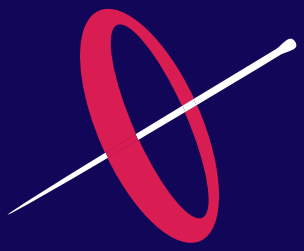


vector

ASSET MANAGEMENT PLAN

1999/2000 and 2000/2001

Auckland's Electricity Network

WELCOME TO VECTOR'S FIRST ASSET MANAGEMENT PLAN (AMP).

The plan sets out how VECTOR will manage its assets to address the changing requirements of our steadily increasing customer base. It also identifies the potential supply and growth issues over the next 10 years and key strategies to address these. Our objective is to give our customers and other interested parties an understanding of how the management of the network assets is aligned with the strategic and operational focus of VECTOR, while also meeting the requirements of the Electricity (Information Disclosure) Regulations, 1999.

VECTOR faces significant challenges in how it manages its network to meet customer needs. The network is maturing and we are the first major New Zealand electricity network to face the need for renewal of assets installed more than half a century ago. Within our service region, some areas are experiencing rapid growth. South east Auckland is growing faster than any other part of New Zealand, while inner city redevelopment is pushing our existing utilisation towards its limits. Concurrently, other areas are experiencing very low growth as industry and commerce move out. The challenge is to balance this wide variety of customer needs.

Since VECTOR was formed in April 1999, we have been seeking to improve our service while bringing costs down. Over the past year we have made a significant improvement in system reliability and security, with our System average interruption duration index (SAIDI) now at record low levels. At the same time, our published prices are amongst the lowest in the country.

VECTOR recognises the importance of clearly defining and delivering on customer requirements. We continue to work towards better ways of defining, clarifying and delivering the performance they want. Our research shows that levels of performance (and options to deliver them) must differ not only by the network, but also by customers within the network.

While much focus is placed on operational costs the real driver of future prices is our level of capital investment. A key initiative is to find ways of increasing the utilisation of our assets so we enhance network operation to limit unnecessary spending. In seeking new and innovative solutions our eyes are open. The solution which may or may not involve investment in the network, may also include automation and demand side management.

Your comments on our plan to provide a cost effective and customer targeted network service are welcomed.

PLAN OUTLINE

VECTOR's AMP for 1999/2000 and 2000/2001 sets out the basis on which VECTOR manages its assets and complements other VECTOR publications including:

- Statement of Corporate Intent
- Annual report

The plan identifies the potential supply and growth issues over the next 10 years and the key strategies to address these. It outlines the performance measures and influencers which drive the development of maintenance and development plans for our lines business. Implicit in this process of planning for our assets is an understanding and evaluation of the risks to operation and the consequences of failure.

Customer service is driven by the need to provide a safe reliable, supply of electricity, in being responsive to failures and being accessible to customers while providing accurate timely information. We believe we must continue the heightened focus we have placed on this over the last year, to achieve significantly increasing levels of customer service, and this is an integral part of the management of our assets.

VECTOR's approach to asset management involves the balance of maintenance and replacement costs against the risk and consequence of asset failure. In this plan we identify the assets essential to maintaining our current network capability and service to the customer. Because customer needs change, the plan also recognises the need for continual review of how the assets function and the performance required from each part of the network.

This combination of changing customer needs, a mature network, planning for load growth and developing efficiencies is core to the plan. Our network wide demand-supply challenges and an overview of the local issues and options are featured in the plan.

In the past year, VECTOR has made significant steps in overall network performance. System reliability and security are improving and SAIDI is at a record low. With a series of initiatives to improve what we know about our assets, our customers and the performance we must provide, the journey is well underway. In moving ahead VECTOR keeps an eye abroad, sharing lessons through it's involvement in technical groups such as CIGRE and ESAA, and participating in the setting of 'Industry Best Practice".

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 VECTOR ASSET MANAGEMENT OVERVIEW

VECTOR's distribution network supplies over 260,000 customers in the greater Auckland area. The management of network assets to provide a safe secure and reliable supply, is the core focus of VECTOR.

VECTOR's origins lie in the Auckland Electric Power Board (AEPB), which distributed and retailed electricity to greater Auckland for more than 70 years. The Energy Companies Act, 1992, removed the monopoly distribution franchise and the AEPB became Mercury Energy Ltd in 1993. In June 1998, the Industry Reform Act required the distribution companies to sell either their lines business or their supply business. The company retained the lines business, sold its customer retail business and the Mercury Energy brand name and became VECTOR. VECTOR has been the owner and operator of the electricity lines network supplying Auckland and Manukau cities and parts of Papakura since April 1, 1999.

This is the first VECTOR Asset Management Plan (AMP) disclosed under the "Electricity (Information Disclosure) Regulations 1999", setting out the basis on which VECTOR manages its assets and identifying the key strategies and projects it plans to implement over the next 10 years. This AMP is for both the 1999/2000 period and the 2000/2001 in line with the Ministry of Commerce guidelines. The structure of the plan, and the issues which are addressed, follow the requirements of those guidelines.

The asset management plan is an evolving document, the review of which is an ongoing process within VECTOR. This ensures that customer, shareholder and regulatory requirements are met. The plan provides an understanding of how the asset management plan aligns with the strategic and operational objectives of the business. VECTOR encourages and welcomes stakeholder comment on the plan.

The plan is a view going forward. It does not commit VECTOR to any of the individual projects or initiatives set out in the plan. These may be modified to reflect changing operational, regulatory or customer requirements and must be approved through normal internal governance procedures.

1.2 VECTOR'S CORE BUSINESS

VECTOR's business is the distribution of electricity. The VECTOR network supplies more than one sixth of the New Zealand's electricity demand. The distribution business involves the operation and maintenance of a regional supply network that covers the cities of Auckland (including Waiheke Island), Manukau and part of Papakura, an area of approximately 900 square kilometres. VECTOR has more than 260,000 customers including 217,000 residential customers and 50 of the country's top 200 industrial/commercial electricity consumers. Nearly 99% of the customers are located in the urban area. Figure 1.1 shows the extent of the VECTOR supply network.

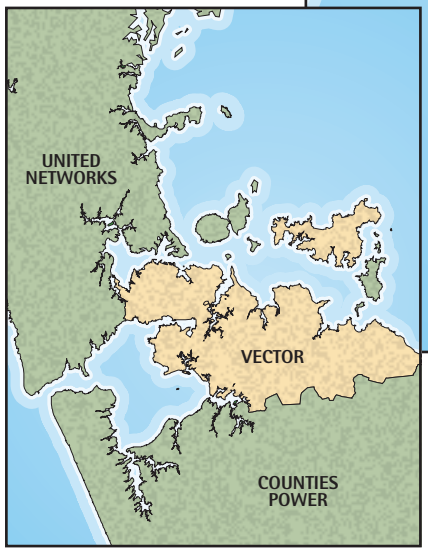
VECTOR's Supply Area

CUSTOMERS	
Residential	87%
Non Residential	13%
Customers Supplied	260,000

DEMAND 1998/1999	
Total Annual	4,400 GWh/annum
Peak	900 MW

Transpower Supply Point

Vector Zone Substations



ASSETS	
Supply Points from Transpower	8
Zone Substations	49
Distribution Substations	over 7700
Underground Subtransmission	90%
Overghead Subtransmission	10%
Underground Distribution	58%
Overhead Distribution	42%

Figure 1.1 VECTOR's Supply Area

1.3 VECTOR'S VISION

The vision of VECTOR is:

> *"to be the network management business viewed by industry peers as the role model for success".*

The Asset Management process will contribute towards the achievement of the vision by providing a sound technical and innovative approach to asset management.

1.4 VECTOR ORGANISATION

VECTOR's organisation was restructured at the end of 1988 after the sale of its retail operations, to focus on network management.

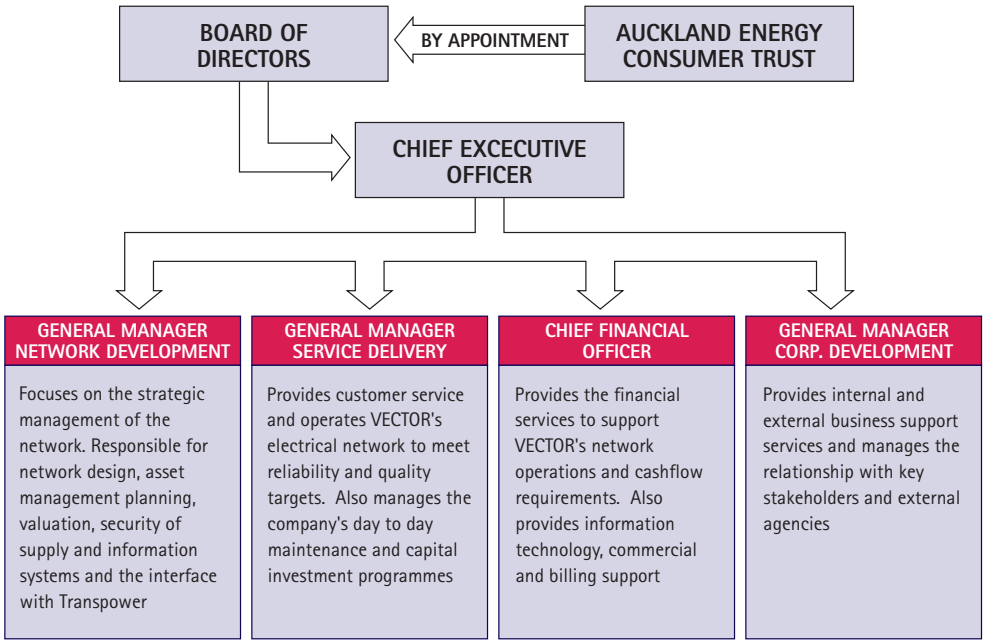


Figure 1.2 VECTOR's Operational Structure

1.5 VECTOR'S CUSTOMER AREAS

For network and asset management, VECTOR has segmented the supply network into the four main areas shown in Figure 1.3. Each of these areas contains a number of different customer types, network types and equipment ages. The focus of VECTOR's current Asset Management Strategy is to align our service delivery to the requirements and expectations of our customers, which vary significantly across the network. This is a significant shift from historical policy, which focused on universal service to a standard level. VECTOR has initiated a planned approach to the assessment of service levels and their value to customers. Customer consultation is a key objective. The network is no longer viewed as a single entity, but rather a set of discrete regions with differing network and customer characteristics. There remain many common elements across the network, but each project or initiative will be targeted to the specific needs of those customers affected.

VECTOR's Customer areas and types

CUSTOMER TYPES

- Commercial
- Industrial
- Mature Residential Network
- Rural
- Residential
- Developing Areas
- Mature Industrial/ Commercial Network

CENTRAL CUSTOMER AREA

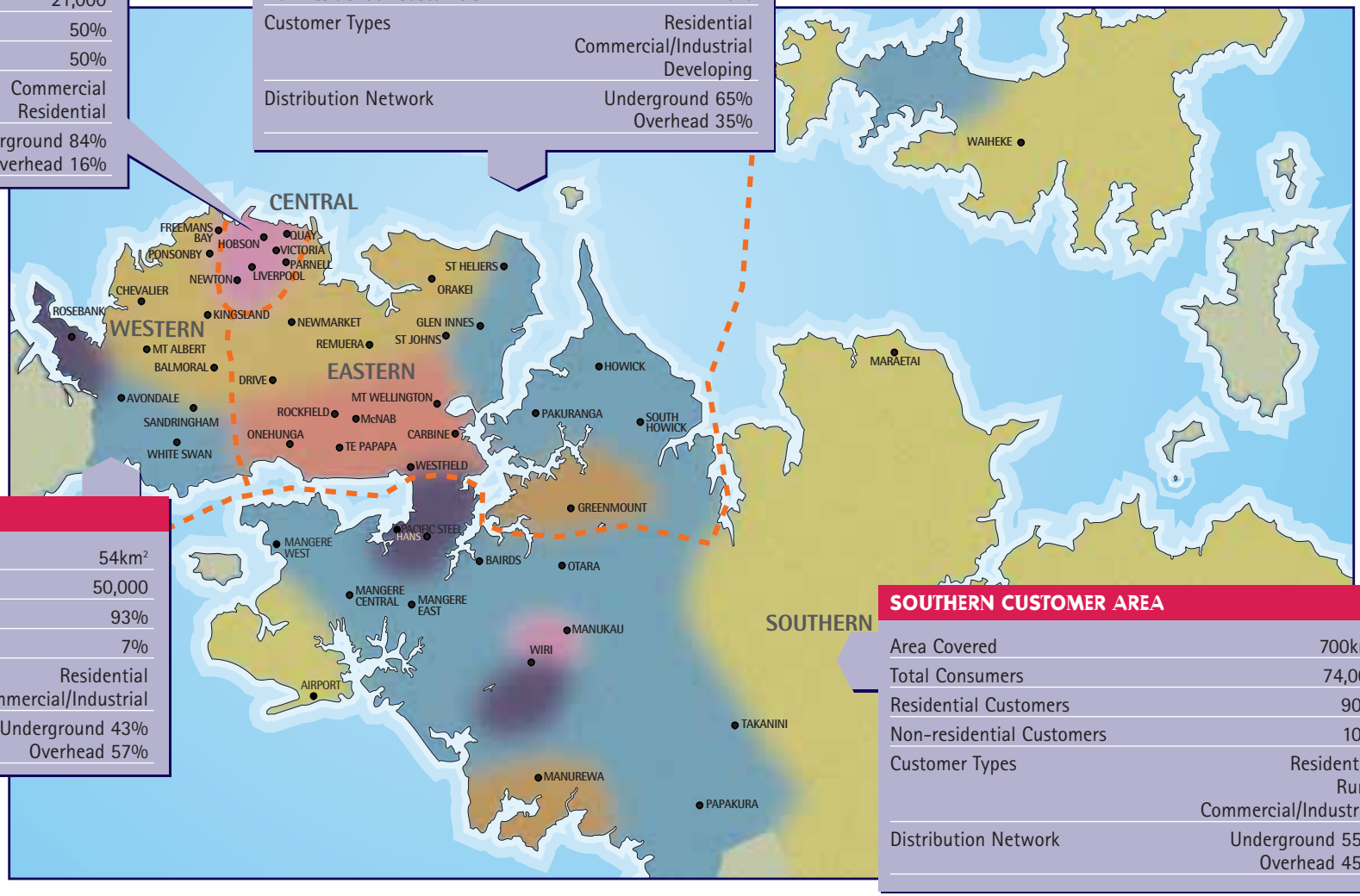
Area Covered	9.5km²
Total Consumers	21,000
Residential Customers	50%
Non-residential Customers	50%
Customer Types	Commercial Residential
Distribution Network	Underground 84% Overhead 16%

EASTERN CUSTOMER AREA

Area Covered	130km²
Total Consumers	115,000
Residential Customers	90%
Non-residential Customers	10%
Customer Types	Residential Commercial/Industrial Developing
Distribution Network	Underground 65% Overhead 35%

WESTERN CUSTOMER AREA

Area Covered	54km²
Total Consumers	50,000
Residential Customers	93%
Non-residential Customers	7%
Customer Types	Residential Commercial/Industrial
Distribution Network	Underground 43% Overhead 57%



SOUTHERN CUSTOMER AREA

Area Covered	700km²
Total Consumers	74,000
Residential Customers	90%
Non-residential Customers	10%
Customer Types	Residential Rural Commercial/Industrial
Distribution Network	Underground 55% Overhead 45%

Figure 1.3 VECTOR's Customer Areas and Types

1.6 VECTOR'S POSITION IN THE ELECTRICITY SUPPLY INDUSTRY

NATIONAL GRID

Transpower is the owner/operator of the national grid that transports energy from generation stations nationwide to the eight Transpower substations which supply VECTOR's network. Transpower is responsible for the security and operation of the grid so as to ensure energy is provided to VECTOR's network in accordance with specified quality standards and prudent security standards. VECTOR maintains a close working relationship with Transpower for day to day operations, the planning of required upgrades at Transpower supply points, and wider regional planning and operational issues. A number of the capital projects forecast in this asset management plan require close liaison with Transpower.

RETAILERS

VECTOR has contracts with and maintains direct links with all customers for provision of network services. Electricity retailers contract with customers to provide electrical energy. Together, retailers and VECTOR sign a Network Access agreement which defines how we work together to deliver electricity to our common customer.

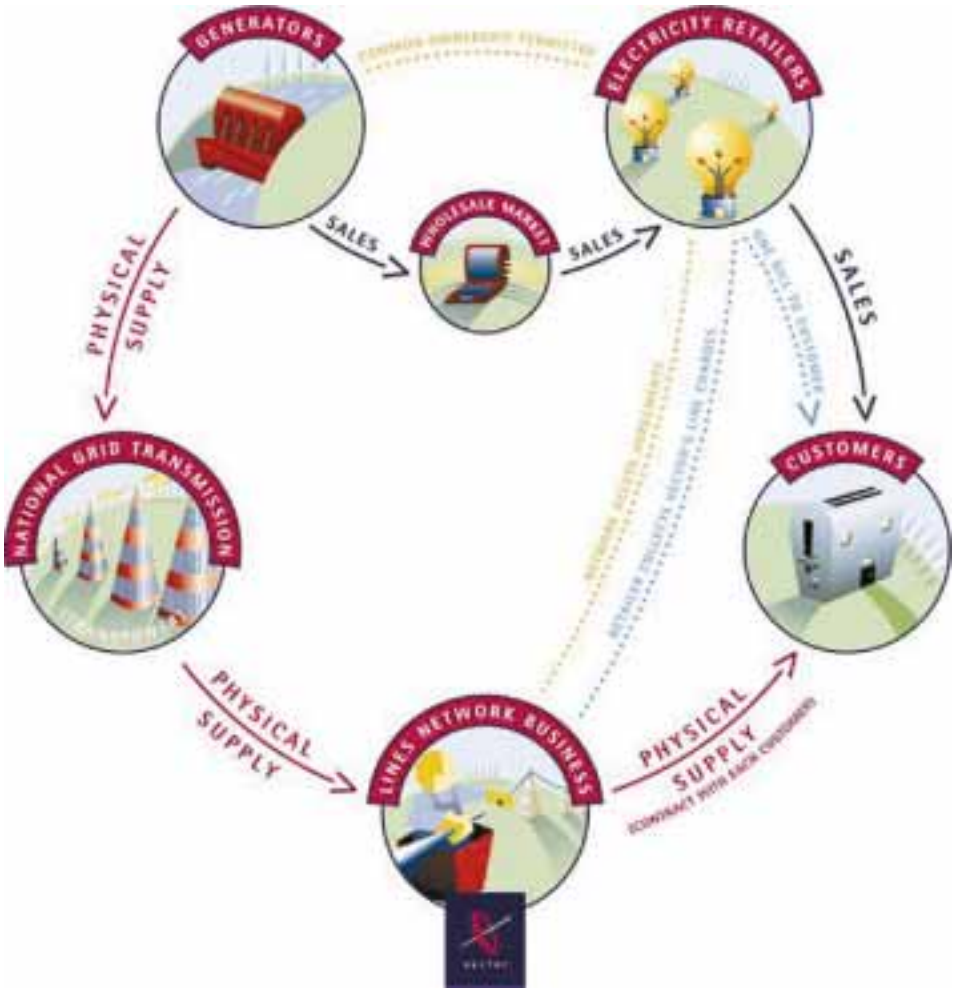


Figure 1.4 VECTOR's postion in the electricity supply market

2 ASSET MANAGEMENT SYSTEM

2.1 ASSET PLANNING PROCESS

The objective of the Asset Management Plan is to describe how VECTOR will manage its assets and investment in its network in order to achieve its performance targets and strategic goals it has set.

