2009
ASSET MANAGEMENT PLAN

SUMMARY OF THE ASSET MANAGEMENT PLAN

PURPOSE OF THE PLAN

This Asset Management Plan (AMP) has been developed as part of requirement 7 of the Commerce Commission's Electricity Distribution (Information Disclosure) Requirements 2008 and covers 10 years from 1 April 2009 to 31 March 2019.

The purpose of this plan is twofold:

- To inform stakeholders how Vector intends to manage its electricity distribution network based on information available to it at the time the plan was prepared; and
- To meet Vector's regulatory obligation in terms of the aforementioned requirement 7.

IMPROVEMENTS TO THE AMP

Vector has taken notice of the results of the Commerce Commission review of Vector's 2007 AMP. This new AMP has been thoroughly revised to take into account the Commission's feedback and to capture new developments in Vector's approach to asset management and thinking in regard to future proofing for emerging technologies.

THE CURRENT INVESTMENT ENVIRONMENT

The overall investment landscape faced by Vector poses a number of challenges. In many respects these translate into potential variability in the level of investment Vector will prudently be able or be required to undertake.

The prevailing economic conditions are having a negative impact on network utilisation and new connections therefore may potentially impact on the timing of investment to meet medium term growth. However, it is difficult to predict the depth and extent of the economic recession, with a direct impact on the accuracy of the forecasts included in this AMP.

Vector's operating environment is complicated by a number of factors. The regulatory framework within which Vector must operate is undergoing considerable change. While Vector believes that the proposed changes to the regulatory regime should bring greater clarity and therefore improve the environment for investment, until the regime is fully specified by the Commerce Commission uncertainty will prevail during this transition period.

The economic crisis introduces further uncertainty into the regulatory outcomes for Vector. While the Reserve Bank has reduced benchmark interest rates for Government stock, risk premia have expanded significantly and the overall cost of funding, both debt and equity, is rising. This is compounded by the severe liquidity issues in the banking sector meaning that accessing funding could be both difficult and expensive.

An additional effect of the Reserve Bank's actions has been the rapid depreciation of the New Zealand currency, thus pushing up the cost of imported materials and equipment. This effect is often more than offsetting any easing in international commodity prices.

In a perverse way, Vector is also exposed to increasing pressure on infrastructure resources (material and skilled labour) as a result of the strong infrastructure focus in the Government's stimulus initiatives. The high dependency on infrastructure build to promote economic activity is likely to keep upward pressure on key input costs as Vector competes with other significant spend programmes (for example roading, transmission etc).

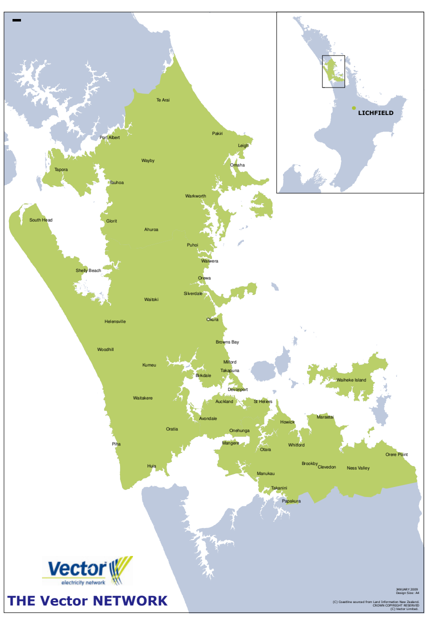
Strategies to enhance utilisation of the existing network assets will help to optimise future investments and enhance return on network investments. These strategies include introducing new products and services supported by new technologies to change the demand profiles on existing assets. Equally technologies such as renewable energy source for distributed generation could strand network investments. It is important to take a cautious approach and to have strategies in place to ensure network investments are protected.

VECTOR NETWORK

The Vector supply area covers most of the Auckland region. Vector operates an electrically contiguous network from Papakura in the south to Rodney in the north. While Vector operates this as a single network, given legacy reasons, it is convenient to describe a southern region and a northern region.

The northern region covers those areas administered by the North Shore City Council, the Waitakere City Council and the Rodney District Council, and consists of residential, commercial and industrial developments in the urban areas, and residential and farming communities in the rural areas.

The southern region covers areas administered by the Auckland City Council, the Manukau City Council and the Papakura District Council, and consists of residential, commercial and industrial developments in the urban areas, and residential and farming communities in the rural areas.



Network Summary (Year ending 31 March 2008)

Description	Quantity
Consumer connections	514,170
Network maximum demand (MW)	1,696*
Network deliveries (GWh)	8,655*
Lines and cables (km)	17,363**
Zone substations	99
Distribution substations	20,757

* Includes embedded generation exports
** Energised circuit length

INTERACTION BETWEEN OBJECTIVES AND CORPORATE GOALS

Vector's over arching goal is expressed in our statement of strategic intent:

"Vector will be New Zealand's first choice provider of infrastructure solutions that enhance peoples lives, creating a brighter and clearer future."

Asset management at Vector is structured to support this strategic intent. This is further reflected in the purpose statement of the asset investment group:

"Maximise value from our assets through effective capital optimisation, efficient delivery and implementation of sustainable long term investment and network performance strategies."

DEMAND FORECASTS

The demand forecasts for zone substations on Vector's network are detailed in Section 4.3. The forecast shows the nominal and cyclic ratings of the zone substation transformers and the associated maximum demand on each zone substation over the planning period. All loads and transformer capacities are in MVA.

Vector's security of supply standards specify that the sub-transmission network and zone substations (with a few pre-identified exceptions) should be able to meet the demand on the substation except for a certain small percentage time in a year. The Commerce Commission's Information Disclosure Requirements however require Vector to present its projected demand against an n-1 security. Vector has therefore inserted an extra column to address this requirement (Table 16 in Section 4).

Network constraints can occur when the forecast load exceeds the equipment ratings. Where constraints are identified, projects are initiated and are listed in Section 4.6. This will be discussed in more detail in Section 4. The peak demand and total energy delivered by the Vector network during the 2007/08 year, are shown below.

	Peak Demand* (MW)	Total Energy Delivered (GWh)
From grid exit points	1,507	8,540
From embedded generation**	189	115
Total	1,696	8,655

* coincident demand
** embedded generation includes Southdown

PLANNING CRITERIA

Vector's approach to network development planning has been driven by:

- Investment strategies and service offering improved value to customers and appropriate return to shareholders
- Meeting network capacity requirements
- Customer needs, which vary by customer segment and are reflected by service level standards (and are continually trending towards higher reliability and improved power quality)

- Striving for least cost solutions (optimum asset utilisation) and optimum timing for capital expenditure
- Aligning risk management strategies with planning philosophy
- Continuously striving for innovation and optimisation in network design, and trialling new technology such as remote switching technology, to improve network performance
- Encouraging non network and demand-side solutions where practicable.

Vector's planning approach is based on meeting its security criteria as described in the following tables.

	Type of load	Acceptable probability of loss of supply in a year due to sub-transmission	Restoration time
1	Predominantly residential substations	5%	For the southern region, any supply loss will be restored within 2.5 hours in urban areas and 3 hours in rural areas. For the northern region, any supply loss will be restored within 3 hours in urban areas and 6 hours in rural areas.
2	Mixed commercial/ industrial/ residential substations	2%	For the southern region, any supply loss will be restored within 2 hours. For the northern region, any supply loss will be restored within 3 hours.
3	Auckland CBD substations	0.5%	Any supply loss will be restored within 2 hours.

Sub-transmission Network

For the Auckland CBD, a switched n-2 security is generally required to meet the acceptable probability of loss of supply.

	Type of load	Acceptable probability of loss of supply in a year due to back stopping shortfall	Restoration time
1	Overhead spurs supplying up to 1MVA urban area	100%	Total loss of supply upon failure. Supply restoration upon repair time.
2	Overhead spurs supplying up to 2.5MVA rural area	100%	Total loss of supply upon failure. Supply restoration upon repair time.
3	Underground spurs supplying up to 400kVA	100%	Total loss of supply upon failure. Supply restoration upon repair time.
4	Predominantly residential feeders	5%	For the southern region, any supply loss will be restored within 2.5 hours in urban areas and 3 hours in rural areas. For the northern region, any supply loss will be restored within 3 hours in urban areas and 6 hours in rural areas.

	Type of load	Acceptable probability of loss of supply in a year due to back stopping shortfall	Restoration time
5	Mixed commercial/ industrial/residential feeders	2%	For the southern region, any supply loss will be restored within 2 hours. For the northern region, any supply loss will be restored within 3 hours.
6	Auckland CBD feeders	0.5%	Any supply loss will be restored within 2 hours.

Distribution Network

SERVICE COMMITMENT

Vector promotes its service commitment through the "Vector promise" under which Vector provides its customers a prescribed supply quality and service standard. Compensation payments will be made to customers if these service standards are breached. (Note that incidents arising as a result of bulk supply failures – generation or transmission – or of extreme events are excluded from this scheme. While Vector will react if breaches in terms of the service commitment come to its attention, in some cases this may require notification by the affected customer).

ASSET MANAGEMENT PLANNING

MAINTENANCE PLANNING POLICIES AND CRITERIA

Vector's overall philosophy on maintaining network assets is based on four key factors:

1. Ensuring the safety of consumers, the public and the network operators.
2. Ensuring reliable network operation.
3. Achieving the optimal trade off between maintenance and replacement costs. That is, replacing assets only when it becomes more expensive to keep them in service. Vector therefore does not adopt purely age based replacement programmes, which is less cost effective.
4. Integration (alignment) of asset management practices given we are a multi utility asset manager.

Vector has developed maintenance standards for each major class of asset it owns. These detail the required inspection, condition monitoring and maintenance tasks together with the frequency at which these are required. The goal of these standards is to ensure that assets can perform safely and efficiently to their rated capacity for their full normal lives and beyond (where economically appropriate). Data and information needs for maintenance purposes are also specified.

Based on these maintenance standards, each of Vector's maintenance contractors develops an annual maintenance schedule for each class of asset in its area of responsibility to ensure that all assets are appropriately inspected and maintained. These asset maintenance schedules are aggregated to form the overall annual maintenance plan which is implemented once it has been signed off by Vector. Progress against the plan is monitored monthly.

Defects identified during the inspections are recorded in the contractor's defect database with a copy being kept by Vector. Contractors prioritise the defects for remedial work based on risk and safety criteria. Work necessary in less than three months is undertaken immediately as corrective maintenance while work that can be carried out over a three to twelve month period is placed in the corrective maintenance or asset replacement programme. Work not required within 12 months is generally held over for the future.

Vector also undertakes block replacement programmes. If, during inspection or maintenance work, it is found that a large number of defects occur within a confined geographic area these may be considered for block replacement, attacking all the problems at once even if individually they may not have warranted immediate replacement or repair. In doing so, substantial long term cost savings are achieved by avoiding repeated contractor reestablishment in the same area over a relatively short period. This approach also minimises the disruption to consumers over time.

Root cause analysis is normally undertaken as a result of faulted equipment. If this identifies performance issues with a particular type of asset, and if the risk exposure warrants it, a project will be developed to carry out the appropriate remedial actions. The asset and maintenance standards are also adapted based on learning from such root cause analysis.

RISK MANAGEMENT

RISK MANAGEMENT POLICIES

Risk management at Vector is an integral part of the asset management process. The consequences and likelihood of failure or non performance, current controls to manage this, and required actions to make risks acceptable, are all documented, understood and evaluated as part of the asset management function.

Risks associated with the assets or operations of the network are evaluated, prioritised and dealt with as part of the asset maintenance, refurbishment and replacement programmes, and work practices. The acceptable level of risk will differ depending on the level of risk customers and the communities are willing to accept and the circumstances and the environment in which the risk will occur. This analysis ranges from high frequency but low impact events, such as tree interference, through to low probability events with high impact such as the total loss of a zone substation for an extended period.

Risks associated with assets are managed at Vector by a combination of:

- Reducing the probability of failure through the capital and maintenance work programme and enhanced work practices including design standards, equipment specification and selection, quality monitoring
- Reducing the impact of failure through the application of appropriate network security standards and network architecture, selected use of automation, robust contingency planning and performance management of field response.

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 is detailed in Section 6.3.

HEALTH AND SAFETY

At Vector, safety is a fundamental value, not merely a priority. We are committed to working towards a goal of zero harm to people, assets and the environment.

Vector's Policy is to:

- Provide a safe and healthy workplace for all staff, contractors, the public and visitors
- Ensure health and safety considerations are part of all business decisions
- Monitor and continuously improve our health and safety performance
- Communicate with staff, contractors, customers, and stakeholders on health and safety matters
- Operate in a manner that minimises health and safety hazards
- Encourage safe and healthy lifestyles, both at work and at home.

To achieve this Vector will:

- As a minimum, meet all relevant legislation, standards and codes of practice for the management of health and safety
- Identify, assess and control workplace hazards
- Accurately report, record and learn from all incidents and near misses
- Establish health and safety goals at all levels within the company, and regularly monitor and review the effectiveness of the health and safety management system
- Consult, support and encourage participation from staff on issues that have the potential to affect their health and safety
- Promote the company's leaders, employees and contractors understanding of their health and safety responsibilities relevant to their roles
- Provide information and advice on the safe and responsible use of Vector's products and services
- Suspend activities if safety would be compromised
- Take all practicable steps to ensure contractors work in line with this policy.

All Vector employees and contractors working for Vector are responsible for:

- Ensuring their own and others safety by adhering to safe work practices, making appropriate use of plant and equipment (including protective clothing and equipment) and promptly reporting incidents, near misses and hazards.

ENVIRONMENT

Vector’s environmental policy is to:

- Ensure environmental considerations are part of all business decisions
- Meet or exceed all relevant environmental legislation, regulations or codes
- Participate and work with Government and other organisations to create responsible laws, regulations, standards and codes of practice to protect the environment
- Monitor and continuously improve our environmental performance
- Operate in a manner that minimises environmental and social impacts
- Take appropriate action where there is a negative impact on the environment and a material breach of the Resource Management Act
- Communicate with employees, contractors, customers and other relevant stakeholders on environmental matters.

To achieve this Vector will:

- Plan to avoid, remedy or mitigate adverse environment effects of our operations
- Focus on responsible energy management and energy efficiency throughout all our premises, plant and equipment where it is cost effective to do so.

The long term operational objectives of Vector are to:

- Utilise fuel as efficiently as practicable
- Mitigate, where economically feasible, fugitive emissions and in particular greenhouse gas emissions
- Wherever practicable use ambient and renewable energy
- Work with consumers to maximise energy efficiency.

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GLOSSARY OF TERMS

AAC	All aluminium conductor
AAAC	All aluminium alloy conductor
ABS	Air break switch
ACSR	Aluminium conductor steel reinforced
ADMD	After diversity maximum demand
AELG	Auckland Engineering Lifelines Group
AMP	Asset management plan
AUFLS	Automatic under frequency load shedding
BRAC	Board risk and assurance committee
CAIDI	Customer average interruption duration index
CAPEX	Capital expenditure
CATI	Computer assisted telephone interviewing
CB	Circuit breaker
CBD	Central business district
CDEM	Civil Defence Emergency Management
CIGRE	Conference Internationale des Grands Reseaux Electriques (International council for large electric systems)
CCT	Covered conductor thick
Cu	Copper
DC	Direct current
DFA	Delegated financial authority
DGA	Dissolved gas analysis
EDO	Expulsion drop out
ERAC	Executive risk and assurance committee
FAR	Fixed asset register
FSP	Field service provider
GWh	Gigawatt hour
GIS	Geographical Information System
GXP	Grid exit point
HV	High voltage
HVABC	High voltage aerial bundle conductor
Hz	Hertz
ICP	Installation control point
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IED	Intelligent electronic data
IP	Internet protocol
km	Kilometre
kV	Kilovolt
kVA	Kilovolt ampere
kVAr	Kilovolt ampere reactive
kW	Kilowatt
LV	Low voltage
LVABC	Low voltage aerial bundle conductor
LTOS	Live tank oil sampling
MARIA	Metering and reconciliation information agreement
MGCU	Mobile generator connection unit
MIS	Maintenance information system
MW	Megawatt
MVA	Mega volt ampere
MVAr	Mega volt ampere reactive
n-1	Security standard
Nilstat ITP	Protection relay
ODV	Optimised deprival value/valuation
ONAN	Oil natural air natural

OPEX	Operational expenditure
PDC	Polarisation depolarisation current
PI	Historical storage software package
PIAS	Paper insulated aluminium sheath
PILC	Paper insulated lead cable
PQ	Power quality
PV	Photo-voltaic
PVC	Polyvinyl Chloride
RTU	Remote terminal unit
SAIDI	System average interruption duration index
SAIFI	System average interruption frequency index
SAP	Systems Applications and Processes
SCADA	Supervisory Control and Data Acquisition System
SF_6	Sulphur hexafluoride
TAR	Technical asset register
TASA	Tap changer activity signature analysis
TCA	Transformer condition assessment
THD	Total harmonic distortion
V	Volt
VRLA	Valve regulated lead acid
XLPE	Cross linked polyethylene cable

1 BACKGROUND AND OBJECTIVES

1.1 PURPOSE OF THE PLAN

This Asset Management Plan (AMP) has been developed as part of requirement 7 of the Commerce Commission's Electricity Distribution Disclosure Requirements 2008 and covers 10 years from 1 April 2009 to 31 March 2019.

The purpose of this plan is twofold:

- To inform stakeholders how Vector intends to manage its electricity distribution network based on information available to it at the time the plan was prepared; and
- To meet Vector's regulatory obligation in terms of the aforementioned requirement 7.

This plan does not commit Vector to any of the individual projects or initiatives or the defined times outlined in the plan. The implementation of the works programmes may be modified to reflect any changing operational and economic conditions, or regulatory or customer requirements that may occur from time to time. Any expenditure must be approved through normal internal governance procedures.

The AMP is subject to regular review which is an ongoing process within Vector as improved knowledge and updated information is gained of our customers' expectations, asset capabilities and condition.

1.2 INTERACTION BETWEEN OBJECTIVES AND CORPORATE GOALS

Vector's over arching goal is expressed though our strategic intent statement:

"Vector will be New Zealand's first choice provider of infrastructure solutions that enhance peoples lives, creating a brighter and clearer future."

Asset management at Vector is structured to support this strategic intent. This is further reflected in the purpose statement of the asset investment group:

"Maximise value from our assets through effective capital optimisation, efficient delivery and implementation of sustainable long term investment and network performance strategies."

The AMP sets out how Vector's strategic intent and the asset investment purpose statement are translated into the practical management of our assets. Being a highly asset intensive company, asset management and associated strategies are key activities at Vector which heavily influence corporate and management decision making at all levels. This is reflected not only in our business policies, procedures and strategies, but also in the key performance indices for all our staff and contractors.

The interaction between the various external and internal business drivers and the AMP is illustrated in Figure 1. Figure 2 provides a high level schematic representation of Vector's asset management philosophy.

