as part of the AMP and report annually on delivery of the plan; and

(d) set network reliability targets that ensure network performance meets the regulated limits.

20 In making the above recommendations, we have taken into account the information provided to the Commission by ENL[1] that the ENL Board has requested that management completes a comprehensive review of network planning and operations (see Annex 1). We consider that our recommendations reinforce the ENL Board's approach. We consider it important that this review is completed and independently reviewed and that its findings are used to inform a broader strategic review that establishes a clear direction for the management of ENL's assets.

[1] Commerce Commission Response DPP 2012

3 Brief overview of ENL and its systems

3.1 Introduction

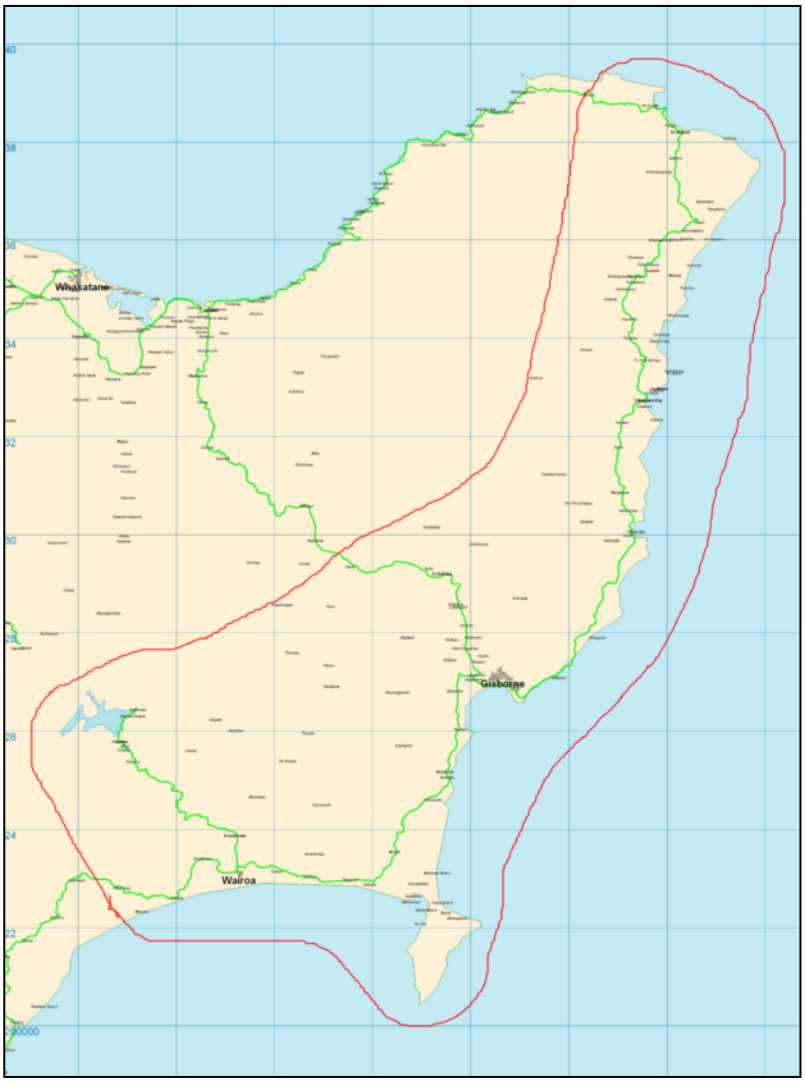
21 ENL's distribution area covers the East Cape and Northern Hawkes Bay regions, as shown in Figure 1. This area corresponds to the Gisborne District Council and the Wairoa District Council territories. ENL is part of the Eastland Group, which owns and operates a range of infrastructure businesses in the Gisborne area.

22 ENL's network topography covers some 11,952 square km, ranging from fertile plains around Gisborne and Wairoa to rugged mountainous areas further inland. The 11 kV network generally consists of ties between zone substations supplied by the 50 kV and 33 kV subtransmission networks, with radial distribution feeds inland that follow river valleys and ridges.

23 The population of ENL's distribution area is approximately 53,000, of which about 41,000 live in the urban Gisborne area and a further 5,000 live in the urban Wairoa area. The remaining 7,000 live in small settlements (such as Te Karaka, Tolaga Bay, Tokomaru Bay, Ruatoria, Matawai and Mahia) and in rural areas.

24 A key feature of ENL's network is that 75% of total network connections are domestic. The last three censuses indicate slightly declining populations in both the Gisborne and Wairoa Districts. Connection numbers for the past 8 years have been relatively static and there have been no significant net demand increases from industrial consumers.

Figure 1 - *ENL network areas*



Source: ENL 2013 AMP

3.2 Governance and management

25 The electricity assets of Eastland Network Ltd are 100% owned by the Eastland Community Trust (ECT). The ECT, originally the Eastland Energy Community Trust, was created in 1993 and took ownership of all the Poverty Bay Electrical Power Board's assets following the implementation of the Electricity Companies Act and subsequent Acts. The Gisborne District Council (GDC) appoints trustees of the ECT. The GDC is the ultimate capital beneficiary of the Trust.

26 Primarily, Eastland Group Ltd is a shared corporate service provider to each of the companies within its structure. It employs the management and operational staff required to run the companies within the Group. A common Board of Directors, appointed by the ECT, provides governance of the Eastland Group.

27 With respect to the management of ENL distribution network assets, Eastland Group provides the services and resources required to carry out all financial management, planning, design and network operating activities. Since all physical installation and maintenance work carried out on network assets is contracted out, the network operating function includes significant responsibility for the management of accredited contractors.

28 Contractors tender for packages of maintenance activity and/or capital works projects. Contracts are awarded on the evaluated performance criteria of price, quality/safety and timeliness. Contract tendering and management is carried out in accordance with NZS 3910:1998 "Conditions of Contract for Building & Civil Engineering Construction".

29 The long term planning function, through which ENL undertakes asset planning and design work, includes the company's professional engineering resources and the drawing/information record keeping. Production of the annual AMP is a key accountability of the Asset and Planning Manager (who reports to the GM).

30 The real-time and short-term system operations function implements work programmes, operates the network and manages contractors. Delivery of reliability, budget costing and safety performance is the key accountability of this group. The group is also responsible for the implementation of specific capital and/or maintenance activities as determined in the AMP.

3.3 Key statistics

31 The following statistics are sourced from the ENL 2013 AMP.

Sub transmission lines & cables	336 km
Zone substations	19
Distribution lines & cables	2,535 km
Distribution transformers	3,704
Low voltage lines & cables	796 km
Customer connection points	25,567
Energy delivered	306 GWh
Distributed generation	15 MW

32 Key industries relate strongly to the primary produce value chain – cultivation, harvesting, processing, storage and transportation of timber, root and leaf vegetables, pip and stone fruits, grapes, meat and fin fish. ENL's largest customers, and their peak demands, include the following:

Juken NZ Ltd (3.5 MW, timber processing)

Affco (3.5 MW, meat processing)

Bernard Mathews (2 MW, meat processing)

Tairawhiti Healthcare (2 MW, healthcare)

Cedenco (2 MW, food processing)

Eastland Group (1.5 MW, cool storage)

3.4 Network configuration

33 The ENL network is supplied from three Transpower GXPs, each supplying a geographically contiguous part of the region. However, there are no distribution network connections between any of the three GXPs at subtransmission or distribution level. Supply to the Gisborne and Wairoa GXPs is by double circuit 110 kV lines running from Tuai power station (part of the Waikaremoana hydro group).

34 The three GXPs are at Gisborne (Massey Rd), Wairoa and Tuai. The subtransmission and distribution networks are shown in Figure 2.

35 ENL's subtransmission is a combination of meshed and radial sections. A single 50 kV ring encircles Gisborne city and radial subtransmission feeders service the rural areas. In particular, a long single circuit 50 kV radial runs from Gisborne along the coast towards East Cape, servicing zone substations at Tolaga Bay, Tokumaru Bay, Ruatoria and Te Araroa.

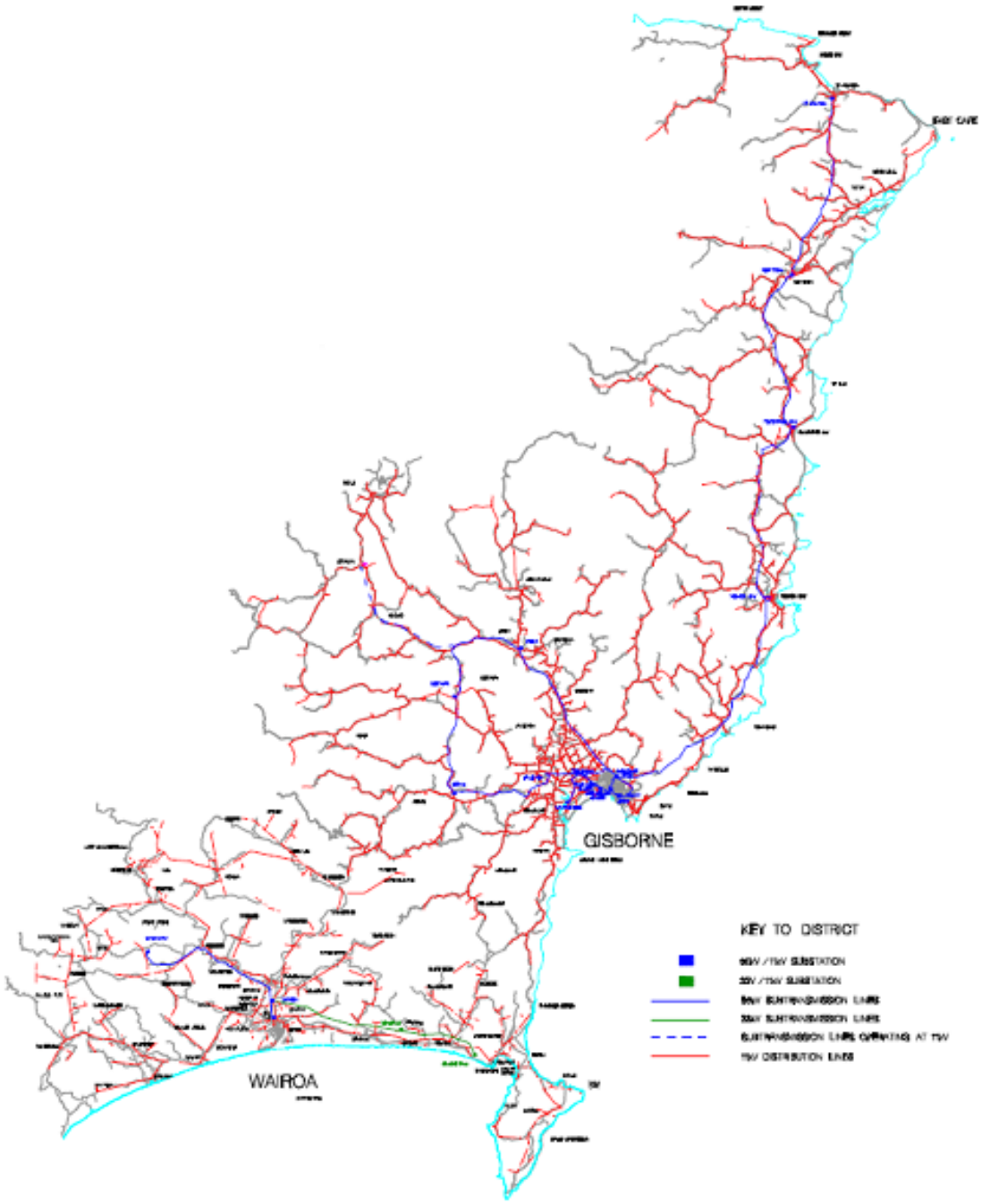
36 To provide backup along the radial network sections, ENL has strategically located 6 x 1 MW and 1 x 0.5 MW transportable diesel generation sets. These gensets are remotely controllable and are used for a variety of network support functions:

(a) to limit transmission peaks;

(b) to provide backup and emergency supply for use during planned and unplanned outages; and

(c) to augment capacity during seasonal peaks that occur in some locations (e.g. the summer holiday peak at Mahia).

Figure 2 -*ENL subtransmission and distribution lines*



3.5 Zone substations

37 We visited two of the 50/11 kV zone substations near Gisborne. These are part of the two subtransmission rings around the city interconnected by a meshed 50 kV largely overhead subtransmission line. Sections of the line have been installed relatively recently and the line appears to be in generally very good condition. The new sections have replaced existing 11 kV and LV overhead lines, which have been undergrounded. This has tidied up the network significantly in the urban area while providing reliable and easily maintained subtransmission around the city.

38 The substation at Matawhero was built in 2000 and supplies the mainly cold-storage load in this area. It is a tidy, well laid out substation in a rural setting that appears to have been well maintained. The site also doubles as a connection point for one of the 1 MW diesel gensets and this was run up by remote control during our visit.

39 It is evident that cost management has been a significant driver in the design of the substation, with low-cost supply transformers having been selected and a Portacom building used as the switch/control room. While there is no over-design in evidence, the substation appears to be perfectly functional and well fit for purpose. It is fully remotely controllable from ENL's control room at the Carnarvon Street headquarters.

40 In contrast to Matawhero, Kaiti is an urban zone substation on a relatively small site in a residential area. There are issues associated with the close proximity of occupied houses (transformer noise, litter thrown into the switchyard) that ENL is working to manage.

41 The overall impression of the subtransmission network is of a typical rural/urban network that has been developed over many decades, exhibiting a wide range of old and new equipment and design standards. ENL has continued to develop and secure this network in the period since 2000 and has achieved a network backbone that is secure (meshed with significant 11 kV backup through switching), flexible (mobile 1 MW diesel gensets) and extensible (through transformer relocations/upgrades) to meet foreseeable customer demands well into the future. The main driver of future subtransmission development is likely to be that necessary to integrate any future generation that might be developed within the region.

3.6 Mobile generators

42 As described in ENL's AMP, the installation of remote diesel gensets between 2002 and 2003 has reduced the impact of planned outages. On average over the past 6 years, use of these generators has avoided 254 SAIDI minutes of outage time annually.

43 ENL uses five 1 MW and one 0.5 MW diesel generators, owned by Eastland Generation Limited. The units are housed in standard shipping containers and weigh about 23 tons each. They can be deployed anywhere in the network

that is accessible to a large mobile crane and where up to 1 MW can be injected at 11 kV. The energy generated is sold to Contact Energy.

44 Benefits derived from operating these generators include:

(a) a reduction of ENL's GXP peak demand by up to 5 MW (using ENL's load control can curtail a further 3-4 MW);

(b) an easing of constraints on ENL's network, thereby avoiding network investment that would only be required for short periods in the year;

(c) maintaining supply during outages caused by subtransmission faults or as required to facilitate network maintenance; and

(d) providing a transmission alternative to meet the requirements of grid emergency procedures.

45 The 1 MW generators are located at Matawhero, Puha, Ruatoria, Te Araroa, Tolaga and Mahia on a semi-permanent basis. The 0.5 MW unit is also used as required to maintain customer supply during planned and/or unplanned outages.

46 It is clear that ENL has been able to optimise its network investment through its use of the mobile gensets. The annual avoided SAIDI alone represents a level of interruption that is approximately 85% of ENL's current SAIDI threshold. The gensets are thus a critical factor in ENL's SAIDI and SAIFI performance outcomes.

47 We suggest that a future AMP should consider the case for additional investment in diesel gensets, including a cost/benefit analysis that uses recent value of lost load (VOLL) data.

3.7 ENL's outage management processes relating to recording of SAIDI and SAIFI

48 ENL's process for collecting outage information starts with the onset of a fault involving high voltage (HV) or subtransmission equipment and ends when supply has been restored to all interrupted consumers. We investigated this process, including a review of sample documentation relating to a real fault.

49 In line with common electricity distribution business (EDB) practice, ENL's control room operator drives the process. The operator compiles a *Supply Interruption Data Input Form* (form ENL1005B) as the outage progresses and completes outage statistics once supply is restored. Exact switching times can be checked from SCADA logs. The number of affected consumers is derived from GIS connection data that is manually updated at the start of each calendar year.

50 The process is documented in Section 12 (Outage Data Recording) of Manual ENL2 *Network Control Operational Procedures Manual*, which sets out reporting requirements.