The asset planning process prioritises the programmes for maintenance and asset development to ensure optimum customer service and operational efficiency. Implicit in the asset planning process is an understanding and evaluation of the risks to operation and the consequences of failure. Also critical is the collection of information from which performance can be monitored and improvement targets set. From this document customers and other interested parties will be able to identify VECTOR's performance targets, areas of business focus, forecast levels of capital investment, and their rationale. The plan also identifies our approach to the management of network risks and our approach to contingency planning.

VECTOR's Asset Management Process is shown in Figure 2.1.

2.1.1 INFLUENCERS

- *Shareholders*
  VECTOR's customers, elect the Auckland Energy Consumer Trust to represent their interests. The Shareholder Trust is responsible for appointing the Board of Directors and agreeing the Statement of Corporate Intent.
- *Customers*
  VECTOR manages the network to meet the needs of its customers; residential, commercial and industrial.
- *Regulations*
  Statutory requirements impact on how VECTOR operates to meet its service delivery standards. The following statutes are of particular relevance to this asset management plan:

  The Electricity Act 1992
  Health and Safety in Employment Act 1992
  Resource Management Act 1991

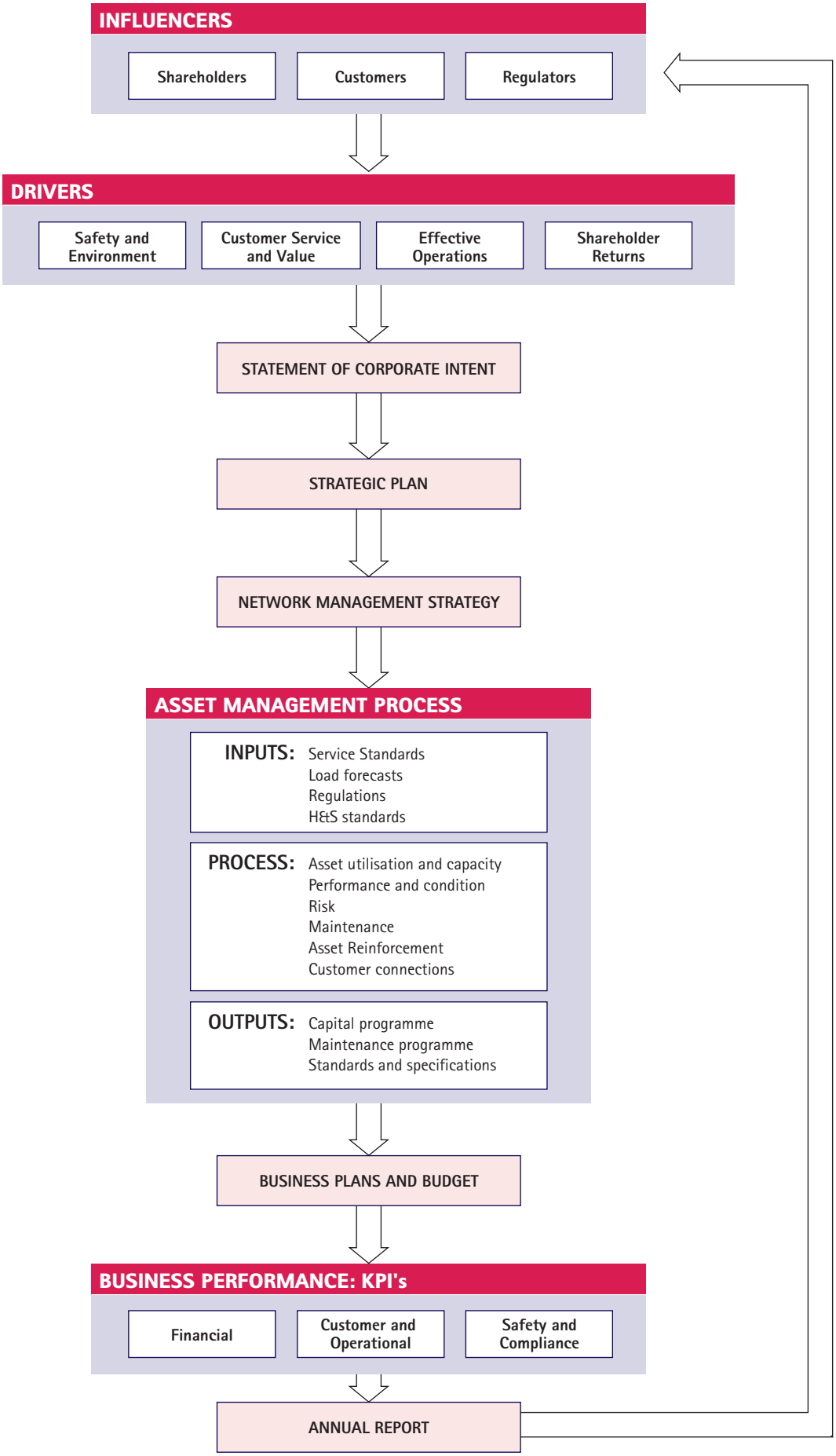


Figure 2.1 VECTOR's Asset Planning process

Other statutes apply to the business as a whole, but are peripheral to the asset management philosophy.

2.1.2 ASSET MANAGEMENT DRIVERS

- *Customer Service and Value*
  VECTOR's objective is to deliver improved customer value by matching the performance of both its assets and contractors to the performance its customers expect and are willing to pay for.
- *Effective Operation*
  VECTOR's objective is to manage the operation of its assets in such a way as to deliver the required performance at the lowest overall cost.
- *Safety and Environmental Responsibility*
  VECTOR will at all times ensure its employees, contractors and customers safety is not put at risk by the management of its assets. VECTOR will manage the network and act in an environmentally responsible manner and comply with all legal environmental requirements.
- *Shareholder Returns*
  VECTOR's objective is to manage its assets to meet the shareholders requirements for return on investment

2.1.3 RELATIONSHIP WITH BUSINESS PROCESSES

The Asset Management Plan is directly influenced by a number of other policy documents and processes:

- *Statement of Corporate Intent*
  This document defines the Directors' intentions and objectives for VECTOR for the financial year and is agreed with the shareholders. This encompasses planned business activities and objectives, values, performance targets and communication methods. See Appendix A for full Statement of Corporate Intent.
- *Strategic and Business Plans*
  Annual plans and key initiatives are established to support the achievement of performance targets
- *Network Management Strategy*
  This defines the approach and direction for network management in terms of Network value, performance, revenue and customer expectations for service and quality.
- *Performance Targets*
  Performance targets are established for the company as part of the long term and annual planning rounds. These include customer service, network performance and financial targets. These targets are also translated into performance targets and incentives for contractors etc.

2.1.4 PLAN IMPLEMENTATION

The outputs from the asset planning process, which incorporates continual review of asset functionality requirements and customer feedback, are the operational, maintenance and capital work programmes.

- *Asset Maintenance Plans / Schedules*
  For each customer area, asset or asset group, specific maintenance programs are established annually.
- *Asset Development*
  For each customer area, capital works programmes are developed to ensure service delivery.
- *Equipment and Design Standards*
  Equipment and design specifications, based on the required functionality of the assets, and are included in the Network Standards Manual. This manual is continually reviewed to ensure the standards are based on current functionality requirements, and to take advantage of new working practises and technology to ensure minimum asset lifecycle costs.

2.2 ASSET MANAGEMENT INFORMATION SYSTEMS

VECTOR utilises a number of systems to store information on its assets, their condition and performance. The information systems are being developed to enhance their ability to manage and analyse large sets of asset condition and performance data. With the implementation of Zone Based Contracts, which were introduced in 1999 and under which contractors provide maintenance services on a performance based fee structure, the information systems required by VECTOR are now focussed on the analysis of the performance of the network. While the Contractors will have systems to manage day to day work activities (work scheduling, resource management etc.), VECTOR will maintain systems which record accurate details of fault and maintenance history against individual assets. This information will be analysed to identify potential improvements to the network, problems with equipment specifications or type and to enhance our understanding of the lifecycle performance of assets.

2.2.1 CURRENT SYSTEMS

The following systems are used to managed VECTOR's assets:

- *Smallworld GIS (Geographic Information System)*
  This system provides a comprehensive register, represented geographically and in text of VECTOR's network assets. Implementation of GIS began in the early 1990' s with extensive data conversion from existing paper records, together with field data capture. A project in late 1998 to early 1999 converted the data and functionality to the Smallworld GIS environment. VECTOR is now well positioned to make effective use of this technology.

- *SAP*
  SAP was implemented over a 12 month period during 1997 / 1998. In addition to providing core financial management functionality, SAP is also used to manage faults, maintenance and work management functions.

- *Test Records*
  An SQL database system is used to record key test records for specific equipment. A key initiative currently underway is to improve the way test and performance records are stored and analysed with an objective of improving performance and understanding the cost/benefit relationships.

- *Network Control*
  The existing SCADA system provides real time data and enables remote control of key components of the network.

- *Network Modelling*
  A new network modelling tool has been purchased to enable the analysis of the proposed changes to the utilisation and operation of the network. This model improves on the functionality of the old model by enabling informed decisions to be made on current and future system performance under changing customer and operational requirements. The new model includes the functionality to perform:

    - Simulations of protection schemes to facilitate protection setting
    - Optimisation functions to allow the minimisation of network losses through changes to the network interconnections.
    - Analysis of harmonics and filter designs
    - Distribution network reliability and contingency analysis
    - Cable capacity ratings
    - Interface with the VECTOR GIS

2.2.2 FUTURE ASSET MANAGEMENT SYSTEMS

The Asset Management systems are being redefined and developed to ensure improvements in network information capture, storage and analysis. VECTOR's initiatives for network information and asset performance improvements are detailed in section 10.0.

3 SERVICE STANDARDS

Customer service for VECTOR is about understanding what our customers value and then meeting these requirements, cost effectively. It encompasses providing our customers with a safe, reliable, supply of electricity, being responsive to failures, being accessible to customers, and providing accurate timely information. In recognising the need to have a better understanding of these customer needs, VECTOR conducts a six monthly survey, known as the Customer Service Monitor (CSM). This is used in conjunction with operational and customer service measures to identify areas for improvement.

Customer requirements and willingness to pay for service levels will ultimately drive performance, VECTOR has a number of current measures against which performance is measured and assessed.

Service delivery standards include:

- Reliability of supply
- Security of supply
- Customer service

VECTOR is currently setting up systems to enable quality of supply performance to be measured and assessed.

The standards give a basis for measuring VECTOR's performance and for determining the required extent of maintenance, repair, renewal, refurbishment and asset acquisition. The standards do not replace any existing legal or regulatory requirements.

3.1 RELIABILITY OF SUPPLY

Reliability of supply is the frequency and duration of interruptions to supply and the number of customers affected by interruption. It is measured by the industry standard measures of SAIDI (System average interruption duration index), CAIDI (Customer average interruption duration index) and SAIFI (System average interruption frequency index).

VECTOR's reliability performance targets for the year ending March 31, 2000 are highlighted below.

MEASURE		TARGET FOR YEAR ENDING 31/03/2000
SAIDI (excluding transmission interruptions)	Average minutes without supply per customer	65 minutes per annum
SAIFI	Average number of outages per customer	1 per annum
CAIDI	Average minutes without supply per outage	65 minutes per annum

Table 3.1 VECTOR's reliability performance targets 1999/2000

Performance over the last 4 years is shown in Figure 3.1. Over the last 18 months excellent improvements have been made in SAIDI by targeted maintenance and the enhancement of working practices. Further gains are expected through the implementation of enhanced asset planning techniques and the zone based contracts. The current SAIDI target is the high voltage network average. VECTOR is now monitoring and in the process of establishing SAIDI targets at a zone substation level.

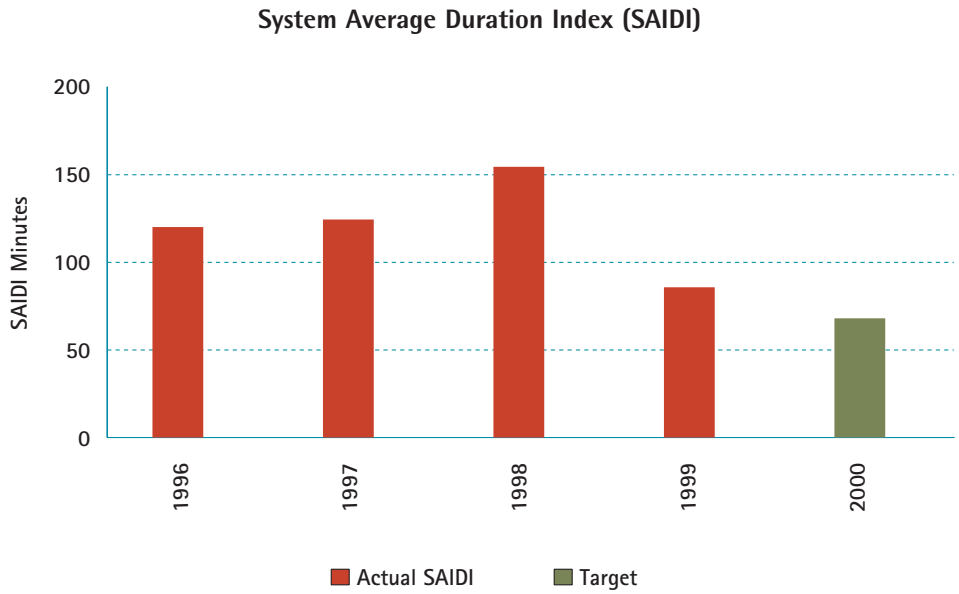


Figure 3.1 Actual and target SAIDI

3.2 SECURITY OF SUPPLY

Security of supply is a measure of our ability to restore supply to customers and to minimise the risk of extended loss of supply.

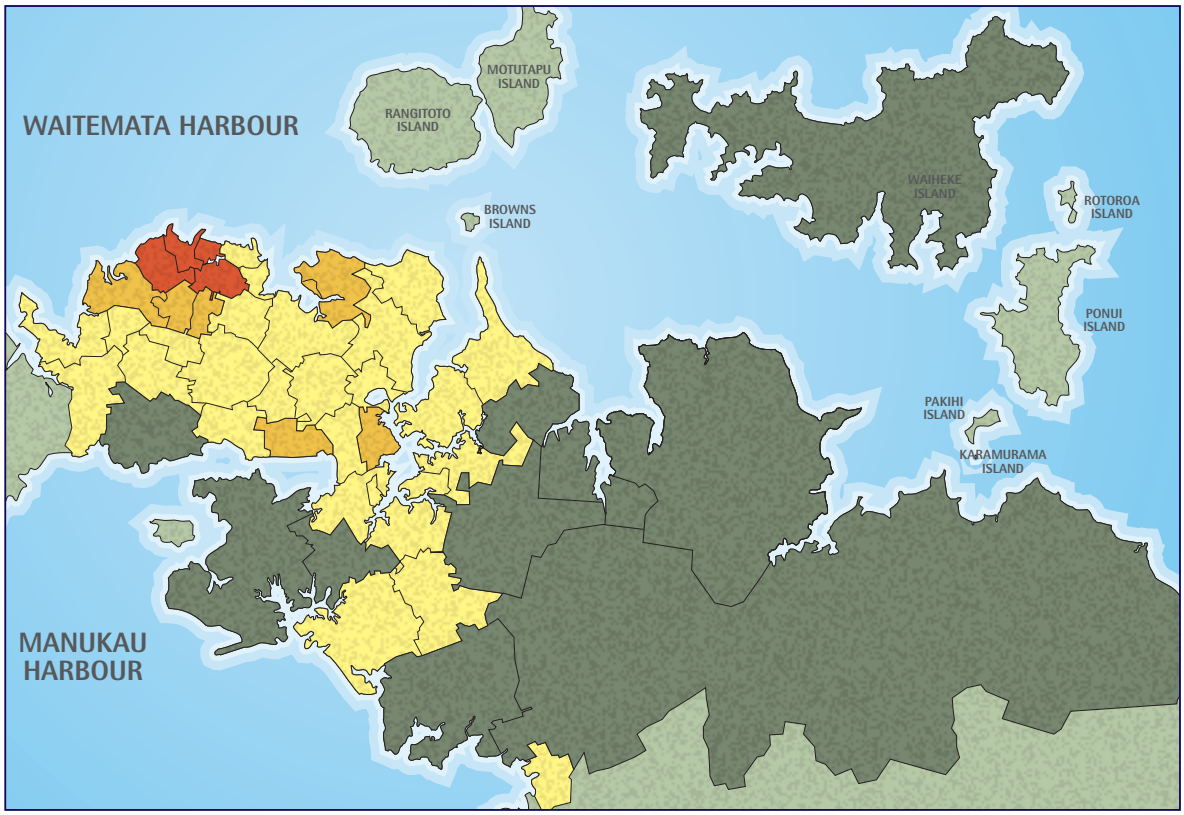
As part of the VECTOR Promise, which is applicable to all of VECTOR's customers, VECTOR promises to:

Restore power within 3 hours of our learning about a fault on the network.*

** This excludes faults caused by extreme storms or other extreme events outside our control. In such extreme situations, we plan ahead for possible repairs and endeavour to restore power as quickly as possible.*

Examples of VECTOR's promise to our customers are included as appendix B.

VECTOR's security performance is shown in Figure 3.2. Consultation and discussions will be held with our customers in each network supply area to determine an acceptable and appropriate balance between service levels and costs.