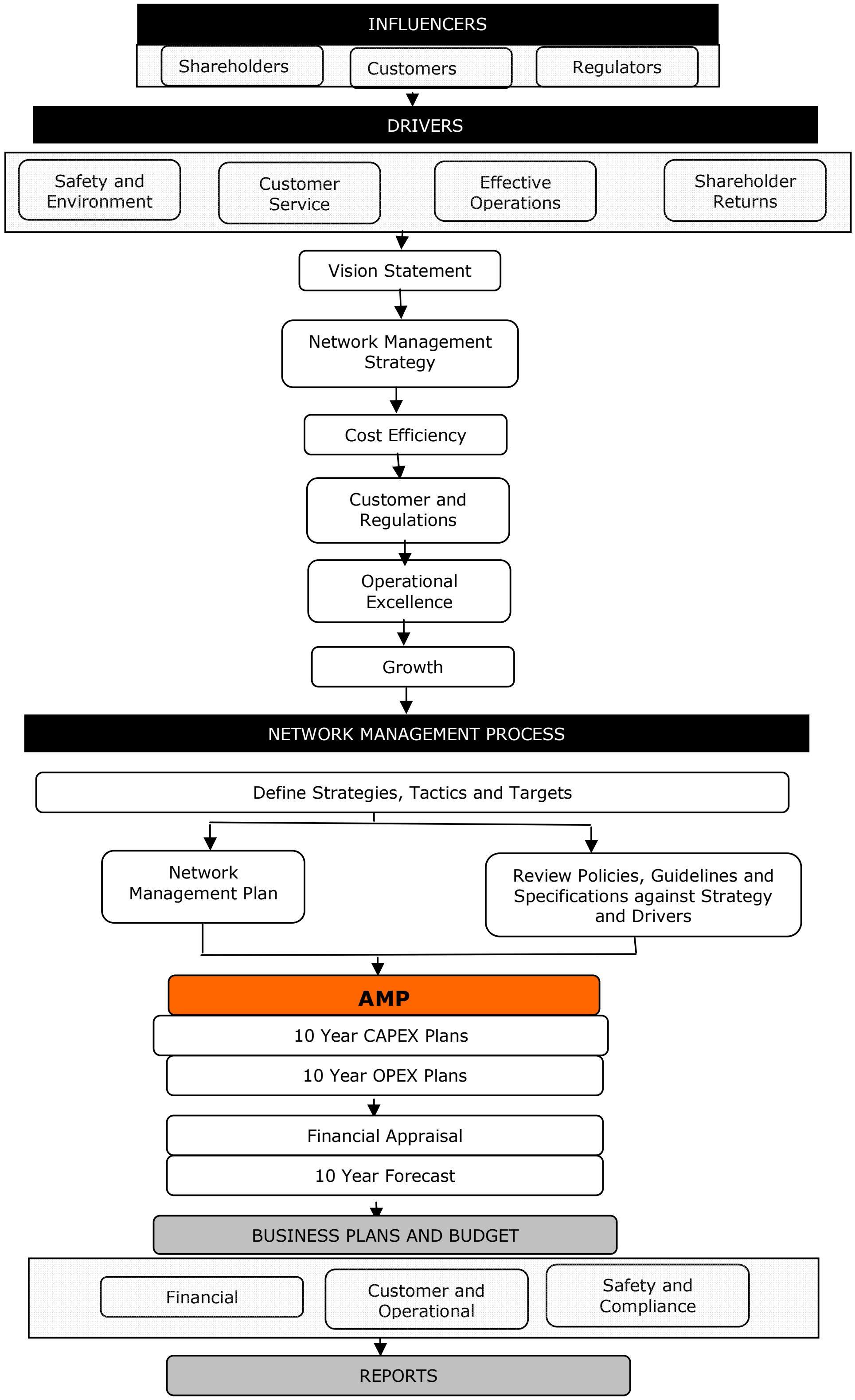


Figure 1 Interaction Between Business Drivers and the AMP

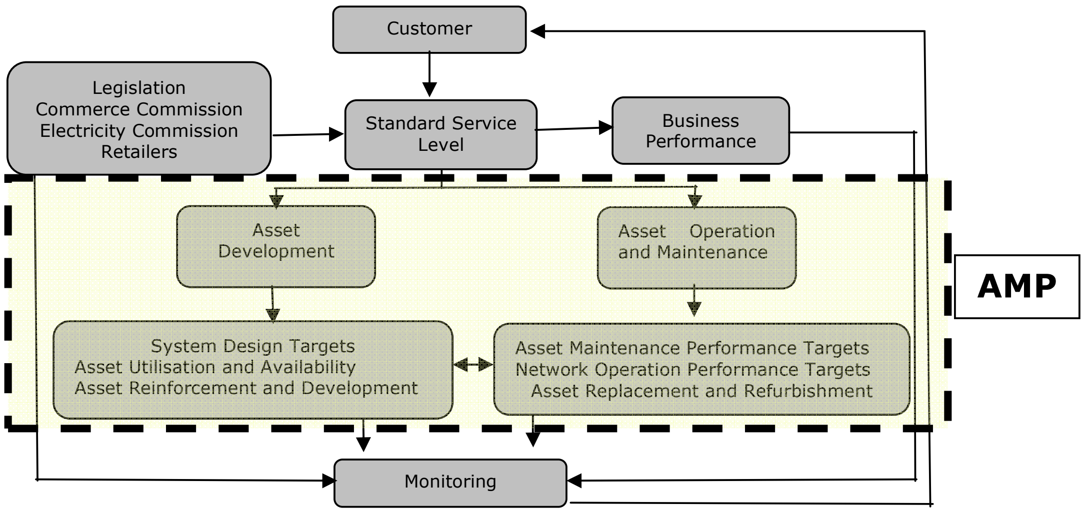


Figure 2 Vector's Asset Management Philosophy

The AMP is supported by a collection of detailed asset management documents and policies. These include:

- Network security standards and policies
- Detailed asset maintenance standards
- Network design policies
- Network architecture
- Risk management policies
- Ownership policy
- Contracts management policy
- Procurement policy
- Health and safety policy
- Environmental policy
- Asset rehabilitation policy
- Load management plans
- Asset settlement manual
- Network contingency plans
- Network projects quality assurance policy.

1.3 PLANNING PERIOD

This plan covers the 10 years from 1 April 2009 to 31 March 2019.

This plan was approved by the directors of Vector Limited on 26 March 2009.

1.4 STAKEHOLDERS AND THEIR INTERESTS

Vector's Key Stakeholders are:

- Customers (end use consumers)
- Shareholders: the Auckland Energy Consumer Trust (AECT) retains a 75.1% ownership; the remaining 24.9% is owned by shareholders who have purchased shares on the stock exchange
- Electricity retailers
- Regulators
- Employees
- Board
- Service providers
- Financial analysts
- Rating agencies
- Lenders
- Government advisors
- Ministers and MPs
- Local government
- Transpower
- Media (broadcast, print and online).

The Interests of Vector's Stakeholders are identified through:

- Meetings and discussion forums
- Consumer engagement surveys
- Engagement with consultation processes
- Employee engagement surveys
- Annual planning sessions
- Membership on industry working groups
- Feedback received via complaints and compliments
- Local community meetings
- Media enquiries and meetings with media representatives.

Vector's Understanding of its Key Stakeholders Requirements is as follows.

Shareholders:

- Return on investment
- Growth
- Reliability
- Regulatory compliance
- Good reputation.

Financial analysts/rating agencies/lenders:

- Transparency of operations
- Accurate information
- Clear strategic direction
- Adhering to New Zealand Stock Exchange rules
- Confidence in board and management.

Customers (end use consumers):

- Reliable supply of electricity
- Quality of supply
- Security of supply
- Efficiency of operations
- Fair price
- Health and safety
- Environment
- Information in fault situations
- Planned outages
- Timely response to complaints/queries
- Timely connections.

Electricity retailers:

- Reliability of supply
- Quality of supply
- Managing customer issues
- Information in fault situations
- Ease of doing business
- Good systems and processes.

Regulators:

- Compliance with statutory requirements
- Accurate and timely provision of information
- Vector's views on specific regulatory issues
- Fair competitive environment and competition.

Government advisors:

- Accurate and timely provision of information
- Vector's views on specific policy issues
- Efficient and equitable markets
- Investment in infrastructure and technologies
- Reduction in emissions.

Ministers and MPs:

- Security of supply
- Reliable supply of electricity
- Efficient and equitable markets
- Investment in infrastructure and technologies
- Environment
- Good regulatory outcomes.

Local government:

- Compliance
- Environment
- Coordination between utilities
- Sustainable business
- Support for economic growth in the area.

Board:

- Return on investment
- Regulatory compliance
- Good governance
- Reliability of supply
- Health and safety.

Employees:

- Health and safety
- Good place to work
- Innovation
- Accurate records and information systems
- Efficient processes
- Rewarded appropriately
- Career development/opportunities.

Service providers:

- Safety of the network
- Stable work volumes
- Quality work standards
- Maintenance standards
- Construction standards
- Consistent contracts
- Good working relationships.

Transpower:

- Good relationships
- Ease of doing business
- Secured source of supply
- Well maintained assets at the networks interface
- Coordinated approach to system planning and operational interfaces.

Media:

- Good relationship
- Access to expertise
- Information on company operations.

From an Asset Management Perspective the Interests of Vector's Stakeholders are Accommodated by Ensuring:

- Creation and maintenance of a safe and reliable distribution network
- Quality of supply performance meeting consumers needs
- Optimisation of capital and operational expenditure
- Maintaining a sustainable business that caters for consumers growth requirements
- Comprehensive risk management strategies and planning for contingencies
- Due consideration to the environmental impact of Vector's operations
- Regulatory and legal compliance
- Economically efficient pricing methodologies
- Security standards reflecting consumers needs
- Network growth and development plans
- Comprehensive asset replacement strategies.

Conflicting Stakeholder Interests

In the operation of any large organisation with numerous stakeholders, situations will inevitably arise where not all stakeholder interests can be accommodated, or where conflicting interests exist. At Vector these are managed by clearly identifying and understanding the conflicts that exist (or may arise), having clear policies in place, effective communication with stakeholders, and always acting with our strategic intent in mind.

A few overriding conditions may arise where action has to be taken even if this conflicts with stakeholder interests. These include:

- Health and safety
- Regulatory and legal compliance
- Ensuring sufficient capacity of supply to all consumers.

Other aspects considered when assessing aspects impacting on stakeholder interests or resolving conflicts include:

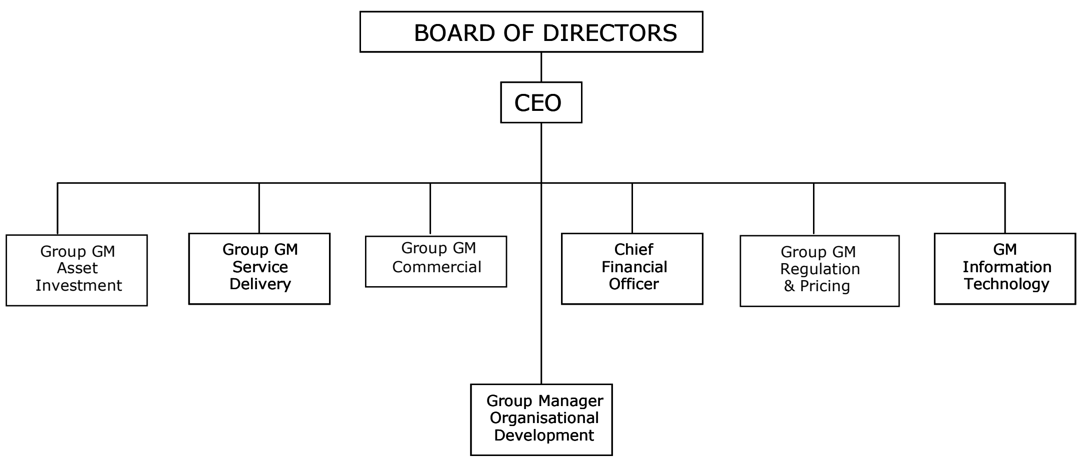
- Cost/benefit analysis
- Long term planning strategy and framework
- Environmental impact
- Societal impact
- Sustainability of solutions (technically and economically)
- Works/projects prioritisation process
- Security and reliability standards
- Work and materials standards and specifications.

1.5 ACCOUNTABILITIES AND RESPONSIBILITIES

1.5.1 EXECUTIVE LEVEL

As part of the organisational redesign Vector has recently reorganised itself into a functional structure to manage it businesses. While Vector Communications remains a standalone business the rest of the company is organised into three business functional units and five shared services units.

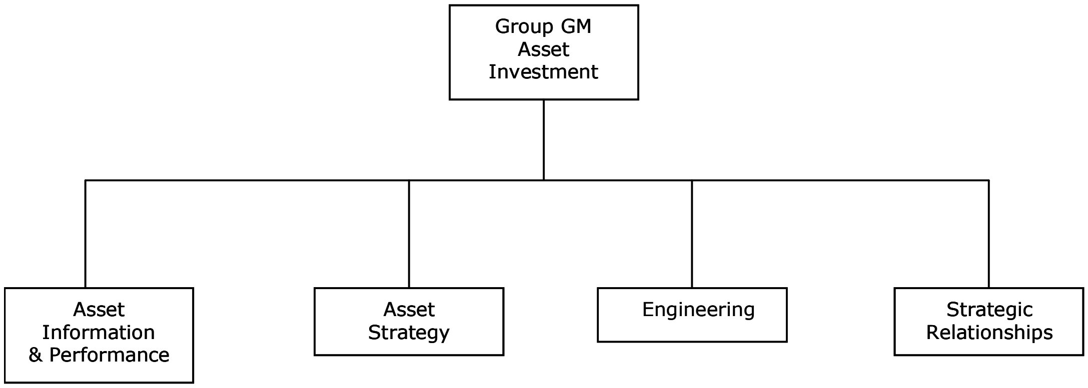
The Vector executive structure is shown in the following diagram:



The accountability for the management of the electricity network assets and the electricity distribution business rests jointly with the asset investment, service delivery and commercial units. These three functional units are supported by finance, regulation and pricing, information technology and organisational development units.

The following diagrams highlight the functional responsibilities of each of the three functional units:

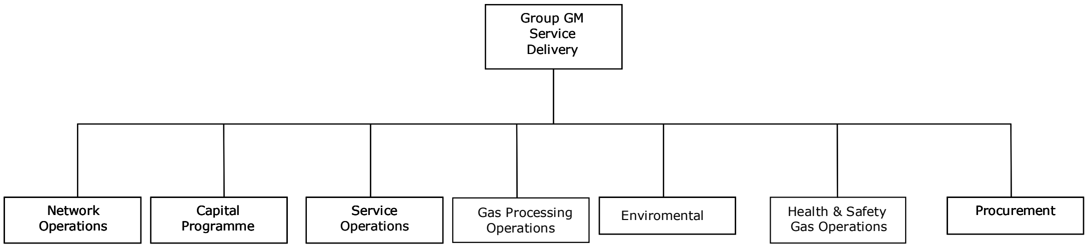
1.5.2 ASSET INVESTMENT



The key accountabilities of the asset investment group include:

- Investment decision making in relation to network growth, renewal and performance
- Analyse asset performance data to contribute to informed decision making across the business, to meet customers needs and to achieve the company's strategic objectives
- Monitor load demand and model future growth patterns
- Undertake complex network modelling and contribute to strategies to ensure the cost effective performance of all assets
- Manage the long term strategic planning for all Vector's network assets including gas and electricity, and integrating renewables where appropriate
- Develop maintenance policies and plans to help ensure serviceability of our assets for the full asset lives
- Develop a clear and innovative strategy for long term asset management linked to business goals and strategies
- Translate strategy into defined project scopes and standards, and provide engineering expertise to the business to build/plan a robust and reliable asset infrastructure and renewables solutions where required
- Identify network planning and performance issues and develop solutions
- Monitor engineering projects from design/specification through to install/commissioning
- Capital and operational expenditure (capex/opex) optimisation and capital efficiency
- Establish strategic relationships with territorial local authorities, roading authorities, ONTRACK and other network utility owners to progress Vector's strategic goals
- Back stop analysis.

1.5.3 SERVICE DELIVERY

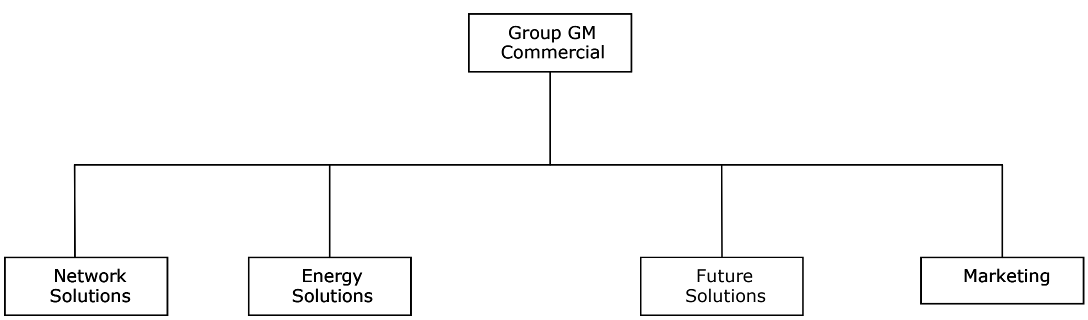


The key accountabilities of the service delivery group include:

- Operate the network to ensure reliability, safety and efficiency within the agreed/defined network design parameters and customer service levels, and to minimise the impact of all outages
- Executing the Vector maintenance policies and overseeing the contractors maintaining the network
- Deliver capital spend efficiently, on time and in an optimised manner
- Optimise value with all internal and external field service providers (FSP) to ensure that contract commitments and service level outcomes are met
- Assess service provider health, safety, quality and environmental management systems to ensure they are robust and are being implemented at field level to meet Vector's standards for quality, health and safety
- Performance manage FSPs.

Construction, maintenance and repair work on the network is carried out by FSPs as described later in Section 1.5.6 (capital and maintenance work strategy).

1.5.4 COMMERCIAL



The key accountabilities of the commercial group include:

- Manage the commercial interface with customers
- Ensure Vector earns an appropriate return from its investments
- Investigate and develop new energy solutions that Vector offers to the market place

- Research, develop and implement future growth options for Vector across its products and services
- Manage and produce all customer communications including the corporate brands
- Gather market intelligence to help determine customer requirements that will drive the business strategy and commercial decision making.

1.5.5 POLICIES

Vector has a number of business policies designed to help the business to operate efficiently and effectively. Many of these interact or impact on the asset management policies and this AMP.

Business

- Code of conduct
- Legal compliance policy
- Protected disclosure policy
- Remuneration policy
- Customer credit policy
- Foreign exchange policy
- Expense management policy
- Capital expenditure policy.

Information Technology

- Access policies
- Password and authentication policy
- Network management policy
- Internet use policy
- Email policy
- Access control policy
- Antivirus policy
- Communications equipment policy
- Computer systems and equipment use policy
- Cyber crime and security incident policy
- E-commerce policy
- Firewall policy
- Hardware management policy
- Information technology exception policy
- Information technology general user policy.

Asset Management

- Network security standards and policies

- Network design policies
- Network architecture
- Risk management policies.

Service Delivery

- Contracts management policy
- Procurement policy
- Health and safety policy
- Environmental policy
- Drug and alcohol pre-employment policy
- Rehabilitation policy
- Contingency plans
- Asset settlement manual
- Network projects quality assurance policy.

1.5.6 CAPITAL AND MAINTENANCE WORK STRATEGY

All capital and maintenance work is contracted out to independent service providers. At present Siemens Energy Services manages the northern region Network and Northpower manages the southern region network. Vector has recently reviewed its contracting model and through a competitive process has procured the services of two independent service providers to undertake its maintenance works. Under the new arrangement Electrix Limited will maintain the northern region network and Northpower Limited will maintain the southern region network. These service providers also compete for capital work across the whole network. Other service providers are also invited from time to time to compete for this work.

1.5.7 ASSET MANAGEMENT DECISION MAKING

Ultimate responsibility for all asset investment and maintenance decisions at Vector rests with the Vector board. As for any effective large organisation the board is not involved in day to day decision making or operational activities and responsibility as this is delegated to the various divisions of the organisation and the management and staff of the company.

Financial responsibility is delegated to various levels of the organisation through awarding delegated financial authorities (DFAs) to individuals. These DFAs specify the level of financial commitment that individuals can make on behalf of the company.

Investment decisions are budget based with the board approving these budgets before any commitment can be made. Critical unbudgeted investments may be taken to the board for approval if supported by a robust business case or arising from an urgent compliance issue. Vector operates a one year budget and 10 year forecast cycle. The longer term forecasts are reviewed annually and adapted to reflect factors such as:

- Load forecasts and new customer connections

- Asset utilisation levels
- Asset performance trends and renewal or refurbishment needs
- Safety, environment and compliance issues
- Technology change.

Performance against the annual budgets is closely monitored, with formalised change management procedures in place.

1.5.8 REPORTING

Regular reports are sent to the Vector board regarding:

- Progress of key capital projects against project programme and budget
- Performance of key assets such as sub-transmission cables
- Health, safety and environmental issues
- Security of supply.