51 The outage record sample we reviewed was for an outage near Awatere (East Cape) in December 2011 (the sample documents are included in Annex 2). An insulator failure caused the outage, which was a progressively developing event that initially partially failed and was successfully relivened on two occasions before failing permanently. The whole event spanned a period of around 14 hours. The handwritten records appear to properly implement ENL's outage recording process. Sample auditing carried out in accordance with information disclosure requirements provides a degree of quality assurance for this process.

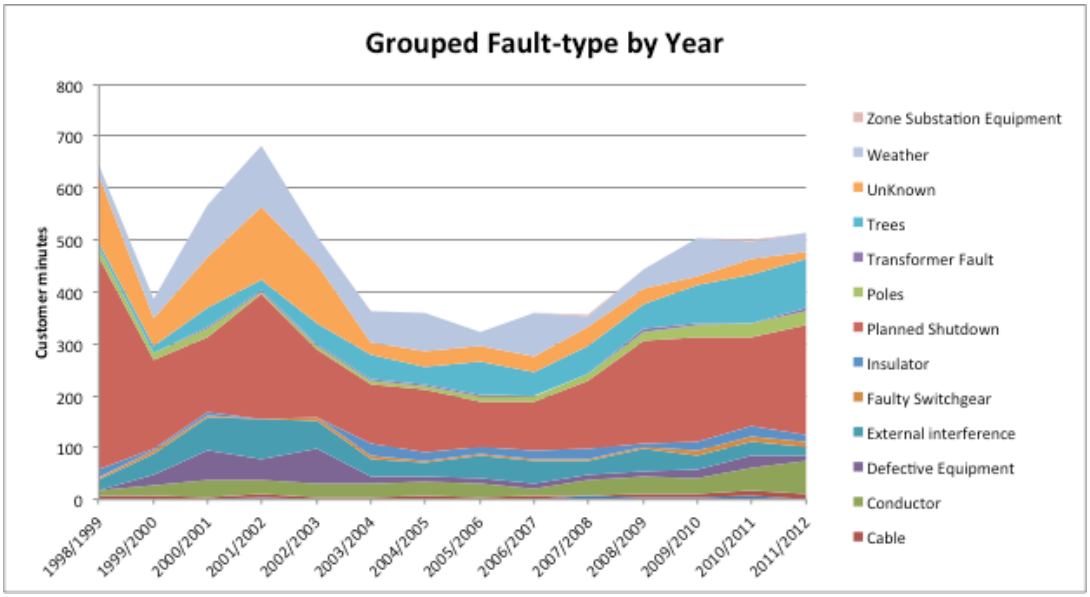
52 The documentation reviewed and the descriptions provided by the General Manager, Energy (who is closely involved in network operations and on occasions acts as control room operator) provided an overall impression of a routine and well-managed process.

53 In line with common EDB operating practice, outage performance recording is a manual process that relies on an operator completing standard forms clearly and accurately and transferring data into an electronic database. Inaccuracies in the manual part of the process will naturally have a ripple-through effect into the electronic records, from which network-wide SAIDI and SAIFI statistics are compiled.

3.8 Network performance

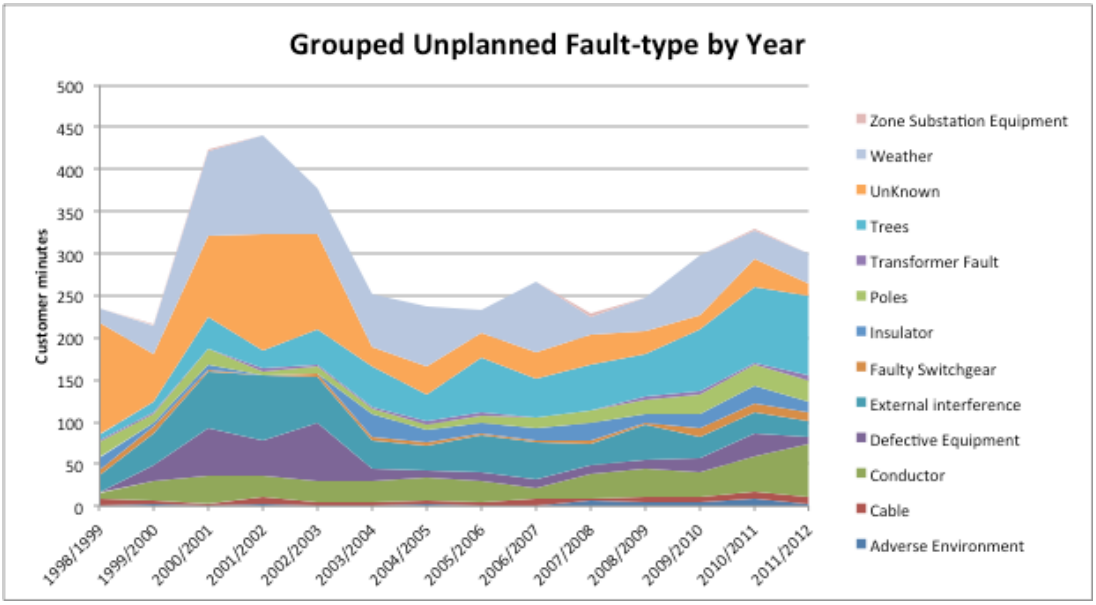
54 The output of the process described in the preceding section delivers the SAIDI and SAIFI statistics. The following figures provide a view of network performance over the last 13 years.

Figure 3 - *Total outages – customer minutes by fault type*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

Figure 4 - *Unplanned outages – customer minutes by fault type*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

55 Contributions to unplanned outage performance can be seen in Figure 3. The increase in faults due to trees is clearly seen in these charts.

3.9 Condition monitoring, assessment and reporting

56 ENL undertakes routine asset inspections and has policies in place covering various types of equipment. We investigated how ENL operates these processes and reviewed a sample of documentation covering routine overhead line and substation inspections.

57 The policy governing overhead line inspections is documented in Section 13 *Line Patrol Procedures* of Manual ENL14 *Network Maintenance Manual.* This policy was issued in November 2012.

58 From our brief review of its contents, the policy appears to be comprehensive and is pragmatically set out. The policy requires ground-level inspections of all overhead line components not less frequently than once in 2 years. Additionally, a below-ground test of wooden poles and an inspection of earthing equipment is required not less frequently than once in 5 years.

59 Thus, the policy specifies the minimum frequency of inspections and tests that can be undertaken. Paragraph 5.1 of the policy document states that:

> *The General Manager, Energy and the Asset Manager decide the frequency of inspection and testing of the poles and conductor.*

60 Hence, management determines actual inspection and testing frequencies but it is not clear on what grounds these decisions are made. The impression gained is that these basic asset management policy settings are subject to a range of unspecified short-term imperatives.

61 Inspections and tests are grouped into work packages and issued to an external contractor. The inspection and test attributes are specified in the policy document. Reports are only required where defects are encountered, in which case a *Defect Notification / Non-Conformance Form* (ENL8 Form: ENL100) is to be completed and returned to the ENL Information Group. If a defect is noted, an indication is provided of the urgency for repair (i.e. immediately (red tag) or 1, 3, 5 years (blue tag)).

62 We note that ENL's process is different to most others that we have observed at other EDBs. More commonly, inspectors are required to complete asset component checklists and assess the condition of every pole visited (whether a defect is identified or not) and return completed forms to the office. We requested samples of relevant documentation and it is interesting to note that a copy of an inspector's informal inspection log (handwritten on a diary page) was included. Clearly the completion of a pole-by-pole log is of value (at a minimum – and, of course, barring intentional deception – it demonstrates that an inspection has actually been carried out) and we wonder why pole asset component and inspection data is not routinely collected and entered into the asset data management system.

63 In contrast, Transformer Inspection Sheets (these forms have no marked reference number) provide highly detailed point-by-point inspection and testing checklists in addition to a detailed register of defects. These provide a rich set of asset condition information that can inform future asset expenditure planning.

64 We have attached sample asset inspection documents covering lines and transformers in Annex 3.

4 Assessment of reliability performance

4.1 Introduction

65 SAIDI and SAIFI regulatory standards were calculated for the reference period 1 April 2004 to 31 March 2009 to be:

- SAIDI limit: 302.38
- SAIFI limit: 4.26

66 ENL's Compliance Statements show that actual network performance against the above SAIDI and SAIFI limits were:

Year ending 31 March 2011

- SAIDI: 334.00
- SAIFI: 3.49

Year ending 31 March 2012

- SAIDI: 392.15
- SAIFI: 3.41

67 ENL exceeded the regulatory standards for SAIDI in both 2010/11 and 2011/12. No events occurred in either of these years where boundary values were substituted for actual SAIDI values.

68 In both 2010/11 and 2011/12 ENL performed within the SAIFI limit.

4.2 ENL explanations for the breaches

69 ENL has provided the following view of the main causes that led to the SAIDI limit being exceeded:

> *The number of Planned events increased in the period 2009/10 – 2011/12 which coincides with an increased program of 11 kV pole renewal implemented in 2009/10.*
>
> *The number of Unplanned events has increased in the period 2009/10 – 2011/12. It is believed that this approximate 10 – 15% increase is due to external factors such as extreme weather events that occurred in those years and is not an overall indication that the performance of network assets is markedly reducing.*
>
> *A marked reduction in SAIDI B + C for the years 2006/07, 2007/08 and 2008/09 from the prior 4 year period. In part this is the result of a low level Class B, (Unplanned) SAIDI. Appreciating that the method of calculating threshold limits changed between the 2005 -2009 and 2010 – 2015*

regulatory periods, ENL believes that the low SAIDI for the years 2006/07, 2007/08 and 2008/09 contributed to the reduction of the SAIDI threshold limit for the current regulatory period.[2]

Levels of SAIDI Class C from 2006/07 to 2011/12 are comparable in value with a significant determinant in total SAIDI for the years 2009/10, 2010/11 and 2012 being increased SAIDI Class B, (Unplanned). These increases in SAIDI Class B coincide with an increased program of 11 kV pole renewal implemented in 2009/10.

70 ENL has provided to the Commission[3] the following additional information on outages caused by interference from trees:

- In 2010/11, 91 tree contacts with the network resulted in 72 SAIDI minutes, (28% of Total Unplanned SAIDI).
- In 2011/12, 97 tree contacts with the network resulted in 92 SAIDI minutes, (33% of Total Unplanned SAIDI).
- In addition to the Unplanned SAIDI above, it is estimated that the level of annual planned outages required for clearing trees around lines and/or the harvesting of forestry blocks accounts for at least 10 SAIDI minutes.

71 During Strata's on-site review, ENL management stated that the rate of tree-related faults has been increasing. In ENL's view, this is mainly a consequence of the significant amount of exotic pine forestry planted in close proximity to ENL overhead lines. Generally, forests are now reaching maturity with trees of up to 40 metres (i.e. 4 times the height of power poles). ENL's experience is that mature trees are more susceptible to damage during severe weather events.

72 ENL considers that the current tree regulations are insufficient to allow appropriate clearances between trees and lines.

73 ENL clearly identifies the reason for the deterioration in reliability performance as:

(a) an increase in planned outages due to the 11 kV pole renewal programme; and

[2] Eastland Networks paper to the Commission titled SAIDI Performance Overview (Nov 2012)

[3] Com Com Response DPP 2012

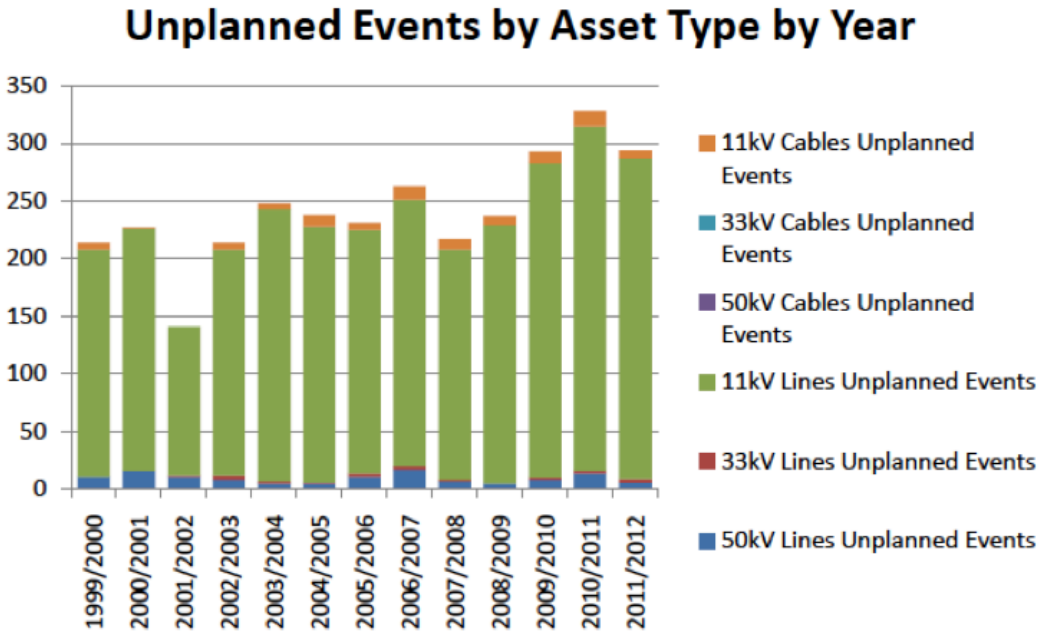
(b) extreme weather events leading to increased interference of overhead lines from vegetation.

74 Our assessment of ENL's explanation is provided in the following section.

4.3 Assessment of ENL's explanation

75 Over the last 10 years, the reliability of the urban network in Gisborne and Wairoa has improved due to the capital asset replacement programme. Over the same period, the performance of the rural network has deteriorated. Figure 5 indicates that there has been an increasing incidence of outages on the 11 kV rural overhead lines.

Figure 5 - *Unplanned events – Contributions by asset type*

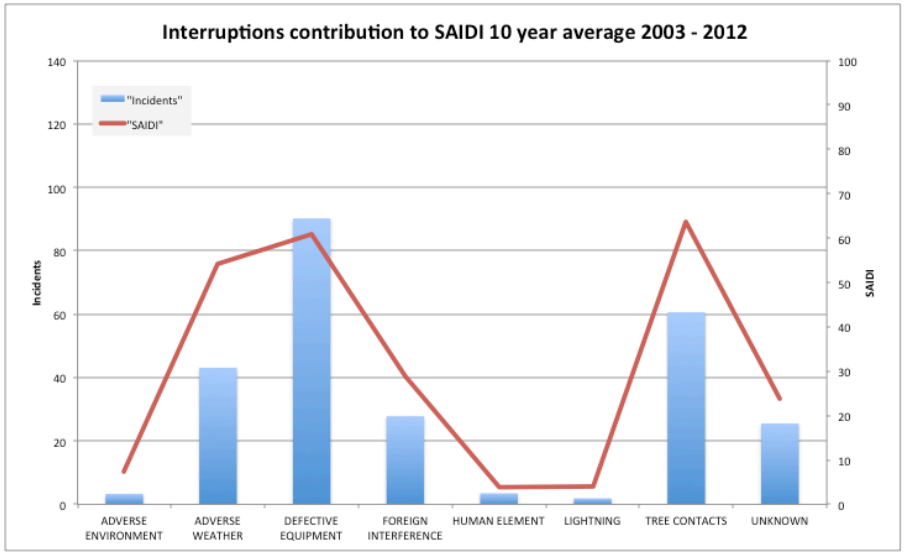


Source: Commerce Commission[4]

76 From a desktop analysis of ENL's network performance data we have found that incidents due to both tree contacts and defective equipment have increased. Figures 6 and 7 provide a comparison of the 10 and 4 year averages.