Total annual unplanned power loss minutes per customer	up to 30	up to 60	up to 180	up to 600
Total annual unplanned interruptions per customer	up to 2	up to 2	up to 4	up to 6

Figure 3.2 Security Performance

3.4 QUALITY OF SUPPLY

Quality of supply is the provision of supply within acceptable parameters such as voltage, frequency and waveform distortion. VECTOR is currently installing power quality meters at selected zone substations and feeders to monitor and understand actual power quality and how it is affected by the VECTOR network and customers. Quality of supply is particularly important for customers using sensitive electronic equipment and VECTOR is willing to work with these individual customers to identify problems and solutions.

3.4 TYPICAL FAULT TYPES

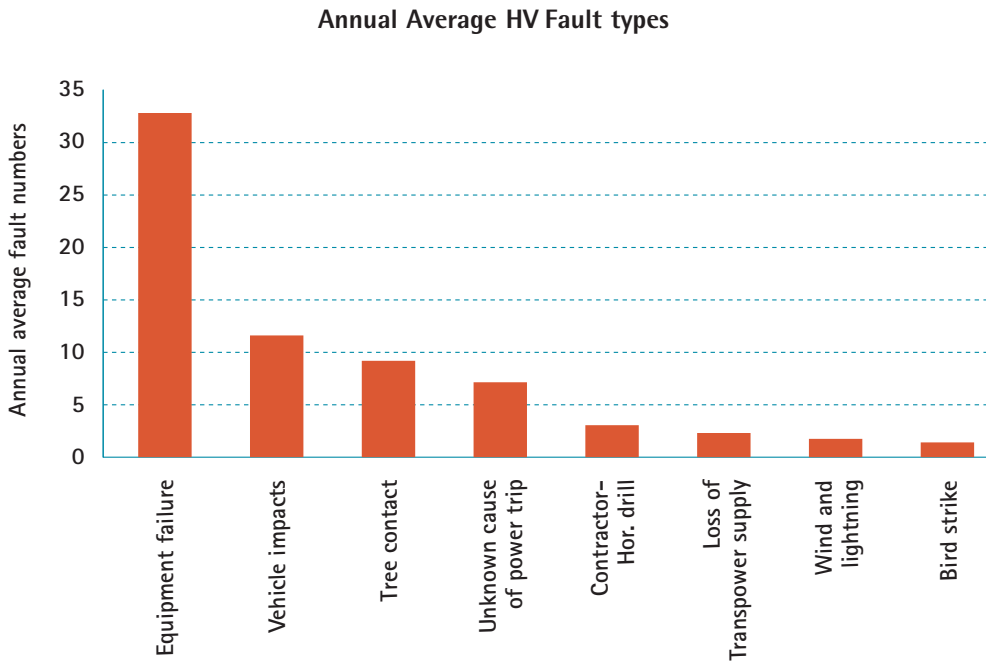


Figure 3.3 Typical HV fault types

Figure 3.3 illustrates the typical HV fault types within the VECTOR network. Fault trends and their impact on customer service levels are continually analysed and VECTOR's asset management strategy is refined to ensure performance and costs are aligned. In response to the high number of vehicle impacts, VECTOR has initiated a trial to evaluate the effectiveness of pole reflectors against car versus pole fault incidents. To date this trial has been successful, and the costs and benefits of extending the initiative are being reviewed.

4 NETWORK ARCHITECTURE & ASSET BASE

4.1 NETWORK OVERVIEW

The overall architecture of the network is shown in Figure 4.1.

The network can be considered as two "sub networks". The high voltage sub transmission connects to the Transpower network at the grid exit points to zone substations, at 110, 33 or 22kV. Each substation serves a particular geographic area, with known asset and customer characteristics. At the substations the voltages are further stepped down to 11kV or 6.6kV. The distribution network then carries the electricity to distribution transformers, or for some commercial customers, directly to their premises. At the distribution transformers electricity is stepped down to 400/230V, for final delivery to customers.

4.2 SUBTRANSMISSION NETWORK

The higher voltage subtransmission network is designed to transfer large amounts of electricity efficiently. The network transfers electricity from Transpower's network via eight grid exit points, to 49 zone substations. A zone substation typically supplies 6000 customers.

The subtransmission network consists of underground cables, except for supply to Maraetai, which is supplied by a combination of underground cable and overhead line, and the temporary 110kV line built to supply the CBD after the 1998 power failure. The historical design philosophy for the subtransmission network was one of dual redundancy so the failure of any single item of equipment would not cause a loss of supply. The design philosophy has now been realigned to meet VECTOR's approach of;

- Improved Asset Utilisation
- Matching Customers Requirements for Capacity and Security of Supply
- Minimising Capital Expenditure

The new approach is detailed in section 5.4.

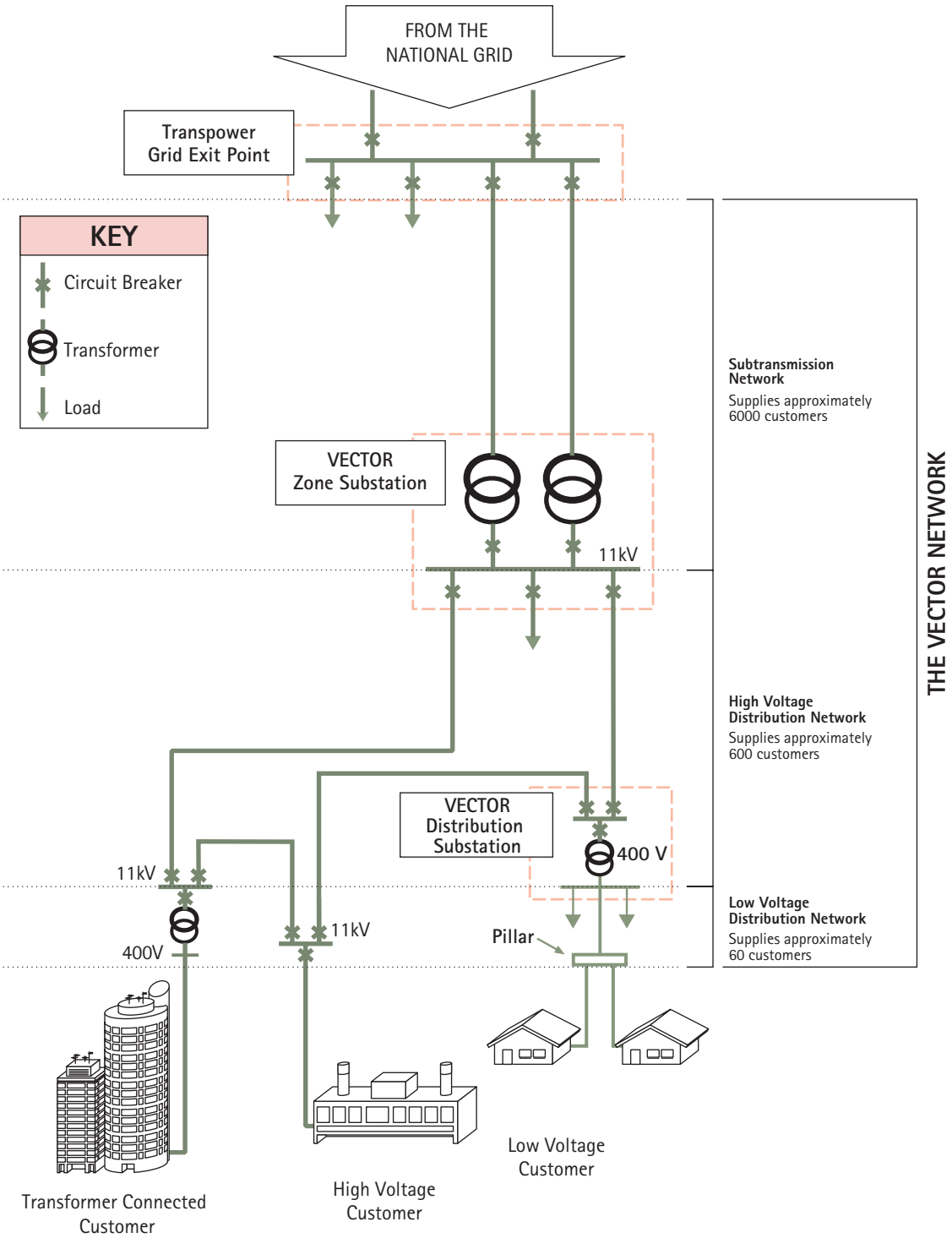


Figure 4.1 Schematic of VECTOR's Network

At the zone substations, the subtransmission voltages are stepped down to 11kV (or 6.6kV) to supply the distribution network. The zone substations are all remotely controlled via the SCADA system, which allows remote operation to be carried out from the Control Room and returns load and equipment operation information.

4.3 DISTRIBUTION NETWORK

The function of the distribution network is to deliver electricity from the zone substations to customers. It includes a system of cables and overhead lines operating mainly at 11kV, with some 6.6kV, which distribute electricity from the zone substations to distribution substations. Typically 600 customers are supplied at the high voltage distribution level. At the distribution substations the electricity is then stepped down to 400V and delivered to customers either directly, or through a reticulation network of overhead lines and cables. Approximately 60 customers are supplied from each distribution substation, via the low voltage distribution network. For larger loads, electricity can also be delivered at 6.6kV or 11kV. Four main categories of customer connection are available and the final network connection type determined through consultation with the customer. The connection types are;

- Single phase low voltage
- Three phase low voltage
- Transformer connection
- High voltage connection

A number of customers are fed by dedicated substations, and take supply at 33 or 11kV.

For most customers electricity is provided at 230V. The point where VECTOR's network ends and the customer's equipment begins, is for LV customers, either at the pole fuse or the service pillar fuse supplying the customer. This is usually at or near the property boundary. The cable or overhead line from this point (known as the service line or service connection) is owned by the customer and is the customer's responsibility to maintain.

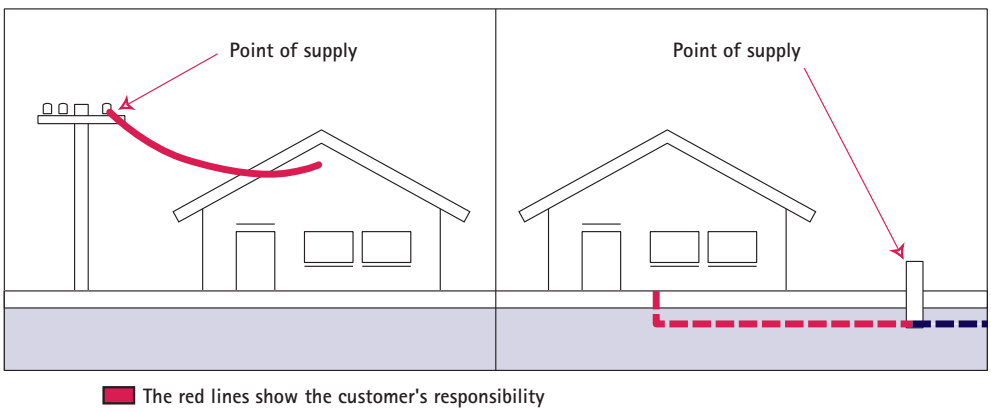


Figure 4.2 Typical customer connection point

The distribution system consists of interconnected radial circuits originating from zone substations. In the event of faults, or during routine maintenance, supply can be restored from alternative sources via the interconnections after manual switching operations. This system provides a very reliable means of electricity supply.

The distribution circuits are controlled by automatic circuit breakers at the zone substations. Oil switches and air break switches are installed at strategic locations on the circuits to provide operational flexibility. Consideration is being given to automating some of these switches to improve response time and provide better customer service.

There are 99 dedicated high voltage customer substations. The ownership of the customer substations varies from site to site, but generally VECTOR owns the incoming switchgear and any protection equipment associated with it. The customer usually owns the transformer/s, any outgoing switchgear and associated protection, and the building.

The Local Councils require all new subdivisions to be reticulated underground and have done since the 1960's. This together with significant undergrounding of existing overhead lines over the last 15 years (principally along major routes), means VECTOR has the most heavily undergrounded network in New Zealand. The benefits of undergrounding in terms of enhanced service and lowered operational costs do not alone offset the increased cost of undergrounding. There are however, other community benefits, such as enhanced aesthetics.

4.4 PROTECTION

The VECTOR network is protected from the Transpower grid exit points to the customer supply point by a series of relays and fuses. The protection network has been designed to interrupt the supply immediately if excessive fault currents arise to ensure that the assets are not working out of normal operation ranges for significant periods and health and safety is not compromised. The protection settings are reviewed to allow for load variation and High Voltage customer coordination changes.

4.5 COMMUNICATION

VECTOR's communication network consists of pilot and fibre optic cables, and associated transmission equipment. It is used for protection, SCADA, control and communication.

4.6 METERING

VECTOR operates 12 bulk meters at the Transpower grid exit points that are used for planning purposes and reactive power management. VECTOR does not own any of the metering equipment used for billing end-use customers. Either the customer, the retailer supplying the customer or some other third party owns the meters. VECTOR does not own the ripple relays located on customers premises, but does own and control the ripple injection system used for load management.

5 DEMAND AND SUPPLY

5.1 CURRENT DEMAND REQUIREMENTS

Current usage on the VECTOR network is around 4,400 GWh/annum, with a peak demand of approximately 900MW in 1999. The demand for electricity in the Auckland area has changed over the last 50 years. The network experienced rapid growth in the 1950's and 1960's, when demand was growing at a rate of more than 7% per annum. This growth was due to rapid development in the CBD and the suburbs. The actual demand for electricity, and especially the peaks, depends on weather conditions over the year, but demand is predicted to continue to increase over the next 15 years, at an average rate of 2% per annum.

Demand is not consistent throughout the network, with some areas experiencing rapid growth due to new developments and others experiencing very low or zero levels of growth, as areas become fully developed or commerce and industry move away. The challenge for VECTOR is to manage the maturing network at an economic level and to maintain customer levels of service and performance expectations.

The historical demand for electricity is shown in Figure 5.1

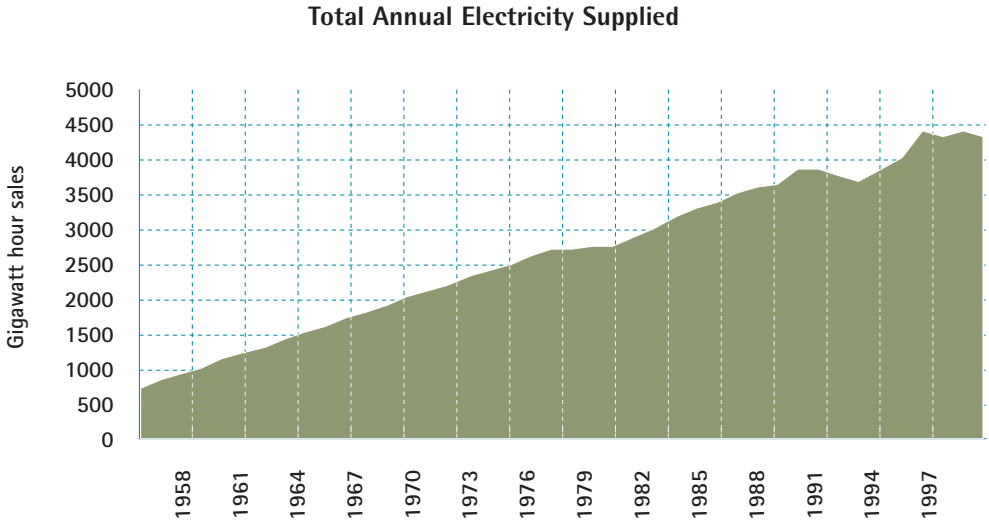


Figure 5.1 Actual and forecast demand in the VECTOR supply area
Note: prior to 1981 data not annual

5.2 DEMAND FORECASTS

Demand projections are based on VECTOR's historical and actual load growth scenarios. Demand forecasting in VECTOR is a bottom up approach, in that forecasts are based on local area information. The following information is used for forecasting;

- Population information from Statistics NZ
- Load requirement information from existing and new customers
- Local council development plans and district plans
- Ultimate load density projections, which are based on the amount of land available for development in an area and the types of development that are likely. The amount of land available and types of development are sourced from the relevant district plans

These small area forecasts are used to assess capacity requirements, identify strategic links and transfer requirements between areas, and highlight when and where performance problems may occur. This enables VECTOR to view the network not as uniform, but as a set of discrete regions with their own demand, supply and performance characteristics.

5.3 FACTORS INFLUENCING DEMAND

5.3.1 LOAD DIVERSITY

The load on VECTOR's network is primarily an urban load, consisting of:

- Residential load
- Small commercial loads, such as dairies and single shops
- Large commercial loads, including shopping malls and light industrial factories
- Large industrial loads, ranging from large factories to steel mills

Peak demands do not occur simultaneously. Advantage is taken of the diversity of load profiles, when designing the network. Residential load tends to peak in the evening, with a peak lasting two or three hours from 5.00pm. Commercial load tends to peak during the day, with a peak lasting five or six hours. Peak demands within the VECTOR network are seasonal and area specific, with some areas peaking in winter and others in summer. The underlying trend for peak demands is moving towards a summer peak, and the network will have to be designed and operated to ensure performance is maintained under changing customer usage patterns.

5.3.2 DEMAND MANAGEMENT

Demand management techniques to influence immediate demand, including VECTOR's extensive ripple relays to turn hot water cylinders on and off, and targeted incentives to shed or move load at critical times, will be actively considered as an alternative to capital expenditure.

5.4 SUPPLY

Historically, the Asset Management Plans of VECTOR's former network operators (AEPB and Mercury Energy) have focussed on a universal system of uniform quality, service and maintenance provision across the network. The design, management, customer service and investment in assets was generally undertaken off a single criteria and applied to all customers.

This network design methodology had not materially changed since the growth period starting in the early seventies. It followed standard UK, Australian, and European general practice, and was inherently conservative and engineering-driven. This approach, which balanced "asset redundancy" against response time so as to minimise the duration of outages and number of customer numbers affected (ie, SAIDI) had been universally applied across the VECTOR network. This deterministic approach to security is now becoming inappropriate practise with the maturing of the network.

A focus of VECTOR's current Asset Management Strategy is to align our service delivery to the requirements and expectations of our customers, which vary significantly across the network. VECTOR has initiated a planned approach to customer consultation, the assessment of service levels and their value to customers. The network is no longer viewed as a single entity, but rather a set of discrete regions with differing network and customer characteristics. There remain many common elements across the network, but each project or initiative will be targeted to the specific needs of those customers affected.