1.6 SYSTEMS AND PROCESSES

The following information systems are used to manage Vector's asset lifecycle data:

- Geographic Information System (GIS)

  A geospatial model of Vector's electricity network between the Transpower grid exit points (GXPs) and the customer connection interfaces is maintained in a proprietary database mapped onto Smallworld GIS. The system is continually updated by GIS specialists within Vector and its FSPs. This acts as the master register for the geospatial coordinates for Vector's network assets along with certain key asset attributes. Analysis and thematic mapping of the information in our GIS is facilitated by exporting base data into ArcGIS and is made accessible to third parties as a reference for underground service locations.

- Maintenance Information System (MIS)

  Vector's FSPs operate proprietary asset maintenance information systems (for example WASP) for the recording, reporting and analysis of asset inspection data, condition data, performance data and maintenance data. Work schedules are derived from this data by Vector's FSPs in line with Vector's operational and engineering standards and supported by Vector's asset specialists.

- Fixed Asset Register (FAR)

  We maintain a register of our fixed network assets in our enterprise resource planning system, Systems Applications and Processes (SAP). The FAR provides the basis for financial reporting and is interfaced with our GIS. The systems are reconciled regularly to ensure consistency. We are currently in the process of developing a separate technical asset register (TAR) linked to the FAR but with a more detailed asset structure aligned more closely to GIS. The TAR will capture historical asset data with the objective of optimising our lifecycle asset management capability.

- Network Valuation Model

Vector's network asset valuation for financial reporting purposes and Commerce Commission disclosure purposes is derived from the asset data maintained in the FAR and GIS.

- Network Modelling Software

  Vector's high voltage and medium voltage electricity networks are modelled with DigSILENT PowerFactory software. We also operate the StationWare application for the management of our system protection settings. This enables us to undertake a wide range of power system studies on the network in its present state and to model the potential impact of changes to the network configuration or to the network load. We are in the process of upgrading our model to enable its updating via an interface with our GIS and ultimately to enhance its use together with the protection setting tool for operational applications.

- Network Monitoring and Control

  Vector's electricity network is monitored and controlled in real time using the Supervisory Control and Data Acquisition (SCADA) system. There are two SCADA systems in use to monitor network status and provide operational control of the network. This ranges from the master stations based in the main Auckland office to the remote terminal units (RTUs) at GXPs and zone substations. The SCADA consists of three sub-systems: the main SCADA system, the ripple control system, and the metering system. Over time, the two SCADA systems will be amalgamated.

- Customer Connections

  Vector maintains a database of all the installation control points (ICPs) in the Gentrack system, which is linked to GIS and interruption events systems and the metering and reconciliation register.

- Historical Load Profile Information

  A very large archive database of historical load values is maintained in a proprietary system (PI), which captures data transmitted across the SCADA system from several hundred current and voltage monitors located at zone substations and other key points around the electricity network. This information is used to provide asset utilisation information and support decision making in network planning and operational control.

- Engineering Documents

  Vector network standards and technical specifications have been developed for design, construction, operation and maintenance of the network, and are the subject of continuous improvement. Key documents are accessible via Vector's intranet. Drawings and related engineering documents from network projects are maintained in a proprietary document management system. Vector is developing standardised approaches to the design and construction of its major capital projects.

- Network Interruption Events

  A replica of Vector's high voltage and medium voltage network structure is maintained in an events database to manage the recording of interruption events and to prioritise network reconfiguration and restoration after an event. The system enables the number of customers affected and the duration of interruptions to be identified against each event, by event type and location. Reporting of network reliability and calculation of asset performance statistics is derived from the data captured in this system.

Automated Daily Fault Reports

Daily summaries of high voltage (HV) faults, similar to those shown in Figure 3, are distributed within Vector and also to the FSPs. This information, updated on a daily basis, is available on Vector's intranet for general information of all staff as well as automatically emailed to staff identified as needing this in the course of their duties.

HV Event Report

Events that have on 09 Jan 2009

KEY:	Cust Affec	Vector SAIDI	Max Time Off (mins)	Recent Trend vs SLA
	0	0	0	
	1-200	0-0.1	0-120	OK
	201-500	0.1-0.5	120-150	< SLA
	201-1000	0.5-1	150-180	= SLA
	1001+	>1.0	180+	> SLA

Click on the blue hyperlinks to go into further detail regarding an individual outage.

Unplanned Events

Event ID	Date & Time	Region	System Level	Location	Substation	Main Reason	Sub Reason	Cust Affec	Vector SAIDI	Max Time Off	Faults Last 12mths	FAIFI*
195620	9 Jan 23:50	Auckland	Feeder	BAIR 4	Bairds	THIRD PARTY INCIDENT	VEHICLE DAMAGE	1,305	0.228	428	2	2
195619	9 Jan 19:57	Northern	Feeder	27KUME	Riverhead	EQUIPMENT - OH	CROSSARM	158	0.012	101	28	11.2
195644	9 Jan 15:00	Auckland	Feeder	CHEV 5		EQUIPMENT - UG	CABLE TERMINATION	0	0.000	0		
195617	9 Jan 11:45	Northern	Feeder	30SYCA	Sunset Rd	EQUIPMENT - UG	CABLE	141	0.030	160	2	0.2

Planned Events

Event ID	Date & Time	Region	System Level	Location	Substation	Cust Affec	Vector SAIDI	Max Time Off (mins)
195616	9 Jan 09:11	Wellington	Feeder	MAI10	Maidstone	8	0.002	142
195618	9 Jan 09:00	Northern	Feeder	20EVER	Manly	46	0.036	408

Auto Reclosers Events

There were no recorded auto-recloser events on this day

Figure 3 Automated Daily Fault Report – Summary Report

The information in the report provides a high level awareness of recent faults. Links to more detailed information are provided through links from the report. An example is provided in Figure 4.

Reliability Reporting

In addition to information on individual events, overall monitoring against performance targets is also reported.

Disclosure Reliability Reporting

Vector's high voltage sub-transmission and distribution networks are operationally managed by Vector's network control room. Resolution of planned and unplanned events at this level is under the direction of the duty control room engineer.

All planned and unplanned records are captured by Vector's network control engineer both in hard copy (electricity fault switching log) and electronically (the HVEvents database). The HVEvents database records such details as outage type, system level, location, cause, customers without supply and restoration times. To ensure accuracy, each outage record is peer reviewed by the network performance analyst. In addition Vector's external auditors, KPMG, review this process annually and conduct spot checks for accuracy.

UNPLANNED HV EVENT DETAILS	
Event ID	195620
Date	09/01/2009 23:50 p.m.
Region	Auckland
System Level	Feeder
Substation	Bairds
Location Code	BAIR 4
Location Name	ASHTON AVENUE
Main Reason	THIRD PARTY INCIDENT
Sub Reason	VEHICLE DAMAGE

Operational Details	
ZBC	Northpower
Contractor	Northpower
Operations Engineer	Rex Newton
Field Person	Ardie
Comments	Car v/s pole @ 256 Bairds Rd
Service Request Nr	1-129033133
Defect Number	

Location Details	
Street Address	256 Bairds Rd
Suburb	
Closest Asset 1	ABS6115
Closest Asset 2	

Fault Trip Details	
Fault Trips	1
Trip Device	Scada CB
Device Nr	CB4
Protection Operation	OK
Function	Over Current
Protection Comments	
FPI Operation	Not Applicable
FPI Comments	

Performance Measure for Event			
Customer Mins	119,033	Vector Saidi	0.2280
Customers Affec	1,305	Vector Saifi	0.0025
Max Time Off for some customers	428	Customers over Restoration SLA	394

Outage Detail by Feeder

Feeder	Service Level	Total Cust Affec	Max Time Off for some customers	Customers over Restoration SLA	Caused by Adjacent Circuit
BAIR 4	Residential	1,305	428	394	No

Outage Restoration Detail by Feeder

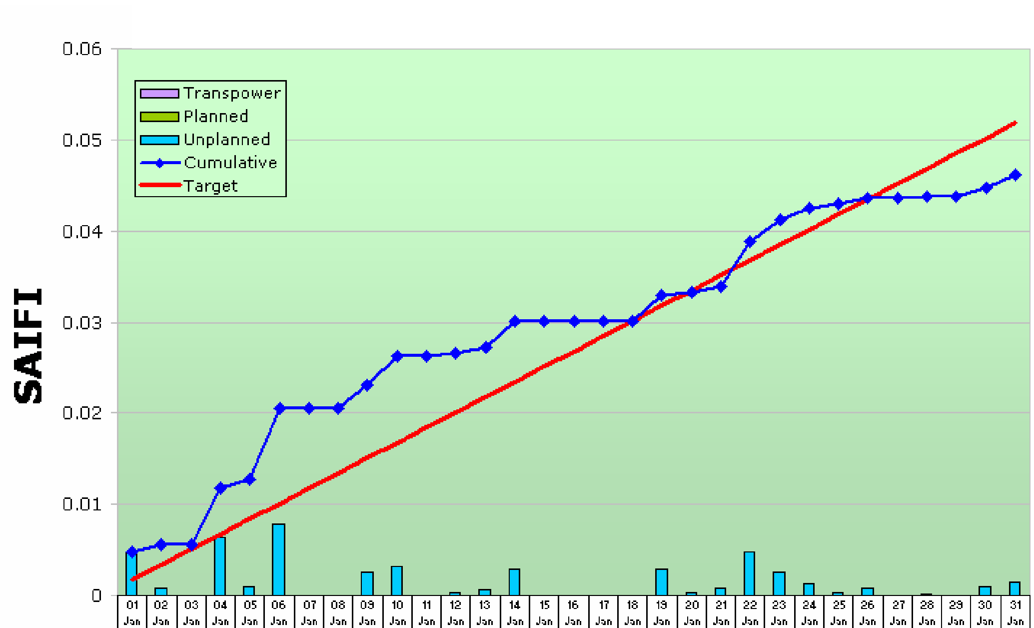
Feeder	Outage Time	Customers out at this time	Comments
BAIR 4	09/01/09 23:50 p.m.	1,305	
	10/01/09 00:33 a.m.	875	
	10/01/09 00:52 a.m.	394	
	10/01/09 02:45 a.m.	7	S-1767
	10/01/09 06:58 a.m.	0	

Figure 4 Unplanned HV Event Details

At year end the period's average network customer base is calculated using the Gentrack billing and revenue system (averaging customers at the start and end of the year). The following reliability metrics are extracted from the HVEvents database for disclosure reporting:

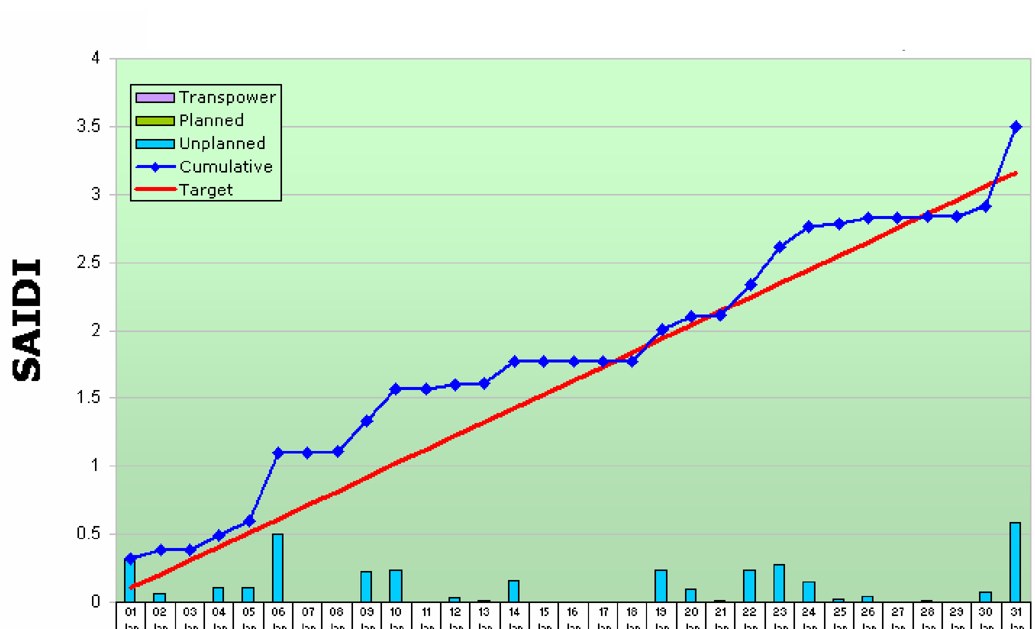
- Interruption frequency by class
- Interruption frequency by voltage level
- Interruption duration by class
- Systems Average Interruption Duration Index (SAIDI), Systems Average Interruption Frequency Index (SAIFI), Customer Average Interruption Duration Index (CAIDI), calculated using average customer count.

Figures 5 to 7 below illustrate one month's reliability metrics for the Auckland region as captured by the HVEvents database.



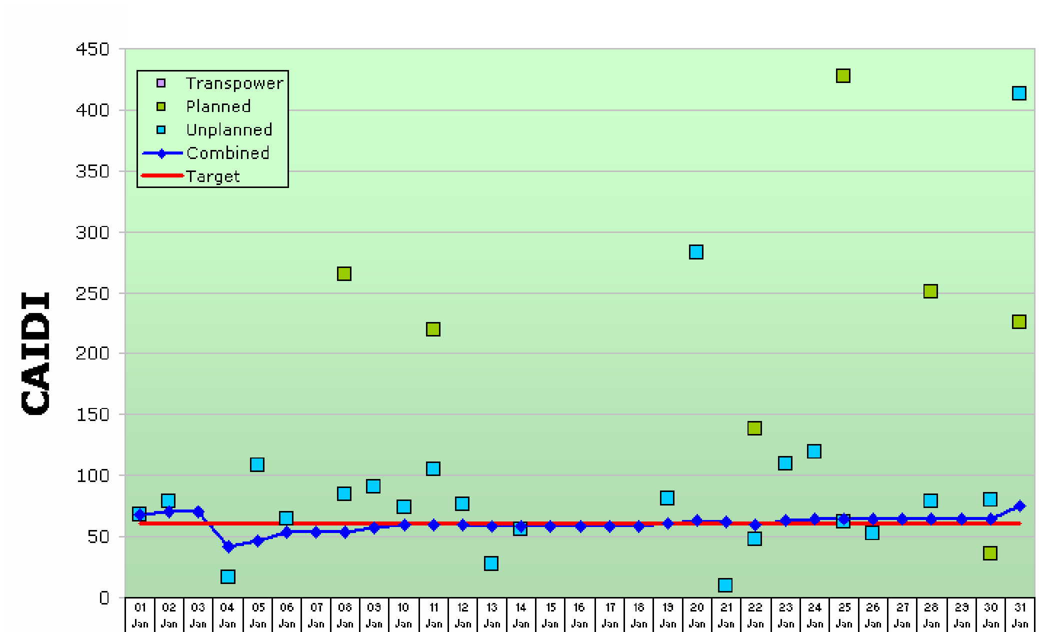
	01 Jan	02 Jan	03 Jan	04 Jan	05 Jan	06 Jan	07 Jan	08 Jan	09 Jan	10 Jan	11 Jan	12 Jan	13 Jan	14 Jan	15 Jan	16 Jan	17 Jan	18 Jan	19 Jan	20 Jan	21 Jan	22 Jan	23 Jan	24 Jan	25 Jan	26 Jan	27 Jan	28 Jan	29 Jan	30 Jan	31 Jan
Transpower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unplanned	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative	0	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
Target	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05

Figure 5 Southern Region Monthly Service Level Report (SAIFI)



	01 Jan	02 Jan	03 Jan	04 Jan	05 Jan	06 Jan	07 Jan	08 Jan	09 Jan	10 Jan	11 Jan	12 Jan	13 Jan	14 Jan	15 Jan	16 Jan	17 Jan	18 Jan	19 Jan	20 Jan	21 Jan	22 Jan	23 Jan	24 Jan	25 Jan	26 Jan	27 Jan	28 Jan	29 Jan	30 Jan	31 Jan
Transpower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unplanned	0.32	0.06	0	0.11	0.11	0.5	0	0	0.23	0.23	0	0.03	0.02	0.16	0	0	0	0	0.23	0.09	0.01	0.23	0.28	0.15	0.02	0.04	0	0.01	0	0.08	0.59
Cumulative	0.32	0.39	0.39	0.5	0.6	1.1	1.1	1.1	1.33	1.57	1.57	1.6	1.61	1.77	1.77	1.77	1.77	1.77	2.01	2.1	2.11	2.34	2.61	2.76	2.79	2.82	2.82	2.84	2.84	2.91	3.5
Target	0.1	0.2	0.31	0.41	0.51	0.61	0.71	0.82	0.92	1.02	1.12	1.22	1.32	1.43	1.53	1.63	1.73	1.83	1.94	2.04	2.14	2.24	2.34	2.45	2.55	2.65	2.75	2.85	2.96	3.06	3.16

Figure 6 Southern Region Monthly Service Level Report (SAIDI)



	01 Jan	02 Jan	03 Jan	04 Jan	05 Jan	06 Jan	07 Jan	08 Jan	09 Jan	10 Jan	11 Jan	12 Jan	13 Jan	14 Jan	15 Jan	16 Jan
Transpower	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
Planned	-0	-0	-0	-0	-0	-0	-0	265	-0	-0	221	-0	-0	-0	-0	-0
Unplanned	69	80	-0	17	109	65	-0	85	91	74	105	77	28	56	-0	-0
Combined	69	70	70	42	47	54	54	54	58	60	60	60	59	59	59	59
Target	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61

	17 Jan	18 Jan	19 Jan	20 Jan	21 Jan	22 Jan	23 Jan	24 Jan	25 Jan	26 Jan	27 Jan	28 Jan	29 Jan	30 Jan	31 Jan
Transpower	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
Planned	-0	-0	-0	-0	-0	139	-0	-0	428	-0	-0	251	-0	36	226
Unplanned	-0	-0	82	283	9	48	111	119	62	53	-0	79	-0	81	414
Combined	59	59	61	63	62	60	63	65	65	65	65	65	65	65	76
Target	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61

Figure 7 Southern Region Monthly Service Level Report (CAIDI)

Initiatives to Improve Data Quality (Accuracy/Completeness)

Table 1 compares Vector's current practice in asset data management with desired improvements from planned and proposed initiatives. In addition to work on specific asset data registers, Vector is undertaking work to enhance its asset data reporting capability through substantial development of its electronic data warehouse and business information reporting tools.

Data set	Current practice	Desired practice
Asset identification	Unique ID numbers in GIS and FAR for all significant assets	Unique ID numbers in GIS and TAR for all assets
Asset classification	Hierarchical network asset structure in place (in GIS) Financial asset classification for depreciation purposes (in FAR)	Practically 1:1 relationship between GIS and TAR and clearly defined relationship between TAR and FAR
Asset serial number	Recorded in GIS	Recorded in TAR
Asset technical attributes	Attributes recorded in GIS, project files and FAR	Master data for all key asset attributes established in TAR accessible via GIS
Asset geospatial coordinates	Coordinates recorded in GIS	Current coordinates recorded in GIS, historical in TAR
Asset financial data	Recorded in FAR	Recorded in FAR
Asset valuation	Derived from data in FAR and GIS	Derived from TAR
Historical asset	Recorded in Vector's field	Critical data fields recorded in

Data set	Current practice	Desired practice
condition, performance, inspection and maintenance data	service providers maintenance information systems	TAR
Past and predicted future asset lifecycle costs	Derived from MIS and network modelling	Derived from TAR and network modelling
Network connectivity	In network diagrams	Dynamically linked to network model and GIS
Network reliability information	Recorded in bespoke database with most faults data also recorded in GIS	Upgraded database interfaced with TAR and GIS
Network security information	Derived from network model	Derived from network model

Table 1 Data Quality Initiatives

1.7 NETWORK DEVELOPMENT PROCESS

The loading on the various parts of the network are reviewed regularly to identify any breaches to the security criteria. Where breaches are identified investigations are carried out to determine the best solution to reinforce the network. Once the solution has been identified and details defined the project cost is calculated and a capital budget prepared.