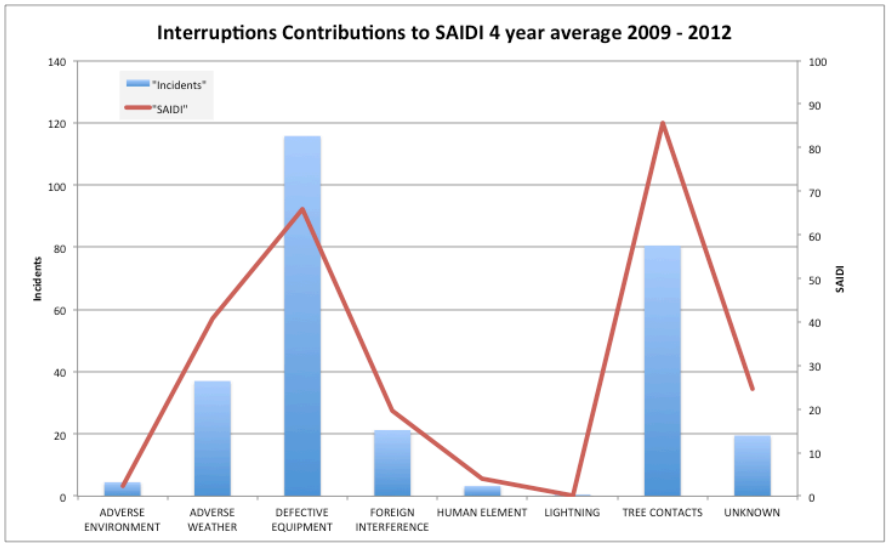
[4] Eastland Network Limited – SAIDI Performance Overview (Nov 2012)

Figure 6 - *Causes of interruptions – 10 year average*



Source: ENL performance by category

Figure 7 - *Causes of interruptions – 4 year average*



Source: ENL performance by category

77 Incidents caused by defective equipment have increased in number, yet their contribution to SAIDI has remained approximately constant. However, tree contacts have increased markedly, both in terms of the number of events and their contribution to SAIDI.

78 It can be seen (by comparing Figures 6 and 7) that for all overhead-related causes (e.g. adverse weather, lightning, foreign interference), the number of incidents and SAIDI have reduced during the most recent years. We consider that this is likely to be a result of the capital investment made in the urban network.

79 As the benefit of improved reliability of the urban networks was being realised, there has been an increase in the number of incidents and impact on

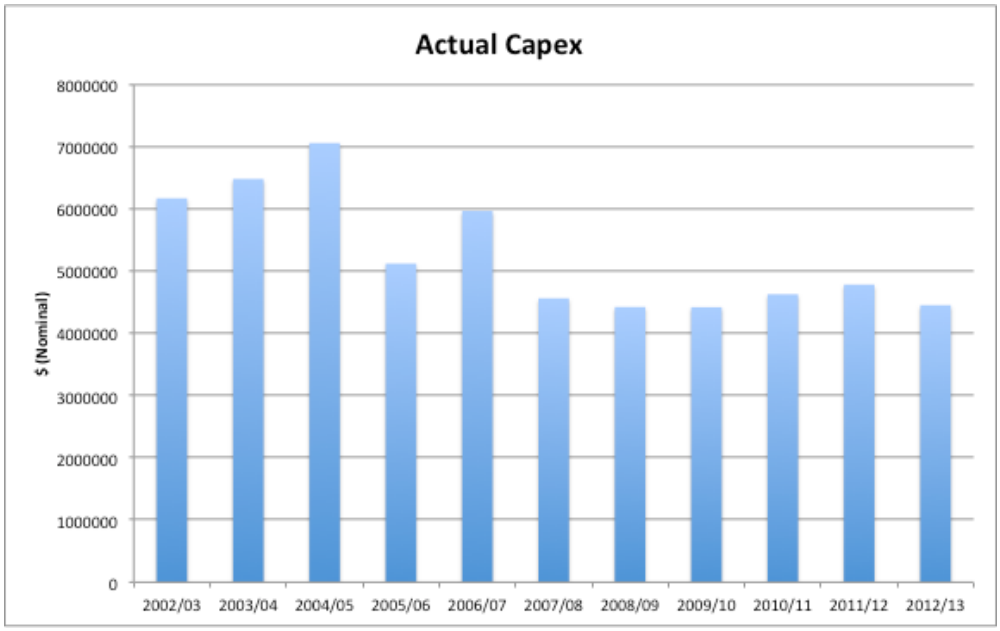
SAIDI from the overhead network assets, which are predominantly rural. The causes of increased SAIDI are observed from Figure 7 to be due to both defective equipment and tree contacts. However, the adverse impact of the increase in tree contact incidents has contributed most to the increase in SAIDI.

80 We found that ENL has actively managed the number of planned outages to achieve the SAIDI and SAIFI targets. This has meant that projects requiring planned outages will likely have been deferred towards the end of the regulatory year as a SAIDI or SAIFI breach becomes a realistic possibility. The network performance data suggests that a catch up in planned outage work has coincided with a period of higher unplanned outages and that this has contributed to the SAIDI breaches.

4.3.1 Planned outages

81 Capital investment has been undertaken during the earlier part of the last decade, achieving replacement of the overhead distribution networks with underground cables and the construction of new overhead 50 kV subtransmission. This substantial replacement programme has largely benefited the urban areas. Figure 8 shows ENL's actual capex.

Figure 8 - *Actual Capex*



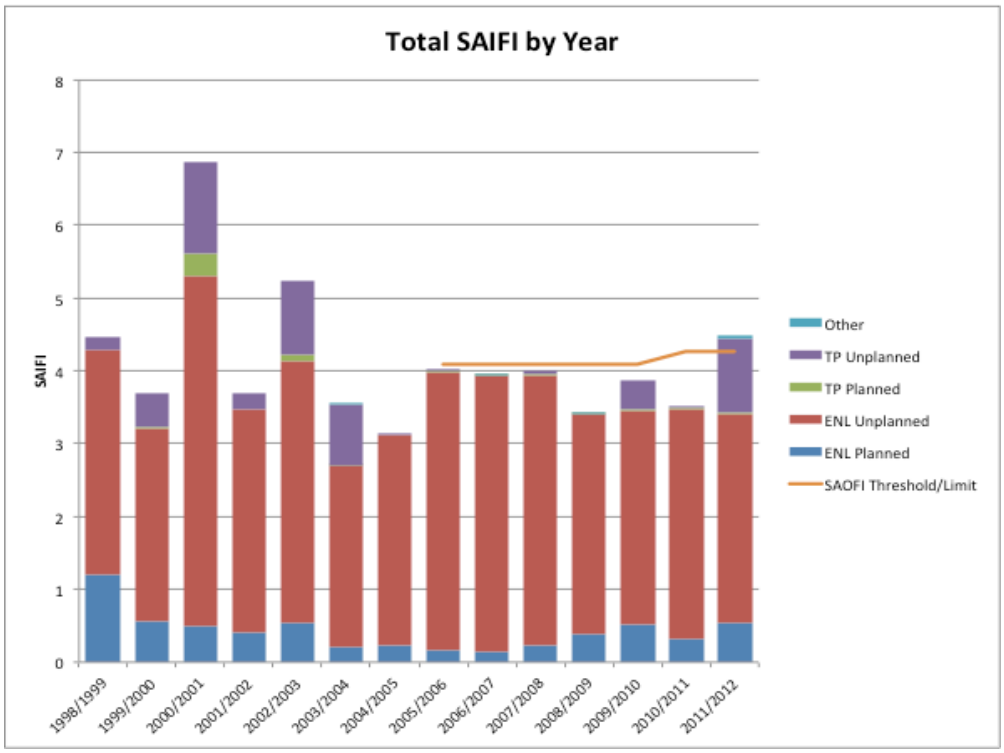
Source: ENL performance by category

82 During our onsite discussions, ENL stated that the focus of their asset replacement capex has more recently been on the replacement of 11 kV wooden poles. We expect that the replacement of wooden poles on the distribution network will have required more planned outages than the work on subtransmission in the early part of the decade.

83 Regardless of the nature of the work undertaken, the actual capex programme profile does not suggest that planned outages can be accepted as the primary cause of the SAIDI breaches.

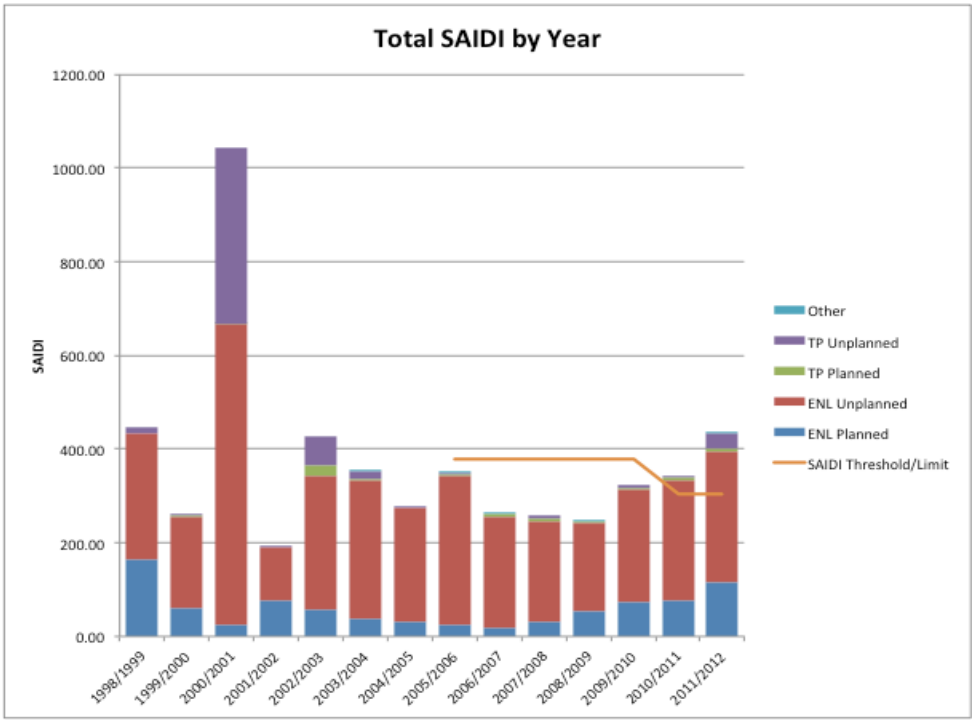
84 Our desktop review indicates that a change may have occurred in ENL's quality performance management at the point at which the regulatory quality measures were introduced. Figure 9 shows variable SAIFI performance pre-2005, which changes to a flat line performance at the SAIFI threshold level for the following three years.

Figure 9 - *SAIFI – actual and threshold/limit*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

Figure 10 - *SAIDI – actual and threshold/limit*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

85 We discussed these observations with ENL management. We gained the impression that ENL management closely monitors network performance on a continuous basis. We were told that the annual SAIDI target is treated as a budget of acceptable system minutes of interruption and the objective is to be close to, but not in excess of, the annual target at year-end.

86 Planned (controllable, as planned work can be deferred) and unplanned (largely uncontrollable in the short-term but controllable in the longer-term by asset maintenance and replacement) SAIDI minutes are thus treated by ENL as substitutable quantities. It was made clear to us that planned work is actively scaled back if there is a threat that the annual SAIDI target is likely to be exceeded.

87 The GM expressed the view that the business is not rewarded by significantly reducing SAIDI below the threshold level in any year. In fact, the business is eventually penalised for consistent good performance because the target is likely to be revised downwards, as happened to ENL at the most recent threshold review. On the other hand, exceeding the SAIDI or SAIFI threshold levels results in a significant penalty to the business due to the resulting Commission investigation.

88 We perceive that ENL management feels it cannot win, unless it is fortunate enough to slide just under the threshold targets year after year. The performance year that triggered the current investigation was cited as a case in point – performance was on target until late summer weather-related unplanned outages (contributing more than 50 SAIDI minutes) triggered a SAIDI blowout.

89 We appreciate that network performance management involves critical trade-offs between short and long-term performance management. Planned work not completed this year will lead to increased fault rates over time, as under-maintained and beyond end-of-life assets remain in service for longer periods.

90 It is possible that ENL has deferred planned work to manage SAIFI to the threshold that also reduced SAIDI. This in turn would have affected the setting of the SAIDI and SAIFI limits resulting in a SAIDI limit that was unrealistic for the business to achieve.

91 We consider there is a strong possibility that the combination of a catch up in planned work and the reduction in SAIDI, when the limits took effect, have contributed to the subsequent breaches of the limits. The extent of this effect is difficult to quantify.

92 We found that ENL has continued to consider the SAIDI and SAIFI limits as targets rather than 'not to be exceeded' limits. We consider that this approach should be reviewed and that ENL set appropriate internal performance targets that are below the regulated limits.

93 We further recommend that the Commission considers our comments in respect of the substitutability of planned and unplanned SAIDI/SAIFI performance in the context of price quality regulation.

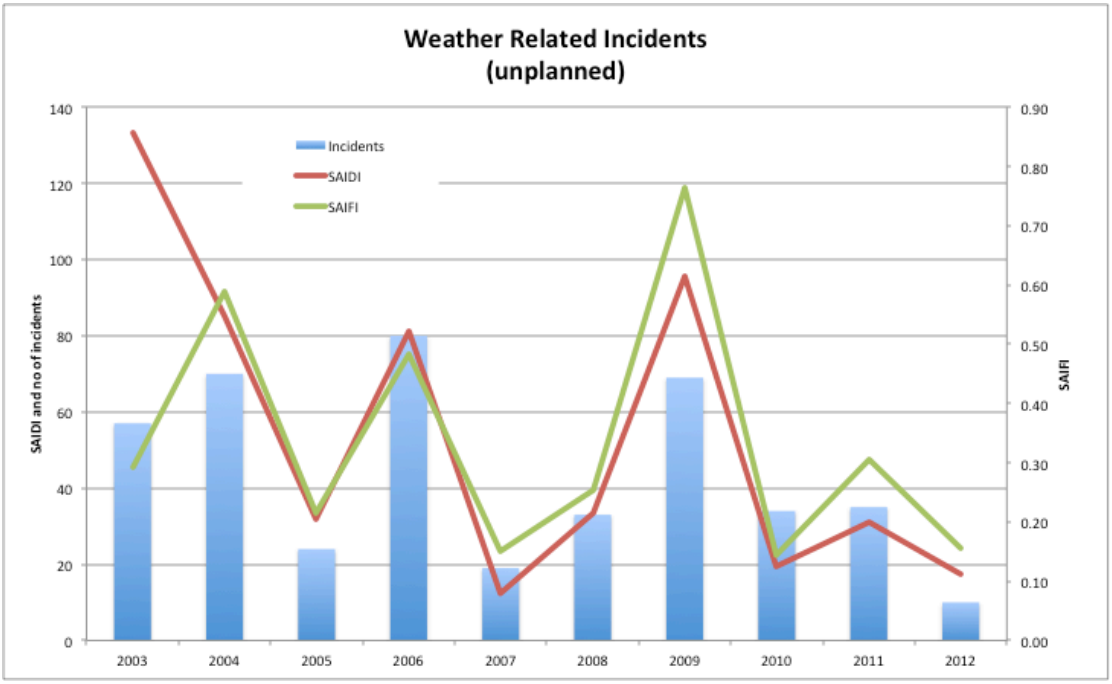
94 If ENL concludes that it cannot perform within the current regulatory limits, it has the option of submitting a Customised Price Path (CPP) application to the Commission.

4.3.2 Extreme weather

95 The North Island's East Coast environment is subject to extreme weather at times. The electricity network in this region would therefore be expected to be constructed and maintained to withstand reasonably severe weather conditions, within economic constraints.

96 Our analysis of network performance data (Figure 11) has shown that, other than for 2009, outages attributed to weather have been declining. The reason for this may be actual reductions in weather-related events or improved fault cause categorisation. We consider that ENL has improved its categorisation of fault causes by looking beyond the immediate cause to the root cause of the outage.

Figure 11 - *Unplanned outages – weather related*



Source: Eastland Networks[5]

97 While we consider that severe weather is a contributor to ENL's performance limit breaches, we do not accept it as the root cause. It is more likely that the adverse weather conditions are triggers that cause some other weakness in the system to fail. Clearly, as identified by ENL, tree contacts are a prime example of this effect.

98 Accordingly, we conclude that extreme weather is a trigger but not the cause of the breach of SAIDI limits.

4.3.3 Tree contacts

99 The SAIDI impact arising from tree contacts trends strongly upwards (Figure 9) in the period of the SAIDI breaches. Figure 12 shows that the increased incidence of tree contacts is driving up both SAIDI and SAIFI. The higher rate of increase in SAIDI suggests that the duration of outages due to tree contacts is increasing. This is understandable given the remoteness of large sections of the overhead 11 kV network.