VECTOR's future direction is one of focusing on increased utilisation of the assets while enhancing performance. When balancing demand with supply, VECTOR will ensure that the Service Delivery standards and performance are maintained to provide a minimum of:

- Reliability – an average network-wide SAIDI of 65 minutes, which target will be reviewed annually
- Security – the capacity for restoration of every customer in three hours of any fault (except for major external events such as very severe weather)

but will refine the review methodology and approach to achieve the performance by;

- Improved asset utilisation
- Matching customers requirements for capacity and security of supply
- Minimising capital expenditure

Security and contingency planning is also being enhanced to consider orderly recovery from complete loss of any zone substation through our risk management process and switching plans.

6 ASSET MANAGEMENT OVERVIEW

6.1 ASSET MANAGEMENT PHILOSOPHY

VECTOR's assets are managed to ensure their availability to meet their performance expectations, based on current and future service delivery standards. VECTOR's approach to effective asset management is designed to ensure a balance between the cost of maintenance and replacement against the risk and consequences of asset failure.

VECTOR's approach to asset management is to;

- Provide a safe environment for operating personnel and the general public
- Avoid environmental damage as a result of failing equipment
- Preserve the required functionality, performance and value of assets to enable the continuation of a viable network business
- Enhance reliability of supply to customers to ensure that the required service standard is met

Assets must be operated and maintained to continue to meet performance standards, at lowest possible cost. Asset functionality and performance requirements are continually reviewed and revised to reflect the changing operational and customer requirements on the network.

Asset Maintenance is a significant proportion of the total asset lifecycle cost and VECTOR is moving progressively towards a new approach to maintenance, which balances reliability centered maintenance, customer expectations and value. This approach will ensure that resources are targeted where they will have most effect. Our ability to do this will be enhanced by increasing our understanding of the condition and performance history of each asset. Development of procedures and systems to capture and analyse this data is an integral part of the Asset Planning process.

6.2 ASSET MAINTENANCE PROCESS DEVELOPMENT

From 1999 VECTOR has consolidated its network fieldwork (maintenance and routine minor capex) under three Zone Based Performance Contracts, and the network has been divided into 3 geographic regions. VECTOR is responsible for specifying the required performance outcomes for the network, for defining minimum maintenance activities and for monitoring the performance of the contractors. The contractors are responsible for developing detailed maintenance work plans to achieve the required results.

The key outcomes targeted through the establishment of the contracts are:

- Continuous improvement in customer service
- Exposure to a greater technical resource pool and innovation.
- A simplified, clear point of contact between VECTOR and its contractors and clear demarcation of roles.
- Responsibility and reward for superior performance given to contractors.
- The removal of duplication in work processes between VECTOR and its contractors
- Enhanced information on the physical condition of the network
- Improved, streamlined work processes to facilitate faster fault and customer response.
- Greater cost certainty

Under the contracts, the contractors propose a detailed annual preventative maintenance plan that is consistent with the objectives and targets of VECTOR's asset management plan. This proposal is subject to review and approval by VECTOR technical specialists, and will be refined as asset condition and performance knowledge is enhanced.

In line with VECTOR's approach to a customer driven level of service provision, the maintenance plans will be developed from analysis of customer requirements, an assessment of the condition of the asset, the risk and consequences of asset failure and analysis of least cost solutions.

6.3 MAINTENANCE PLANS

The development of VECTOR's asset maintenance plans recognises a variety of environmental, performance and condition factors. While generic maintenance actions are developed for each asset type, these will be applied differently, based on asset performance requirements and criticality. Assets that are at greater risk of a certain type of failure will have a higher frequency of maintenance actions designed to prevent that type of failure (eg. areas exposed to storms may have higher frequency of tree trimming).

Maintenance on the VECTOR network is designed to maintain the functionality of the asset and the operating capability of the network. Preventative maintenance on VECTOR's network consists of three elements:

- Routine asset inspections, condition assessments, servicing and testing of assets.
- Evaluation of the results in terms of service delivery, performance expectations, risks etc.
- Repair, refurbishment or replacement of assets when required.

For certain classes of asset in a particular area or environment, special maintenance, or asset refurbishment or replacement programmes are applied to address known condition or performance issue with those assets.

The actual timing for any replacement is based on condition and performance assessments, made as the asset;

- approaches the end of its useful life and is no longer suitable for its application, in terms of asset functionality or customer requirements
- when the asset presents an unacceptable risk for performance or to the operating and maintenance personnel.
- for economic reasons.

When the requirement arises for an asset to be replaced, the opportunity is taken to consider the justification for both an upgrade and/or capacity increase to meet future supply requirements and replacement with modern technology to ensure minimum asset lifecycle costs.

6.4 MAINTENANCE EXPENDITURE

VECTOR's total maintenance expenditure is a combination of the expenditure on remedial maintenance and preventative maintenance. At VECTOR, preventative maintenance is the inspection, condition monitoring and repair, refurbishment and replacement of assets when necessary. Remedial maintenance is the fixing of faults when they occur. Remedial maintenance is more expensive on a unit basis, and better targeted preventative maintenance can have a large payback. Overall it is VECTOR's intention to reduce the amount that it spends in total on maintenance (while maintaining or improving current asset performance levels). This will be achieved through:

- Improved understanding of asset condition
- Better preventative maintenance planning and execution (there may be an initial increase in preventative maintenance expenditure, offset by reduced remedial maintenance)
- Appropriate targeting of effort
- More effective maintenance methods and practices
- Incentivising the performance of contractors
- Understanding customer expectations

7 ASSET MAINTENANCE

7.1 SUBTRANSMISSION CABLES AND LINES

7.1.1 ASSET STATUS

VECTOR operates 487 km of subtransmission cables and lines rated at 110kV, 33 kV and 22 kV. VECTOR is the only electricity distributor other then Transpower, to operate at 110kV in New Zealand.

SUBTRANSMISSION CABLE TYPE	TOTAL LENGTH (km)
Overhead	45
Underground Solid	205
Underground Gas	45
Underground Oil	192
TOTAL	487

SUBTRANSMISSION VOLTAGE	TOTAL LENGTH (km)
110KV	64
33kV	274
22kV	149
TOTAL	487

Table 7.1 Subtransmission cable lengths and voltages

VECTOR also operates 12.5km of 110kV overhead line, installed in the CBD following the 1998 power failure. The emergency overhead line, which was installed under emergency Resource Management Conditions, is scheduled to be removed before the end of 2001, following completion of the tunnel and CBD reinforcement.

The age profile of the subtransmission cables and lines is shown in Figure 7.1.

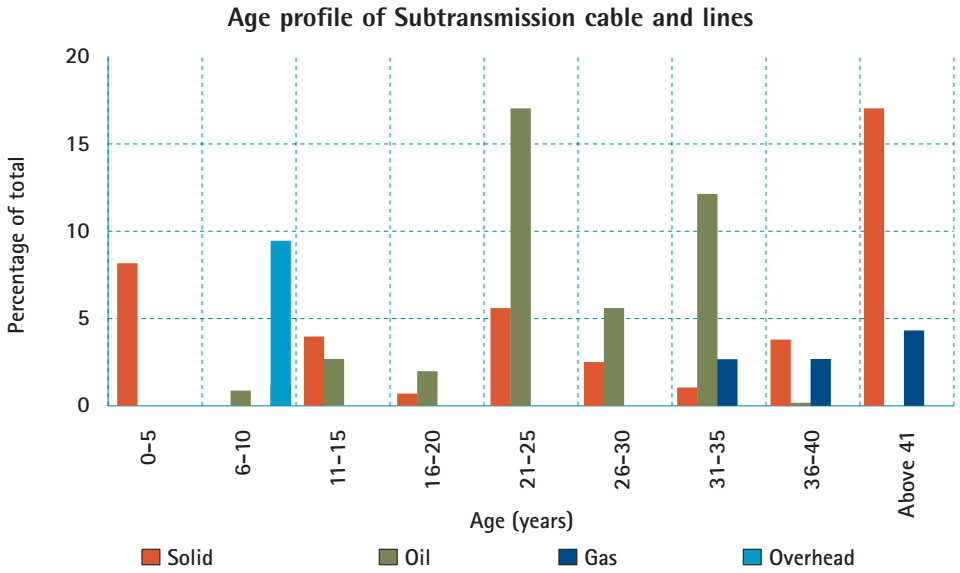


Figure 7.1 Age profile of Subtransmission cable and lines

The cables have varying design lives, but condition and performance are used as the main guide for replacement. The design life for oil and PILC cables is 70 years, XPLE 45-50 years, and experience has indicated at least 50 years for gas. VECTOR has an existing programme of continuous pressure monitoring, via the SCADA system, for the oil and gas cables. When gas and oil leaks are identified the appropriate remedial maintenance is carried out. Condition monitoring will determine when replacement is required.

7.1.2 ASSET ISSUES AND RISKS

The following issues, their current controls and required actions have been identified for subtransmission cables and are detailed in Table 7.2.

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Oil cable joint, wipe and sheath failures	• Security of supply • Environmental	• Maintenance policy • Contingency plans • Discussions with ARC for envelope joint covers – effectiveness under review	• Enhanced fault classification and failure analysis • Project to remove foam filled sleeves to facilitate serving tests

Table 7.2 Subtransmission cables and lines issues, controls and actions

7.1.3 ASSET PERFORMANCE

The following Special Maintenance programmes for cable condition assessment have been developed to improve our knowledge of the asset condition and expected performance levels.

CABLE JOINT SLEEVE INVESTIGATION AND REPLACEMENT

Driver Replacement
Timescale ongoing through 2000/2001
Status Proposed

A number of joints on the gas and oil cables have their outer sleeve filled with a foam compound that prevents serving tests being performed. Serving tests prove the integrity of the cable outer sheath, and will provide data on cable condition that can be used when determining the asset utilisation capability and network strategy for the supply area. Serving tests are programmed for 2000, and the foam filled outer sleeves will be replaced if required.

CABLE RATING AND CABLE TEMPERATURE INVESTIGATIONS

Driver Performance and Security of supply
Timescale Ongoing
Status Committed, subject to need

Through the problems highlighted with cable ratings during the CBD crisis, VECTOR has undertaken a rigorous assessment of the factors influencing cable ratings. New software will allow VECTOR to more accurately model, calculate and confirm cable ratings. This together with the temperature data will enable the optimum loads for cables to be determined and facilitate informed decisions to be made on increased asset utilisation and the need and timing for asset reinforcement.

Cables highlighted through the CBD crisis or through routine condition assessments as not meeting the expected performance criteria, or nearing expected capacity, are scheduled for temperature investigation, to evaluate cable ratings. This ensures that appropriate maintenance programmes and cable loads are applied to specific cables, and that reinforcement is scheduled when required. Temperature monitoring points will be installed at three locations on the Wiri cable this year, to evaluate the capacity prior to commencement of the Wiri asset development investigation.

Permanent temperature monitoring (Distributed temperature Systems DTS) was installed as part of the new 110kV Roskill to Liverpool cable in 1999/2000. The temperature profiles are being analysed to identify hot spots, to enhance operations. All future subtransmission cables will have the capability for real time temperature monitoring. VECTOR will evaluate the results from the existing monitoring, to determine the operational benefits of extending the monitoring programme, to existing cables.

7.2 SUBTRANSMISSION SWITCHGEAR

7.2.1 ASSET STATUS

VECTOR own and operate over 800 subtransmission circuit breakers, rated at 110, 33, 22, 11 and 6.6kV. The circuit breakers are oil, gas, vacuum, oil/vacuum or GIS, with an average age of 24 years.

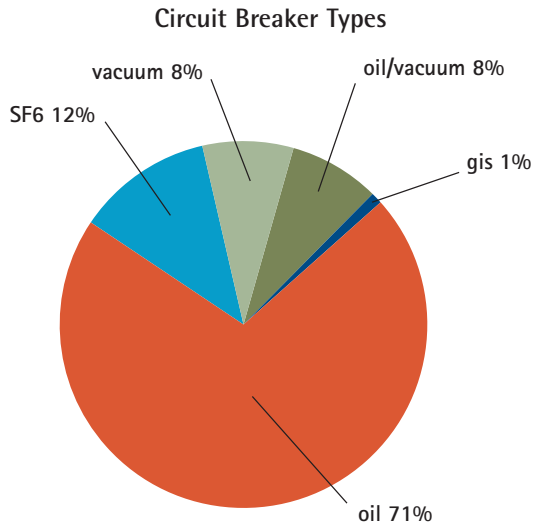


Figure 7.2 Subtransmission circuit breaker by type

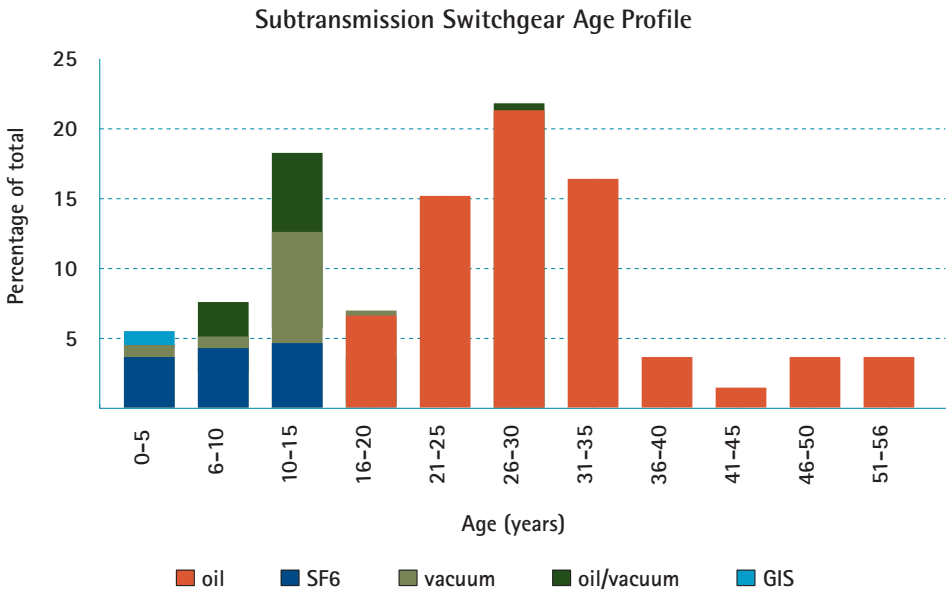


Figure 7.3 Subtransmission switchgear age profile

Circuit breaker performance and reliability is generally good, with no condition problems identified. All switchboards are tested for deterioration on an annual cycle, using non-invasive ultra sound and infrared tests. The design life of subtransmission switchgear is 50 years, but replacement of switchgear is based not only on asset age and condition, but availability of components, and the benefits of reliability of new switchgear, compared to refurbishment. McNab, Kingsland, Westfield, Onehunga and Mareatai switchgear are over 40 years old and have compound filled busbars. These sites are programmed for partial discharges testing in 2000. Replacement will be scheduled, if required, following the test results.

7.2.2. ASSET ISSUES AND RISKS

No current asset issues, requiring controls or actions were identified for the subtransmission switchgear.

7.3 SUBTRANSMISSION TRANSFORMERS AND CAPACITORS

7.3.1 ASSET STATUS

VECTOR own and operate 112 subtransmission transformers, which have an average age of 23 years.

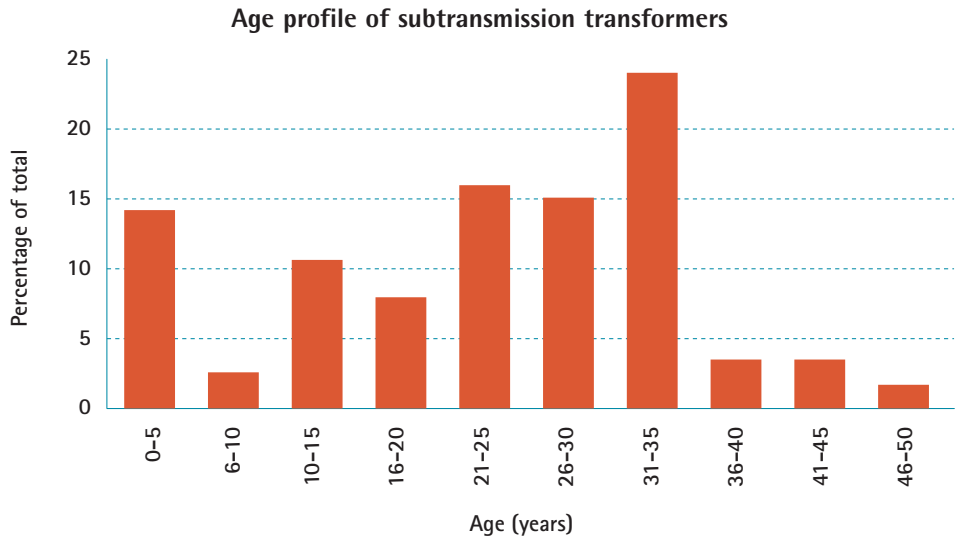


Figure 7.4 Subtransmission transformer age profile

The design life of the subtransmission transformers is 60 years, when under normal operating conditions. Routine condition monitoring and mid-life refurbishments are enhancing VECTOR's knowledge of expected transformer life and performance. Reliability and performance of the transformers is good, with only a small number of trips or forced outages in the last year.

7.3.2 ASSET ISSUES AND RISKS

The following issues and actions have been identified for Subtransmission transformers, are detailed in Table 7.3

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Moisture content in transformers affecting transformer utilisation	• Security of supply • Performance	• DGA testing • Monthly inspections	• Evaluation of testing techniques to enhance knowledge of insulation settings and alarm settings required

Table 7.3 Subtransmission transformers issues, controls and actions

7.3.3 ASSET MAINTENANCE

Routine condition monitoring of power transformer components is done using non-invasive methods. Each transformer is subject to monthly visual checks for moisture and oil leaks, and an annual DGA test, which evaluates condition, by monitoring moisture, acidity, dialectic strength and dissolved gas. Transformers or components that have deteriorated beyond acceptable parameters are taken out of service for a detailed inspection of moisture levels, the core and windings. This investigation gives an indication of the life expectation of the transformer, and a decision is made on refurbishment or replacement. VECTOR is currently evaluating new assessment techniques to provide better information on transformer insulation condition. This will enable the alarm settings to be calculated accurately, increased utilisation of the asset, and better targeted maintenance programmes.

VECTOR has a high proportion of transformers which were installed in the 1960's, which could drive an extended replacement programme over the next 20 – 30 years. Six transformers have been scheduled for detailed investigation and refurbishment if required in 2000/01. The timing and number of refurbishments will be dependent upon the availability of refurbishment facilities and the ability of the network to schedule in transformer outages.