Prior to capital investment the following options are considered:

- Increased asset utilisation through advanced automation or dynamic equipment ratings
- Load management including demand-side management
- Level of acceptable risk
- Asset performance improvement
- Customer requirements and customer based solutions
- Capital investment meeting commercial objectives.

Projects are prioritised in accordance with the following criteria:

- Safety, regulatory or environmental issues
- Risk and consequences of project deferral
- Impact on customers
- Project deferral opportunities based on other options
- Rate of return on investment
- Performance and operation of the network
- Synergies with other projects
- Capex/opex optimisation.

Once these checks have been carried out a capital budget for network development projects is finalised.

2 ASSETS COVERED

2.1 GENERAL DESCRIPTION OF DISTRIBUTION AREAS

The Vector supply area covers most of the Auckland region as shown on the following map (Figure 8). Vector operates an electrically contiguous network from Papakura in the south to Rodney in the north. While Vector operates this as a single network it is convenient to describe a southern region and a northern region.

The northern region covers those areas administered by the North Shore City Council, the Waitakere City Council and the Rodney District Council, and consists of residential, commercial and industrial developments in the urban areas and residential and farming communities in the rural areas.

Most commercial and industrial developments centre around the Takapuna, Albany basin, Glenfield, Henderson and Te Atatu areas. New regional commercial centres are being developed as part of the development in growth areas such as Westgate, Orewa/Silverdale and Whenuapai. There are few high density, high rise developments typical of major central business districts (CBDs) but the trend is evolving.

Areas north of the Whangaparaoa Peninsula and west of Henderson and Te Atatu are predominantly rural apart from scattered small townships. Zoning in these areas is largely for farming or conservation use.

The eastern and south eastern parts of Waitakere City and the southern parts of North Shore City consist of medium density urban dwellings that are part of metropolitan Auckland.

The historical development of the electrical network has pivoted around coastal townships that have, in time, expanded with population growth. The first major expansion was the result of Auckland City extending westwards across the isthmus (New Lynn area), with major subsequent growth occurring in the Takapuna area when the Auckland Harbour Bridge was commissioned in 1959. Most of the distribution network was established using overhead construction which has a significant impact on network reliability performance.

With New Zealand Transport Agency's plan to expand the motorway network north of the Albany basin it is expected that urban development will move northwards. The completion of the section of SH1 between Albany and Orewa in 2000 has resulted in accelerated growth in the Silverdale/Orewa areas. The completion of the extension of this motorway to Puhoi in early 2009 is expected to further boost the rate of growth in the area.

The southern region covers areas administered by the Auckland City Council, the Manukau City Council and the Papakura District Council, and consists of residential, commercial and industrial developments in the urban areas and residential and farming communities in the rural areas.

Most commercial and industrial developments centre around the Penrose, Newmarket, St Lukes, Mt Wellington, East Tamaki, Mangere, Takanini and Onehunga areas. Auckland also has the largest CBD development in New Zealand that accommodates the commercial centre of the country. There is also a significant amount of infilled commercial and residential developments scattered throughout the whole region. Development density in the Auckland region tends to be higher than in other regions. This includes high rise residential apartments in the CBD, high density town house developments in suburban areas, industrial parks, etc.

Large scale urban developments are centred around the Flat Bush/East Tamaki/Mangere areas where extensive land stock is available for residential and industrial development.

Vector has a number of large customer sites at various locations in its network. The following are those customer sites with demand above 5MVA:

- Auckland International Airport
- Mangere waste water treatment plant
- Owens Illinois
- Fisher and Paykel appliance factory at East Tamaki
- Pacific Steel
- Ports of Auckland
- Laminex, Penrose
- Coca Cola Amatil (NZ) Limited
- Naval Base, Devonport
- Carter Holt Harvey, Penrose
- Masport Limited
- Westfield NZ Limited: Albany, St Lukes, Manukau.

In addition, Vector also supplies the Fonterra Cheese Factory at Lichfield in the Waikato.

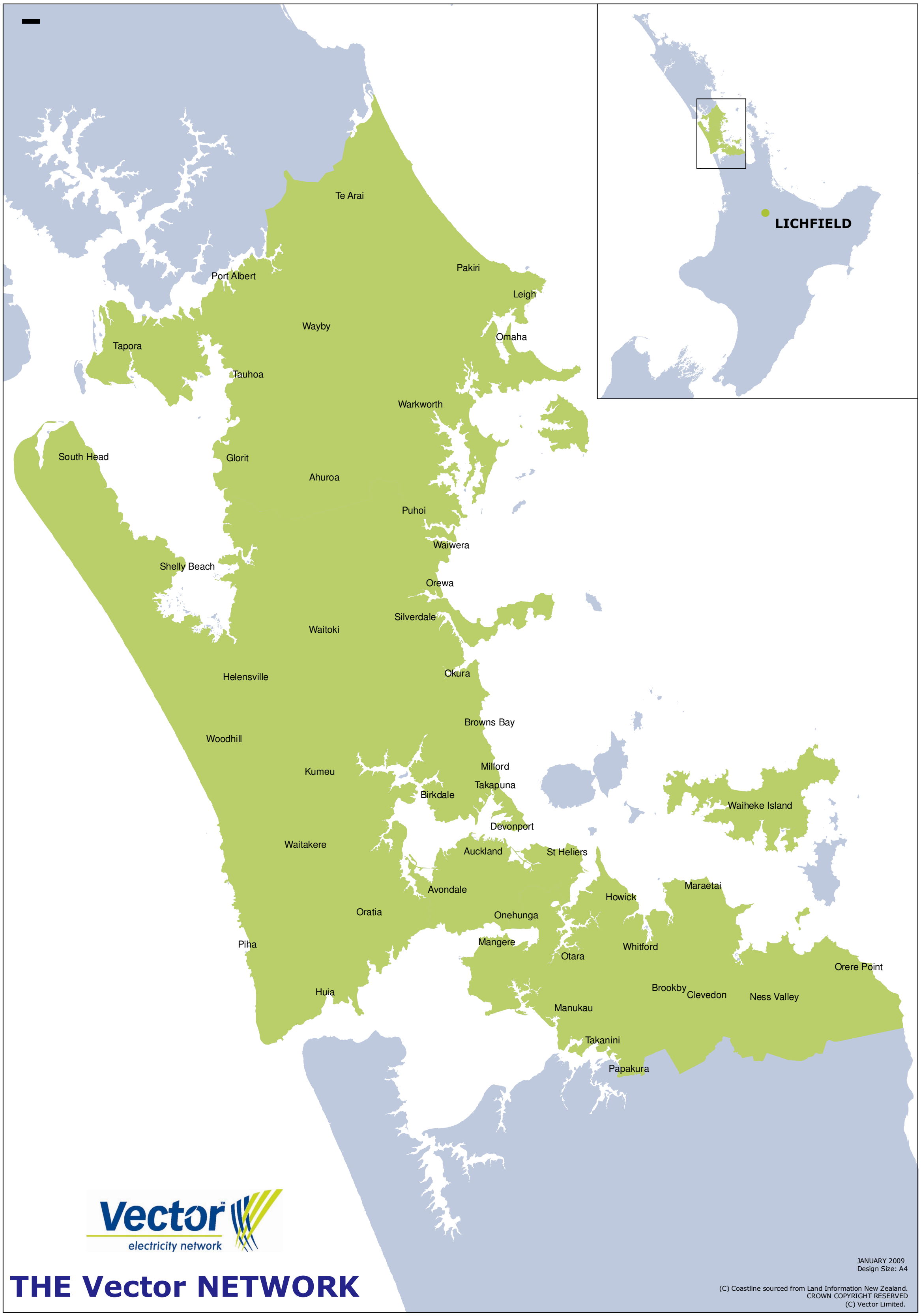


Figure 8 Vector's Supply Area

Figure 9 to Figure 12 below shows the typical load characteristics for different categories of customers.

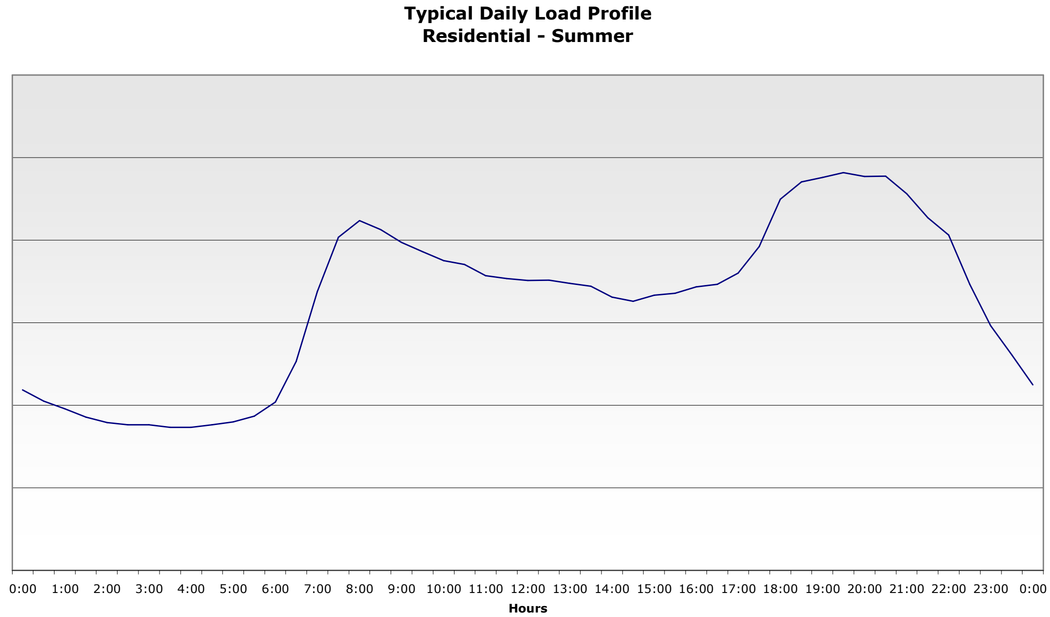


Figure 9 Typical Summer Load Profile for Residential Customers

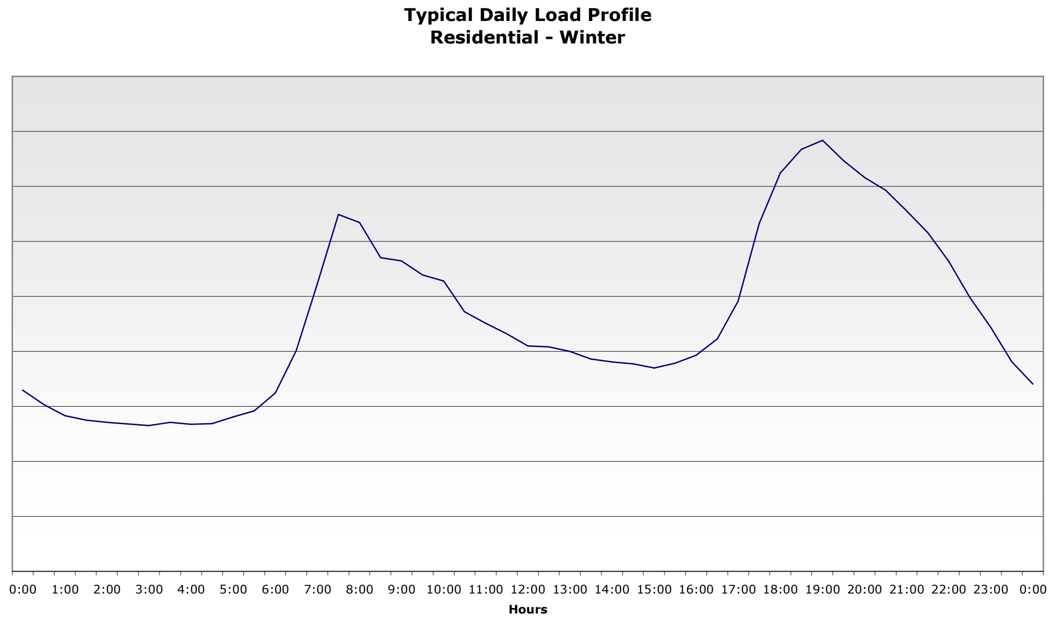


Figure 10 Typical Winter Load Profile for Residential Customers

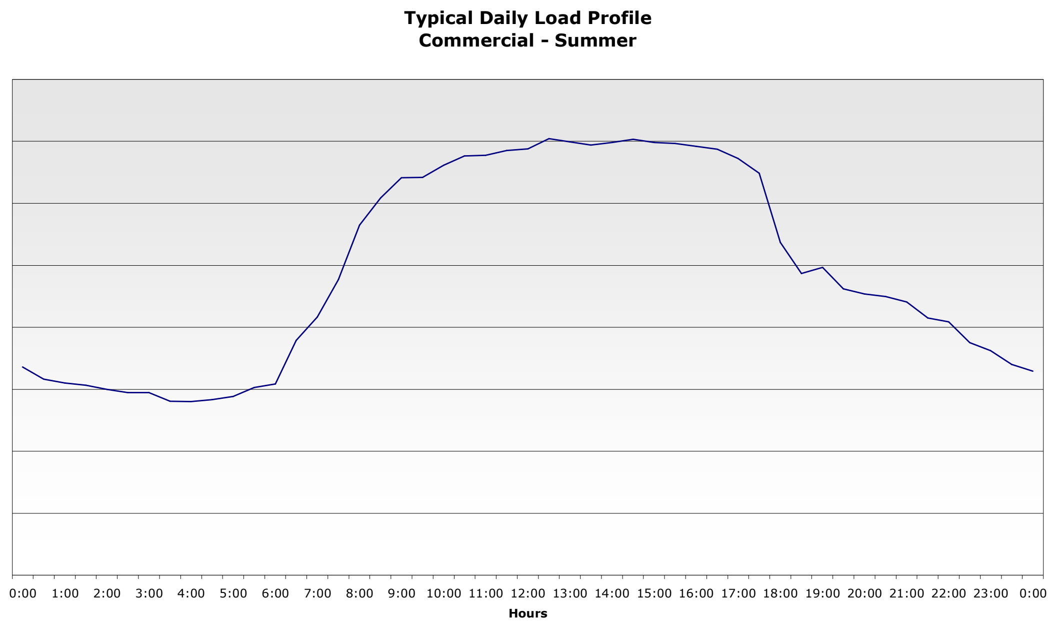


Figure 11 Typical Summer Load Profile for Commercial Customers

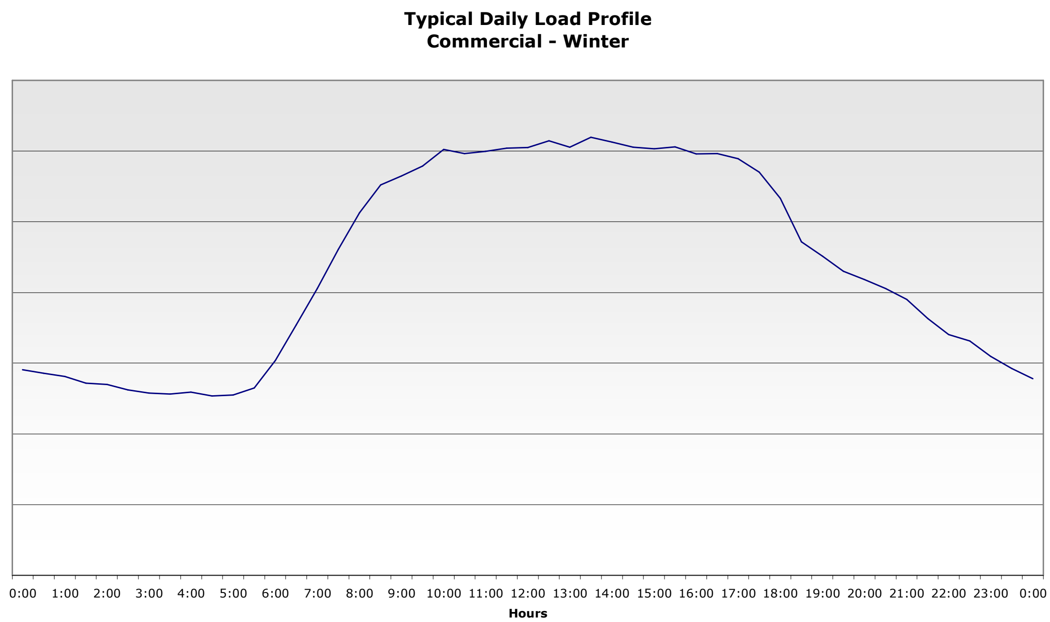


Figure 12 Typical Winter Load Profile for Commercial Customers

A measure of load diversity is achieved with residential customers providing peaks in the morning and early evening, with the commercial load filling in the trough between these peaks. Clearly the mix of customer types on a feeder influences the size and duration of the peaks.

Growing demand for residential air conditioning in summer is increasing overall electricity consumption and is an area that is receiving close attention. Not only is this load unavailable for demand management through traditional load management systems but residential air conditioning systems are relatively cheap to the customer and easy to install.

Summer peaks have already been observed at CBD substations and similar trends are being observed at other substations. This load will eventually create summer peaks on the Vector network which traditionally is winter peaking. The increase in summer demand is being closely monitored as an integral part of the load forecasts procedure. Any breach in security will be identified and reinforcement projects planned and solutions implemented to ensure forecast loads do not exceed the system security criteria outlined in Section 4.

2.1.1 DEMAND FORECASTS

The demand forecasts for zone substations on Vector's network are detailed in Section 4.3. The forecast shows the nominal and cyclic ratings of the zone substation transformers and the associated maximum demand on each zone substation over the planning period. All loads and transformer capacities are in MVA.

Vector's security of supply standards specify that the sub-transmission network and zone substations (with a few pre-identified exceptions) should be able to meet the demand on the substation except for a certain small percentage time in a year. The Commerce Commission's Information Disclosure Requirements however require Vector to present its projected demand against an n-1 security. Vector has therefore inserted an extra column to indicate the extent to which we meet this deterministic standard. It should also be noted that although a number of substations do not meet the n-1 security at a sub-transmission level (they are designed to meet our probabilistic standard), these substations may be supported at a distribution level achieving the same overall security standard.

Network constraints can occur when the forecast load exceeds the equipment ratings. Where constraints are identified projects are initiated and are listed in Section 4.7. This will be discussed in more detail in section 4. The peak demand and total energy delivered by the Vector network during the 2007/08 year are shown below in Table 2.

	Peak Demand* (MW)	Total Energy Delivered (GWh)
From GXPs	1,507	8,540
From embedded generation**	189	115
Total	1,696	8,655

*coincident demand
** embedded generation includes Southdown

Table 2 Peak Demand and Total Energy Delivered 2007/08 Year

2.2 NETWORK CONFIGURATION

The overall architecture of the Vector distribution network is shown in Figure 13 below. The network is made up of three main component networks: transmission, sub-transmission and distribution.