[5] ENL Performance by category.xls

Figure 12 - *Unplanned outages – tree related incidents*

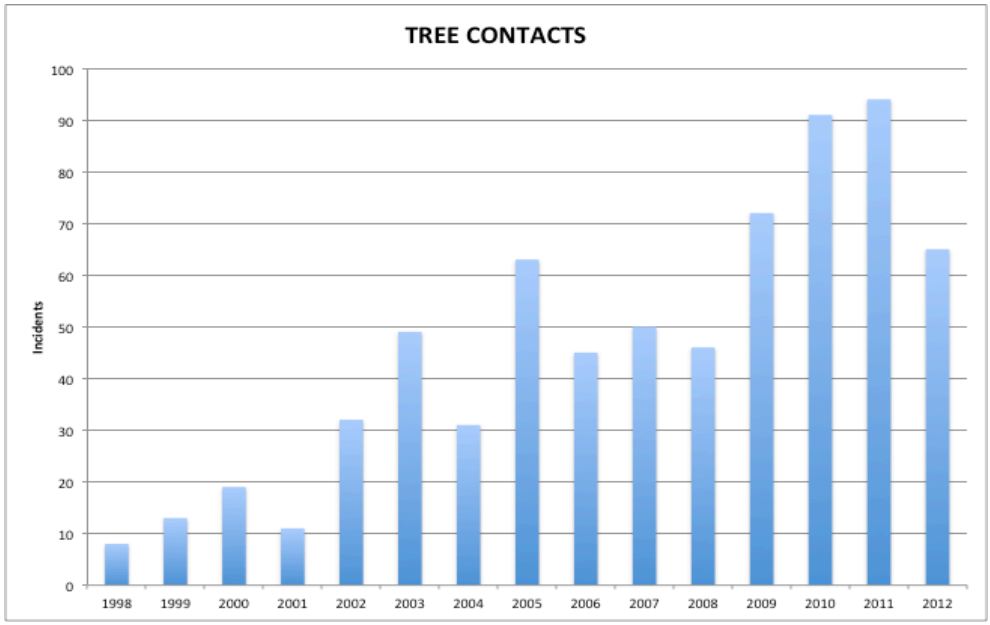
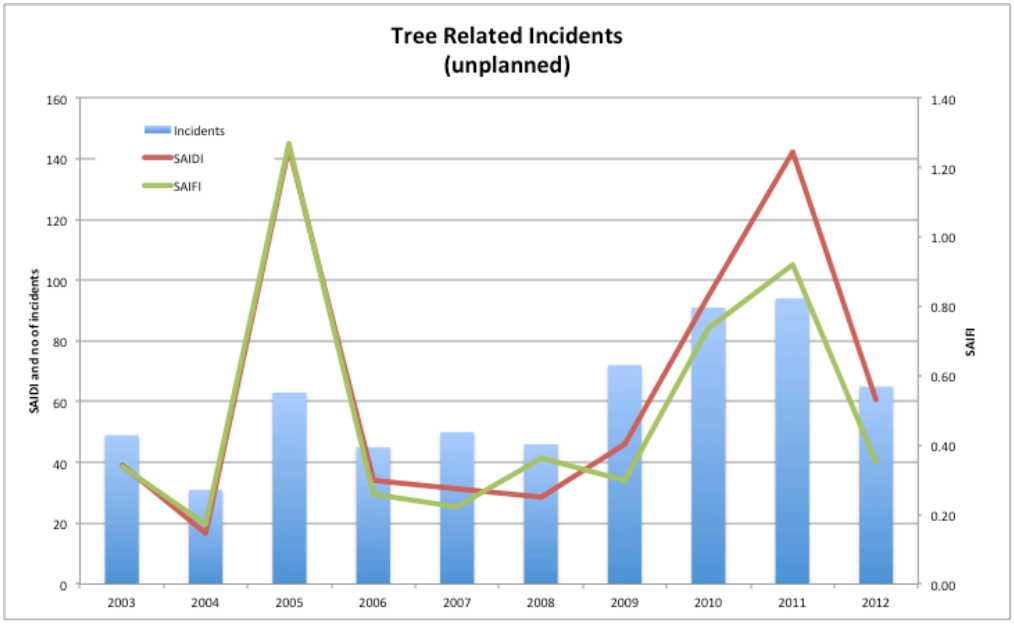


Figure 13 - *Unplanned outages – tree related*



Source: ENL Performance by category

100 ENL considers that the increase in tree contacts is mainly due to forests reaching full maturity, with 40 m high trees being situated close to 10 m high 11 kV distribution lines. ENL has found that mature pines cause significantly more damage when they fall across lines and become weaker and more susceptible to problems as they age.

101 Our on-site observations and discussions have confirmed that tree management, and the impact of changes made to the tree regulations, is an on-going and significant issue for ENL. The remote and rugged terrain in the ENL region may make management of the tree encroachment of overhead lines significantly more difficult than in other regions.

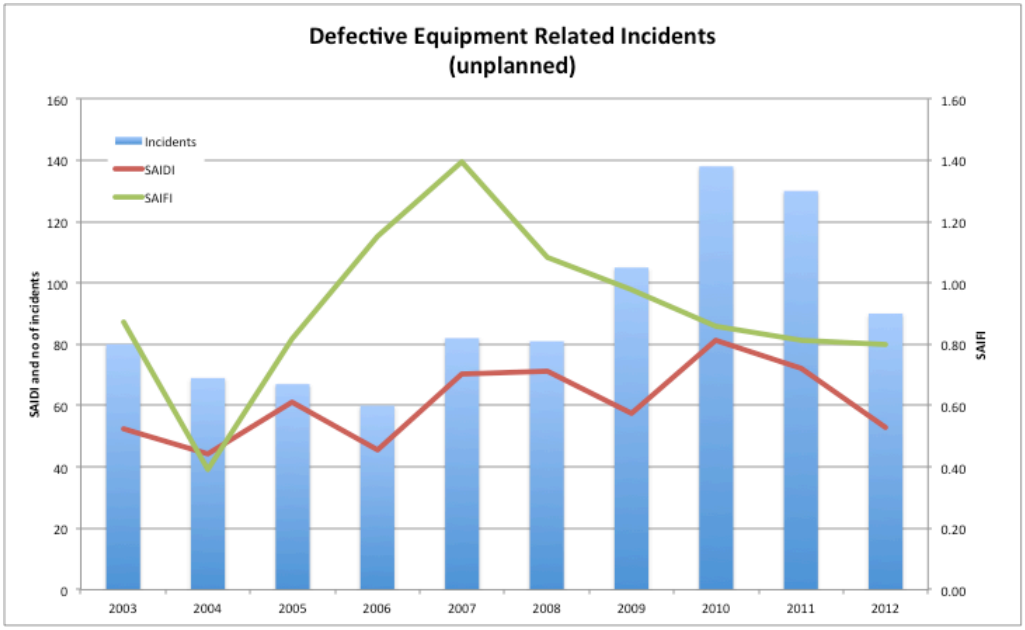
Figure 14 - *Rugged terrain inland from Wairoa – there's an 11 kV line in there*

102 ENL has responded to its vegetation control problem by increasing the amount of expenditure in this category. This can be seen in Figure 13.

4.3.4 Defective equipment causes

103 It can be seen in Figure 14 that the incidence of defective equipment failures has been increasing and that there is an upward trend in the contribution to SAIDI from these incidents. It is probable that the increase in incidents is due to aging conductors and poles on the rural lines. This is discussed further in section 6.

Figure 15 - *Defective equipment – SAIDI and SAIFI*



Source: ENL Performance by category

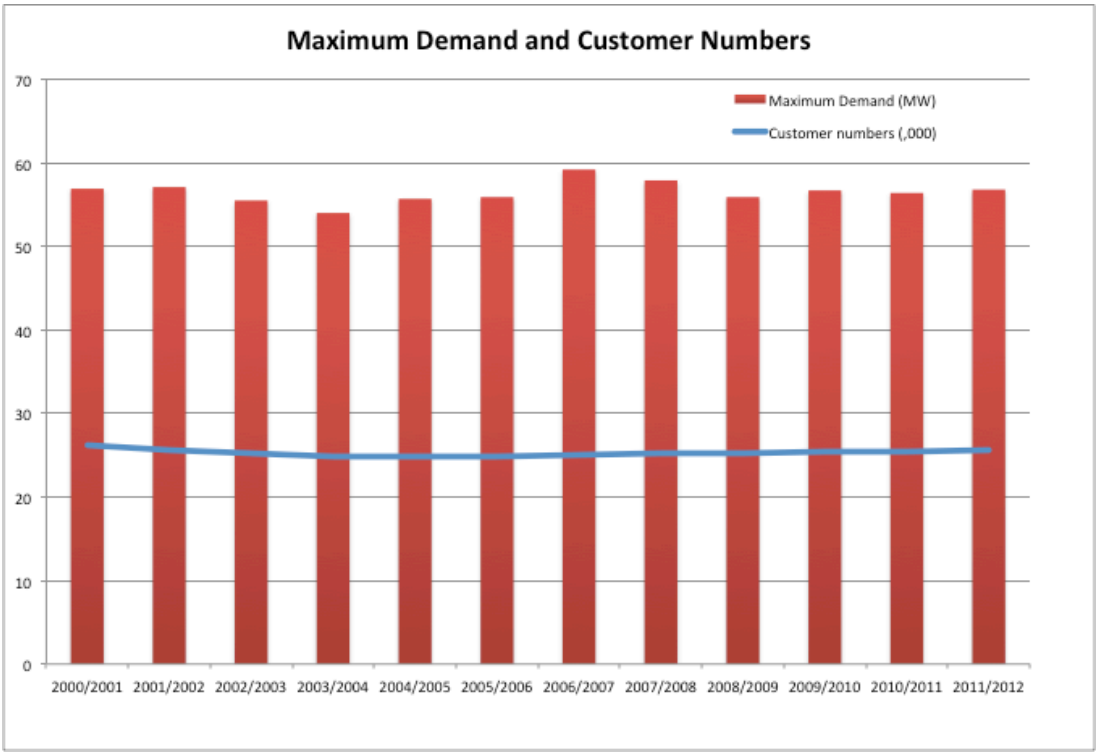
104 As noted above, for a relatively unchanged customer base, we would expect SAIFI and the number of incidents to be strongly correlated.

5 How ENL is addressing performance

5.1 Asset management

105 It is common for electricity networks to replace a proportion of their older assets, and thereby reduce average asset age, through network upgrades required to meet growth in customer connections and demand. In recent years, network augmentation has not been possible for ENL due to flat demand in the region (Figure 16).

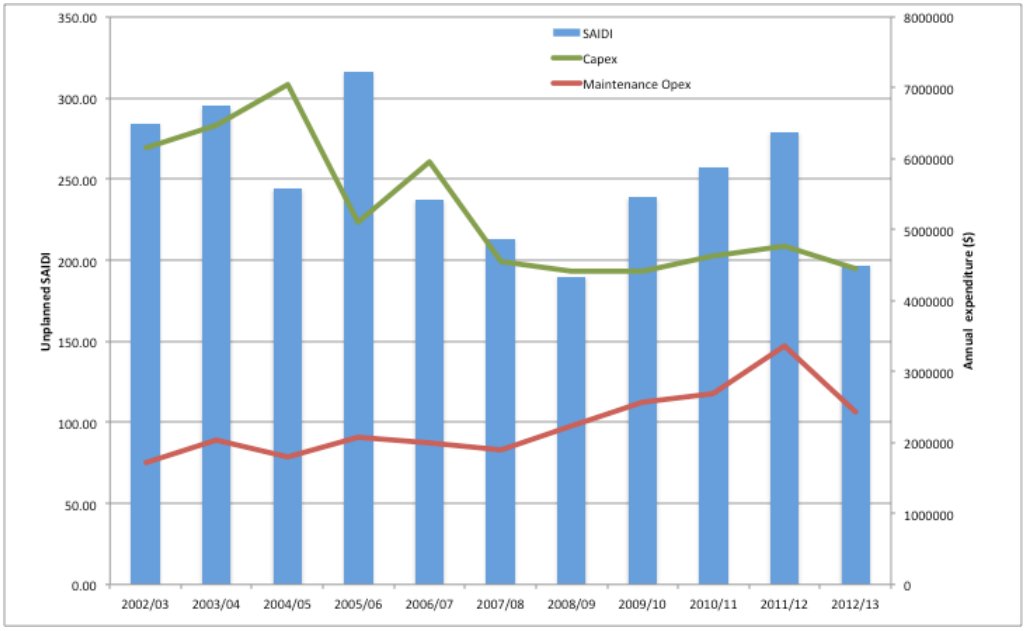
Figure 16 - *Growth – demand and customer numbers*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

106 Given these circumstances, ENL's focus has been on replacement capex and opex. Capex and opex profiles against SAIDI performance can be seen in Figure 17.

Figure 17 - *Capex and opex – historical (Real $2013)*



Source: ENL Performance by category

5.1.1 Asset replacement and renewal

107 Capex has fallen as the urban subtransmission and distribution network renewal programmes have been completed. Since that time, capex has levelled.

108 ENL informed us that its 'steady state' practice is to set budgets for renewal capex at the level of its annual asset depreciation. ENL considers that this will maintain average asset age within appropriate levels and ensure that the network will perform at a steady state level. This reflects a decision in respect of a price/reliability trade-off:

Being subject to regulated price control, the lack of growth also has an influence on the allowable revenue that can be sourced to fund the operation, maintenance, renewal and development of assets, and provide a return to the shareholder. Accordingly, being in a steady state and working within a prescribed revenue envelope means that, for ENL, any additional expenditure or investment made to improve beyond steady state performance will reduce network ROI.[6]

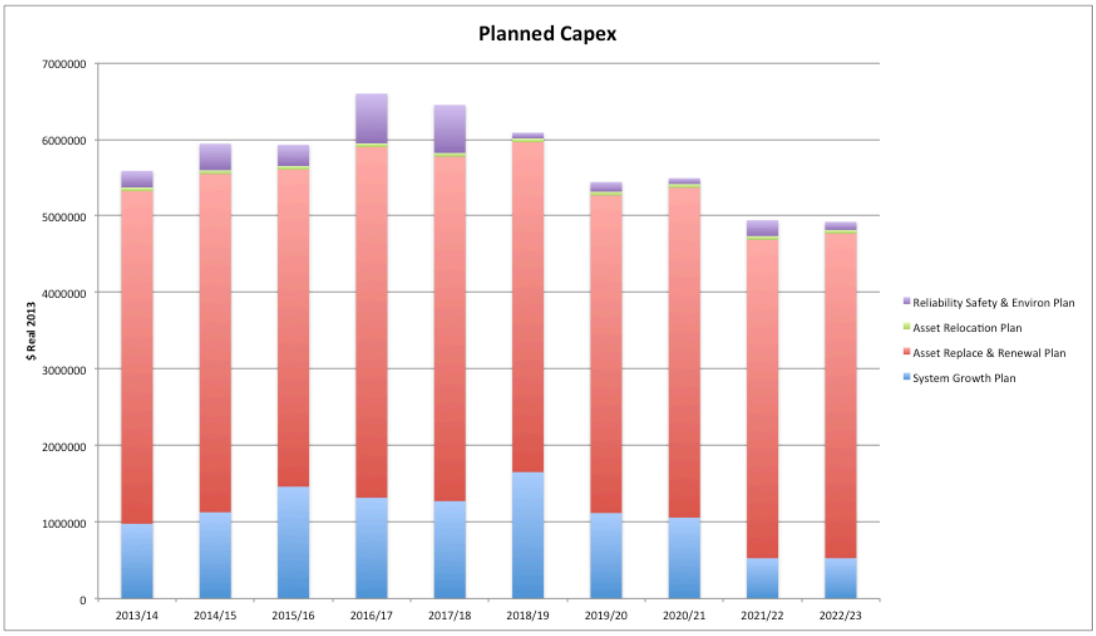
109 ENL has also identified the need to undertake replacement of its aging 11 kV overhead lines to ensure performance is maintained within limits.