Transformer Tap changers have a similar age profile to the transformers. Maintenance type and frequency is a function of the make and age of the tap changer.

Capacitor Banks were installed in 1998/99 in 19 zone substations for reactive support. The capacitors are in good condition and meeting performance expectations.

7.4 SUBTRANSMISSION SUBSTATION

7.4.1 ASSET STATUS

VECTOR owns 49 zone substations in the greater Auckland area. Each is maintained with regard to access security, condition and safety. All zone substation and ripple injection spaces are inspected periodically as part of an integrated inspection routine that, in addition to the building, includes other assets such as batteries and safety equipment. Equipment such as lighting, fire systems, fans, heaters and hoists is also included.

7.4.2 ASSET ISSUES AND RISKS

The following issues, controls and actions were identified for the zone substations and are detailed in Table 7.4.

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Earthing integrity	• Health and Safety • Compliance (HSE and Electricity Regulations)	• Advise staff and contractors of potential issues	• Earthing review and remedial work where required
Oil containment	• Environmental • Compliance (RMA)	• Environmental Management System procedures for responding to spills	• substation refurbishment programme: bunding and roofing of transformer bays
Seismic	• Compliance (RMA and HSE Acts)		• substation refurbishment programme: investigation and remedial work where required
Security	• Health and Safety • Compliance	• Locks at zone substations replaced and security keys issued to staff	• substation refurbishment programme: security fences to prevent general access to sites

Table 7.4 Subtransmission substation issues, controls and actions

Following a comprehensive survey of the condition of substation structures a number of refurbishment programmes are underway and scheduled for completion by 2003.

7.4.3 ASSET REFURBISHMENT

EARTHING INTEGRITY

Driver Compliance and Health and Safety
Timescale Completion by 2003
Status In progress

Earthing tests at 70% of the zone substations have been completed and the results analysed. Problem sites have been identified and where required remedial action to improve the earthing gradient implemented. The remaining sites will be tested in 2000 and work scheduled as required.

OIL CONTAINMENT

Driver Compliance and Environmental
Timescale Completion by 2003
Status In progress

As part of Vector's environmental programme and to comply with RMA requirements, each substation has been evaluated in terms of the risks and controls for oil leaks and containment. A programme to ensure compliance, consisting of installation of bunds around

the transformers and roofs or oil separators, is up and running and is scheduled to be complete by 2003.

SEISMIC

Driver Performance, Compliance and Security of supply
Timescale Completion by 2002
Status In progress

To ensure compliance with RMA and Health and Safety requirements, each substation has been evaluated in terms of the risks to the building and equipment from seismic effects. A programme to rectify problem areas is up and running and is scheduled to be complete by 2002.

SECURITY

Driver Performance, Compliance and Health and Safety
Timescale Completion by 2002
Status In progress

As part of the zone substation revitalisation programme, security fencing at selected substations is to be enhanced. Three substations have been completed to date, and 10 substations - Mt Albert, Parnell. Liverpool, The Drive, Westfield, Takanini, Onehunga, Hobson Street, Mt Wellington and Te Papapa have been selected as priority for completion by March 2000, due to public access and Health and Safety issues. The remaining substations will be scheduled for security enhancements over the next two years.

7.5 DISTRIBUTION CABLE AND LINES

7.5.1 ASSET STATUS

VECTOR operates more than 7,000 km of distribution cables and lines, which transfer power from the zone substations to customers.

The current approach to asset management is to repair or replace the asset when it has failed.

7.5.2 ASSET ISSUES AND RISKS

The following issues actions and controls for distribution cables and lines and are detailed in Table 7.5.

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Failure of Cable terminations on pole mounted cable boxes. The failure is linked to sites with HDPE (PILC) cable	• Performance	• Replacement of failed assets with pressure termination kits	• Failure is occurring world wide and VECTOR is liaising with other utilities and manufacturers to evaluate causal factors and optimum solutions

Table 7.5 Distribution cables, issues, controls and actions

7.5.3 ASSET MAINTENANCE

Trials were conducted in 1999 to evaluate ground and air based thermographic inspection techniques. The zone based contractors will determine the applicability and the need for thermographic inspection in their areas.

7.6 POLES

7.6.1 ASSET STATUS

VECTOR owns approximately 50,000 poles in its the distribution network. The poles are made of various materials;

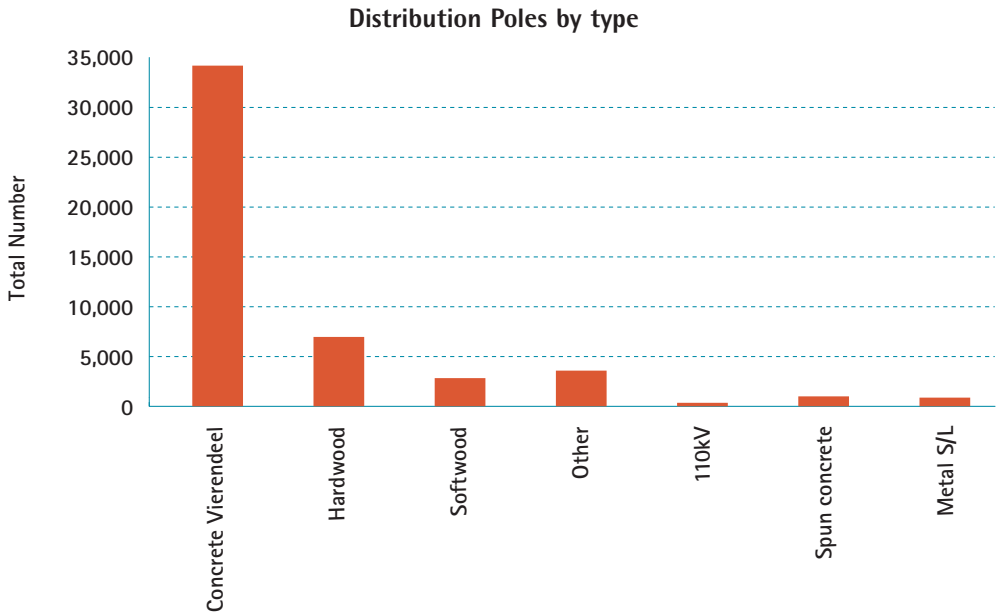


Figure 7.5 Distribution poles by type

7.6.2 ASSET ISSUES AND RISKS

Pole Inspections are an integral part of the Zone Based Contractors work and VECTOR has approved methods for field inspection, condition assessment and replacement that meet statutory requirements. From these inspections an optimum programme of pole replacements is developed.

Six hundred poles were replaced in 1999 because they did not meet the required standards and performance expectations. The replaced poles were mainly reinforced concrete and wood. Areas where problems were expected due to network age and pole type were targeted for inspection and replacements occurred in Remuera, Orakei, Newton, Balmoral, Freemans Bay, and selected areas of Onehunga, Mt Wellington and Papakura.

As part of VECTOR's storm readiness programme, cross arms were investigated and replaced where necessary in coastal areas exposed to high winds. Replacement programmes were undertaken in Takanini, Howick, Manurewa, Maraetei and parts of Manurewa and Mangere central in 1999.

Failing pole foundations can cause excessive sag in cables due to pole leaning. Revised standard requirements for foundation construction have been developed and issued as part of the Network Standards to contractors.

A trial is currently underway to evaluate the effectiveness of pole reflectors against car versus pole fault incidents. A sample of 1000 poles plus any poles, on the three worst feeders, previously hit by vehicles has had reflectors installed. To date the trial has been successful, with no vehicle collisions on feeders with reflectors.

7.7 DISTRIBUTION SWITCHGEAR

7.7.1 ASSET STATUS

VECTOR operates over 7000 ground mounted distribution switchgear units.

7.7.2 ASSET ISSUES AND RISKS

The following issues, controls and actions identified for the distribution switchgear, are detailed in Table 7.6

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Auto-recloser performance reliability	• Performance	• Performance monitored by Zone based contractors	• Replacement of auto-recloser when required

Table 7.6 Distribution switchgear issues, controls and actions.

Replacement of switchgear is based not only on asset age and condition, but availability of components and the benefits of reliability of new switchgear compared to refurbishment.

7.8 DISTRIBUTION TRANSFORMER

7.8.1 ASSET STATUS

VECTOR operates over 7700 distribution transformers. These are pole mounted, metal or fibreglass ground mounted, open enclosures or fully enclosed within other buildings.

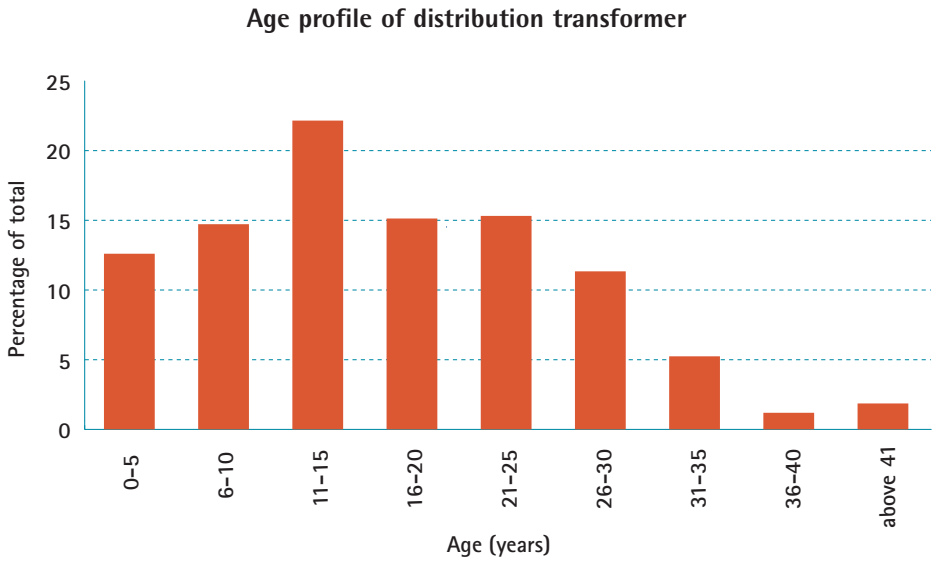


Figure 7.6 Distribution transformer age profile

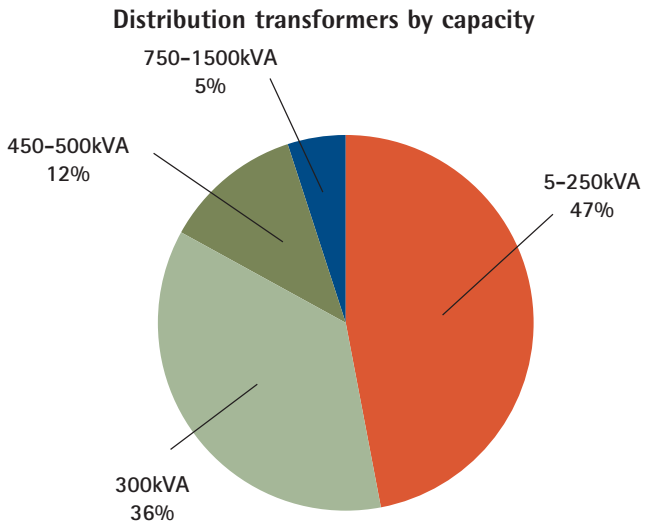


Figure 7.7 Distribution transformers by capacity

7.8.2 ASSET ISSUES AND RISKS

The following issues and risks were identified for distribution transformers:

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Exposed LV bushing in some ground mounted sites	• Health and Safety • Security of supply	• Contractors advised of risk	• A bushing cover has been designed and will be installed on sites when identified by the zone based contractors

Table 7.7 Distribution transformers issues, controls and actions

7.8.3 ASSET REFURBISHMENT

Performance of the transformers is good and current policy is to replace assets when they fail.

7.9 DISTRIBUTION SUBSTATION

7.9.1 ASSET STATUS

VECTOR operates over 7700 Substations, which are maintained with regard to security, condition and safety.

7.9.2 ASSET ISSUES AND RISKS

The following issues, controls and actions for distribution substations are detailed in Table 7.8.

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Exposed LV frames in some ground mounted substations	• Health and Safety • Compliance	• Contractors advised of risk	• A frame cover has been designed for LV frames and installation has commenced
Earthing integrity	• Health and Safety • Compliance	• Contractors advised of risk	• Testing in accordance with Electricity Regulations. In coordination with other NZ lines companies a new test procedure for earthing has been developed and implemented

Table 7.8 Distribution substation issues, controls and actions

7.10 DISTRIBUTION EQUIPMENT

7.10.1 ASSET STATUS

This section covers pillars, lightning arrestors, fault passage indicators and fuse isolators.

VECTOR's network falls into a low lightning zone, and lightning arrestors are only installed in known or probable strike positions. Fault passage indicators have been recently installed in selected points of the network to shorten the fault response time.

7.10.2 ASSET ISSUES AND RISKS

The following issues, controls and actions were identified for distribution equipment are detailed in Table 7.9

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Damaged or non-secure pillars identified	• Health and Safety	• Contractors advised of risk	• VECTOR has notified the manufacturers of the need to revise the design of pillar covers • Remedial work on existing pillars as part of zone based contractors inspection programmes

Table 7.9 Distribution equipment issues, controls and actions

7.10.3 ASSET MAINTENANCE AND REPLACEMENT

Condition monitoring has shown that the failure rate of fuse isolators is high, caused by rusting pins swelling and cracking the insulators. Fifteen hundred sets of isolators have been replaced to date, and the remainder are scheduled for inspection and replacement if necessary in 2000.

7.11 LIGHTING

7.11.1 ASSET STATUS

The relevant territorial local authority (TLA) is generally the owner of the lighting hardware (poles, arms, lamps etc.) where the distribution network is underground. In areas where the distribution network is overhead, the TLA's will generally use VECTOR's poles as supports for streetlights. In all cases VECTOR own the cables up to the point of isolation and relays or photocells. The TLA is responsible for maintenance of their street furniture and VECTOR responds to failures in supply, as directed by the TLA's maintenance contractor.

7.11.2 ASSET ISSUES AND RISKS

No issues or risks requiring controls or actions were identified for the lighting units.

7.12 PROTECTION

7.12.1 ASSET STATUS

Protection equipment is regularly tested to ensure it functions as expected. The maintenance of the protection equipment is initially failure-finding (see if the asset is still performing), and then replacement or refurbishment if required.

7.12.2 ASSET ISSUES AND RISKS

The following issues, actions and controls were identified for the Protection system and are detailed in Table 7.10.

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
NILSTAT relays performance and functionality, not to expectations	• Security of supply	• Enhanced failure condition monitoring programme established	• NILSTAT replacement investigation and replacement programme under review

Table 7.10 Protection issues, controls and actions

7.12.3 ASSET REPLACEMENT

The following refurbishment and replacement programmes for Protection have been developed to enhance the asset performance.

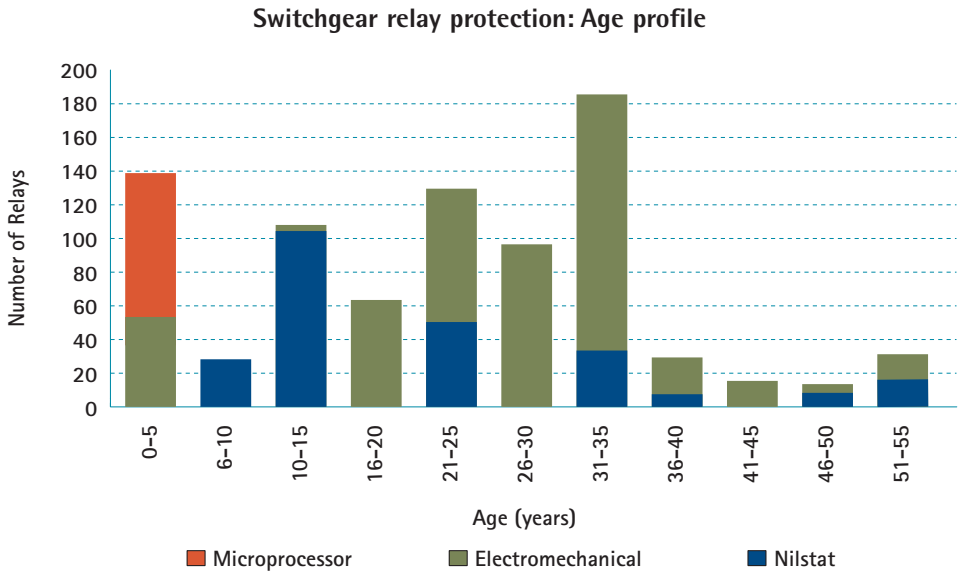


Figure 7.8 Age profile of Switchgear relay

NILSTAT RELAY REPLACEMENT PROGRAM

Driver Replacement to enhance network performance
Timescale Complete by 2004/2005
Status Proposal

Condition and performance monitoring of the Nilstat ITP type relays has indicated they are not performing as expected, although not adversely affecting operations. The total number of NILSTAT relays currently installed in the network is 198. A programme to prioritise the required replacement programme is currently underway, and advantage will be taken of modern microprocessor devices that allow communication and control through the new SCADA system. The electromechanical relays, although generally older, are performing to expectations. McNab, Kingsland, Westfield, Onehunga and Mareatai switchgear and relays are more than 40 years old and are programmed for partial discharge testing and replacement if necessary. Kingsland has NILSTAT relays, but the remaining four have electromechanical relays, which will be replaced when condition monitoring indicates that performance is not acceptable.

REPLACEMENT OF VOLTAGE REGULATING RELAYS AND TEMPERATURE INDICATORS

Driver Replacement to enhance network performance
Timescale In line with transformer refurbishment programme
Status Proposal

The costs and benefits of replacing the existing voltage regulating relays with current specification voltage regulating relays and temperature profiling equipment, is being reviewed. The relays and temperature information would communicate with the SCADA system to enable real-time information to be analysed and the results used to make informed decisions on increased asset utilisations. The programme would be scheduled to fit in with the transformer refurbishment programme, but at sites where there are concerns or problems, the programme could be accelerated.

7.13 COMMUNICATION AND CONTROL

7.13.1 ASSET STATUS

VECTOR's communication network consists of pilot and fibre optic cables and transmission equipment, and is used for protection, SCADA, communication and monitoring purposes.

The control room computer systems are reliable and have full back up should the main system fail. Service contracts are in place for the regular upgrade and enhancement of the systems based on the supplier's/manufacturers recommendation. The SCADA RTU's do not have full back up and maintenance is based on failure.

VECTOR owns ripple injection units at each Transpower grid exit point. The ripple injection RTU's have full back up and maintenance is predominantly on failure, although operational tests occur at regular intervals.