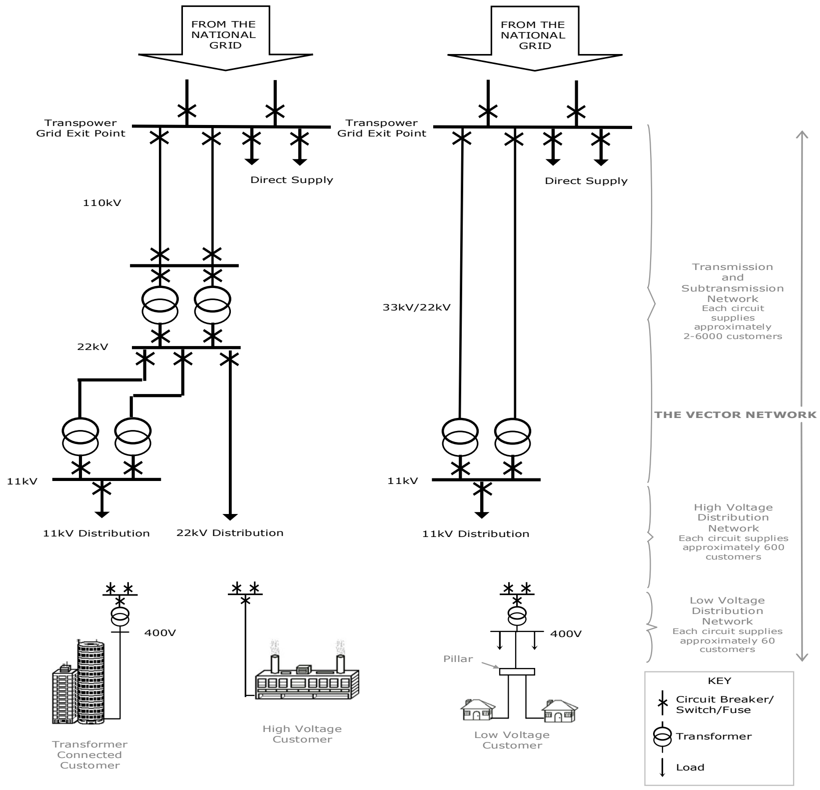


Figure 13 Schematic of Vector's Network

Vector takes supply from the national grid at 110kV, 33kV and 22kV to supply its transmission and distribution networks.

Vector operates five 110kV bulk supply substations and an associated 110kV transmission network[1]. Electricity is converted to 33kV or 22kV at these bulk supply substations to supply its sub-transmission network and zone substations. Each zone substation serves a specific geographic area with known asset and customer characteristics.

At the zone substations the voltages are further stepped down to 22kV[2], 11kV or 6.6kV. The distribution network delivers the electricity to distribution transformers or for some commercial high voltage customers directly to their premises. At the distribution transformers, electricity is stepped down to 400/230V for final delivery to customers.

2.2.1 TRANSMISSION AND SUB-TRANSMISSION NETWORK

The higher voltage transmission and sub-transmission network is designed to transfer large amounts of electricity efficiently. The network transfers electricity from Transpower's network, via 13 GXPs, to 99 zone substations.

The GXPs, their installed capacity and the 2008 peak demand are listed in Table 3.

[1] In addition, there are also individual dedicated Vector 110kV substations for Pacific Steel and the Fonterra cheese factory at Lichfield.
[2] 22kV is used for both sub-transmission and distribution purposes.

Network	Grid Exit Point	Installed Transformer Capacity (MVA)	Firm Capacity (MVA)[1]	2008 Peak Demand (MVA)
Auckland	Mangere 110kV			62
	Mangere 33kV	2*120	108	93.4
	Otahuhu 22kV	2*50	60	49
	Pakuranga 33kV	2*120	136	134.9
	Penrose 110kV			187
	Penrose 33kV[2]	2*160, 1*200	427	237.6
	Penrose 22kV	3*45	90	60.5
	Roskill 110kV			54.3
	Roskill 22kV	2*70, 1*50	141	102.5
	Takanini 33kV	2*150	123	114.6
	Wiri 33kV	1*100, 1*95	107	67.6
	Albany 110kV			130.7
	Albany 33kV	3*120	240	142.7
	Henderson 33kV	2*120	135	99
	Hepburn 33kV	1*85, 2*120	205	117.3
	Silverdale 33kV	1*120, 1*100	100	61.9
	Wellsford 33kV	2*30	31	24.6
Lichfield	Lichfield	2*20	24	6.9

[1] Firm capacity is the cyclic capacity remaining after the loss of one transformer. Reinforcement is indicated if the load exceeds the firm capacity.
[2] Includes 22kV load.

Table 3 GXPs, Capacity and Demand

2.2.2 EMBEDDED GENERATION

The following embedded generation (greater than 1MW) sites are connected to the Vector network:

- Auckland Hospital
- Greenmount landfill power station
- Rosedale landfill power station
- Redvale landfill power station
- Whitford landfill power station.

Southdown power station is connected to the transmission grid at 220kV and is considered as a "notionally embedded generator".

2.2.3 TRANSMISSION AND SUB-TRANSMISSION DESIGN

With the exception of the supply to Liverpool substation the transmission network has been developed as a radial network. At Liverpool substation the 110kV switchboard is connected to Penrose GXP for its main supply and to Mt Roskill GXP for its backup supply. For technical and operational reasons supply cannot be connected to Penrose and Mt Roskill GXPs at the same time. Development of the transmission network is driven by the delivery capacity requirements and security of supply standards at the bulk supply substations.

Sub-transmission networks in the southern region have been designed as underground radial feeders with between one and three transformers at each zone substation. There are no ties between zone substations at sub-transmission level (other than in the CBD). The sub-transmission network in the northern region is developed as a combination of radial and meshed feeders.

The future development of the sub-transmission system is driven by reliability, security and safety requirements, demand growth, the economic environment, design standards and customer service levels. Generally the load on zone substations in the southern region is kept below 30MVA in order to keep the number and size of 11kV distribution feeders radiating from the substations within practical and economic limits. In some cases where the load is relatively concentrated the design maximum load can rise to 50MVA (for example in the CBD or in heavily industrialised areas). In the Auckland CBD the design maximum load for a zone substation supplying the 22kV distribution network is 120MVA.

The sub-transmission network in the northern region is generally overhead and configured in a mesh formation. Security of the network is dependent on the power flow in the network under different contingency conditions. Except for some rural zone substations a well interconnected 11kV network in the region helps to maintain supply security by providing mutual backup for zone substations.

To achieve the required supply security levels managing loss of supply on a single sub-transmission circuit requires the allowable load on a substation to be limited to the sum of the short term ratings of the remaining healthy circuits. This takes into account the cyclic rating of equipment and allows for load in excess of the cyclic rating of the equipment to be offloaded onto adjacent substations within three hours[3]. In the event that the demand exceeds the total remaining capacity (including that of the backstopping circuits) temporary generation or load shedding will be required to ensure the remaining circuits are not loaded above their cyclic ratings.

Table 16 (Section 4.3) illustrates the capacity of zone substations and the voltage of the sub-transmission network.

2.2.4 DISTRIBUTION NETWORK

The function of the distribution network is to deliver electricity from the zone substation to customers. It includes a system of cables and overhead lines, operating at 6.6kV, 11kV, or 22kV, which distribute electricity from the zone substations to smaller distribution substations. Typically anywhere between one and 2,000 customers are supplied by high voltage distribution feeders, the number determined by the load and level of security to be afforded.

At distribution substations the electricity is stepped down to 400/230V and delivered to customers either directly or through a reticulation network of low voltage overhead lines and cables. Approximately 30 to 150 customers are supplied from each distribution substation.

[3] Most electrical equipment can withstand moderate levels of short term loading exceeding normal operating capacity. This allows Vector to conduct switching and reconfiguration of the network to accommodate a sub-transmission fault at a zone substation while maintaining supply through temporarily operating the remaining sub-transmission feeders at their short term cyclical ratings.

For larger loads electricity may be delivered to the customer at 6.6kV, 11kV, 22kV or (for very large loads) 33kV. Four main categories of customer connection are offered and the final network connection type is determined through discussion with the customer. The connection types are:

- Single phase low voltage: typical of low capacity customers such as residential or small commercial, generally supplied from a shared distribution substation
- Three phase low voltage: typical of large residential, commercial or small industrial, generally supplied from a shared distribution substation
- Transformer connection: typically a large commercial or industrial customer where the load is sufficient to warrant a dedicated transformer but supply is provided at 400V
- High voltage connection: these connections are generally associated with larger industrial customers or customers that warrant a number of distributed transformers on their premises. The electricity is supplied at a high voltage, typically 33kV or 11kV.

The distribution network is 53% underground and 47% overhead. All new subdivisions are reticulated underground and parts of the southern region network are being undergrounded. Thus, over time, the percentage of underground network will increase.

2.2.5 DISTRIBUTION DESIGN

The distribution system consists of interconnected radial circuits originating from zone substations. The design is based on the availability of feeder backstopping capacity according to the Vector security standards. A distribution feeder fault may result in an outage but in urban areas supply should largely be restored within two to three hours by switching carried out on the distribution network.

Distribution circuits are controlled by automatic circuit breakers at the zone substations. Further high voltage switches are installed at strategic locations on the network to provide operational flexibility and reduce the SAIDI impact of outages. A current key focus at Vector is on the automation of these switches to improve reliability performance (for the distribution security targets see Section 4.1).

There are a number of large customers in the southern region connected to the network at higher voltage levels. The ownership of the substations serving these customers varies from site to site but generally Vector owns the incoming switchgear and any protection equipment associated with it. The customer owns the transformer(s), any outgoing switchgear and associated protection, and the building.

2.2.6 LOW VOLTAGE NETWORK

While substantial parts of the existing Vector distribution network are still overhead all new subdivisions are reticulated underground. Vector has an ongoing undergrounding programme[4] in the southern region.

[4] This is a Vector obligation in terms of the AECT Trust Deed.

Distribution transformers are designed to supply a predetermined number of customers based on an expected after diversity maximum demand (ADMD) and can withstand some cyclic overloading, based on industry standards. The low voltage cables are configured radially with limited interconnection capacity to other distribution transformers (low voltage cables are not sized to supply adjacent substations). In the event that a transformer fails a mobile generator will be deployed to restore supply while the transformer is replaced.

2.2.7 SCADA

Vector makes extensive use of SCADA systems to provide an overview of network operations for remote switching and control, network protection functions, various measurement and monitoring functions, and for data collection. All zone substations are fully automated and remotely monitored through the SCADA system as well as the automatic switches on the network.

Vector's SCADA consists of a number of sub-systems. These have been installed over time and Vector is currently replacing elements of the system which have been superseded by superior technologies and integrate better with Vector's other business applications.

SCADA Integration Strategy

The integration strategy enables Vector to implement technologies across the whole network using standard communication protocols with the ability to easily migrate to a future overall SCADA system.

SCADA Master Stations

A Siemens Telegyr (PowerTG) master station has been deployed for monitoring and control of the southern region electricity networks. This system is currently undergoing a software and hardware upgrade including more powerful processors and improved testing and staging.

A LN2068 SCADA master station, from Leeds and Northrop, with Foxboro workstations, is used on the northern part of the Auckland electricity network.

Remote Terminal Units (RTU)

Over time a number of different RTUs have been installed in Vector's network, many of which are nearing the end of their technical life or are obsolete. Vector has embarked on a replacement programme enabling a standard RTU to be deployed across the network.

Communication Protocols

A variety of SCADA communication protocols are presently used to communicate between the various SCADA systems and different type of intelligent electronic devices (IEDs) installed on the network.

2.2.8 COMMUNICATION SYSTEM

Vector's communications network consists of differing architectures and technologies some of which are based on proprietary solutions. The physical network infrastructure consists of a mix of optical fibre, copper wire telephone type pilot cables and third party radio communication systems.

The communications network is used for protection signalling, SCADA communications, operational telephony, access security, metering, remote equipment monitoring and automation.

Vector is committed to an open communications architecture based on industry standards. This has resulted in the adoption and deployment of Ethernet and internet protocol (IP) based communication technology.

2.2.9 POWER SYSTEM PROTECTION

The main role of protection relays is to detect network faults and initiate primary circuit isolation upon detection of abnormal conditions. Protection systems take into account the following principles:

- Reliability: the ability of the protection to operate correctly
- Speed: minimum operating time to clear a fault
- Selectivity: disconnection of minimum network sections in order to isolate the fault
- Cost: maximum value from investments.

All new and refurbished substations are equipped with multifunctional intelligent electronic devices (IEDs). Each IED combines protection, control, metering monitoring, and automation functions within a single hardware platform. It also communicates with the substation computer or directly to SCADA central computers over the IP based communication network using industry standard communication protocols.

2.2.10 ENERGY AND POWER QUALITY METERING

Vector's supply point energy and power quality (PQ) metering system consists of a number of intelligent web enabled revenue class energy and PQ meters. The meters communicate to the metering central software over an Ethernet based IP routed communication network.

The metering system provides Vector with essential information about quantity, quality and reliability of the power delivered to Vector's customers, and is currently used to:

- Improve asset utilisation by managing network peak demands
- Provide PQ and load data for network management and planning purposes
- Provide information to assist in the resolution of customer related PQ issues
- Contribute to the power system stability by initiating instantaneous load shedding during under frequency events.

2.2.11 LOAD CONTROL SYSTEM

Vector's load control system consists of a number of audio control frequency ripple control plants, pilot wire and direct current (DC) bias systems, to manage network load. These assets offer the ability to:

- Control residential hot water cylinders and space heating (load shedding)
- Control streetlighting
- Meter switch for tariff control
- Time shift load to improve network asset utilisation
- Time shift load to defer reinforcement of network assets
- Manage GXP demand charges from Transpower.

Load control equipment utilises older technology much of which is approaching the end of its life. In time there will be a convergence with newer metering technologies and it is anticipated that the audio frequency ripple plants and the pilot wire system may be phased out.

2.3 DESCRIPTION OF ASSETS

2.3.1 OVERHEAD NETWORK

Overhead Lines

The overhead system consists of 26km of 110kV line, 378km of 33kV line, 4km of 22kV (linked to the adjacent Counties Power network), 3,893km of 11kV line and 4,257km of 400V line. There is still 24km of 6.6kV line in service in the southern region but this is being progressively uprated to 11kV. Around 115,000 poles support the overhead distribution network of which 11% are wood and the rest concrete. (There are also 118 steel towers on the northern region network.)

In Figure 14 the age profile of the overhead network is presented.

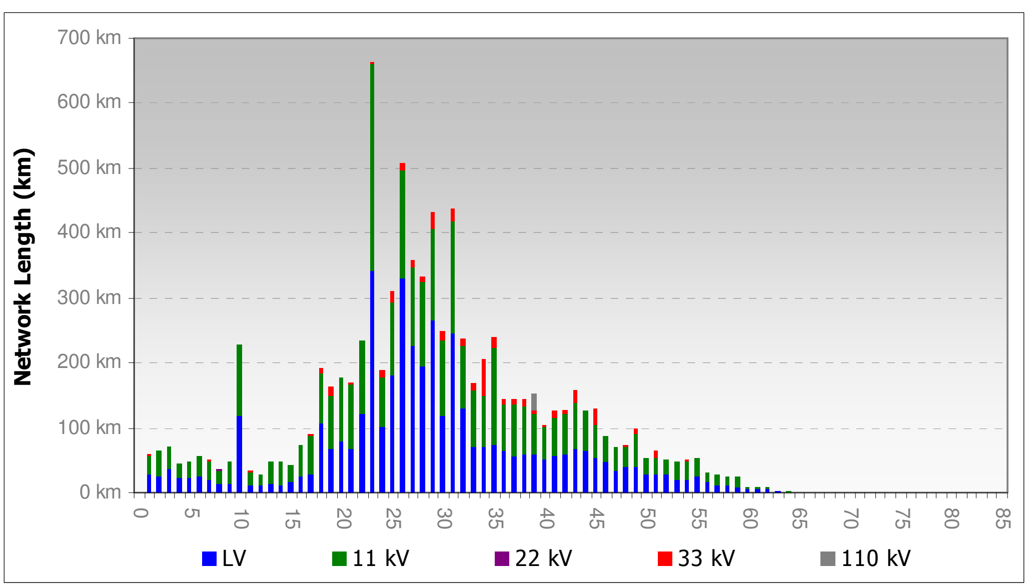


Figure 14 Overhead Lines Age Profile

The poles have an average age of 29 years; however there are a large number (24%) older than 40 years. The expected life of a wood pole is 40 years, 60 years for concrete. Relatively few new wood poles have been installed since the early 1960s. In the 1980s pole nails were installed on wood poles in the southern region as a way of extending the life of the poles. This was very successful and some of these poles are still in service today. In general, poles are in fair to good condition.

Vector has replacement programmes in place for poles that have reached the end of their economic lives. This is further described in Section 5.

The circuits supported by the steel towers range in voltage from 110kV to 400V with most having been in service for more than 70 years. Almost all of these have now been thoroughly refurbished.

Conductors vary across the overhead network but are predominantly copper (Cu), all aluminium conductor (AAC) and aluminium conductor steel reinforced (ACSR) conductors. New line reconstruction utilises all aluminium alloy conductors (AAAC).

Low voltage aerial bundle conductor (LVABC) and covered conductor thick (CCT) for 11kV lines are used in areas susceptible to tree damage. There is a small section of high voltage aerial bundle conductor (HVABC) which was installed about 15 years ago. Although the material proved to be effective for improving reliability, it was not continued with because of high installation costs.

Conductors are generally in good condition.

The crossarms on the network are mostly hardwood (99%) and are in a fair to poor condition. The remaining few are steel (and in acceptable condition), Crossarms are progressively being replaced under Vector's pole replacement programme.

Fault passage indicators, both remote and local, have been installed at most major tee offs on the overhead lines. These assist maintenance crews with fault finding and also to track the root cause of problems.

Overhead Switches

There are 1,179 air break switches (ABS) and 314 sulphur hexafluoride (SF_6) filled switches installed to facilitate network operation, reduce impact of faults on customers and enhance reliability performance. Most of the ABSs are more than 20 years old and in fair to poor condition. The policy is that ABSs meeting the criteria for end of life replacement are replaced with SF_6 units, and in addition when block replacement and pole replacements occur the associated ABSs will be replaced with SF_6 units. The vast majority of the SF_6 switches are less than seven years old and all are in excellent condition.

In Figure 15 the age profile of the switches is provided.

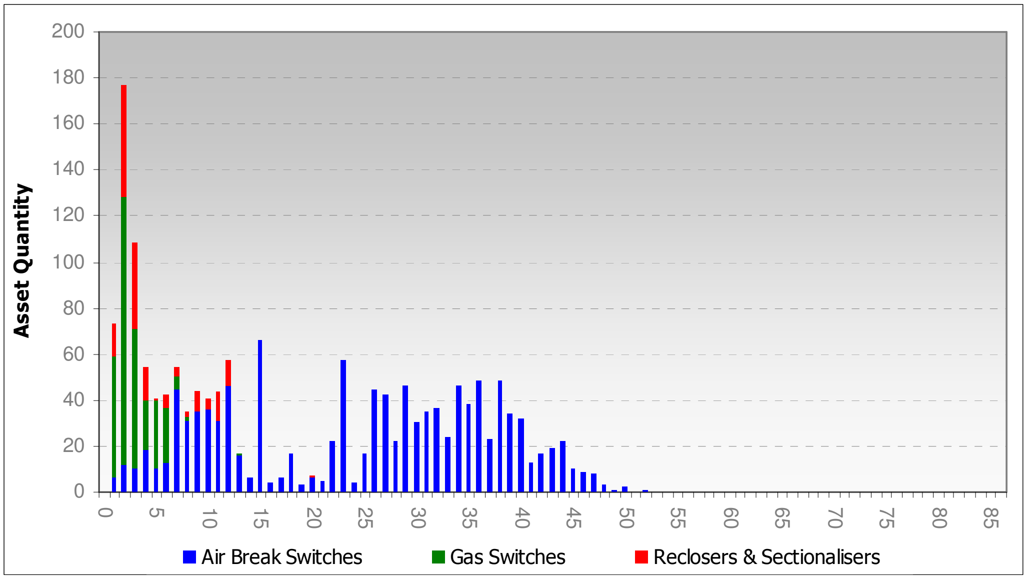


Figure 15 Overhead Switches Age Profile

There are 165 oil filled, SF_6 and vacuum reclosers and sectionalisers on the network. The older reclosers are oil filled and are in good condition. All other reclosers are less than 12 years old and in excellent condition.

2.3.2 SUB-TRANSMISSION CABLES

The sub-transmission network consists of 545km of cables rated at 110kV, 33kV and 22kV as detailed below. The length weighted average age of the cables is 27 years.

A breakdown of the cable network is provided in Table 4 and the age profile of sub-transmission cables is indicated in Figure 16.