[6] ENL Board Paper extract, Meeting Date 20 February 2013, Agenda Item 10.3

110 It has been identified through age profile information and asset condition surveys that a large proportion of ENL assets that influence network performance (i.e. 11 kV overhead lines), are in the age replacement phase of their life cycle. Accordingly, the management approach is to replace these assets rather than to continue with a heavy maintenance strategy. The resulting improvement in average asset condition should maintain long-term performance.[7]

111 Figure 18 provides ENL's planned capex for the 2013/23 period.

Figure 18 -*Capex – Planned 2013/14 to 2022/23*



Source: ENL Performance by Category

112 75% of the forecast capex is identified as replacement and renewal with 65% of this category being allocated to subtransmission lines and distribution lines. ENL informed us that:

> *The condition of these assets are primary influences on network reliability performance.*[8]

5.1.2 Asset Maintenance

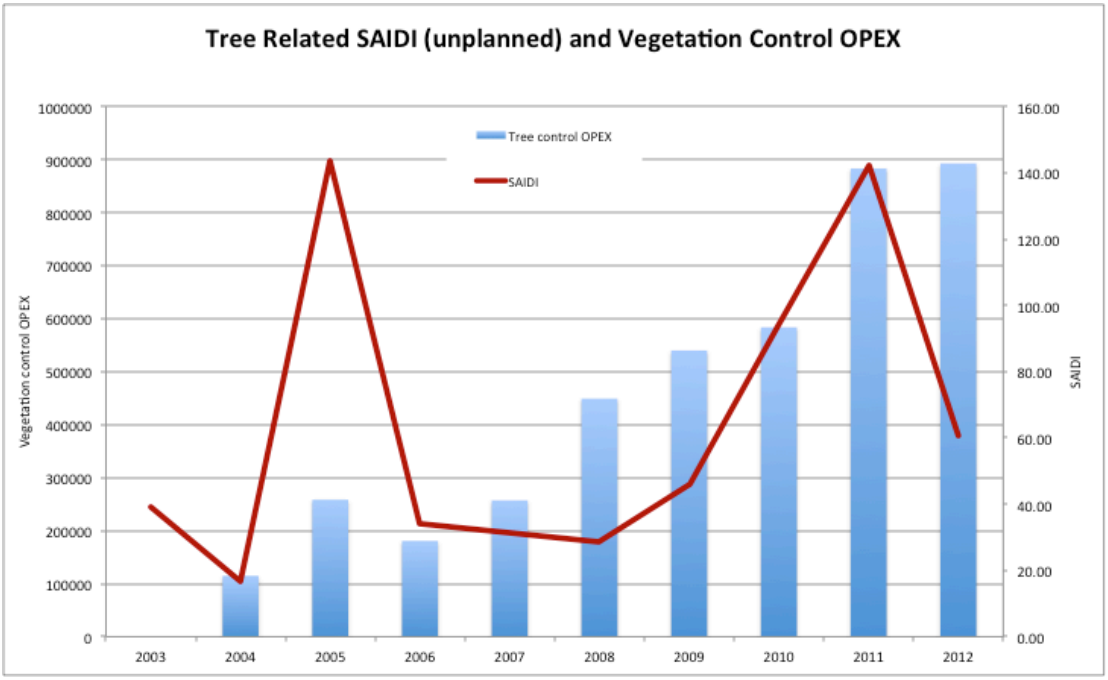
113 Opex has been increasing, probably in response to increases in network faults, as is observed in the SAIDI trend.

[7] ibid

[8] ibid

114 In response to the tree-related issues identified by ENL, there has been a significant increase in the opex allocated to vegetation management. Figure 19 shows how ENL has responded to the impact of increasing tree-related faults. ENL management informed us that ENL has an on-going commitment to maintain the appropriate levels of expenditure in this area.

Figure 19 - *Tree control opex (Real $2013)*

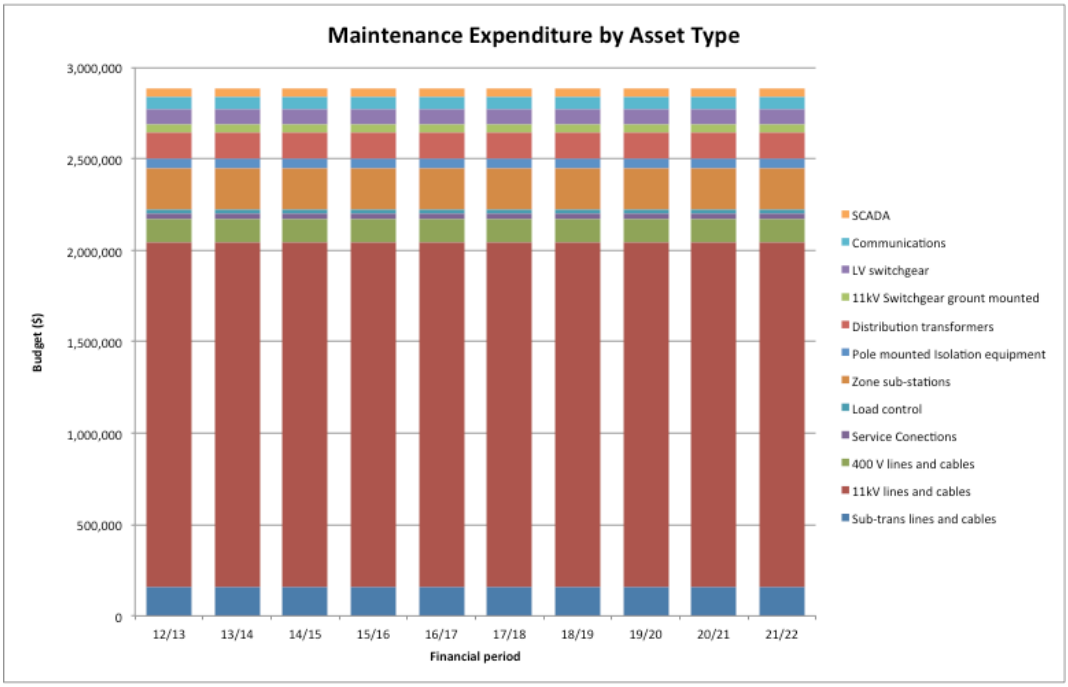


Source: ENL Performance by category

115 ENL's methodology for planned opex is to extrapolate budget forecasts from a base year. This is a not uncommon approach for electricity network businesses, as the actual expenditure is reasonably predictable at a high level. As money is spent in response to changing events, circumstances and information, the allocation to specific work parcels will change, but expenditure will normally remain within the overall budget.

116 Therefore, to remain within the overall opex budget, the increased expenditure on vegetation management will mean that spending on other areas will need to be less than planned. Figure 20 sets out ENL's planned maintenance opex for the next ten years. The extrapolation from a base year is clearly seen.

Figure 20 - *Maintenance opex (Real $2013)*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

117 ENL is increasing planned capex during the first half of the next decade. However, this appears to be driven by an anticipated system growth requirement but not asset renewal, with average expenditure for this category not materially different from that planned for the last four years.

118 Our conclusion is that ENL's response to address the breaches in SAIDI limits is to increase spending on vegetation management. However, in doing this, they seek to remain within a level total planned opex budget. In addition, ENL intends to manage performance limits by assessment of asset age, condition and performance, while not committing more capex than the equivalent of annual asset depreciation.

6 Our assessment of ENL's actions to address performance issues

6.1 Overview

119 In this section, we set out our assessment of the actions ENL plans to address the network performance issues and provide options for required additional actions.

120 We will firstly deal with ENL's planned actions to address the increasing fault incidence and outage durations due to tree contacts. We will then consider the broader issue of network age and condition and ENL's approach to asset management.

6.2 Tree control

121 During our site visit, we undertook field inspection of ENL's vegetation management. Trees in this network area fall into one of two categories:

(a) plantation trees (predominantly pinus radiata), that make up the significant areas of managed forestry in the region; and

(b) other areas of free growing forest/bush/scrub, shelter belts, smaller one-off local plantations and decorative plantings.

122 Maturing pine forestry is widespread throughout ENL's region and presents an on-going management issue. Invariably, line construction has pre-dated the planting of forests. In mature forested areas, narrow felled strips are maintained on either side of lines (see photos in Annex 4). These require frequent trimming of boundary trees to avoid contact with the line. Scrub and regrowth management is required in the felled strip immediately beneath the line.

123 The forested tracts we observed along SH2 between Gisborne and Wairoa appeared to have been actively managed. However, it is evident from the photos that 30+ m tall mature trees are always going to present a threat to 10 m lines, even with 3 metres of clearance on either side of the line. Forests planted in rugged terrain present additional issues of access for tree maintenance and fault response.

124 In other areas, re-planting patterns highlight issues that will arise within a decade or so. We observed some tracts where new trees have been planted directly beneath the line.

125 In non-forested areas with significant tree and vegetation growth, relatively low amenity values are placed on trees and other vegetation. Landowners are generally happy to have encroaching vegetation clear felled.

126 The Raupunga feeder, inland from Wairoa and one of ENL's worst performing feeders, highlights the challenge of vegetation management and the maintenance and operation of line assets across remote and rugged terrain. It frequently runs adjacent to tall trees and other vegetation in difficult terrain. We observed many replaced poles and recent worksites where pole refurbishment and vegetation management have been carried out.

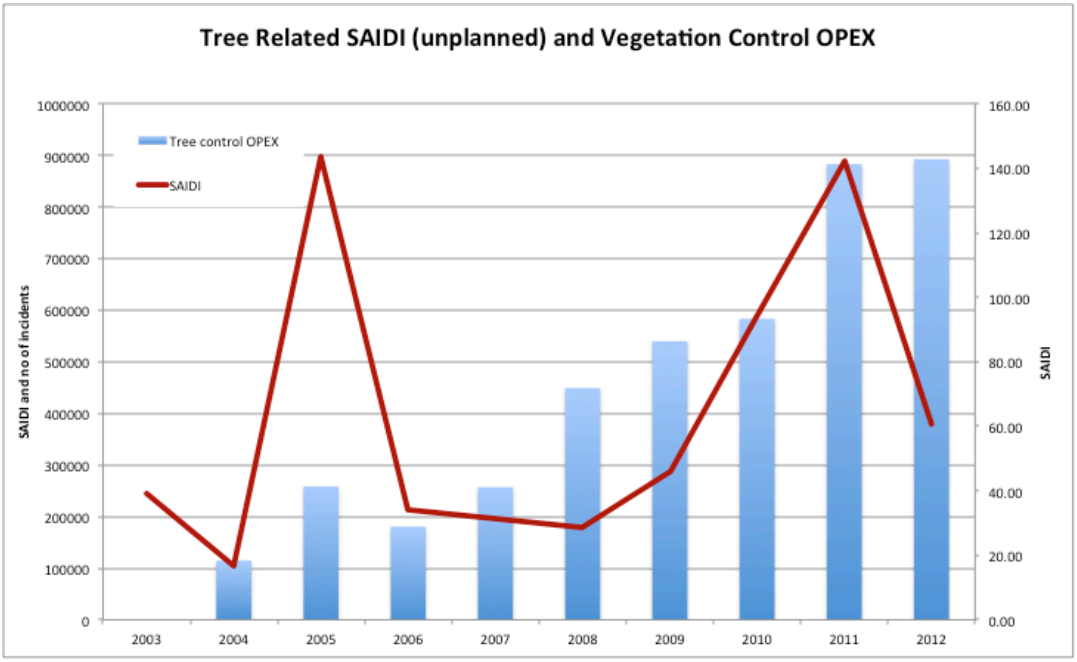
127 After speaking with the staff responsible for planning line inspections and processing the information returned, we gained the impression of a well-coordinated effort to get on top of line inspections and to follow up with remedial work where necessary. It appears that significant on-going resource in both the arboreal and administrative workforces will be needed to catch up and keep on top of vegetation management.

128 Line conductors are a longer-term issue in this network area. It is evident that no significant re-conductoring has been carried out in association with the pole replacements that we observed. In networks with demand growth, replacement with a higher capacity conductor is frequently used as a means of providing increased capacity on existing line routes, with the additional benefit of replacing aged conductors.

129 This replacement strategy is not generally available to ENL, where remote feeders contain significant lengths of old, thin and frequently patched conductor. The current maintenance approach is to patch broken and damaged sections of conductor. At some point, aged conductors will become an even more significant contributor to adverse performance statistics.

130 The dramatic decrease in SAIDI for 2012 suggests that the ~$1m spent annually on vegetation management appears to be having an impact on network performance (see Figure 21). A key question is whether this performance improvement is sustainable. To answer this question, the relationship between control effort and network performance needs to be established.

Figure 21 - *Unplanned outages - tree related expenditure*



Source: Commerce Commission, Outage Financial Data 1998-99 to 2011-12

131 It is clear that tree control is a major issue for ENL and could lead to increased costs for consumers. Yet this is not an issue that has suddenly appeared; the problem was one that was visible and would have been identified by ENL during the early years of the last decade. Proactive management of the situation would be expected and an increased focus placed on vegetation management during the years 2004 to 2007. If this had been done, it is likely that the SAIDI limit breaches would not have occurred.

132 Accordingly, we consider that the lower levels of vegetation control opex seen in the 2006 to 2009 period is likely to have been the root cause of the SAIDI limit breaches.

133 Current increases in vegetation management expenditure are appropriate and are likely to result in improved network performance on the rural distribution lines that pass through the dense forestry areas.

134 We have learned of ENL's efforts to improve relationships with forest owners and how they are addressing issues with contractor resources. On our site visit we observed the extensive tree management operations that were being undertaken. We consider that the capability of the management team to organise and prioritise this work is good.

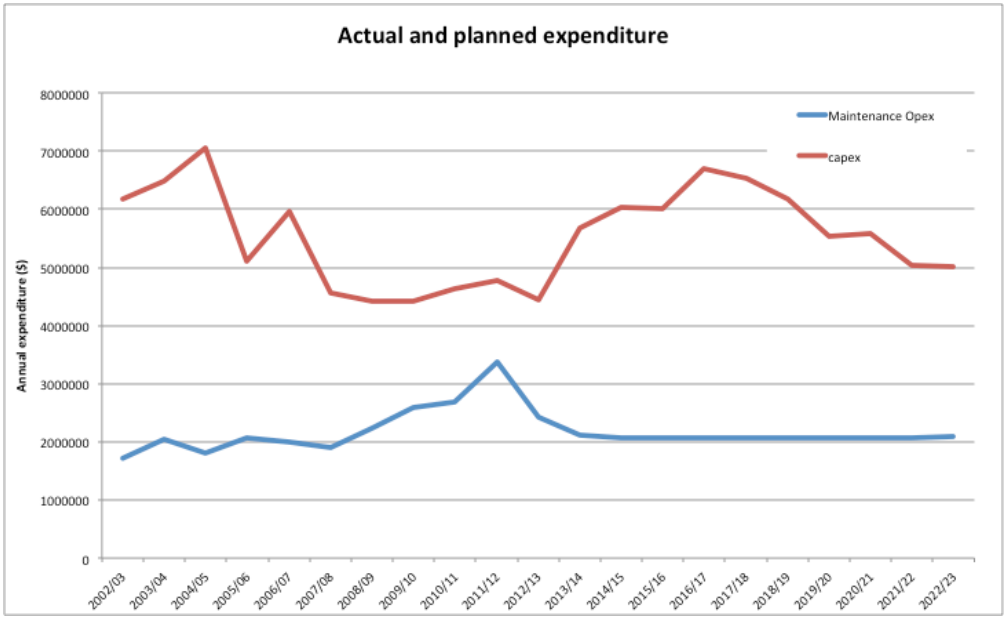
135 We consider that ENL's tree management efforts will improve the immediate issue that has led to the breaches of SAIDI limits however the effort will need to be maintained to achieve a sustained long-term improvement.

6.3 Asset Management

136 As shown in Figure 17, capex levels have been falling since 2006/07. During the same period, maintenance opex levels have been increasing in response to deteriorating SAIDI. ENL has informed us[9] that, in the steady state environment (i.e. with little or no demand growth), capex has been aligned with asset depreciation.