The 12 bulk meters located at the Transpower grid exit points, used for planning purposes and reactive power management, are reliable and monitored for failure through the SCADA system.

7.13.2 ASSET ISSUES AND RISKS

The following issues, controls and actions were identified for Communications and control and are detailed in Table 7.11

ISSUE DESCRIPTION	ISSUE IMPACT	CURRENT CONTROLS	ACTION
Ni-cad batteries at end of operational life	• Security of supply		• Replacement programme is in progress

Table 7.11 Communication and control issues, controls and actions

7.13.3 ASSET REPLACEMENT

The following asset replacement programmes have been identified to enhance performance:

DC CHARGER AND STAND-BY BATTERIES

Driver Replacement to enhance network performance
Timescale Complete by 2001
Status In progress

The majority of the installed batteries are of Ni-CAD type and at 10 years old, are at the end of their technical life. Sealed lead acid batteries are being used to replace the existing batteries. SCADA and communication batteries will be replaced with priority

LOAD CONTROL RIPPLE PROJECTS

Driver Performance
Timescale Not set
Status Under investigation

The ripple system was traditionally used to manage load at times of peak demand. The use of the ripple system is now mainly to off load demand during problems and is part of the switching contingency plans. In line with VECTOR's policy to increase asset utilisation, the ripple systems will be refurbished, relocated and replaced, as required to manage load within the network, following rigorous cost benefit analysis.

8 ASSET DEVELOPMENT

A number of localised areas within the VECTOR network have been identified as approaching or having reached the point where the VECTOR traditional, conservative supply criteria cannot be maintained. In line with VECTOR's revised design approach, each issue and constraint will be reviewed to determine the optimum operational and economic approach to addressing the problem and maintain adequate security by considering the following options:

- Increased asset utilisation, through advanced automation, dynamic ratings etc.
- Load management (including demand side management)
- Level of acceptable risk
- Asset Performance improvement
- Customer requirements and customer based solutions
- Capital investment

This will result in a revised asset development programme in terms of the;

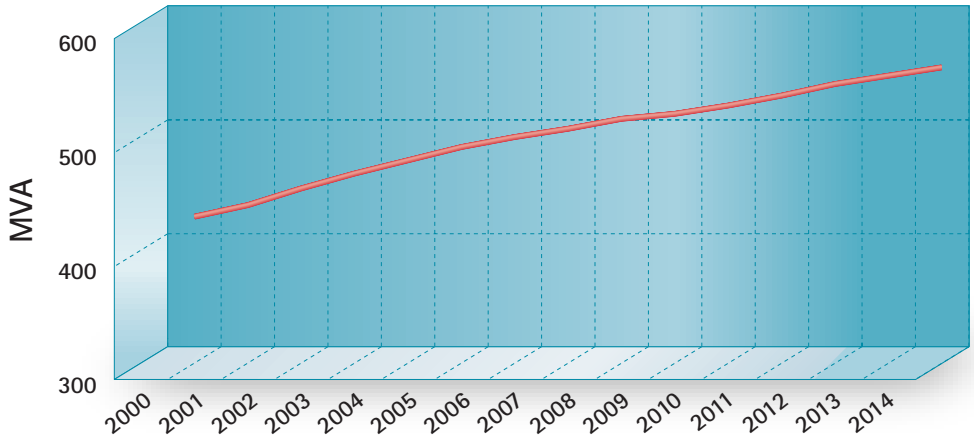
- Solution adopted to address the issue or constraint,
- Timing of the solution
- Cost of the solution

It is expected that by improving the utilisation of the assets, VECTOR will be able to stage investments and delay or reduce capital expenditure. Detailed investigation of the options using the new approach will occur before any new project is committed. Significant projects are summarised in this section and their approximate cost range (ie. < $1million, between $1 and $5 million and > $5million). Committed status indicates that the project has approved budget.

Eastern Customer Area

● Vector Zone Substations

FORECAST PEAK DEMAND



CUSTOMER TYPES

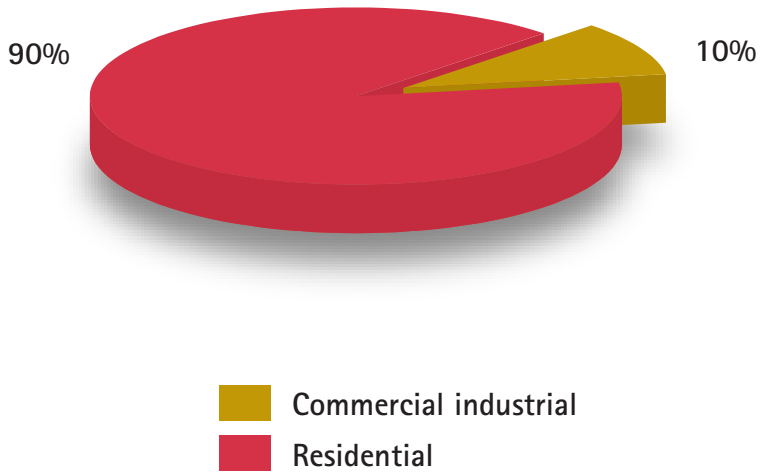


Figure 8.1 Eastern Customer Area

8.1 EASTERN CUSTOMER AREA

8.1.1 GROWTH IN THE EASTERN AREA

Residential growth will mainly be focused in the eastern Manukau City area, with a high number of planned sub-divisions. Residential growth elsewhere in the Eastern area is expected to be low, with infill housing being the major form of development. Industrial and commercial development is expected to be focused around East Tamaki and Westfield/Southdown, with small pockets of retail development in Mt Wellington and Botany Downs.

8.1.2 ISSUES AND OPTIONS FOR THE EASTERN AREA

BOTANY DOWNS, NORTHPARK AND EAST TAMAKI AREAS

Project Greenmount Reinforcement
Driver Growth
Timescale Complete early 2001
Status Committed Estimated capital: $1 – 5 million

Due to the high level of residential growth in the Botany Downs and East Tamaki areas, the existing supply capacity into the area is unable to meet expected customer demand and the security criteria.

The option selected to address this issue was the installation of a third transformer, switchgear and feeder at Greenmount substation. Contingency plans for switching have been developed as an interim measure until the third transformer is in place.

NEWMARKET AND REMUERA AREA

Project Newmarket and Remuera upgrade
Driver Growth
Timescale December 2000
Status Committed Estimated capital: $1 – 5 million

Condition monitoring indicated that the existing Newmarket and Remuera 22kV cables had reached the end of their life. The supply capacity to Newmarket and Remuera did not comply with VECTOR's supply criteria.

The option selected to address this issue, based on economic and operational efficiency, was to uprate both substations to 33kV, with a common trench for both sets of cables, over part of the route. Remuera is now operating at 33kV and Newmarket has one cable operating at 33kV. Two additional 33kV circuits to Newmarket will be installed in the CBD tunnel, scheduled for commissioning in December 2000. The Newmarket load will be managed using temporary transfers and contingency switching until project completion.

ELLERSLIE, PENROSE AREA

Project McNab 11kV switchboard replacement
Driver Replacement
Timescale 2000/2001
Status Subject to condition monitoring Estimated capital: < $1 million

The 11kV switchgear at McNab substation is 47 years old and is nearing the end of its technical life. Condition monitoring using partial discharge testing, scheduled for early

2000, is expected to show the condition to be deteriorating beyond minimal acceptable performance, so budget has been allowed for replacement.

The options to address this issue are limited to replacement of the switchgear. Replacement will only occur when ongoing condition monitoring confirms that the actual performance is unacceptable.

EASTERN BAYS AREA

Driver Growth
Timescale 2000/2001
Status Proposal — Estimated capital: $1 – 5 million

Demand increases, through infill housing development, are leading to constraints in the Eastern Bays area. Options to address the constraint are;

- Commission a new 33/11kV substation at the existing St Johns 33kV switching station, which currently supplies Orakei and St Heliers zone substations, which would enable the load at Orakei and St Heliers to be offloaded, to enable contingency switching plans to be enhanced in the area.
- Upgrade the Glen Innes substation
- Increased asset utilisation
- Load transfers, asset performance analysis and risk evaluation

ST JOHNS PROTECTION UPGRADE

Driver Performance
Timescale 2000
Status Proposal — Estimated capital: $1 – 5 million

Lack of appropriate protection coordination has been identified between VECTOR's St Johns 33kV switching station and Transpower Penrose substation. A system fault at the switching station could lead to loss of supply to the area supplied at 33kV from Transpower Penrose. All over-current and earth fault relays at the St John 33kV switching station will be replaced with modern numerical relays incorporating breaker failure and busbar protection. This work is being closely coordinated with Transpower.

ONEHUNGA AND TE PAPAPA AREA

Driver Growth
Timescale 2000-2001
Status Proposal — Estimated capital: $1 – 5 million

Load growth in the Onehunga and Te Papapa areas has led to a requirement to re-evaluate the current network capacity and supply requirements. Options under review in this area include;

- Reinforcement by uprating Onehunga to 33kV. Works would be optimised by part using a section of the new trench to install a duct for a future additional 33kV cable to Te Papapa. The increased capacity could then be used to defer an upgrade of Rockfield, which is currently scheduled in 2007.
- Increased asset utilisation
- 11kV reinforcement to facilitate load transfer
- Load management, asset performance analysis and risk evaluation

MT WELLINGTON, CARBINE AND WESTFIELD AREAS

Driver Replacement
Timescale 2001/02
Status Proposal Estimated capital: $1 – 5 million

Performance requirements and load growth have led to a need to review the supply options in the Mt Wellington and Southdown areas. In addition, the performance of the existing Mt Wellington gas cables is deteriorating, with an increasing number of gas leaks. Condition monitoring will determine when replacement is necessary, and this will be a factor when options for supplying the wider area are considered. Options under review include;

- Installation of one or more cables
- Load transfer to the St Johns substation when commissioned
- Installation of capacitor banks at selected locations
- Increased asset utilisation
- Load management, asset performance analysis and risk evaluation

8.2 WESTERN CUSTOMER AREA

8.2.1 GROWTH IN THE WESTERN AREA

Residential growth in this area is expected to be low, with ongoing infill housing being the major form of development. Industrial and commercial development is expected to be focused around the Avondale area, with some isolated pockets of growth (eg. St Lukes).

8.2.2 ISSUES AND OPTIONS IN THE WESTERN AREA.

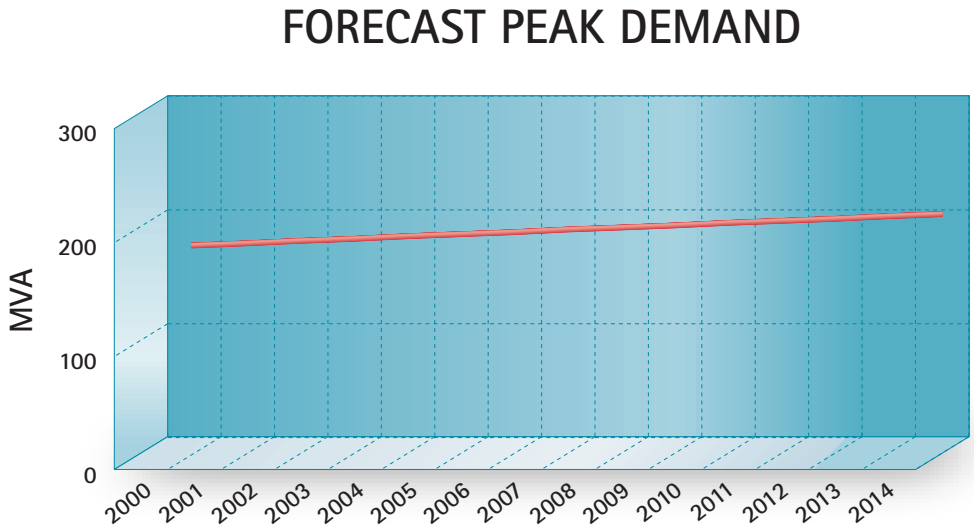
SANDRINGHAM AND BALMORAL AREA

Project Sandringham Balmoral upgrade
Driver Replacement and Security of supply
Timescale 2001
Status Committed Estimated capital: $1 – 5 million

Load growth and asset performance issues in the Sandringham/Balmoral area have led to a requirement for supply options to be re-evaluated.

The selected option is a staged upgrade from 22kV to 33kV at Sandringham and Balmoral. Stage one involves installation of a 33kV rated switchboard at Sandringham and termination of the existing 22kV Sandringham and Balmoral cables to it, to address the existing supply criteria issues. The existing Balmoral 22kV switchboard will be replaced at the same time, due to unacceptable performance.

Western Customer Area



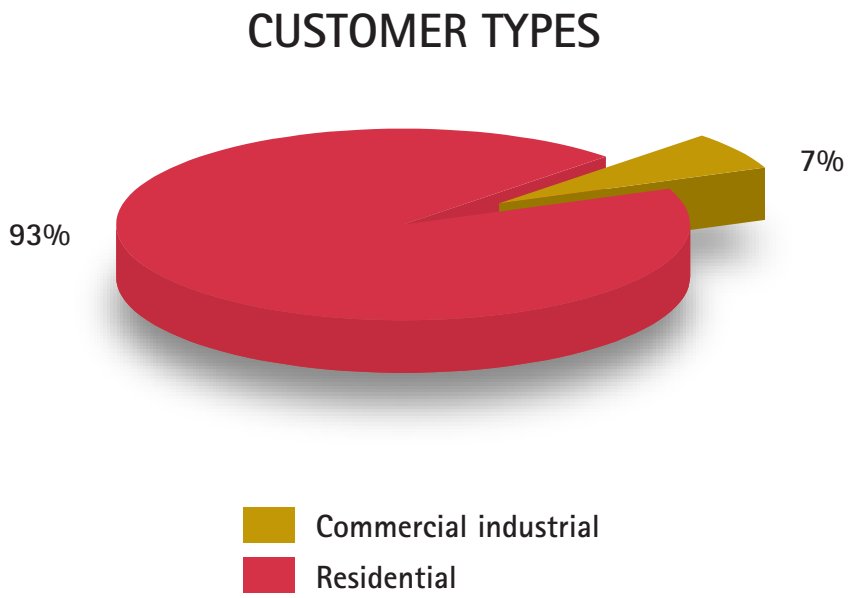


Figure 8.2 Western Customer Area

PONSONBY AREA

Driver Replacement
Timescale 2000/2001
Status Proposal Estimated capital: <$1 million

The Ponsonby transformers are 49 years old and reaching the end of their technical life. Condition assessments and high transformer losses indicate that refurbishment is not an option. Options under review include;

- Installation of surplus 22/11/6.6kV transformers (ex-Newton) at Ponsonby, following the completion of the Newton reinforcement project.
- Replacement of existing transformers

The preferred option is installation of the surplus ex-Newton transformers. The dual ratio on these transformers will enable the uprating of the Ponsonby distribution network from 6.6kV to 11kV to be deferred until 2008, at which time it is expected that the 6.6kV network will no longer have sufficient capacity to deliver the required load.

PONSONBY AND CHEVALIER AREAS

Driver Growth
Timescale 2008
Status Proposal Estimated capital: $1 – 5 million

Ponsonby and Chevalier will be the last remaining substations operating at 6.6kV. By 2008 the load on these substations is forecast to be at a level where continued operation of the distribution network at 6.6kV is no longer sustainable. The uprating will require new transformers to be purchased for Chevalier, unless suitable surplus transformers have become available from elsewhere in the network.

8.3 SOUTHERN CUSTOMER AREA

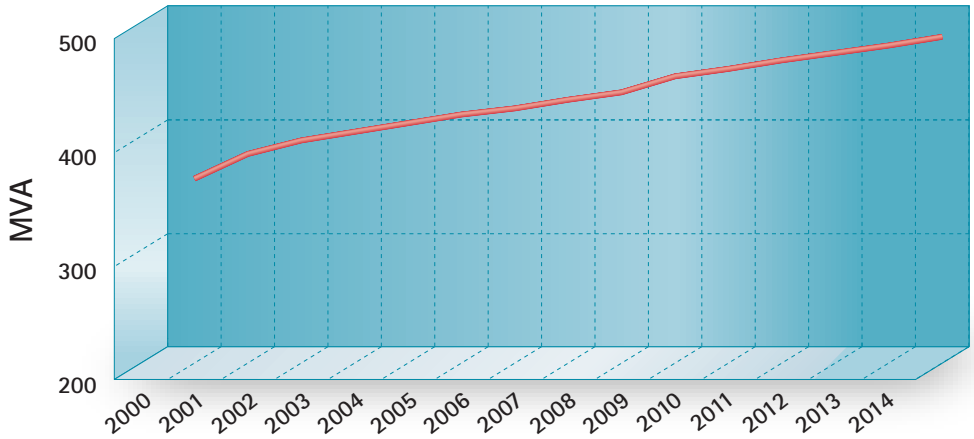
8.3.1 GROWTH IN THE SOUTHERN AREA

Residential demand is expected to increase in the Clendon/Wattle Downs and Takanini/Alfriston areas with a high number of subdivisions under construction and planned. Smaller residential growth is expected in the Maraetai area. Industrial and commercial growth is expected in the Wiri and Manukau areas, and in the vicinity of Auckland airport and the Watercare waste water treatment plant.

Southern Customer Area

● Vector Zone Substations

FORECAST PEAK DEMAND



CUSTOMER TYPES

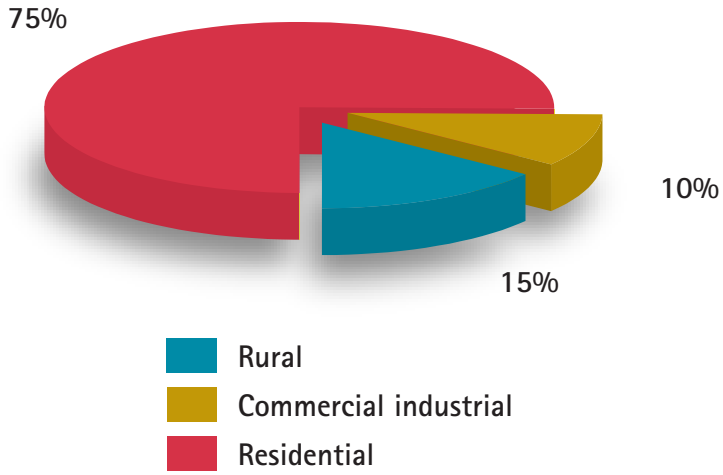


Figure 8.3 Southern Customer Area

8.3.2 ISSUES AND OPTIONS IN THE SOUTHERN AREA

CLENDON AREA

Driver	Growth		
Timescale	2000/01:	Stage 1	
	2005/06:	Stage 2	
Status	Stage 1:	Committed	Estimated capital: $1 – 5 million
	Stage 2:	Proposal	

Load in the Clendon/Wattle Downs area has reached the point where the required supply criteria is not being achieved. To relieve this constraint and to cater for on-going load growth in the area, a two-stage development is planned. Stage 1 involves installing two 11kV infeeds to the area from Wiri, and establishing an 11kV switching station on the site of a future zone substation. Stage 2 is the establishment of a new zone substation at Clendon. This had been planned for 2000/01, but the 11kV reinforcement is expected to allow deferral of this stage to 2006.