Cable Type	110kV	33kV	22kV	Total Circuit Length (km)
Underground PILC	0km	19km	69km	89km
Underground XLPE	28km	208km	27km	263km
Underground Fluid Filled	18km	127km	24km	168km
Underground Gas Pressurised	20km	0km	5km	25km
Total by Voltage	66km	354km	125km	545km

Table 4 Sub-transmission Cables by Lengths and Voltage

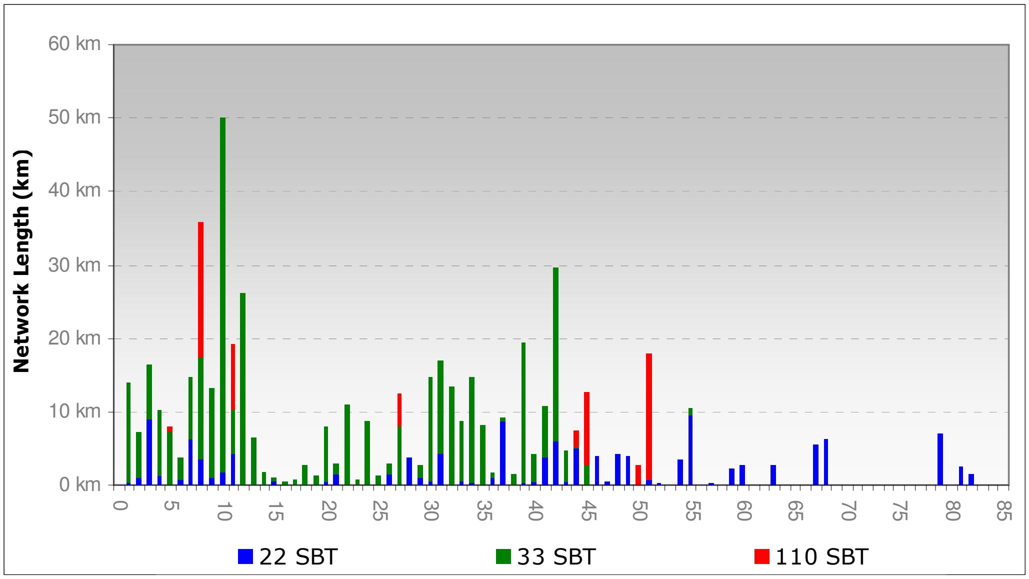


Figure 16 Sub-transmission Cable Age Profiles

On average the sub-transmission cables are 27 years old and generally they are in good to very good condition.

Two cross linked polyethylene cable (XLPE) circuits installed in the late 1990s have had a number of premature joint failures, and following further failures over the last 12 months, all the joints on these circuits have been replaced.

Selected circuits are subject to ongoing partial discharge testing to gain an early indication of any problems. There are also some older gas filled cables that are starting to exhibit signs of ageing with increasing frequencies of gas leakage. This is closely monitored and a number of these cables have been programmed for replacement within the planning period.

2.3.3 DISTRIBUTION CABLES

The underground distribution network is via 23km of 22kV, 3,751km of 11kV, 48km of 6.6kV and 5,122km of 400V cables.

The 6.6kV and the older 11kV cables are paper insulated lead cables (PILC) or paper insulated aluminium sheath (PIAS) construction while the more recent 11kV and the 22kV cables are XLPE insulated. The PILC cables are in good condition although some early 1950s cables have been failing. There is a concern that the PIAS cable may be subject to corrosion of the extruded aluminium sheath and while some cable has been replaced over the last few years there is no evidence yet that this is likely to become a major problem.

The XLPE insulated cables are in good condition with the exception of the early natural polyethylene cables which are prone to develop water trees and fail. A programme to proactively replace these cables is being implemented.

The age profile for the distribution cable network is provided in Figure 17.

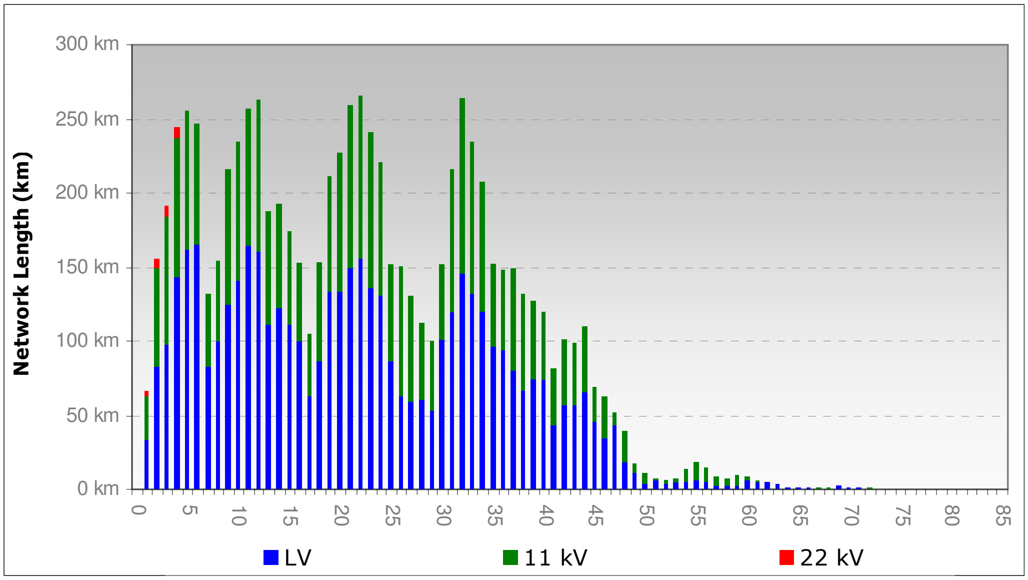


Figure 17 Distribution Cables Age Profile

Old 400V cables are PILC construction while newer cables utilise either PVC or XLPE insulation. In general the PILC and XLPE cables are in good condition. Some of the single core polyvinyl chloride (PVC) cables have failed and this may become an issue in the future. This is being closely monitored.

Pillars and Pits

Pillars and pits provide the point for a service cable to connect to Vector's reticulation. They contain the fuses necessary to isolate the service cable from the network distribution cable and to prevent major damage to the service cable following a fault in the installation.

For loads up to 100 amps an underground pit has largely superseded the above ground pillar for new work, although there are still some applications where a pillar will be preferred.

Pits are manufactured from polyethylene as are most of the newer pillars. Earlier pillars have made use of concrete pipe, steel and aluminium.

The older pillars which have mild steel components are showing signs of age and in many cases the steel portion is suffering from severe corrosion - regular replacement of individual pillars is being undertaken. A particular type of pillar with a concrete base and an aluminium lid was identified as being a prospective safety hazard and is the subject of a targeted replacement programme.

The older polyethylene pillars are generally adequate for their purpose although many have suffered knocks and minor vehicle impact.

Installation of pits began about 10 years ago and comprehensive inspections to date have not shown up any potential maintenance issues.

2.3.4 SUB-TRANSMISSION TRANSFORMERS

Vector owns 196 sub-transmission transformers including two at Lichfield which lies outside of Vector's main supply network. There are 16 transformers with a primary voltage of 110kV, 137 at 33kV and 43 at 22kV ranging in rating from 5MVA to 65MVA. The age profile of the sub-transmission transformers is shown in Figure 18 below.

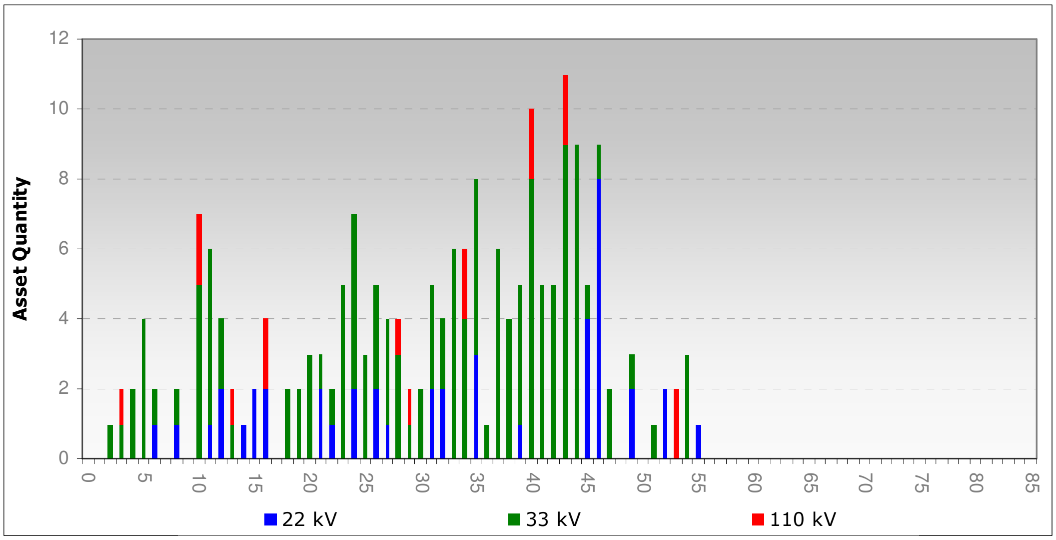


Figure 18 Sub-transmission Transformers

The transformer population is in good condition overall but there are a small number where tests indicate they are coming to the end of their technical life. These are monitored closely. The design life is 45 years but if a transformer is not subject to abnormal operating conditions and is well maintained this life can normally be economically extended.

2.3.5 CIRCUIT BREAKERS

There are 1,536 circuit breakers (CBs) on Vector's network. Thirty five 33kV CBs are installed at Transpower GXPs with the remainder installed at Vector Zone Substations. Vector also owns two 110kV CBs and associated isolators at Lichfield and a nine bay double busbar 110kV gas insulated switchgear at Liverpool Street.

Zone substations contain CBs in either an indoor switchboard configuration (consisting of multiple CBs connected to a common bus) or individually connected in outdoor switchyards.

The CBs range from new to over 50 years of age; an age profile is provided in Figure 19. Further, the CBs consist of a mix of technologies which also corresponds to the relative age of the equipment. The oil type circuit breakers are the oldest in the network with an average age of 34 years and these constitute 64% of the asset followed by SF_6 at 19% and vacuum at 17% .

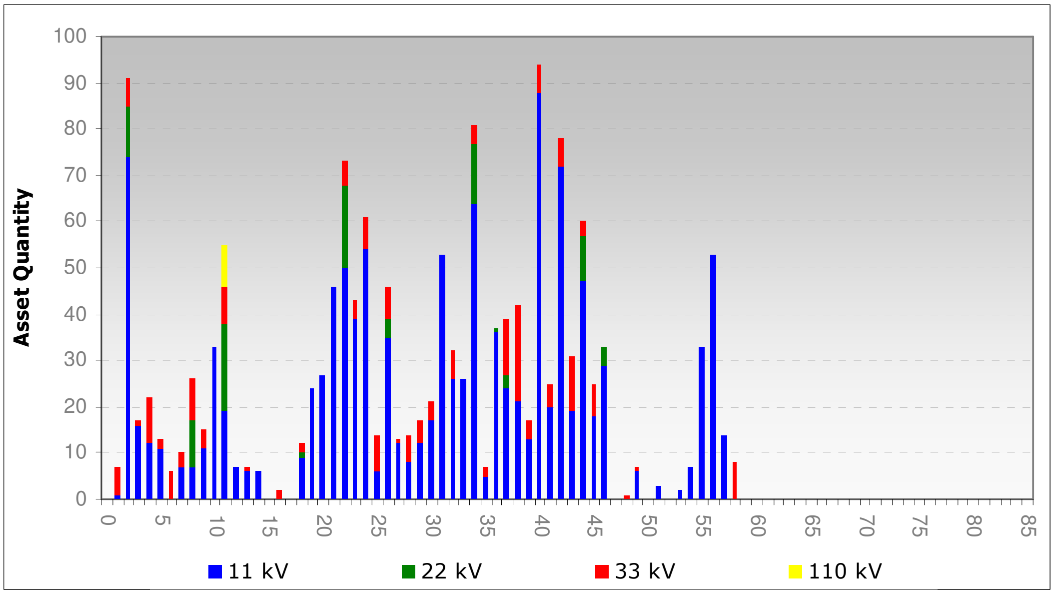


Figure 19 Circuit Breaker Age Profile

The majority of CBs (75%) are less than 40 years of age. The bulk of installations occurred in two waves: in the 1965-70 era and to a lesser extent in the 1980s.

The SF_6 and vacuum CBs are the newest in the networks with average ages of 12 and 15 years respectively. They are generally in very good condition and pose little risk to the network due to modern manufacturing technologies, higher specifications and compliance with the latest international equipment standards. However there are eight Motorpol outdoor SF_6 33kV circuit breakers manufactured in the late 1990s currently being replaced due to latent design defects.

The oil type CBs are approaching the end of their technical life. Failures and a lack of spare parts are causing concern over this aged equipment. Systematic replacement programmes for the worst affected CBs are underway.

2.3.6 ZONE SUBSTATION BUILDINGS

There are 99 buildings located at zone substations in the Vector network. These buildings are generally stand alone and house switchgear, protection equipment, ancillary supplies plus, in some instances, transformers and ripple injection equipment. An age profile of the buildings is provided in Figure 20.

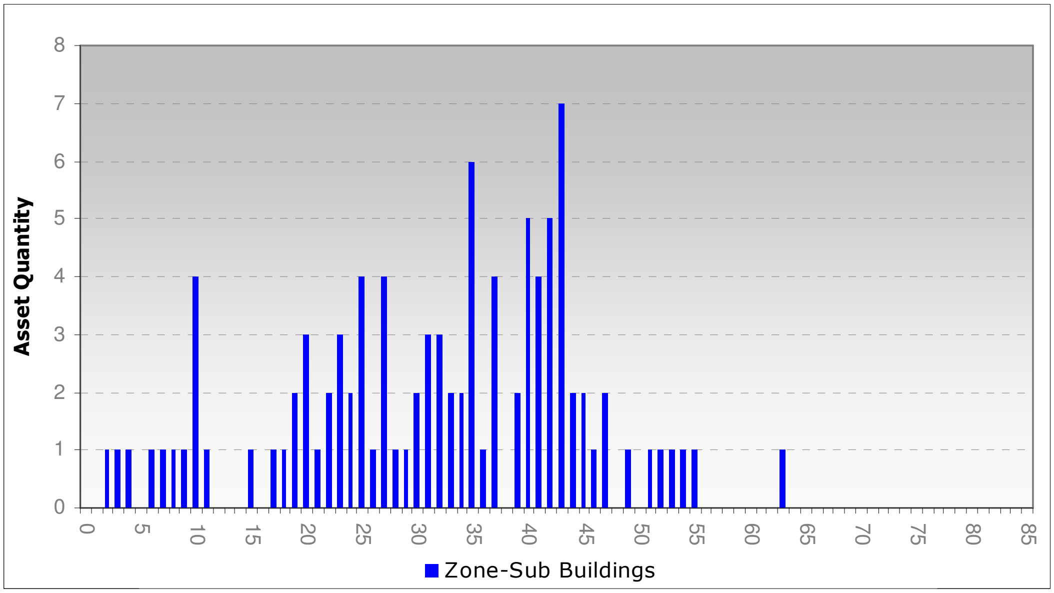


Figure 20 Zone Substation Building Age Profile

The average age of the buildings is 32 years and they are generally in good condition.

2.3.7 PROTECTION SYSTEM

Vector operates more than 2,538 protection relays of which 61% are electromechanical, 8% static (solid state) and 31% of digital or numerical type. An age profile of Vector's protection systems is provided in Figure 21.

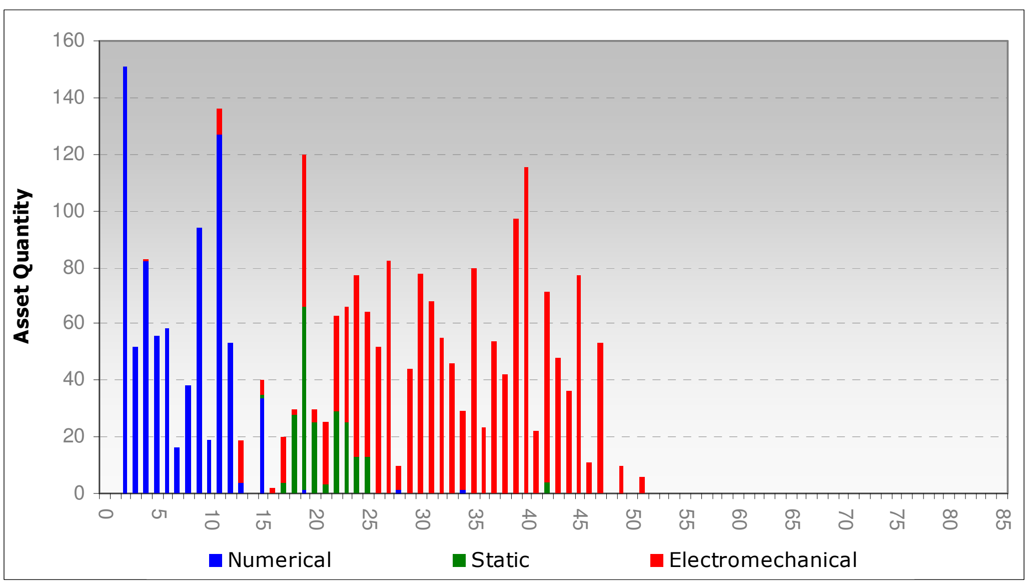


Figure 21 Protection Relays Age Profile

There are still a small number of Nilstat ITP relays in service and these are currently being replaced due to poor performance. The remaining relays are generally in a good condition.

2.3.8 SUBSTATION DC AUXILIARY SUPPLY

There are 252 DC auxiliary systems with an average age of 23 years that provide power supply to the substation protection, control, metering, monitoring, automation and communication systems, as well as power to the circuit breaker tripping and closing coils. These systems are in good condition. An age profile is provided in Figure 22.

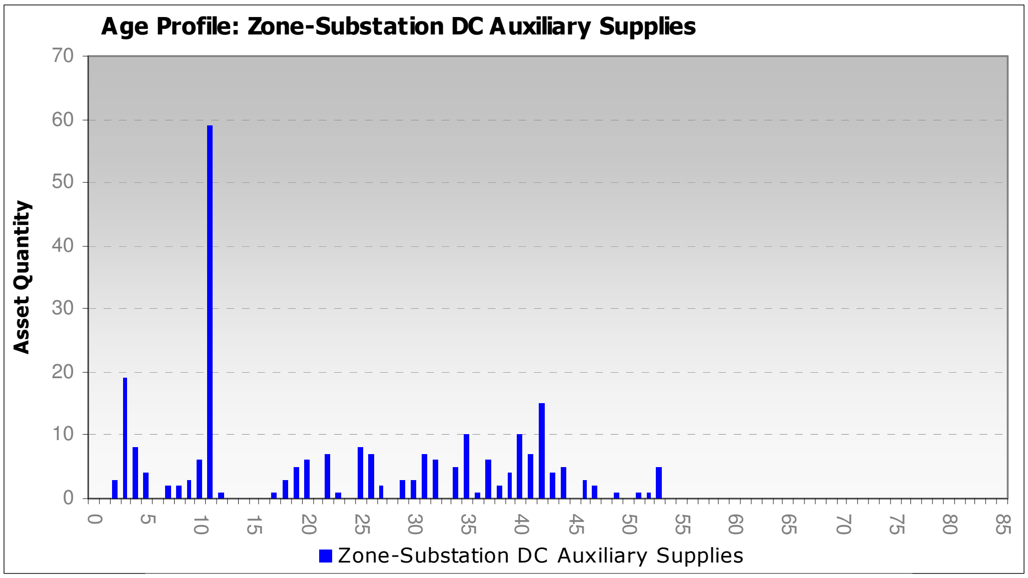


Figure 22 DC Auxiliary Supplies Age Profile

Vector’s standard DC auxiliary systems consist of a dual string of batteries, battery charger, a number of DC/DC converters and a battery monitoring system.

The major substations are equipped with a redundant DC auxiliary system.

2.3.9 SCADA

There are two SCADA systems in use to monitor network status and provide operational control of the network. This ranges from the master stations based in the main Auckland office to the RTUs at GXPs and zone substations. The SCADA consists of three sub-systems: the main SCADA system, the ripple control system and metering system. Over time the two SCADA systems will be amalgamated.