137 Figure 23 provides actual and planned capex and opex across a twenty-one year period.

Figure 22 - *Capex and opex – actual and planned (Real $2013)*

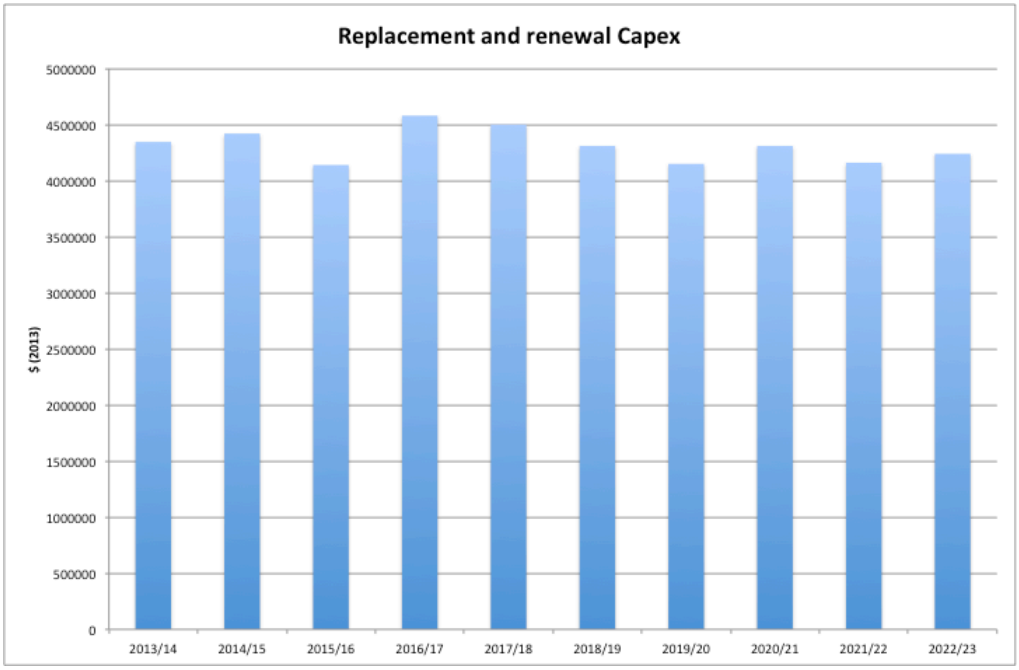


Source: ENL Performance by Category

138 The capex profile indicates that ENL is proposing to increase capex during the 2013 – 2018 period above 2006 – 2013 period levels. However this appears to be largely driven by an expectation of some growth rather than for asset replacement and renewal capex, as this expenditure category is forecast to remain reasonably constant at an average annual spend of $4.3m across the period (see figure 23).

9

Figure 23 -*Planned replacement and renewal capex (Real $2013)*



Source: ENL Performance by Category

139 ENL describes its approach to planning its replacement and renewal assets in the following statement:

> *When operating in "steady state", (without the benefits of growth which reduces average asset age), ideally for key network asset types a steady state replacement rate based on theoretical standard asset life should preserve the age profile of those assets and result in steady state network performance.*

140 The current average asset age across all network assets is 28 years. ENL has calculated that the average asset age in 2023 resulting from delivery of the forecast replacement programme will be 31 years. ENL benchmarks this against the New Zealand average of 25 years. Detail of asset ages by asset type is provided in Annex 5.

141 The proposed replacement programme has the greatest impact on lines, leading to the following movement in asset age:

	Standard life (years)	Average age at 2012/13	Average age at 2022/23
Sub-transmission lines	60	41	50
Distribution lines	60	37	46
LV Lines	60	44	52

Source: ENL

142 It is clear that ENL has implemented an asset management strategy that will lead to increased average age of key assets that currently contribute most to SAIDI and SAIFI. ENL also recognises that its strategy to increase the average asset age *is also aligned with the approach of reducing the value of assets employed in uneconomic sections of the network.*[10]

143 The relatively flat replacement and renewal capex forecast suggests that ENL is using a flat depreciation profile to equate to capex. This would not take into account the asset age profile, performance and condition. A strategy of increasing asset age on key assets closer to their expected life means that this approach is not sustainable. It is not clear that ENL has determined the point at which this strategy will need to change and what the impact will be on long-term asset replacement expenditure.

144 Good practice asset management requires broader consideration of asset health parameters when determining asset replacement strategies. ENL recognises this in the following statement:

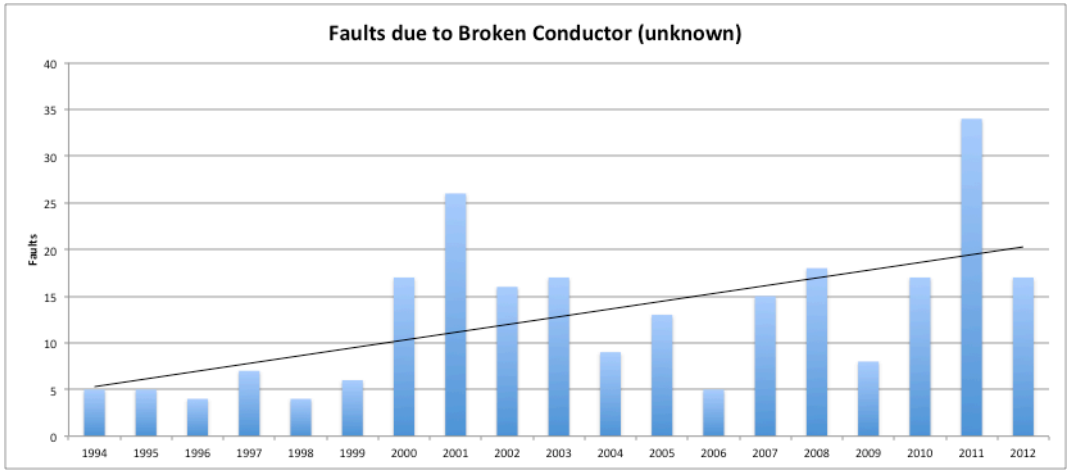
> *Age profile of assets is not the sole determinant of performance, other factors such as variances between types of assets in relation to asset condition/ performance against age, external environmental considerations and the requirement to operate within a prescribed revenue envelope are considered by management when determining annual asset replacement rates*[11]*.*

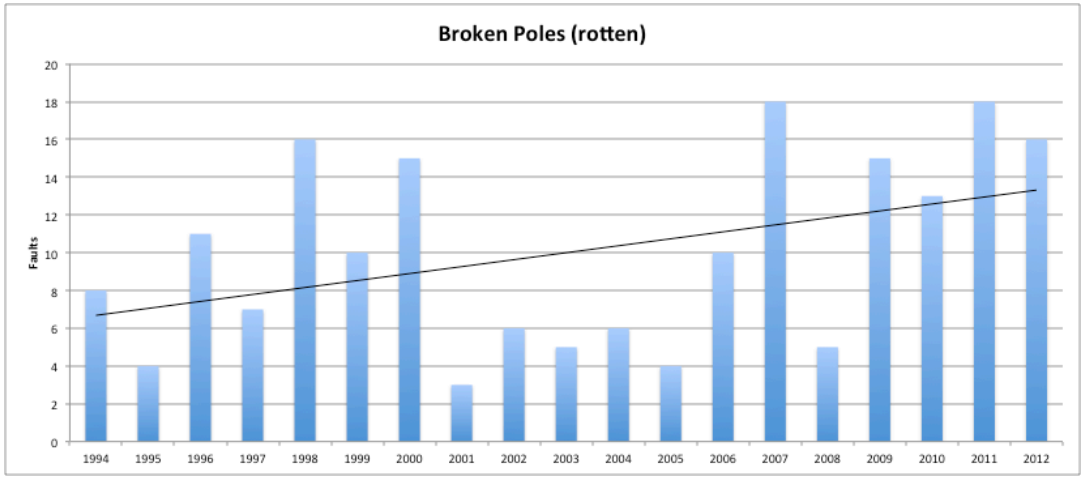
145 One indication of asset condition is the trend in faults due to equipment failure. The incidence of equipment-related faults on the ENL network has shown a marked upward trend for many asset types.

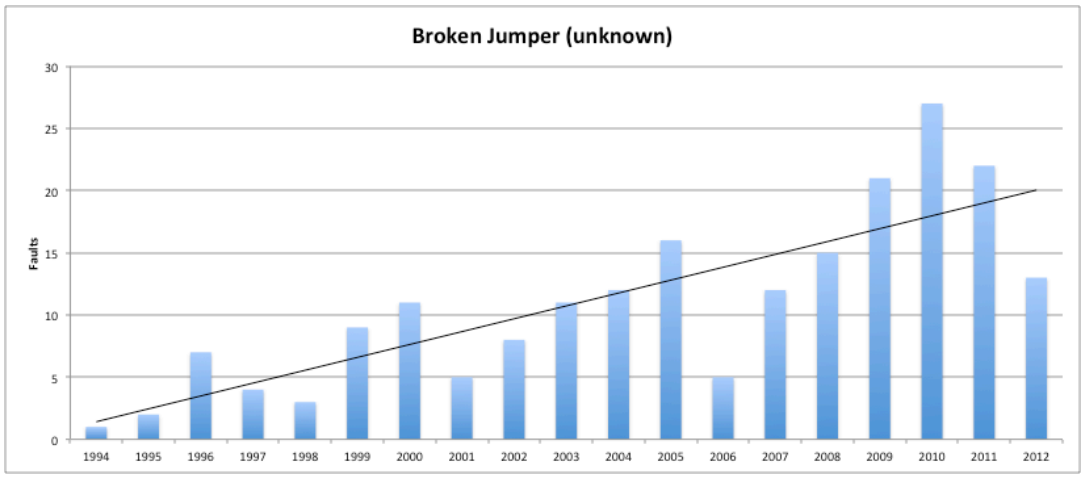
[10] ENL Board Paper extract, Meeting Date 20 February 2013,

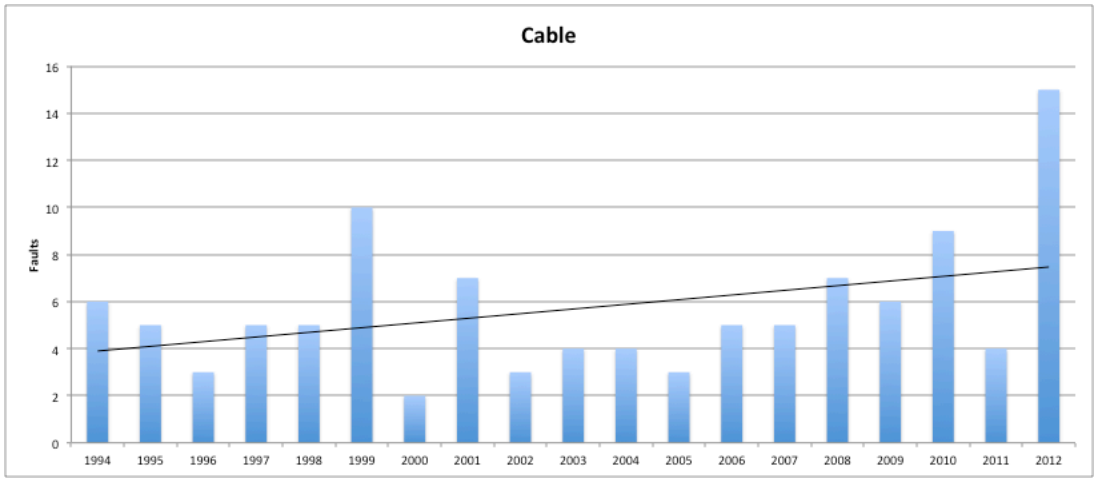
[11] ibid

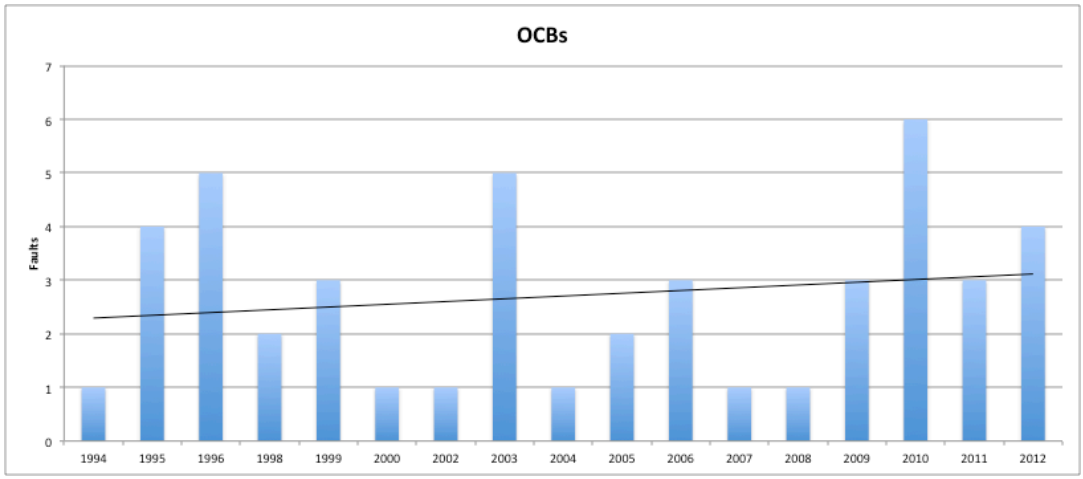
Figure 24 - *Faults trend lines*

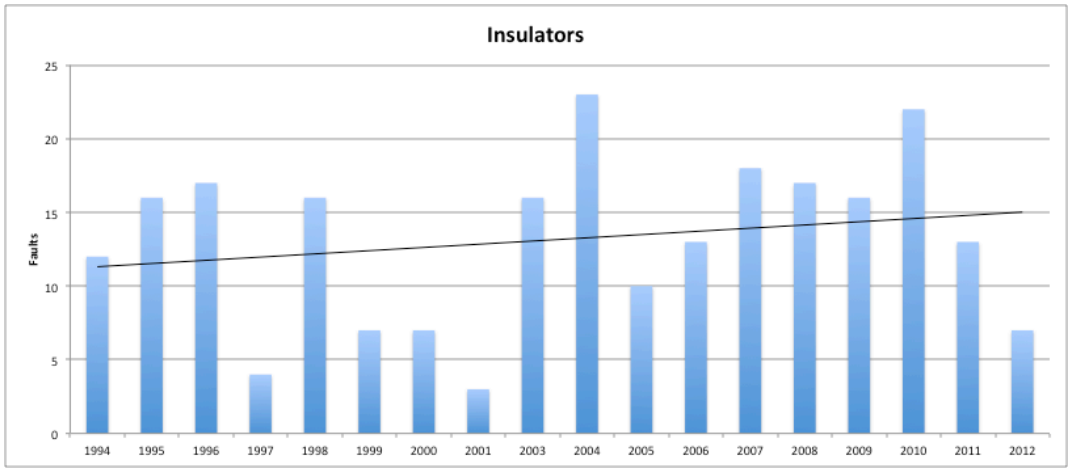












Source: ENL Defective equipment interruptions data

146 Forecast opex is also of concern, as it does not appear to take into account the increasing cost of maintaining aging assets. There will clearly be an on-going need to manage vegetation and address the equipment failure issues. Yet the additional expenditure on vegetation control is not in addition to historical maintenance opex, implying that other maintenance will need to be reduced. The planned opex levels suggest that ENL does not have a good

understanding of how this will be done, what it will cost, and what the impact on reliability performance will be.