KAWAKAWA BAY AREA

Project	Supply upgrade	
Driver	Performance	
Timescale	August 2000	
Status	Committed	Estimated capital: <$1 million

The supply to the Clevedon and Kawakawa Bay area has historically had a very poor performance, with a high number of interruptions of long duration and problems with low voltage. This will be addressed by a combination of measures:

- Installation of a new, single transformer substation at Clevedon
- Pole marking with reflectors
- Installation of an emergency backup connection to the Counties Power network.

WIRI AREA

Driver	Replacement and Growth	
Timescale	2000/2001	
Status	Proposal	Estimated capital: $1 – 5 million

The capacity of the subtransmission network to Wiri is to be confirmed by cable temperature monitoring. If the capacity is found to be constrained, as expected, options under review to address this issue include;

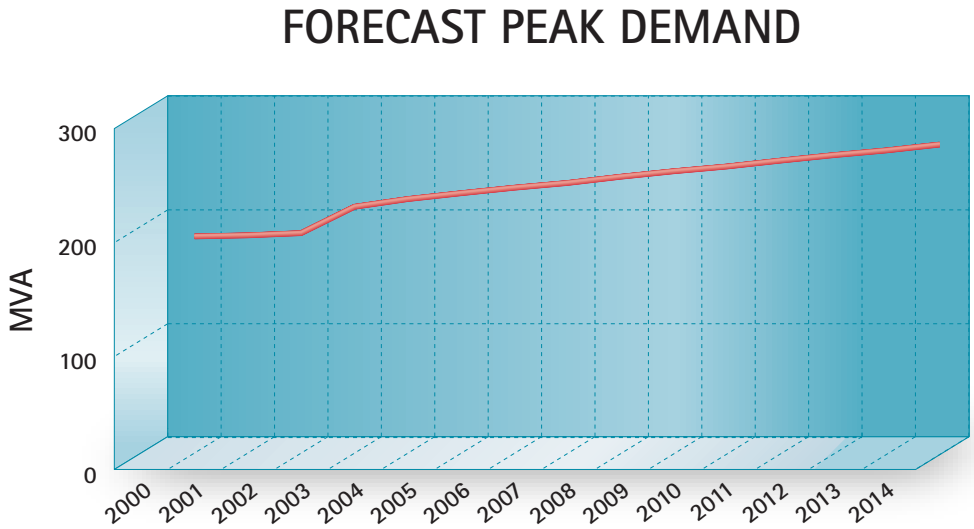
- Uprating of existing cables by remediation of hot spots
- Reinforcement of Wiri zone substation, by installation of two new 30MVA cables from Transpower Wiri.
- Increased asset utilisation
- Load management, asset performance analysis and risk evaluation

LINKED PROJECTS:

- Subtransmission special maintenance: cable temperature investigations.
- Transpower Wiri grid exit point capacity upgrade

Central Customer Area

Vector Zone Substations



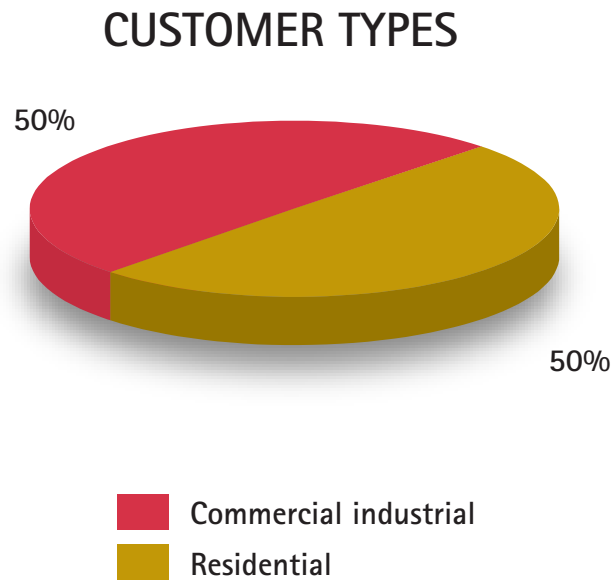


Figure 8.4 Central Customer Area

MANUKAU/OTARA AREA

Driver Growth
Timescale 2001/2002
Status Proposal Estimated capital: $1 – 5 million

Manukau and Otara may require reinforcement or changes to the operating regime if the forecast load growth is realised. Options under review include;

- Installation at Manukau of additional 11kV switchgear in 2000 and a third transformer and additional 33kV cable in 2002. Manukau can then be used to off-load Otara.
- Increased asset utilisation
- Load management, asset performance analysis and risk evaluation

FLAT BUSH AREA

Driver Growth
Timescale 2008/2009
Status Proposal Estimated capital: >$5 million

Load forecasts indicate that demand may exceed available capacity in the Flat Bush area by 2009, due to the high level of current and proposed subdivision development. Options under review include;

- Capacity increase at Otara and Manukau
- Establishment of a new zone substation at Flat Bush
- Increased asset utilisation
- Load management, asset performance analysis and risk evaluation

8.4 CENTRAL CUSTOMER AREA

8.4.1 GROWTH IN THE CENTRAL AREA

Residential demand is expected to increase in the Central area with the development of new apartments and refurbishment of offices into apartments. Commercial and retail will continue to develop. Cancellation of the Britomart development will reduce or defer the previously forecast growth in the Downtown area. Re-development of the Auckland Hospital site over the next 2 years will increase the demand, and will require reinforcement of the network.

8.4.2 ISSUES AND OPTIONS IN THE CENTRAL AREA

Completion of the current CBD reinforcement project (CBD tunnel and associated high voltage equipment) in March 2001 will provide reliability and security of supply in the CBD, and enable removal of the emergency overhead lines to begin. In line with VECTOR's approach to customer consultation and provision of differentiated service levels, CBD customers will be consulted in 2000 to explain the current level of service provision, the potential future service levels, and their costs. CBD customers will then be able to have input as to what level of service/cost trade-off they require.

CENTRAL AREA

Project CBD reinforcement
Driver Growth
Timescale 2001
Status Committed — Estimated capital: >$ 5 million

The current CBD reinforcement programme has been developed to ensure load growth is met and that areas are strategically linked to enable efficient contingency switching, with optimum utilisation of the existing assets. The programme includes;

- Completion of the tunnel
- Installation of a new 110kV supply from Penrose to Liverpool
- Establishment of Hobson as a 110kV point of supply
- Upgrades to the switchgear at Liverpool and Hobson.
- Replacement of the Roskill to Liverpool 110kV cable

RELATED AND LINKED CBD PROJECTS:

NEWTON CAPACITY UPGRADE

Driver Growth
Timescale December 2000
Status Committed — Estimated capital: $1 – 5 million

- Installation of new larger subtransmission transformers at Newton and replacement of the existing 22kV oil filled cables with cables of larger capacity is required to meet load growth in the area.

FREEMANS BAY AREA

Driver Growth
Timescale 2001/2002
Status Proposal — Estimated capital: $1 – 5 million

Load forecasts for the Freemans Bay area indicate that the existing 6.6kV operating voltage will be unsustainable beyond 2002, requiring an upgrade to 11kV. The option of transferring Freemans Bay from the Kingsland point of supply to Hobson at the same time is being considered to make better use of the 110/22kV capacity at Hobson, and defer the need to reinforce the 110/22kV capacity at Kingsland. A further possible refinement is the installation of a 22kV switchboard at Freemans Bay, which would provide a 22kV 25MVA connection between Hobson and Kinsgland via the existing Freemans Bay cables.

Options for future reinforcement in the CBD, if required, following customer consultation on requirements include;

- Reinforcement of the Quay area. Planned works to install a third transformer to meet capacity have been deferred because of the Britomart cancellation.
- A new zone substation to supply increasing load on the western side of the CBD. The new substation will be supplied from Hobson, with the 22kV cables laid in the tunnel to minimise costs and disruption to the public. Site purchase is currently being investigated.
- Installation of a fourth 110kV infeed to the CBD

- Installation of a third 110/22kV transformer at Hobson
- Increased asset utilisation
- Load management, asset performance analysis and risk evaluation

TRANSFORMER REDEPLOYMENT

To ensure optimum utilisation of existing assets, transformers are relocated when released if performance and condition criteria are met. The CBD, Newton and Newmarket/Remuera reinforcement projects will release the following transformers;

- Newton transformers to be relocated to Ponsonby
- Hobson transformers to be relocated to Freemans Bay
- Newmarket transformer to be relocated to Mt Albert
- Remuera transformer to be relocated to Parnell.

8.5 TRANSPOWER SUPPLY POINTS

Transpower supplies the VECTOR network through 8 grid exit points. Transpower and VECTOR liaise on works programmes to ensure priority and critical issues are addressed.

8.5.1 ISSUES AND OPTIONS AT THE GRID EXIT POINTS

ROSKILL AND PENROSE GRID EXIT POINTS

Driver Rationalisation of feeders
Timescale February 2000
Status Committed

Following switchgear replacements and transformer upgrades at Transpower's Penrose and Roskill grid exit points alterations are required to VECTOR's cable terminations to maximise supply availability and operational flexibility.

WIRI GRID EXIT POINT

Driver Security of supply and performance
Timescale 2000/01
Status Proposal

An increase in transformer capacity at Wiri is required given that load growth in the area is expected to continue. VECTOR will work with Transpower to determine the most cost-effective option to achieve this.

MANGERE GRID EXIT POINT

Driver Security of supply and performance
Timescale 2000/01
Status Proposal

A high standard of protection is required to ensure security of supply to key customers. VECTOR will consider the option of requesting Transpower to install a 110kV bus circuit breaker and 110kV bus zone protection.

PAKURANGA GRID EXIT POINT

Driver Security of supply and performance
Timescale 2000/01
Status Proposal

The existing transformer capacity at Pakuranga is insufficient to meet the required security standard. Load growth in the area is high and is expected to continue. An increase in transformer capacity is required. VECTOR will work with Transpower to determine the most cost-effective option to achieve this.

HEPBURN GRID EXIT POINT

Driver Security of supply and performance
Timescale 2001/02
Status Proposal

The existing transformer capacity at Hepburn is insufficient to meet the Transpower security standard. The Hepburn grid exit point supplies VECTOR and United Networks. VECTOR will work with United Networks and Transpower to determine the most cost-effective option for increasing transformer capacity.

8.6 CUSTOMER INITIATED NETWORK DEVELOPMENTS

On the distribution network, there are a number of ongoing developments that are driven by customer requirements. These are:

- Residential subdivisions
- Business subdivisions
- Customer substations
- Capacity changes
- New services

The demands from the customer led initiatives are included in the load forecasts and influence the timing and priority of capital works in the VECTOR network.

8.7 NETWORK PERFORMANCE PROJECTS

VECTOR has initiated a number of network wide projects to enhance its knowledge and control of the network.

POWER QUALITY METERING

Driver Service Delivery
Timescale Stage 1 complete by March 2000
Status Stage 1 committed

This programme will install power quality metering at selected zone substations and selected points on the distribution network to provide information on the quality of supply and enable VECTOR to take a more pro-active approach to improving quality of supply. The results from stage 1 will be reviewed and a decision made on the need and timing of Stage 2.

FIBRE OPTIC CABLE EXTENSIONS

Driver Growth
Timescale Ongoing
Status Committed

The fibre optic cables are used for communication, control and protection. It is proposed to extend VECTOR's fibre optic network backbone to connect all Transpower points of supply. It is planned to extend the cable network to the Transpower Pakuranga substation in 2000. As a part of the CBD tunnel project a 48- core fibre optic cable is to be laid between VECTOR's Hobson and Transpower Penrose Substations.

Any new zone substation built will be connected to the Transpower point of supply via fibre optic cable. Cables have been laid between Transpower Mangere substation and new zone substations at Auckland International Airport and Mangere West.

8.8 EXPENDITURE FORECAST

The expenditure plan that corresponds to the Asset replacement, refurbishment and development projects is given in Table 8.1. These forecasts are based on known, current solutions only. Extensive analysis of alternate approaches, including load management, increased asset utilisation through advanced technology etc. is expected to enable the forecast expenditure to be reduced.

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Subtransmission										
Growth	15.7	10.4	0.0	0.0	0.0	6.1	17.1	10.0	26.0	0.0
Replacement	9.0	0.3	1.6	0.0	1.8	0.0	1.3	8.5	4.0	0.0
Performance	1.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTRANSMISSION TOTAL	**26.0**	**11.0**	**1.6**	**0.0**	**1.8**	**6.1**	**18.4**	**18.5**	**30.0**	**0.0**
Distribution										
Growth	8.1	5.0	6.0	4.0	4.0	4.0	4.0	7.0	4.0	9.0
Replacement	3.1	0.8	2.2	0.6	0.6	0.4	0.4	0.4	0.4	1.0
Performance	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compliance	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DISTRIBUTION TOTAL	**12.3**	**6.3**	**8.2**	**4.6**	**4.6**	**4.4**	**4.4**	**7.4**	**4.4**	**10.0**
Infrastructure										
Compliance	1.2	1.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Performance	2.1	3.2	0.1	0.1	0.1	0.1	0.0	2.5	0.6	0.0
Replacement	3.4	1.9	0.8	0.7	0.9	2.2	0.3	0.3	0.3	0.3
Growth	0.6	0.4	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0
INFRASTUCTURE TOTAL	**7.4**	**6.7**	**2.2**	**0.7**	**0.9**	**2.3**	**0.3**	**2.8**	**0.9**	**0.3**
CUSTOMER TOTAL	**10.8**	**10.7**	**11.2**	**11.8**	**12.4**	**13.0**	**13.7**	**14.4**	**15.1**	**15.8**
TOTAL CAPEX	**56.5**	**34.6**	**23.2**	**17.1**	**19.5**	**25.8**	**36.8**	**43.1**	**50.4**	**26.1**

Table 8.1 Capital expenditure budget

All costs are expressed in $million, at 1999 price level

9 RISK MANAGEMENT

Asset risk in VECTOR is an integral part of the asset management process. Asset risks, the consequences of failure, current controls to manage this, and required actions are all understood and evaluated as part of the asset function and performance analysis. Any risks associated with the assets or operation of the network are evaluated, prioritised and dealt with as part of the asset maintenance, refurbishment and replacement programmes. The acceptable level of risk will differ depending upon the level of risk our customers are willing to accept and the circumstances and the environment in which the risk will occur. Risk is managed in VECTOR by a combination of:

- Reducing the probability of the failure, through the capital and maintenance work programme and enhanced working practises.
- Reducing the impact of failure, through contingency and emergency plan development.

The capital and maintenance asset risk management strategies are outlined in the Asset Maintenance and Development sections. VECTOR's contingency and emergency planning is based around procedures for restoring power in the event of a fault occurring on the network, and are detailed in section 9.5.

9.1 RISK ACCOUNTABILITY AND AUTHORITY

VECTOR BOARD

The Board endorses the risk context under which VECTOR operates. A Board Risk Committee meets regularly, reviewing the Risk Register and risk methodologies at least quarterly.

EXECUTIVE RISK MANAGEMENT COMMITTEE

The Executive Risk Management Committee oversees and monitors implementation of appropriate and consistent risk management in each business unit, and across the Company as a whole, by:

- Developing and maintaining, for the Board's review and approval, a risk management policy for VECTOR consistent with the Company's objectives
- Overseeing and monitoring the implementation of risk management across VECTOR to ensure that it is in compliance with the risk management policy

RISK COMMITTEE

The Risk Committee is a small inter-functional team which evaluates any identified risks in a consistent manner, assign priorities and actions, and monitors progress. The Risk Committee meets monthly to

- Assess all new risks identified, assign priority and actions to the risks and record them in the risk register.
- Define accountabilities for the Risk Management programme.
- Review priority and actions for entries on the active register.
- Monitor progress on actions assigned against entries in the register.
- Report on new high-priority entries and progress on resolution of existing high priority entries.
- Create a company risk profile.

ALL EMPLOYEES

All staff and contractors are responsible for reporting any identified risks that come to their notice.

9.2 RISK MANAGEMENT PROCESS

The Risk management process for VECTOR is now in the process of evolving to one of focusing on and analysing critical and catastrophic type events. The output of this is an understanding of the consequences of failure of critical and catastrophic events, valuing the impact of the event and defining response plans. (Ordinary risks, the consequences of which can be relatively easily 'absorbed' by VECTOR or the customer are managed in the normal line of business).

The risk management process adopted by VECTOR is shown in Figure 9.1.