Zone substation automation is based on the International Electrotechnical Commission (IEC) 61850 standard (communications networks and systems in substations) and IP based communication networks.

There are 148 RTUs of various types in operation across the network and they are generally in a fair condition.

2.3.10 LOAD CONTROL SYSTEM

There are four load control systems operating across the networks which are used for:

- Network capacity
- Transmission capacity
- Streetlight control
- Tariff switching
- Grid security.

The receivers and contactors at customer premises for each of the systems are generally owned by the retailers. Streetlight receivers are owned by Vector. A load control equipment age profile is provided in Figure 23.

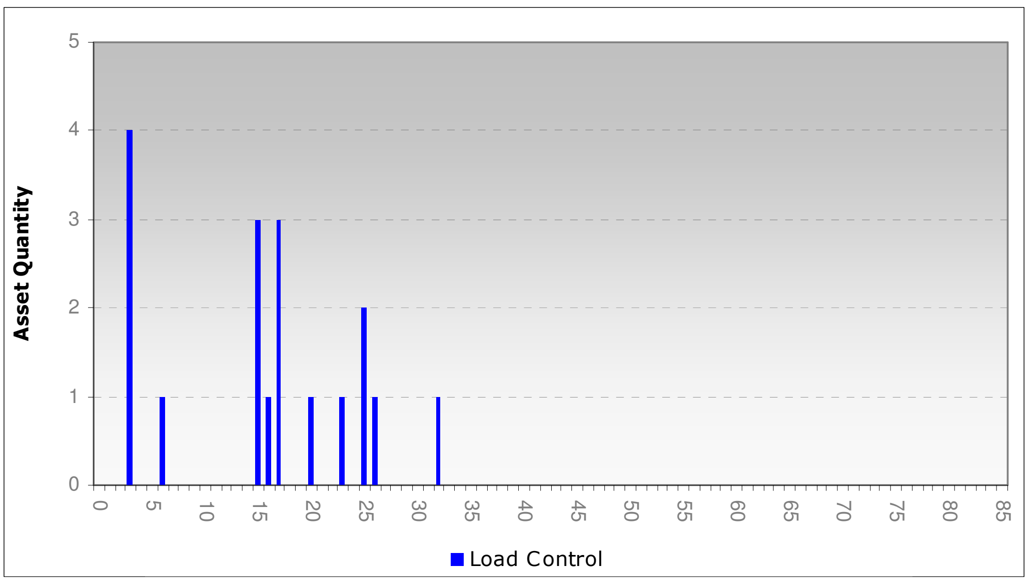


Figure 23 Load Control Equipment Age Profile

Southern Region

In the southern region load control is managed by a 475 Hz ripple control system. There are 15 solid state injection plants located at the Transpower points of supply for injection onto the 33kV and 22kV sub-transmission system. There are also seven 11kV solid state injection plants located at zone substations that supply the Auckland CBD. This equipment is on average 13 years old, has been well maintained, and is in good condition.

Northern Region

The southern and western parts of this region use two types of load control systems, namely ripple control at 1050 Hz, and pilot wire. The ripple control system is used to trigger the pilot systems in urban areas and there are also pilot wires emanating from most zone substations.

Ripple Control

There are nine rotary ripple control plants situated at various zone substations around the network with eight being installed between 1960 and 1964 and one installed in 1975. This equipment has been well maintained over its life and is in good condition.

Pilot Wire Control

The pilot wire control system uses equipment in the zone substations to send control signals along starting pilot wires. Pick up relays are situated at regular intervals along the 11kV feeders to detect the pilot signal and drive the signal onto the next section. There are also check back relays located on 11kV feeders to provide feedback for the SCADA system. The pilot wire equipment is approximately 60 years old and is fair condition. It is unreliable in extreme weather events and restoration of the system can take several days.

The Warkworth and Wellsford areas have their load controlled by the Cyclo control system. The two Cyclo control transmitters located in the zone substations at Warkworth and Wellsford are 26 years old. The performance of Cyclo control system is satisfactory with failures occurring on average once every two years mainly due to lightning. There are no spare parts available for the Cyclo control plants. The silicon controlled rectifiers are difficult to source from GEC.

In conjunction with the rolling out of the smart metering in the Vector network area, consideration is being given to the adoption of the smart metering technology as a replacement technology for the ageing load control systems.

2.3.11 ENERGY AND POWER QUALITY METERS

Most consumer energy meters on the Vector network are owned by metering companies operating in the Vector supply area. Vector’s distribution business generally focuses only on the electricity flowing through the system at substations and feeders (Vector owns a separate, non regulated metering business which does own consumer meters and is promoting the use of smart metering systems).

Vector’s bulk metering system, installed in GXPs in the southern region, consists of 35 intelligent web enabled revenue class energy and PQ meters communicating within the metering central server over an Ethernet based IP routed communication network.

This system provides information to assist in the control of demand, quality and reliability of the power delivered to customers. It is currently used to:

- Improve operational efficiency by controlling peak demands at the GXPs which ultimately reflects in reduced line charges
- Provide comprehensive PQ and reliability information that will enable the verification of quality of power delivered to customers against the published Vector service levels, and faster resolutions of PQ issues
- Increase the power supply stability at the national grid level by initiating instantaneous load shedding during grid under frequency events.

These meters have been installed since 1999 and are in very good condition.

2.3.12 DISTRIBUTION TRANSFORMERS

Vector owns and operates approximately 20,806 distribution transformers of which 62% are ground mounted and 38% are pole mounted. Ground mounted transformers are either stand alone, enclosed in metal or fibreglass canopies, open enclosures, or fully enclosed within other buildings. The transformers are generally 11kV/415V and rated between 30 and 1,500kVA, although there are a small number rated at 1.5kVA, 5kVA, 7.5kVA and 10kVA. There are some 11/6.6kV auto transformers for special applications.

With the development of the 22kV distribution network in the Auckland CBD and Highbrook Business Park, 22kV/415V transformers are also being used. Transformers for these networks are rated between 300kVA and 1,000kVA.

An age profile of Vector's distribution transformers is provided in Figure 24.

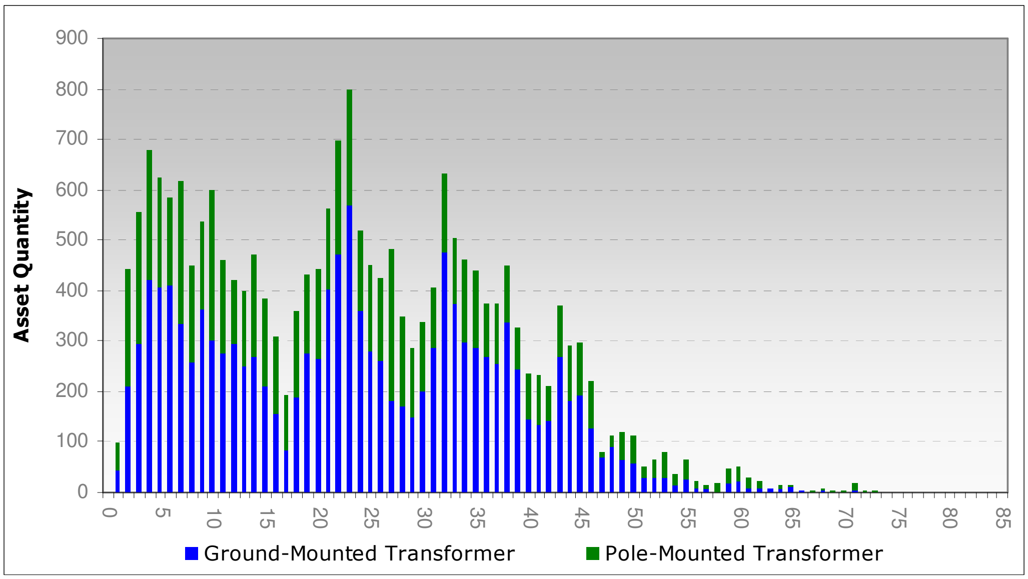


Figure 24 Distribution Transformers Age Profile

In general, transformer condition has improved due to recent renewal programmes across the network. These replacements have been done predominantly for rusting units or those with oil leaks. Many of the transformers have been replaced with refurbished transformers.

2.3.13 GROUND MOUNTED DISTRIBUTION SWITCHGEAR

Vector owns and operates more than 2,435 ground mounted switchgear made up of oil, SF_6 and resin insulated equipment of varying ages and manufacturers. The majority of the switchgear is 11kV with a very small quantity of 6.6kV units. 24kV rated SF_6 switchgear is installed on the 22kV distribution networks in the Auckland CBD and Highbrook Business Park.

An age profile of Vector's ground mounted distribution switchgear is provided in Figure 25.

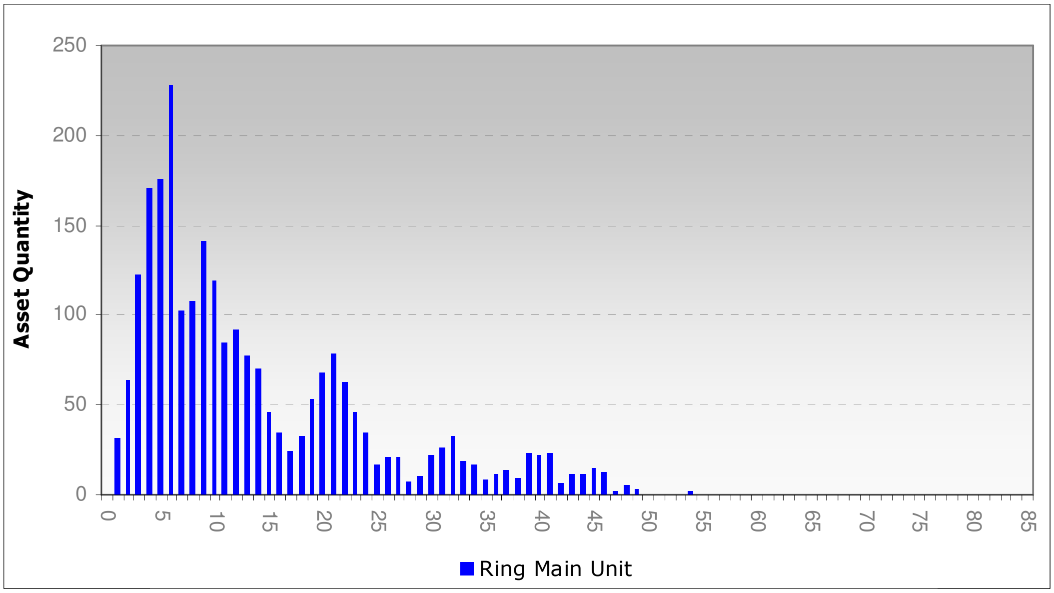


Figure 25 Ground Mounted Distribution Switchgear Age Profile

In general these assets have had recent renewal programmes similar to that for distribution transformers. Some replacements have also been driven by transformer replacement by either being physically attached to a transformer requiring replacement or where there is synergy opportunity to replace during other work. Other general causes for replacement are corrosion, minor oil leaks and, to a lesser degree, vehicle damage.

2.3.14 MOBILE GENERATOR CONNECTION UNITS

Vector has two mobile generator connection units (MGCUs) which can be transported to site and connected to hired generators to restore power in case of network failures. Each MGCU contains a 2.5MVA 415V/11kV transformer, low voltage (LV) and 11kV switchgear, protection and accessories. Both MGCUs were commissioned in 2005.

2.3.15 POWER FACTOR CORRECTION PLANT

There are a number of capacitor banks installed across the network to improve power factor and provide voltage support.

In the southern region there are 153MVAr of capacitor banks installed in 25 zone substations. These capacitor banks are connected to the 11kV bus at zone substations and are rated at 3MVAr each. Up to three banks are connected to a zone substation. In the northern region there are 75 pole mounted 11kV capacitor banks each rated at 750kVAr and two ground mounted 33kV bus connected capacitor banks rated at 18MVAr connected to the 33kV bus at Wairau substation.

The majority of the 11KV capacitor banks in both regions were installed during 1998/99 and are generally in a fair to good condition.

2.4 JUSTIFICATION FOR ASSETS

Network assets are created for a number of reasons. It should be noted that while asset investment is often the most effective and convenient means of addressing network issues. Vector also considers other solutions to network issues and applies these where practical and economic. Such alternatives may include network reconfiguration, asset refurbishment, adopting non network solutions or entering into load profiling arrangements with customers.

The key factors leading to asset investment at Vector are:

- Health and safety: where health and safety concerns indicate the need for asset investment, this takes priority
- Legal and regulatory compliance: ensuring that Vector is not in breach of statutory obligations of electricity service providers or regulatory requirements
- Capacity: maintaining sufficient network capacity to supply the needs of consumers is a key driver for asset investment
- New developments: where new building or urban developments occur, or existing developments are extended, this usually requires investment in network assets
- Security of supply standards: Vector is committed to meeting its security of supply standards, and potential breaches of these often indicate a need for asset investment
- Customer requirements: assets are often installed at the behest of customers (who then normally contribute to the investment cost)
- Renewal: assets are usually replaced when they have deteriorated to the extent that they pose a safety or reliability risk, or have reached the end of their economic lives (where maintenance or refurbishment start to be more expensive than replacing an asset)
- Technology improvements: when technology becomes obsolete and assets can no longer fulfil the basic requirements of a modern, effective network, this may give rise to replacement expenditure.

In Section 4.2 the general project prioritisation sequence is discussed.

As illustrated in Section 4.1, network standards vary over different parts of the network and for different customers. The associated network assets also vary accordingly.

The network is designed in accordance with Vector's security standards as detailed under Section 4.1. Breaches of security standards highlight the need for additional capacity or other non network solutions. If the optimal solution involves a network solution the security shortfall identifies the capacity of assets that need to be installed or upgraded to meet the standards.

Network equipment specifications ensure that optimally rated equipment is installed to meet a range of possible distribution situations. However, in order to limit the cost of maintaining excessive spares a restricted range of equipment and capacities are available for use on the network. On occasion this leads to network component over capacity, although careful design and planning mitigates this.

Uncertainty of load due to weather and the need to provide for operational contingencies such as faults mean that equipment must have an inbuilt capacity margin when installed. Careful planning has ensured that any such capacity margin is kept to a minimum within the framework of standardisation.

Load growth, load density and historical network architecture result in varying states of security throughout the network. While historical network architectures converge over time the cost of aligning standards in the short term is prohibitive. As assets are replaced or new assets added to the network the new assets are generally designed to comply with the present standard specifications. Equipment standards are selected to be cost effective and appropriate for the situation in which it is to be used.

Vector's network investment has traditionally been very prudent, meeting only realistic network requirements. This is also illustrated by the most recent optimised deprival valuation (ODV) of the electricity network carried out in 2004. For this ODV, Vector recorded $51.6m of optimisation for its Auckland assets, being assets deemed unnecessary for current requirements due to stranding, over capacity for current demand or other similar factors. This figure equates to 3.4% of the corresponding ODV, a very small margin[5].

3 SERVICE LEVELS

This section describes the asset performance targets set under Vector's asset management strategy.

3.1 CONSUMER ORIENTED PERFORMANCE TARGETS

Our service goal is to provide all our customers with a reliable, safe and secure supply of electricity. From an asset management perspective this challenge requires effective and efficient network solutions that can balance these expectations with the optimum investment required.

3.1.1 CUSTOMER EXPECTATIONS

Vector is committed to providing a high standard of service and a reliable electricity supply. As such we recognise that communication is essential in order to improve and understand what services and products our customers like and what they don't like.

Customers are widely consulted and are able to feed back their expectations through a variety of contact points:

- Call centre representatives
- Customer service team representatives
- Operations and project representatives

[5] In practice there is always likely to be some optimisation required. This is mainly as a result of the optimisation process applying shorter planning windows than the engineering design process (for example, a zone substation transformer typically has a 40 year life and engineering planning therefore has to look at utilisation over an extended period, whereas the prescribed optimisation planning window for these assets is only 10 years). Furthermore, stranded assets can by definition not always be avoided by utilities; these mainly arise when previous customers terminate or downscale their original activities for which network capacity was originally required.

- Service provider/contracting representatives
- Customer service feedback surveys
- Customer engagement surveys
- External publications and websites.

Keeping engaged and aligned with changing customer expectations is absolutely fundamental to optimal asset investment and asset management practices. Vector's larger scale engagements tend to focus on councils and community groups. In terms of individual engagement the most significant feedback comes from our bi-annual consumer surveys.

Customer service levels are determined based on consumer surveys. Recent surveys covering the full network extent were performed in 2006 and 2008. The intention of both engagement surveys was to draw out customer preferences around the level of supply reliability that customers required or are satisfied with in terms of outages and duration of outages, and the amount they would be prepared to pay to alter these parameters.

Vector's Customer Service Target: 83% or Greater Satisfaction

The 2006 sample size covered 2,141 residential customers. The standard margin of error at the 95% confidence level is +/- 2.1%. Rural customer representation was 958 (45%), urban representation was 1,183. Data collection was conducted during March 2006.

The 2008 sample size covered 1,500 residential customers. The standard margin of error at the 95% confidence level is +/- 2.5%. Rural customer representation was 671 (45%), urban representation was 829. Data collection was conducted during December 2007 and January 2008.

Both researches were undertaken by computer assisted telephone interviewing (CATI). Participants were identified as the "person most responsible for making decisions relating to electricity".

The results of both the 2006 and 2008 surveys are presented as follows: Table 5, rural residential customers and Table 6, urban residential customers.

Rural Customer Survey Statement	05/06	07/08
Satisfied with the value for money regarding their electricity supply.	70%	70%
Rate the current service provided by Vector as adequate or better.	74%	79%
Believe they have experienced less than 3 outages over 12 months.	37%	32%
Believe they have experienced less than 6 outages over 12 months.	68%	61%
Rate the frequency of outages experienced to be acceptable.	58%	50%
Do not wish to pay an additional amount for fewer outages.	85%	82%
Do not wish to pay an additional amount for NO outages.	84%	85%
Consider a maximum of 3 outages per annum to be acceptable.	76%	72%
Believe the last outage they experienced was less than 3 hours.	67%	48%
Believe the last outage they experienced was more than 3 hours.	16%	33%
Rate the duration of the last outage experienced to be acceptable.	49%	49%
Do not wish to pay an additional amount for shorter duration outages.	87%	89%
Consider a 30 to 60 minute outage to be acceptable.	30%	61%

Table 5 Rural Residential Customer Preferences

Urban Customer Survey Statement	05/06	07/08
Satisfied with the value for money regarding their electricity supply.	81%	79%
Rate the current service provided by Vector as adequate or better.	84%	91%
Believe they have experienced less than 3 outages over 12 months.	74%	74%
Believe they have experienced less than 6 outages over 12 months.	92%	89%
Rate the frequency of outages experienced to be acceptable.	77%	71%
Do not wish to pay an additional amount for fewer outages.	79%	85%
Do not wish to pay an additional amount for NO outages.	82%	84%
Consider a maximum of 3 outages per annum to be acceptable.	76%	81%
Believe the last outage they experienced was less than 3 hours.	55%	58%
Believe the last outage they experienced was more than 3 hours.	10%	23%
Rate the duration of the last outage experienced to be acceptable.	68%	63%
Do not wish to pay an additional amount for shorter duration outages.	85%	90%
Consider a 30 to 60 minute outage to be acceptable.	43%	56%

Table 6 Urban Residential Customer Preferences

In summary the feedback received from the most recent engagement survey has continued to validate strong results in terms of customer service, specifically the following preferences:

- The absolute majority of our customers rate the service provided by Vector as adequate or better than expected
- No clear opinion either way regarding their acceptability of the number of outages experienced or the duration of outages experienced
- The absolute majority of customers are highly satisfied with the value for money experienced regarding their electricity supply
- The absolute majority of customers have expressed no desire to pay any additional amount to receive a reduced number of outages or reduced duration of outages.

Supply Quality

Vector's supply quality objectives are focused on ensuring that the required service levels are achieved and maintained in accordance with its published customer expectations and regulatory requirements. In this context supply quality refers to the magnitude, shape, phase and frequency of the supplied voltage waveform.