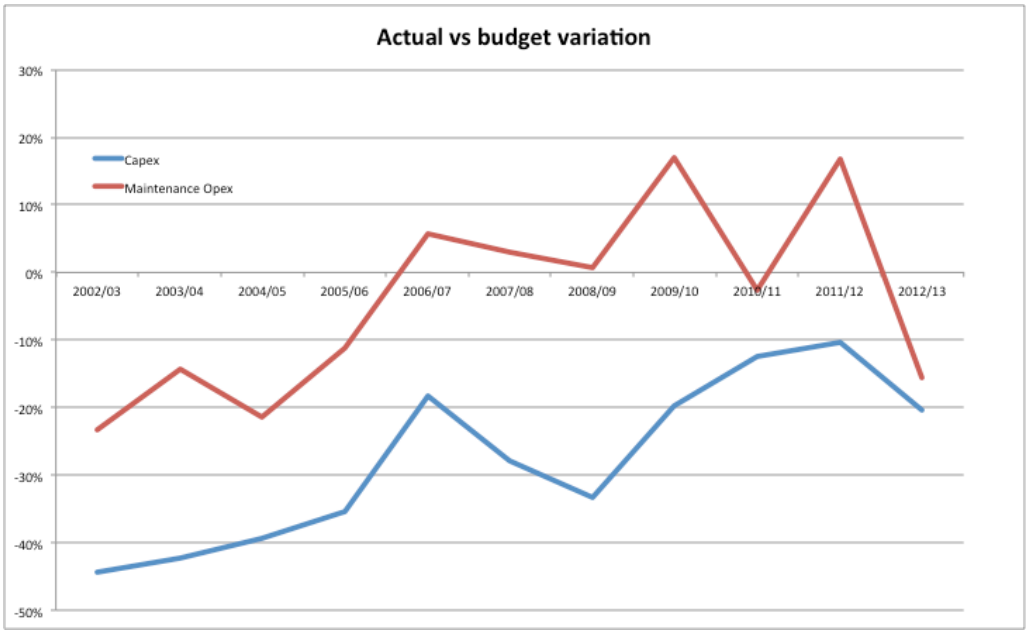
147 Our analysis of the assets and planned expenditure indicates that there is a performance/cost trade-off occurring where ENL is planning expenditure to *operate within a prescribed revenue envelope.* Given the increasing average asset age on lines and the trend of increasing incidences of equipment failure, we are not convinced that this strategy will enable the network to perform within the current SAIDI and SAIFI limits.

148 The increasing incidence of equipment failure suggests that the proposed flat opex profile will not be appropriate given the age and condition of the rural distribution network. If ENL continues to consider that it is important to apply a depreciation-linked replacement capex profile, it will be very important that this planned expenditure is actually delivered.

6.3.1 Deliverability

149 ENL consistently spends less on capex than it has budgeted (Figure 25). This means that either the capex budgets have been set at an inappropriate level or there is insufficient delivery of planned activity. We consider that planned capex is based on management's knowledge of the network and forecast external conditions but that during each year spending is constrained.

Figure 25 - *Capex and Opex variations*



Source: ENL Performance by Category

150 Figure 25 shows actual expenditure to 2012/13 and planned expenditure to 2013/23. For maintenance opex, there is an indication that insufficient maintenance was undertaken in the years 2003 to 2007. More recently, maintenance opex spend has been at or in excess of budget. Note the 2012/13 figures are for a part year.

151 In the four years 2009/10 to 2012/13, ENL has on average spent to plan on vegetation management but has underspent against budget on other major maintenance. The budget for asset replacement has been underspent by almost 50%. The average underspend on maintenance opex over the four years is 12% (see Table 1).

Table 1 - *Maintenance opex 2009/10 to 2012/13*

Expenditure category	Budget	Actual	Variation	Variation %
Operations Unplanned	$3,988,829	$3,763,843	$224,986	6%
Routine & Preventive	$5,652,320	$4,703,679	$948,641	17%
Vegetation Management	$2,900,000	$2,898,812	$1,188	0%
Asset Replacement	$1,083,000	$589,290	$493,710	46%
Total	**$13,624,149**	**$11,955,624**	**$1,668,525**	**12%**

6.4 Conclusions on ENL's actions to address performance issues

152 Strata considers that while ENL's increased expenditure on vegetation management will likely reduce the incidence of vegetation-related faults, network performance is likely to struggle to remain within the current SAIDI and SAIFI limits. Rural service performance is likely to reflect a continued adverse trend under the current asset management strategy.

153 If planned expenditure is increased, the additional costs incurred will need to be recovered through distribution charges. Because of this, consumers should be made fully aware of the issues and the trade-offs being committed on their behalf.

154 Strata has observed that the network assets are being required to perform within tight SAIDI limits, a constrained expenditure budget, to an older age, and with a trend of increasing incidence of equipment failure. This, combined with ENL's historical underspend of its budgeted capex, suggests that achieving SAIDI and SAIFI limits will remain a challenge.

7 Organisational capability

155 The Eastland Community Trust has established the Eastland Group of companies. The Eastland Group describes itself as: *a portfolio of businesses that operate in the energy and logistics sectors. It is a company with its heart in Gisborne but with businesses throughout New Zealand.*[12]

156 The Eastland Group includes energy-related businesses (Eastland Networks, Eastland Generation, Eastech) and non-energy-related businesses (Eastland Port, Eastland Harbour, Inner Harbour). While review of the Eastland Group structure falls outside the scope of this review, we note that the group structure would likely reduce corporate overheads and improve the quality of governance due to economies of scale. The larger organisation is also likely to have additional financial benefits to Eastland Network, such as through access to capital.

157 Given that the corporate resources are located at the Eastland Group level, Eastland Network's management operates at a more operational level than in many equivalent electricity distribution businesses. For example, the GM undertakes shifts in the control room and the Asset and Planning Manager undertakes field activities when required.

158 We consider that the closeness of the ENL management team to the assets gives it an in-depth and hands-on understanding of the assets and the field resources. ENL management has a very detailed understanding of the current condition of the assets and how the available resources are most effectively managed.

159 Our view is that the management team includes highly capable engineers that are managing the assets against tight financial budgets. We were impressed with their commitment to the company and the community.

160 During our site visit, we learned of the difficulties of securing appropriate levels of skilled staff and contractors in the Eastland region. We also gained an understanding of the challenges faced by management in extending organisational capabilities to the remote parts of the region. In particular, the establishment of local line mechanics that can respond rapidly to faults is a significant challenge.

161 The Eastland region is clearly a challenging environment for electricity supply. In our discussions, the GM and managers outlined their strategies and actions

[12] www.eastland.co.nz

for managing the issues and the immediate challenges they had identified. We found that the actions being taken are well thought through and are being applied pragmatically.

162 The GM provided information regarding the challenges ENL had faced in securing adequate levels of competent contracting resources to undertake work on the network. The establishment of Eastech appears to be a logical response to secure asset management capability within the Eastland region after other contracting companies had pulled out.

163 Overall, we found the organisational capability to be well matched to the operational side of the business. The hands-on management team is capable and is running the business within budget and resource constraints.

164 Our major concern relates to strategic analysis and planning in the organisation. We consider that while the Eastland Group acts at a strategic level for the group, there appears to be a gap between this and the operational management at ENL. This gap relates to the strategic planning that needs to be applied to the ENL assets.

165 The GM's role includes management and operational components. He also has a governance role for Eastech. The day-to-day operational role has the benefit of bringing the GM closer to the people and assets but competes for time with the critical strategic planning aspects of the business.

166 Our view is that ENL should consider either reviewing the scope of the GM's role or providing additional support to the GM in the form of periodic strategic advice. Our preference would be the latter, as this would allow continuation of the benefits of having a GM who operates close to the coalface.

8 Concluding comments

167 The findings and recommendations of our review are summarised in Section 2 of this report.

168 This review was conducted within a relatively short timeframe and relied on the cooperation of ENL management and its responsiveness to our requests for information. ENL has taken a positive approach to the review and cooperated fully and transparently with the reviewers.

169 While the primary objective of this review was to inform the Commission, the open approach we took was intended to provide ENL with an external perspective on the reasons for historical reliability trends and where opportunities for improved asset management may exist. We trust that ENL management finds our observations, insights and advice to be of value.

A. Annexures

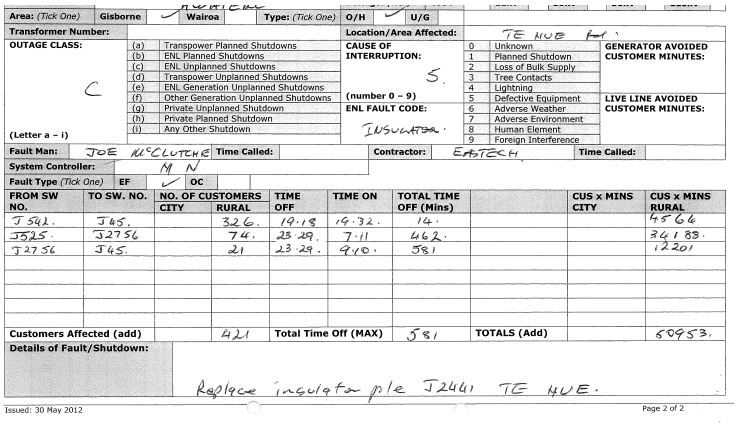
Annex 1: ENL Board of Directors' request for a review

170 The following is a response from ENL to the recent breach of SAIDI limits.

The ENL board of Directors has been fully briefed on the 2012 quality breach. Reflecting their concern at the breach, the Board has requested that management complete a comprehensive review of all aspects of network planning and operations with a view to implementing changes and initiatives that will deliver compliance with quality targets. Areas to be covered in the review include;

- *Asset age profiles, reliability performance and subsequent asset renewal programs and levels of forecast expenditure.*
- *Routine and Preventative work programs and levels of forecast expenditure.*
- *Network operational procedures including fault restoration management and planned outage management processes and procedures.*
- *Project management processes and procedures associated with forecast capital and maintenance work programs.*
- *Field crew work procedures including fault restoration and planned work techniques.*
- *Resourcing level requirements for both field crew and project management activities.*
- *Tree management procedures and processes and forecast work programs and levels of expenditure.*
- *The review is scheduled for completion in early 2013 with a view that changes and initiatives be included in the 2013/14 AMP.*

Annex 2: Outage management documents



Area: *(Tick One)*	Gisborne		Wairoa	✓	**Type:** *(Tick One)*	O/H	U/G ✓
Transformer Number:					**Location/Area Affected:**	TE HUE for.	
OUTAGE CLASS:	(a)	Transpower Planned Shutdowns			**CAUSE OF INTERRUPTION:**	0	Unknown
	(b)	ENL Planned Shutdowns				1	Planned Shutdown
	(c)	ENL Unplanned Shutdowns				2	Loss of Bulk Supply
	(d)	Transpower Unplanned Shutdowns				3	Tree Contacts
	(e)	ENL Generation Unplanned Shutdowns				4	Lightning
	(f)	Other Generation Unplanned Shutdowns			(number 0 – 9) 5.	5	Defective Equipment
	(g)	Private Unplanned Shutdown			**ENL FAULT CODE:**	6	Adverse Weather
	(h)	Private Planned Shutdown				7	Adverse Environment
C	(i)	Any Other Shutdown			INSULATOR.	8	Human Element
(Letter a – i)						9	Foreign Interference

GENERATOR AVOIDED CUSTOMER MINUTES:

LIVE LINE AVOIDED CUSTOMER MINUTES:

Fault Man:	JOE MCCLUTCHIE	**Time Called:**		**Contractor:**	EASTECH	**Time Called:**			
System Controller:	M N								
Fault Type *(Tick One)*	**EF**	✓	**OC**						

FROM SW NO.	TO SW. NO.	NO. OF CUSTOMERS CITY	NO. OF CUSTOMERS RURAL	TIME OFF	TIME ON	TOTAL TIME OFF (Mins)		CUS x MINS CITY	CUS x MINS RURAL
J542.	J45.		326.	19:18	19:32.	14.			4566
J525.	J2756		74.	23.29.	7:11	462.			34183.
J2756	J45.		21	23.29.	9:10.	581			12201
Customers Affected (add)			421	**Total Time Off (MAX)**		581	**TOTALS (Add)**		50953.

Details of Fault/Shutdown: Replace insulator pole J2441 TE HUE.

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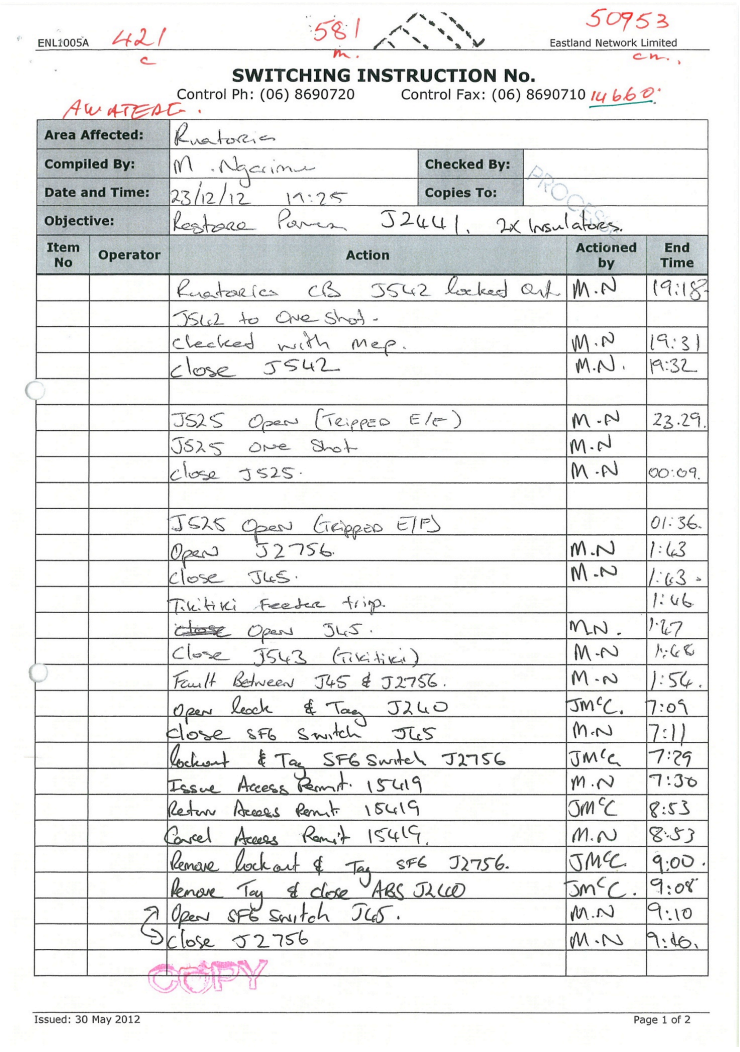


ENL1005A 421 c 581 m. 50953 cm.

Eastland Network Limited

SWITCHING INSTRUCTION No.

Control Ph: (06) 8690720 Control Fax: (06) 8690710 14660.

AWATERE.

Area Affected:	Ruatoria		
Compiled By:	M. Ngarimu	**Checked By:**	
Date and Time:	23/12/12 17:25	**Copies To:**	
Objective:	Restore Power J2441. 2x Insulators.		

Item No	Operator	Action	Actioned by	End Time
		Ruatoria CB J542 locked out.	M.N	19:18
		J542 to One Shot.		
		checked with Mep.	M.N	19:31
		close J542	M.N.	19:32
		J525 Open (Tripped E/F)	M.N	23.29.
		J525 One Shot	M.N	
		close J525.	M.N	00:09.
		J525 Open (Tripped E/F)		01:36.
		Open J2756.	M.N	1:63
		close J45.	M.N	1:63.
		Tikitiki Feeder trip.		1:46
		~~close~~ Open J45.	MN.	1:67
		close J543 (Tikitiki)	M.N	1:68
		Fault Between J45 & J2756.	M.N	1:54.
		Open Recls & Tag J240	JMcC.	7:09
		close SF6 Switch J45	M.N	7:11
		Lockout & Tag SF6 Switch J2756	JMcC	7:29
		Issue Access Remit 15419	M.N	7:30
		Return Access Remit 15419	JMcC	8:53
		Cancel Access Remit 15419.	M.N	8:53
		Remove lockout & Tag SF6 J2756.	JMcC.	9:00.
		Remove Tag & close ABS J240	JMcC.	9:08
		Open SF6 Switch J45.	M.N	9:10
		close J2756	M.N	9:46.