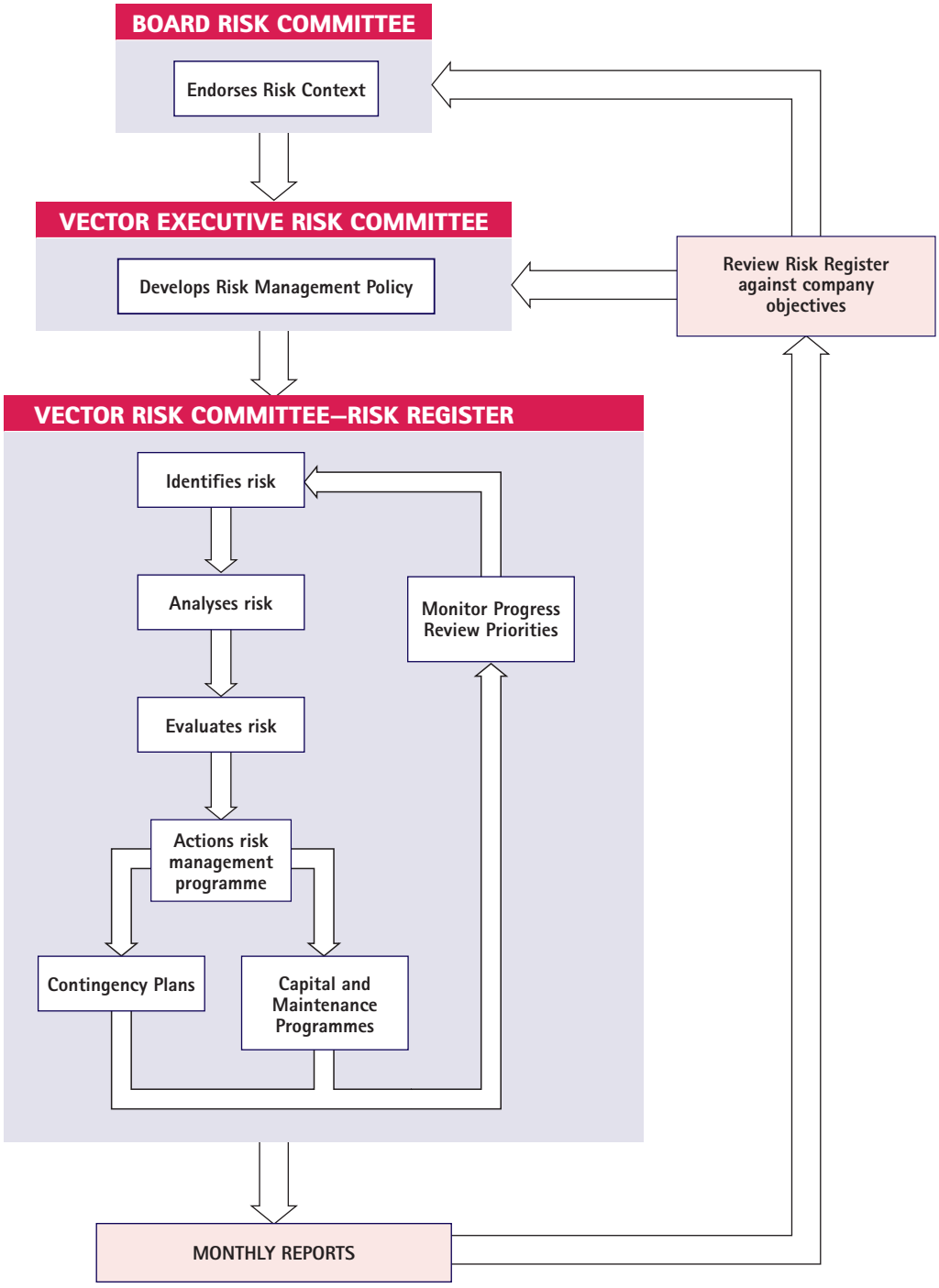


Figure 9.1 VECTOR's risk management process

VECTOR's risk management policy is defined to ensure that:

- All risks to the business are identified and understood and works prioritised to mitigate risk with a top 20 risk register being maintained and tracked at Board level.
- Practises that could cause disruption to service and operations, injury to people or the environment, or significant financial loss are understood, documented and mitigated.
- The business is protected by suitable insurance polices, or contingency plans, wherever necessary.

9.3 RISK IDENTIFICATION AND ANALYSIS

All risks are assigned a risk level based on the likelihood and consequence of the risk. Risk is determined using Vector's risk prioritisation matrix, shown in Figure 9.2.

Catastrophic risk includes loss of life, extended loss of supply, or financial loss of a magnitude sufficient to impact on the company.

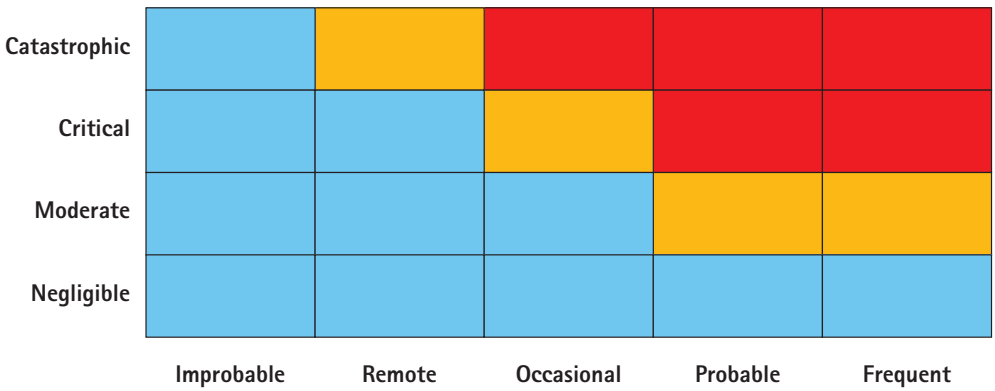


Figure 9.2 VECTOR risk prioritisation matrix

HIGH	These risks require immediate review and continuous monitoring to ensure the "due care" test is met. If measures cannot be implemented to control the risk, actions are required to reduce the inherent nature of the risk.
MODERATE	These risks require less rigorous ongoing control, but require continuous monitoring to ensure they do not become a high risk
LOW	These risks require tracking on a periodic basis, to ensure they remain a low risk.

All catastrophic risks are assessed in terms of contingency planning, irrespective of their probability.

9.4 RISK MANAGEMENT PROGRAMME

VECTOR maintains a risk register, which is formally updated on a monthly basis for presentation to the Executive Risk Management Committee, and quarterly to the Board Risk Management Committee. The risk register documents the top 20 risks to the business and their response plans.

9.5 CONTINGENCY PLANS

SWITCHING

For all major feeders, the network is designed to allow reconfiguration by switching so that power can be fed through an alternative path if there is a failure or a need to shift load. For the CBD, this switching is carried out remotely through the SCADA system.

In the event of failure of a minor feeder, system control operators undertake network analysis and instruct field crews to undertake manual switching to restore power to as many customers as possible (while the fault is repaired), especially to critical customers.

CRITICAL SPARES

A stock of spares is maintained for critical components of the network so that fault repair is not hindered by the lack of availability of required parts. Whenever construction of a new part of the network is undertaken, an evaluation is made of the spares that will be retained to support repair of any key equipment installed.

DISASTER ANALYSIS

Plans are developed, as part of the overall management of the network, which consider the actions that would be taken in the event of a major failure of part of the network. Such plans consider switching options and the rapid construction of temporary lines.

If there is specific concern regarding a risk to the network, detailed contingency plans are developed, which include detailed design of the required temporary lines and the securing of materials required to allow immediate construction.

DISASTER PREPAREDNESS

VECTOR has been actively participating in the Auckland Engineering Lifelines Project. This project involves all engineering lifelines, such as power, water, telecommunications, etc which could be affected during a natural disaster and identified areas of common risk so that future planning can either eliminate or reduce the risks to the VECTOR network.

A disaster recovery plan has been prepared for the system control centre. This is to ensure that the control centre can still operate after a natural disaster.

HEALTH & SAFETY

The company is required to comply with the Health and Safety in Employment Act 1992. All contractors working for the company are required to have a health and safety plan approved before carrying out any work on the network.

10 AMP IMPROVEMENT PROGRAMME

VECTOR is undertaking a number of network information and asset performance initiatives in 2000 to improve its knowledge and management of its assets.

10.1 NETWORK INFORMATION

ESTABLISH GIS AS THE PRINCIPAL INDEX TO ALL ASSET INFORMATION

The GIS will be developed to hold the existing asset information, and be the index to all CAD drawings, specifications, test records and performance results.

ESTABLISH FULL CONNECTIVITY FROM THE TRANSPOWER GRID EXIT POINT TO THE CUSTOMER IN GIS

Work will be completed in 2000 to integrate the Customer Information System and the GIS. This will allow geographic analysis of customer characteristics. Future work will link individual customers with the appropriate distribution transformer to allow full tracing through the network. This will allow a more accurate understanding of network loading and will assist in outage analysis.

IMPLEMENTATION OF A NETWORK SCHEMATIC VIEW FROM THE GIS

To replace the existing hard copy schematic maps, the GIS will produce schematic network views in addition to the spatially correct views. The schematics are used to provide simplified representations of connectivity. Provision of the schematics from the GIS will ensure that access to current data is available to all users.

IMPROVE THE GIS ANALYSIS FUNCTIONALITY ACROSS VECTOR

Appropriate analysis tools and standard reports will be developed to ensure the information stored in, and accessed via the GIS is easily accessible and in the correct formats for use.

IMPLEMENT APPROPRIATE INCIDENT MANAGEMENT SYSTEMS

SAP is currently used in VECTOR to manage the resolution of faults on the network, and a custom application AFS (Application for Supply system) is used to manage customer requests for new connections. These systems will not be appropriate with the introduction of the zone based contractors, and a review is currently underway to identify appropriate systems that can be used by the zone based contractors and VECTOR.

SCADA MASTER STATION

The SCADA system is able to provide network information on loads, status and condition. Analysis tools and standard reports will be developed to enhance the use of the SCADA information, as part of the current review of the SCADA system replacement.

10.2 ASSET PERFORMANCE

IMPLEMENT IMPROVED ASSET PERFORMANCE ANALYSIS

Functionality has been established in the GIS to record fault and maintenance history for each asset. The ability to analyse this information by asset and customer area will be beneficial in asset targeting maintenance and development programmes.

ASSET MAINTENANCE PHILOSOPHY REVIEW

It is VECTOR's intention to move towards advanced condition, performance and reliability centered maintenance management. A review will be undertaken in 2000 to identify the key performance drivers and performance expectations from the VECTOR assets, and define the most appropriate and applicable maintenance strategy.

EQUIPMENT SPECIFICATIONS

A review of equipment specifications is currently underway to ensure procurement, installation and maintenance requirements are identified and analysed as part of both the ongoing maintenance work and new developments.

10.3 BENCHMARKING AND PERFORMANCE MEASURES

VECTOR will develop performance measures to evaluate the effectiveness of the AMP for asset planning purposes and highlight any areas of weakness for action. The performance measures will be developed in terms of VECTOR's operational requirements, but it is intended to benchmark our AMP and planning against comparable lines companies. As part of the benchmarking process, consultation and visits with advanced Australian and UK utilities was undertaken in 1999.

Together we're making three simple promises

The VECTOR Promise

Effective 7 August 1999

- To give customers 4 days notice if we have to turn the power off for network upgrades or planned maintenance and to have their power back on in the time we tell them
- To install the connection point to a brand new home or business premises within 5 working days from completion of all necessary council and other approvals
- To restore power within 3 hours* of our learning about a fault on our network.

** This would include unexpected power losses due to a car damaging a pole or damage caused to a cable by directional drilling, because these are things that, as a network, we can plan for. We can't give such a promise for faults caused by extreme storms or other extreme events outside our control. An extreme storm is where the wind speed reaches storm force, (a mean of 47 knots) or hurricane force, (above 63 knots). In extreme situations, we will plan ahead for possible repairs and restore power as quickly as possible.*

Let's work together to keep these three simple promises. If we fail to meet them, affected residential customers will receive $50 and commercial customers will receive $200 when they call us on **0508 VECTOR, (0508 832 867).**

vector

STATEMENT OF CORPORATE INTENT

Introduction

This Statement of Corporate Intent (SCI) has been prepared in accordance with Section 39 of the Energy Companies Act. It states the Directors' intentions and objectives for VECTOR Limited for the financial year ending 31 March 2000.

Statement of Purpose

VECTOR is an electricity distribution business, committed to providing a reliable and efficient electricity service to its customers.

Nature and Scope of Activities

VECTOR's core business is the distribution of electricity over its network. VECTOR will pursue activities consistent with this core business, and with the objective of providing efficient, reliable and secure services to its customers.

VECTOR will also seek profitable and complementary investment opportunities in energy distribution nationally, to add to its ability to meet these objectives and to maximise the return to its shareholder.

Core Values

VECTOR will follow these core values in everything that it does.

Customer Service

- Being responsive to customers' needs
- Providing customers high quality electricity services, with reliability that consistently exceeds their expectations

Development

- Committing to continuous improvement of network operating standards
- Seeking technological innovation to optimise our performance
- Being aware of future technological change
- Using energy efficiency as an alternative to network investment
- Applying modern, effective management practices

Shareholder Value

- Ensuring investments in capital projects maximise shareholder value
- Maximizing returns to shareholders within any regulatory cap, while minimizing prices through superior operating performance

Human Resources

- Recognising and rewarding outstanding performance by our employees
- Using honesty and integrity in all communication with employees
- Creating a safe working environment

The Community

- Operating to the spirit and letter of regulations for electricity distribution businesses
- Behaving as a respected member of the community

Objectives of VECTOR

Commercial

The Directors will operate VECTOR as a successful business, maintaining earnings sufficient to support the growth of the company and maximise shareholder returns.

They will ensure that VECTOR implements the strategies necessary for its long-term success as an electricity distribution business in New Zealand.

To maximise shareholder value, VECTOR will:

- Monitor and report key performance indicators
- Optimise our operational costs and those of our contractors, and access operational synergies with other distribution businesses
- Use network automation and asset management to increase network utilisation whilst maintaining security and quality standards
- Undertake new investments which, over their life:

  (i) yield a risk-adjusted return at least equal to VECTOR's weighted average cost of capital

  (ii) increase the commercial value of the business
- Actively manage risk, limiting the exposure of the company, customers and public within prudent levels

Customer Service

The Directors will ensure that VECTOR remains 'customer driven' by:

- Using systems and staff training to reinforce its customer service orientation
- Providing open and equal access to its network, maximising the choice of electricity retailer for its customers
- Writing customer contracts in plain language
- Replacing our pre-reform customer commitment programme with a new programme that recognises breaches in our standards of lines service by direct payments to our customers

Security of Supply

The Directors believe that security of supply is of vital importance to VECTOR and our customers, and the company will:

- Maintain, upgrade and expand its network as necessary to ensure a high reliability of supply to customers
- Develop enhanced contracts for the supply of line function services, managing risk to, and maximising value for, VECTOR's customers
- Monitor the security of the transmission system supplying VECTOR's network, and seek to ensure that it is maintained cost-effectively
- Understand alternative technologies and energy sources and encourage those which are economically viable

Pricing

VECTOR will progressively develop line charges that:

- Ensure sustainability of the business
- Promote energy efficiency

In particular, we will introduce differentiated zones across our network to allow pricing and service levels to reflect over time the requirements and characteristics of different customer groups, and the true cost of providing services to them.

Compliance

The Directors will ensure comprehensive compliance programmes are in place to ensure VECTOR meets its obligations under all Acts of Parliament, and regulations thereunder, including the Health and Safety in Employment Act 1992, Resource Management Act 1991, Commerce Act 1986, Electricity Act 1992, Electricity Industry Reform Act 1998.

Social and Community

VECTOR will operate in a manner sensitive to the diversity of our social environment, and:

- Consult with local community groups and territorial authorities on issues that the Directors consider will significantly affect the communities in which we operate
- Ensure electricity is delivered to all members of the community safely
- Minimise disruption to communities when working on our network, and inform affected customers directly of planned outages when they are necessary
- Be a socially responsible employer - our ability to recruit and retain well-qualified and committed staff is vital to our effectiveness

Environmental

VECTOR will:

- Minimise the impact on the environment as much as practicable, and will comply with the spirit and letter of the Resource Management Act 1991
- Encourage customers to adopt energy efficiency practices, with consequential long-term benefits for the wider environment
- This year, lead discussions with our customers and the local authorities to seek ways to enable existing lines to be undergrounded where the beneficiaries are willing to meet the costs involved

Financial Structure and Policies

VECTOR will seek to achieve an optimum capital structure, and to maintain a credit rating of A+ or better (Standard & Poors or equivalent).

The accounting policies to be adopted by VECTOR are in accordance with generally accepted accounting practice.

Performance Objectives

Financial Performance

Our immediate targets are:

- Ratio of Earnings Before Interest and Tax to Total Assets, for 1999/2000 Financial Year 6.9 percent
- We will also establish targets for the Ratio of Net Profit After Tax to Shareholders' Funds, consistent with our capital structure

Dividends

Each year, VECTOR will distribute all funds surplus to the investment and operating requirements defined in this Statement of Corporate Intent. The dividend payout ratio will be a minimum of 80 per cent of net profit after tax, subject to the solvency requirements of the Companies Act 1993, the satisfaction of the capital structure condition above, and meeting the investment needs to maintain the integrity of the network and development of the company.

Operational Performance

VECTOR will focus on network reliability, and strive to better the following targets, using the industry-standard measures.

These are averages across our network. We will monitor performance by zone and, in subsequent years, establish targets specific to zones.

Measure		Target
SAIDI (excluding transmission interruptions)	average minutes without supply per customer.	65 minutes
SAIFI	average outages per customer.	1 per annum
CAIDI	average minutes without supply per outage.	65 minutes

Safety and Compliance Performance

VECTOR and its contractors and subcontractors will, for work on the VECTOR network, achieve a rolling twelve-month Lost Time Incident frequency rate of better than 12 by March 2000.

Further, we will have zero fines for non-compliance with the RMA or any other statutory act.

Regulatory Performance

VECTOR will comply with all regulatory requirements, and take into account the interests of customers, shareholders and other stakeholders when doing so.

We will keep informed of, and prepared to comply with regulatory developments within the industry, such as that proposed by the Ministry of Commerce in its "Discussion Paper on the Operation of the Specific Thresholds for Price Control for Electricity Lines Businesses," released in December 1998.

Communications with Shareholder

Information

Any information that would normally be supplied to a controlling private shareholder will be made available to the AECT.

An annual report will be published containing audited financial statements and disclosures which are consistent with that of a listed company wherever possible. A half yearly report including audited statements of financial performance, statement of financial position, and statement of cashflows, and such other details as are necessary, will also be published.

Reporting

The Chairman and Chief Executive Officer will provide regular briefings to the AECT on all material matters.

In addition, VECTOR will report quarterly to the AECT on its performance and achievements against this Statement of Corporate Intent.

A summary of the VECTOR business plan and forecasts of financial performance will be provided to the AECT prior to the commencement of the financial year to which they relate.

Sale or Purchase of Shares or Assets

Subscriptions for shares in any company or interests in any other organisation, or the purchase of associated assets, will be subject to approval of the shareholder as defined in VECTOR's constitution.

Similarly, any material sale of assets, or shares, or interests in any company, will also be subject to approval by the shareholder in accordance with the constitution.

VECTOR ASSET MANAGEMENT PLAN

We hope you found the information in this document to be informative. VECTOR values your feedback and would welcome any comments.

Could you please indicate your views on the Asset Management Plan by using the scale outlined below:

1 Excellent
3 Good
5 Poor

	1	2	3	4	5
Range of issues covered					
Level of information provided					
Clarity of written information					
Clarity of diagrams, graphs and tables					
Report presentation					

Additional comments

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Name: .....

Company name: .....

Position: .....

Postal address: .....

Telephone: .....

Please return the form to:

Asset Planning Specialist, VECTOR Limited, 101 Carlton Gore Road, PO Box 9982, Auckland, New Zealand. Fax: 64-9-978 7504