COPY

Issued: 30 May 2012 Page 1 of 2

UNPLANNED

List of Shutdowns and Faults for December 2012

Date:	Location:	Cause:		Customers affected:	Time off:		Customer min
21		*TREES IN LINE*					
6/12/2012	0206 Tiki Tiki Gisborne	*Ref 14652*	Remove tree from 11kV lines poles J2707 to J2708 Mangaoporo	12	57	8:40	684
5	**DEFECTIVE EQUIPMENT**		**No. of Faults** 6				
13		*BROKEN CONDUCTOR (UNKNOWN)*					
4/12/2012	3203 Frasertown/Nuhaka Wairoa	*Ref 14650*	Repair 11kV lines poles W6083 to W6084 Mangapoikie Rd	724	197	11:40	22748
72		*BROKEN POLE (OK)*					
6/12/2012	0201 Ruatoria Gisborne	*Ref 14653*	Replace 11kV pole J1350 Harrison Rd Ruatoria	86	185	14:20	15910
153		*Cable*					
1/12/2012	3202 Affco Wairoa	*Ref 14649*	Cable fault between N502 & N231 Affco Site	49	49	8:00	2401
9/12/2012	0701 Lytton Gisborne	*Ref 14657*	Repair 11kV cable SW/GR B6276 Awapuni Rd	95	362	16:08	12585
28/12/2012	0601 Kahutia Gisborne	*Ref 14661*	Isolate 11kV cable between switches B251 to B371 Cosy Club	151	59	8:36	4589
40		*INSULATOUR FAULT*					
23/12/2012	0101 Awatere Gisborne	*Ref 14660*	Replace insulators pole J2441 Te Hue Rd Crn	421	581	17:05	50953
6	**ADVERSE WEATHER**		**No. of Faults** 1				
162		*Wind*					
6/12/2012	2003 Ruakituri Wairoa	*Ref 14654*	Reclose CB 24 Ruakituri at Tuai High Winds	170	18	23:10	1318
9	**FOREIGN INTERFERENCE**		**No. of Faults** 2				
191		*Vehicles*					
7/12/2012	1502 Harris Gisborne	*Ref 14655*	Replace 11kV pole B4873 Russell St	1526	405	22:57	96028
7/12/2012	0201 Ruatoria Gisborne	*Ref 14656*	Replace 11kV pole J1748 Ruatoria	86	192	4:30	16512

COPY OF DEFECT REPORT

Defect Notification/Non Conformance Form

REF No:

Recommend:	☐ **Urgent**	☐ 6 months	☐ 1 Year	☐ 2 Years	☑ 3 Years
Asset Owner:	☑ **ENL**	☐ Private	☐ Transit	☐ GDC	☐ WDC

Tick the appropriate box(s)

☐ Hazard	☐ Tree	☐ 400V	☐ Environmental
☐ Incident/Event/ Near Miss	☑ Overhead	☑ 11KV	☐ Theft/Security Breach or Issue
☐ Non Compliance	☐ Underground	☐ 50KV	☐ New Idea/Suggestion
☐ Customer/Public Complaint, Feedback, or Enquiry	☐ Maintenance Required / Improvement		☐ Other

Date/Time:	7-12	**Form Completed By:**	[illegible]
Site Ref:	J6214	**Person Assigned Close Out:**	
Owner Details (If Private):			
Location:	[illegible]	**Area:**	Hicks Bay [illegible]

Access Requirements: Roadside ☐ | Paddock ☐ | 4WD ☑ | Helicopter ☐ | Restricted ☐

Other Information: e.g conductor type /size, tree information, voltage and construction

H pole [illegible]

What's the Defect/Non Conformance? *Describe what has happened with as much details as, including illustrations. Attach photos where applicable.*

[illegible]

ok 3 years

[illegible]

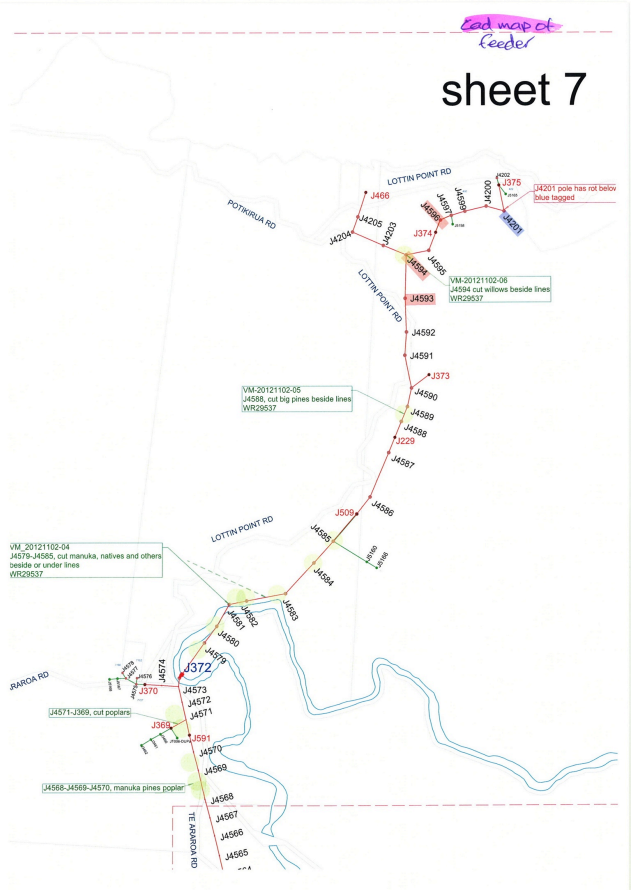
3=3 [illegible]

ENTERED 25 AUG 2012

What has been done or describe what needs to happen? *Describe the immediate actions taken:*

What is the cause and how can we prevent it from happening again?

Annex 3: Asset condition assessment documents



Name	Subclass	Pole Type	Safety Tag T	Highest Vo	Conductor	Make	Date Made	Status
AFS11389	SLPL			400 V	400 V	Unknown		Pending Se
J1443	SW ENL	10.0m MST CP 9KN Softwood		11 kV	11 kV	Unknown	1/01/1976	In Service
J149	CONCR PRV	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1974	In Service
J185	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1988	In Service
J210	CONCR PRV	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1978	In Service
J229	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1976	In Service
J2452	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2453	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1976	In Service
J2455	SW ENL	10.0m MST CP 9KN Softwood		11 kV	11 kV	Unknown	1/01/1980	In Service
J2456	SW ENL	10.0m MST CP 9KN Softwood		11 kV	11 kV	Unknown	1/01/1992	In Service
J2457	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11/400	Unknown	1/01/1978	In Service
J2458	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11/400	Unknown	1/01/1978	In Service
J2460	SW ENL	10.0m MST CP 9KN Softwood		400 V	400 V	Unknown	1/01/1976	In Service
J2494	HW ENL	High Density hardwood (MAH)		11 kV	11 kV	AHH	1/01/1972	In Service
J2519	HW ENL	High Density hardwood (MAH)		400 V	400 V	AHH	1/01/1965	In Service
J2573	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2574	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2575	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2576	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2577	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2578	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2579	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2580	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2581	HW ENL	High Density hardwood (MAH)		11 kV	11 kV	AHH	1/01/1972	In Service
J2582	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2583	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2584	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2585	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2586	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11 kV	Unknown	1/01/1972	In Service
J2587	CONCR ENL	Prestressed concrete	Pole Ok	11 kV	11/400	Unknown	1/01/1972	In Service
J2588	CONCR ENL	11.2m Taylor Prestressed Conc	Pole Ok	11 kV	11/400	Taylor	1/01/2008	In Service
J2589	CONCR ENL	103A 9.2m HD P04 On Edge Prestressed Conc	Pole Ok	400 V	400 V	Firth	1/01/1999	In Service

8 JANUARY 2013

PHILIPS

Tuesday

week 2 : 8-357

A1088 SP Flat SW pole, steel xarm, pole OK, xarm OK, bolts and insulators secure, trees need felling/ trimming. Sandy has photos.

A1087 SH Flat Treated HW pole good, xarms good, bolts and insulators secure.

A1086 SP Flat SW pole OK, xarm OK, bolts and insulators secure.

A1085 SP Flat SW new, pole OK, xarm OK, bolts and insulators secure.

A1084 SP Flat Treated HW pole OK xarm OK bolts and insulators secure

A1083 DP Flat Treated HW pole good. Xarms good, bolts and insulators secure ~~willow trees need topping at the least. Sandy has the photos~~

General Cable

January : 13 | February : 13 | March : 13 | April : 13 | May : 13 | June : 13

COPY FROM SOKU Pole test data.

SmartVent

JANUA

week 2 : 9-356

Wednesd

Devonport Cup Day (

A1082 DP Flat Treated HW pole ok, Xarms ok, bolts and insulators secure

A1081 SP delta SW pole OK, Xarm OK, bolts and insulators secure. Willow trees need topping at the least. Sandy has the photos

A1080 SP Flat SW, pole OK, xarm OK, no defects found

A1079 SP Flat concrete pole, no defects found.

A1078 SP Flat, concrete pole no defects found.

A1077 SH delta SW, no defects found. but, re-check below GL in 5 years or so Looks a bit funny.

Schneider Electric

July : 13 | August : 13 | September : 13 | October : 13 | November : 13 | December : 13

18 April 2013

A-61

copy of Pole MT earth test

ENL9 Eastland Network Limited

Earth Test and Condition Rating Form

Tx B266 Switch ☐ Tag ☐

Location: Aberdeen Rd

Bank 1: 6.26Ω Bank 2: 12.39Ω MEN: 3.93Ω Connection Changed? Y N

Date: 26/7/12 By: Ray

Inspection

Make: _____ Serial No: _____ Rating: 25 kV kVa

Tap: _____ _____V Phase: 1 2 (3)

X	New	Good	Poor	High Risk	Replace
Paint		✓			
Rust		✓			
Conductor		✓			
Oil Seals		✓			
Insulators		✓			

11 kV Bushing Booted: Y N

Comments:

X	Description of Defect	Tracking DB	Tracking Date	Tracking Who
1				
2				
3				
4				
5				

Office Use Only:

ENTERED 27 JUL 2012

___/___/___ _____

Return To:
Eastland Network Limited
172 Carnarvon Street
Gisborne

Fax: 06 867 8563

Date of Issue: 8 January 2008
Version: Two

Page 1 of 1

COPY OF Earth Test & Insp. GM

TRANSFORMER INSPECTION SHEET

(tick ☐ where required)

Action Required: Y N U (circle one)

SITE

Asset No: B.1087 Location: AWAPUNI RD (OUTSIDE SPEEDWAY) GIS. ☑WAI.☐ City ☑ Rural ☐ Coast ☐

Asset Position: Berm ☑ Private Property ☐

Access: 24 hrs Yes ☑ No ☐ Drive to: Yes ☑ No ☐ 1m clear in Front: Yes ☑ No ☐ 4WD: Yes ☐ No ☑

ASSET

KvA: 200 Serial No: 01009-98 Make: ETEL Man Year: 2001

Type: Berm Mini Sub-new ☐ Tin Cover ☐ | Chip coat Canopy ☐ Multi Fins-old ☐ | Fenced Compound ☐ Conversion ☑ | GPC on/in-service ☐ ☐ | Doors: Double Front ☐ Single Ends ☑

↓ Tick 'Y' 'N' or 'N/A' where required ↓

INSPECTION DETAILS — HIGH VOLTAGE

	Y	N	N/A		Y	N		Y	N
Door Bolted OK	✓			Bushings booted	✓		Corona noise OK	✓	
Door Lock OK	✓			Bushing clean (if not booted)			Corona visual OK	✓	
Door Handle or...	✓			Bushing seals OK	✓				
has Hasp & Staple			✓	Condensation level OK	✓		Insects/vermin OK	✓	
Bolt hole bungs in		✓		Cable condition OK	✓		Dust/Cobwebs OK	✓	
Hinges work OK	✓			Cable phasing marked	✓		Vegetation OK	✓	
Cable Earthed	✓			TX Phasing marked	✓		General condition OK	✓	

Termination Type: Raychem ☑ Pitch ☐ Tape ☐ Magnifix ☐ Other ☐ (state): _____

INSPECTION DETAILS — LOW VOLTAGE

	Y	N	N/A		Y	N		Y	N
Door Lock OK	✓			Bushings covered	✓		Circuits labelled	✓	
Door Handle OK	✓			Bushing seals OK	✓		LV fuse size stated	✓	
Name Plate Legible	✓			TX phasing marked	✓		LV runs on door		✓
Bushings clean	✓			LV frame secured	✓		Cable connection OK	✓	
Formica panel cover			✓	Fuse panel secure	✓		Cable damage check	✓	
Contactors/s covered			✓	Fuses fitted securely	✓		Panel fuses labelled –		
Relay/s terms covered			✓	Main earths tagged	✓		Panel wiring tidy –		
CT secured	✓			Case/Tank earthed	✓		Insects/vermin OK	✓	
MDI working OK	✓			Condensation OK	✓		Connections – rust & corrosion free	✓	
Hinges working OK	✓			Oil level OK	✓				
Silica Gel OK			✓	Dust/Cobwebs OK	✓		General condition OK	✓	
ALL LV 'finger touch' live parts covered OK					✓				

LV Rack Type: ABB ☑ Jean Muller ☐ Lucy (old) ☐ Lucy (pole type on frame) ☐ Jean Muller 'brick' ☐ | Cable direct bolted ✓ | Other ☐ (state): _____

TESTS — MDI

MDI Multiplier	MDI Reading	MAX Amps	MDI Reset
x 80	1.1	88	✓

TESTS — EARTH

Bank 1	Bank 2	MEN	Tap Set
39.7 Ω	42.9 Ω	3.72 Ω	3 (11,000)

GENERAL MAINTENANCE ONSITE — SITE GENERAL

	Y	N		Y	N		Y	N
Danger signs OK	✓		Weeds around pad OK	✓		Trenches 'slump-free' (L/T SIDE)	✓	
Asset No. OK	✓		Weed free inside doors	✓		Bolted to pad OK	✓	
Oil leaks OK	✓		Rubbish/debris OK	✓		TX Damage free	✓	

Graffiti:	None ☑	Minor ☐	Major ☐	Offensive ☐	Needs painting over ☐
Paintwork:	All OK ☑	Scratches ☐	Chips ☐	Flaking ☐	Flaking ☐
Rust/Corrosion:	All OK ☑	Surface ☐	Spots ☐	Minor rust ☐	Major Rust ☐

GENERAL MAINTENANCE ONSITE — MINOR WORKS

↓ Indicate using either: (D) = Done (R) = Required ↓

Repair Fence/Gate		Clean/Dust/De-cobweb LV ☐ HV ☐		Fit hasp & staple	
Lube Hinges		Asset No.s replaced		Cover exposed 'live' parts	
Lube Locks		Danger labels/stickers replaced		Change silica gel	
Repair Locks		Loop main earths for clamp tests		Fill slumped trench	
Replace Locks		Label main earths		Paint over graffiti	
Insect Spray		Lube HV door bolts (before seizing up)		Remove obstructions (from doorways)	
Weed Spray		Fit HV door bolts		Bolt Down TX	
Clear Rubbish		Fit HV door bolt bungs			

Annex 4: Photographs

Figure 26 - *Line route through forest alongside SH2 between Gisborne and Wairoa*

Figure 27 - *Replanting beneath 50 kV line near Wairoa*

Figure 28 - *Urban 50 kV subtransmission*

Figure 29 - *Matawhero zone substation switchyard*

Figure 30 - *1 MW diesel genset at Matawhero*

Annex 5: Asset Life

Asset description	Quantity	Standard Life (years)	Steady state replacement rate per annum	Replacement rate per annum (AMP)	Average Age (years) 2012/13	Average Age (years) 2022/23
Sub-transmission line	335 km	60 *	5 km	1 km	41	50
Sub-transmission poles	2441	60/45	47	60	24	22
Sub-transmission cable	2 km	60 *	NA		6	16
50kV CBs	32	40	0.8	1 in period 2018/19, then 1 in period 2020/21	16	25
11kV CBs	163	40	4	10 in 2013/14	18	24
Zone transformers	24	45	0.5	1 in period 2016/17, then 1 in period 2017/18	24	29
Distribution line	2411 km	60 *	40 km	9km until 2016/17, then 18km per annum thereafter	37	46
Distribution poles	24892	60/45	550	650	29	28
Distribution cable	135 km	60 *	2.25 km	1 km	24	34
11kV ABS	585	35	16.7	15	28	29
Distribution transformers	3629	45	80.6	65	27	29
Distribution fuses	3814	35	108	50	31	38
Distribution switchgear RMUs	911	40	22.7	12	13	19
Communications		15	NA	Technology determines condition	8	10
SCADA & system control		15	NA	Technology determines condition	6	10
Connection assets	25421	45	NA	Customer-driven and performance related upgrades	33	40
Below does not affect SAIDI						
LV lines	540	60 *	9 km	2 km	44	52
LV poles	6550	60/45	120	100	28	31
LV cable	258	60 *	4.3 km	1 km	24	28
Total network					28	31

Source: ENL Board Paper extract 20th February 2013