Modern technology increasingly incorporates sophisticated electronic equipment which can be very sensitive to supply quality problems. It is therefore important that appropriate supply quality levels are maintained. Vector has therefore adopted the standards described below.

Vector's Supply Quality Obligations are:

- If you are a single phase connected customer the voltage at your point of supply to the Vector network shall be within ± 6% at 230 Volts
- If you are a three phase connected customer the voltage at your point of supply to the Vector network shall be within ± 6% at 400 Volts
- Frequency of supply shall be within ± 1.5% at 50 Hertz
- Voltage Harmonic Levels within 0 – 5% Total Harmonic Distortion in accordance with NZECP 36.

All electrical networks are subject to supply quality disturbances, the most typically observed phenomena being momentary voltage sags but surges or harmonic distortion also occur.

Vector has put in place supply quality service standards that recognise that not everybody experiences the same quality levels or has the same expectation of supply quality. The service standards do recognise that larger customers, particularly those involved in manufacturing and service industries, have a higher reliance on disturbance free supply.

Vector's Momentary Sag Targets are:

- CBD or industrial areas: we aim to allow no more than 20 voltage sags in one year
- Urban areas: we aim to allow no more than 30 voltage sags in one year
- Rural areas: we aim to allow no more than 40 voltage sags in one year.

Vector has been proactively monitoring momentary voltage sags at the zone substation 11kV bus level since 2004. Our monitoring programme now includes 12 fixed PQ monitors, the selected zone substations covering a fair representation of CBD, urban and rural customer locations.

Table 7 below provides a summary of compliance to the published service standards disaggregated by customer location. The definition of momentary sag is considered to include any recorded event as measured at the 11kV zone substation bus which falls below 80% of nominal voltage, regardless of the event's duration. These momentary sags are typically associated with faults on and around the Vector network along with transmitted disturbances from the national grid.

Zone Substation	Customer Type	03/04	04/05	05/06	06/07	07/08	Target
Quay	Commercial	6	17	6	26	11	≤20
Victoria	Commercial	18	13	8	16	9	≤20
Carbine	Industrial	-	6	6	18	7	≤20
McNab	Industrial	8	9	5	14	5	≤20
Rockfield	Industrial	-	8	11	13	4	≤20
Rosebank	Industrial	-	10	8	17	14	≤20
Wiri	Industrial	26	10	20	15	13	≤20
Bairds	Residential	18	17	20	39	25	≤30
Howick	Residential	10	6	22	22	12	≤30
Manurewa	Residential	24	15	15	23	33	≤30
Otara	Rural	9	8	35	25	17	≤40
Takanini	Rural	33	22	25	26	28	≤40

Table 7 Momentary Sag Time Series

Vector's PQ monitors are also keeping track of total voltage harmonic distortion (THD) measured at the 11kV zone substation bus. This enables Vector to gain an understanding of the potential effects of the increased usage of modern electronics and the impact of the use of compact fluorescent lamps. The annual values provided in Table 8 are in fact the 95th percentile values of the mean THD readings calculated as a three phase value provided on an hourly basis.

Zone Substation	Customer Type	03/04	04/05	05/06	06/07	07/08	Target
Quay	Commercial	1.1	1.3	1.5	1.6	1.6	≤5.0
Victoria	Commercial	2.1	2.0	1.7	1.6	1.4	≤5.0
Carbine	Industrial	-	3.2	3.4	3.6	3.5	≤5.0
McNab	Industrial	1.0	1.0	0.9	1.1	1.6	≤5.0
Rockfield	Industrial	-	2.8	2.9	3.1	3.2	≤5.0
Rosebank	Industrial	-	3.2	3.1	3.5	3.3	≤5.0
Wiri	Industrial	1.7	1.9	2.0	2.2	2.1	≤5.0
Bairds	Residential	1.5	1.5	1.5	1.6	1.9	≤5.0
Howick	Residential	2.5	2.5	2.5	2.6	2.9	≤5.0
Manurewa	Residential	3.3	3.2	3.1	3.4	3.7	≤5.0
Otara	Rural	1.5	1.4	1.2	1.4	2.2	≤5.0
Takanini	Rural	2.7	2.7	2.7	2.6	2.7	≤5.0

Table 8 Percentage Total Harmonic Distortion Time Series (%)

Some of the latest step changes, especially in the residential areas, coincided with retailer compact fluorescent lamp offerings. At this stage although THD levels are considerably below levels of statutory concern increased harmonic content levels are observed.

Vector's future objective is to have PQ measurement covering all zone substations in the network to ensure a more comprehensive understanding of the impacts of PQ solutions.

Supply Reliability

Vector's supply reliability goal is to ensure that supply reliability performance is achieved and maintained in accordance with regulatory requirements and customer expectation (as ascertained through regular customer surveys). Vector has set clear targets and developed measures on both counts. Regulation focuses on average network supply reliability whereas Vector's standard service levels focus on individual supply reliability expectations.

Average network supply reliability is recorded and reported through the following internationally recognised measures:

- SAIDI minutes: the average length of time the average customer spends without supply over a year
- SAIFI interruptions: the average number of sustained supply interruptions which the average customer experiences over a year.

Vector's supply reliability SAIDI and SAIFI targets are shown in Tables 9 and 10[6].

[6] These targets are for distribution network related outages only; that is, they exclude outages arising from failures in the external bulk supply network (transmission or generation). They include planned and unplanned outages.

Disclosure Year	08/09	09/10	10/11	11/12	12/13	+ 5 Years
SAIDI (Minutes)	104	104	104	104	104	104

Table 9 Vector's Supply Reliability SAIDI Target

Disclosure Year	08/09	09/10	10/11	11/12	12/13	+ 5 Years
SAIFI (Interruptions)	1.6	1.6	1.6	1.6	1.6	1.6

Table 10 Vector's Supply Reliability SAIFI Target

Both SAIDI and SAIFI are required measures as part of the current regulatory targeted control regime, and both measures have prescribed thresholds. New Zealand regulations require that both these measures consider only the impact of sustained interruptions related to high voltage distribution and sub-transmission network. The impact associated with low voltage network is excluded; these interruptions are highly localised and generally affect only an individual or small cluster of customers with a resulting immaterial impact on reliability.

The following section gives an account of the time series performance charts and commentary, covering both SAIDI and SAIFI measures, and highlights how the network has historically performed. To be consistent with the above targets, all presented SAIDI and SAIFI measures consider planned and unplanned network events but exclude the impact of any Transpower events.

Figure 26 presents SAIDI performance since inception of information disclosure through to the last complete return. The total overall SAIDI performance is the combination of Vector SAIDI (underlying performance) and excluded events. Excluded events are those events so severe that the reasonable response capacity of network operations and maintenance staff is overwhelmed. These events have been identified using the Institute of Electrical and Electronic Engineers (IEEE) Beta Method[7], which is also applied (with modifications) by the Commerce Commission in evaluating the impact of extreme events on performance.

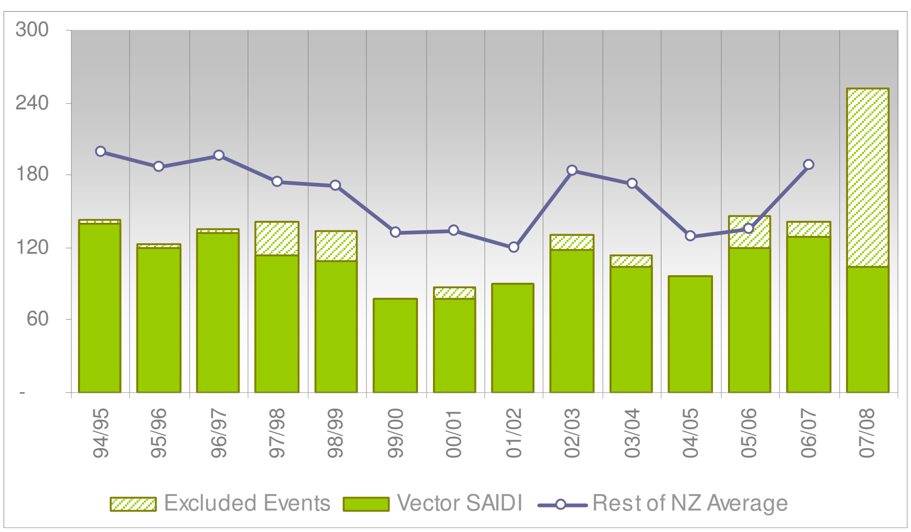


Figure 26 Network SAIDI Reliability Time Series

[7] Described by the IEEE in their standard 1366-2003, IEEE Guide for Electric Power Distribution Reliability Indices.

The Vector SAIDI compares well against other New Zealand lines business averages. Performance highs and lows are closely mirrored by the rest of the country indicating the impact of underlying national factors, most likely dominant weather patterns or weather events.

The return filed for the 2007/08 financial year indicated significant network damage resulting from extreme weather impacting the network over the July 10-11 storm of 2007. The severity of this event was well publicised with this single extreme period recording 155 SAIDI minutes. The overall year end Vector network SAIDI finished at 252 SAIDI minutes, clearly exceeding the supply reliability target. If the extreme events are backed out the resulting SAIDI performance is within the threshold target.

On the same basis the time series of SAIFI performance is presented in Figure 27. Due to the impact of the July 10-11 extreme weather event the 2007/08 return recorded an overall 1.66 SAIFI interruptions, again exceeding the supply reliability target. If the extreme events are backed out the resulting SAIFI performance is within the threshold target.

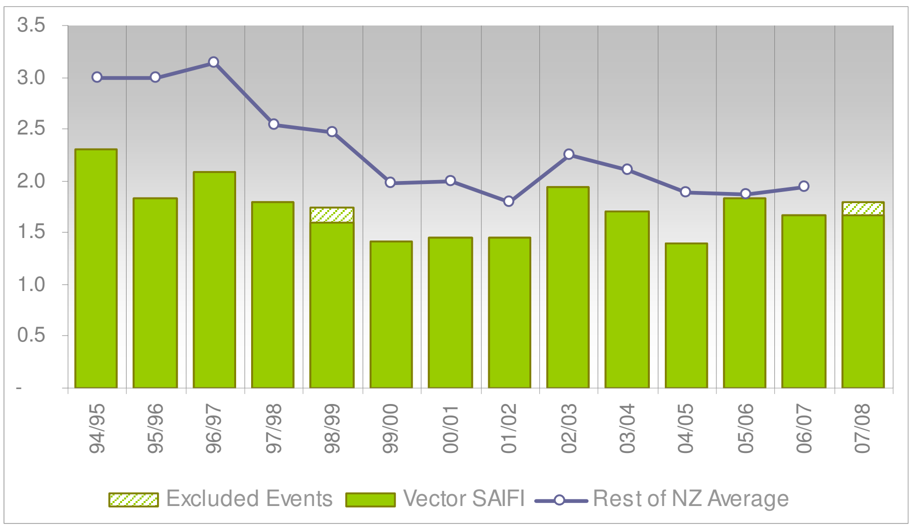


Figure 27 Network SAIFI Reliability Time Series

There are a host of reasons interruptions to supply occur on the electricity system. About 95% of these interruptions on the Vector network are unplanned and result from a range of causes including vegetation, animals, third parties, asset condition and, of course, weather. The remaining 5% of interruptions are planned shutdowns and are undertaken for maintenance or upgrades on the network. As part of managing the asset base and guiding our response, Vector monitors the cause of outages. The cause and effect charts (Figures 28 and 29) demonstrate the impact over time of the main drivers of network interruptions on the Vector network.

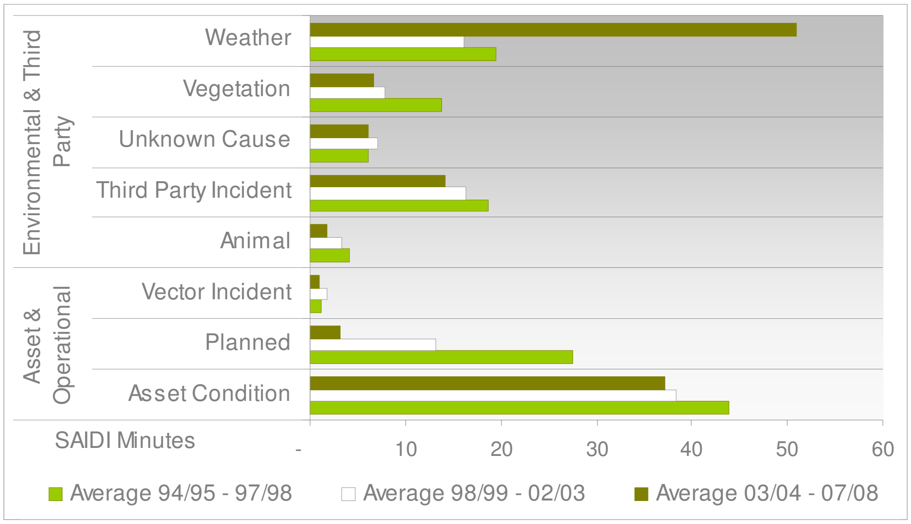


Figure 28 Cause and Effect of Network Interruptions

Weather (Lightning and Wind)

This category considers unplanned interruptions due to the weather, such as lightning damage or extremely high winds, without question the single most unpredictable and significant cause of interruptions to the Vector network. The impact of extreme weather and lightning over recent years has seen a 160% increase in interruption time as compared with that experienced a decade ago.

Vegetation

Vegetation faults result from overhanging branches and trees caught in power lines. On average the interruption impact from vegetation faults has dropped over time to around 50% less than a decade ago. Vector has dedicated a substantial amount of maintenance effort into its cyclic tree cutting and vegetation control programmes. New tree regulations have recently addressed the previous uncertainty around clearance responsibilities and have increased education and public awareness and, together with additional network protection devices, are all contributing factors to an improved result.

Unknown Interruptions

These occur when circuit protection devices operate to initiate the interruption to customers but, after fault finding and line patrolling, no cause can be isolated or observed and the circuit is reenergised. The interruption cause is recorded as unknown. As expected the average impact on customer interruption time due to unknown causes continues to remain around historical levels.

Third Party Incidents

Third party faults are caused by external human interference. These include cars colliding with poles, vandalism, underground assets dug up by other authorities or trees cut down onto power lines by members of the public. An average customer experiences 25% less interruption time due to these factors than experienced a decade ago. There are a host of contributing controls that continue to be put in place, additional protection devices, increased public education, better coordination around locating and digging near underground assets, relocation or undergrounding of prone or repeat offending assets.

Offsetting this positive trend, is an increasing burden arising from Police protocols – where network restoration after faults caused by third parties often has to be significantly delayed until an incident has been investigated and recorded.

Animals

In most cases sustained interruptions are due to birds and possums. Possums climb along power lines and can create short circuits, whereas birds will often perch on overhead assets or clash and damage lines to create short circuits. The average interruption time has reduced by around 55% from that a decade ago. Many initiatives contribute to the reduced risk of animal failures, such as vegetation clearance, new pole installations in wooded areas with fitted possum guards, open air break switches upgraded to fully enclosed gas insulated switches, pin insulators replaced by post insulators give additional clearance.

Planned Interruptions

Undertaken to replace assets, perform maintenance or to upgrade the network. Continued use of "glove and barrier" work practices to allow live line works and the increased use of local generation has enabled a reduction in the effect of planned interruptions. The average impact from planned shutdowns has reduced to around 90% less than experienced a decade ago.

Asset Condition

Underground assets are generally extremely reliable being buried away from the weather and external influences such as trees or cars. Overhead asset failures include faults on switches, transformers, insulators, crossarms and conductors. Although individually extremely reliable, the volume of these installed across the network means that despite all practical efforts there will be some asset condition failures. The impact in terms of interruption time from asset condition related failures has lessened by around 15% from that a decade ago. In terms of contributing to the improvements in interruption time, assets with excessive failure rates are targeted for maintenance and renewal programmes, thermal and ultraviolet surveying continues to detect hot and potential breakdown spots, increased network protection devices limit the impact of interruptions, and new non invasive condition based detection techniques help direct risk based maintenance decisions.

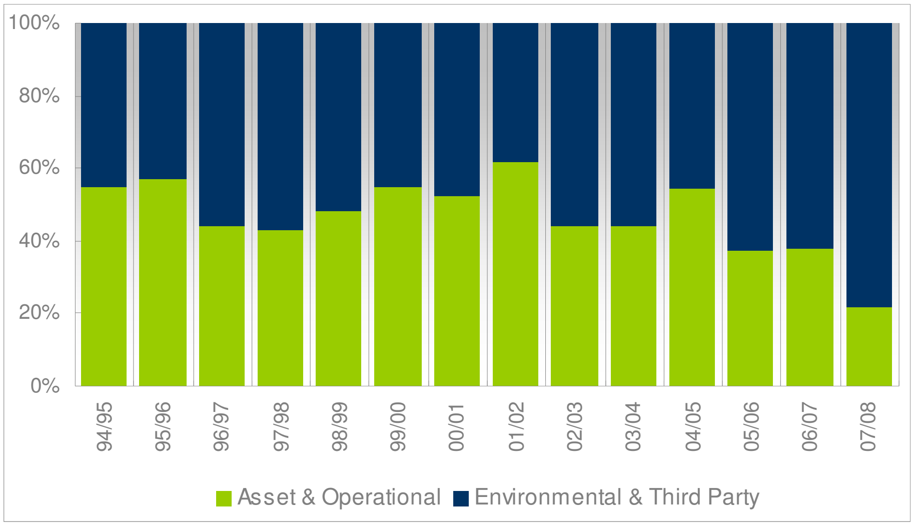


Figure 29 Cause and Effect Percentage SAIDI Impact Time Series

Overall the causes associated with environmental and third party incidents (highly uncontrolled) have as a percentage of SAIDI been increasing over time. Conversely, the impact of asset and operational interruptions has reduced significantly over time.

Vector's Customer Service Commitment

To address individual reliability expectations Vector has in place both fault duration and frequency service standards. These service standards are specific to the type of embedded customer/retailer model adopted on the various parts of our network. Vector's service commitments are shown in Table 11.

Customer- Retailer Model	Conveyance – Southern				Interposed - Northern	
Service Level Type	CBD	IND	Urban	Rural	Urban	Rural
Maximum Fault Frequency	3 pa	4 pa	4 pa	14 pa	4 pa	14 pa
Maximum Fault Duration	2 hrs	2.5 hrs	3 hrs	6 hrs	3 hrs	6 hrs

Table 11 Vector's Service Commitments

(Note that incidents arising as a result of bulk supply failures – generation or transmission – or of extreme events are excluded from this scheme. While Vector will react if breaches in terms of the service commitment come to its attention, in some cases this may require notification by the affected customer).

Enhancing Vector's Performance for the Future

Performance improvement programmes will continues to address the following:

- Reducing the number of interruptions customers experience
- Reducing the time customers are without electricity
- Improving the supply quality delivered.
- Introducing new technologies to reduce the impact of momentary voltage sags

- Upgrading assets in the worst performing areas
- Targeting major cause contributors to reduce the frequency of customer interruptions
- Expanding the use of automatic control equipment at remote locations allowing faster restoration and response times
- Minimising the use of planned shutdowns by continuing to work live line where possible, and using generators to avoid outages
- Increased use of mobile generator units.

Justification of Consumer and Reliability Targets

Supply reliability and response targets are normally established through taking into account consumer needs. Given the major complexity and informational requirements of quantifying customer requirements, and relating them to network performance, targets are normally set on a qualitative basis.

Under the current regulatory regime reliability targets are prescribed. As indicated by customer surveys, at present there is no weight of evidence from the Vector customer base to support heightened (or reduced) levels of supply reliability, especially where these would involve increased line charges. This implies that Vector's main current driver for setting network reliability targets is therefore regulatory in nature[8].

3.2 OTHER PERFORMANCE MEASURES

3.2.1 FAILURE RATE

Failure rate is a direct measure of the number of recordable events per system length. It is a further tool for understanding performance outliers and underlying failure trends. The definition is:

"Failure Rate. The fault rate associated with high voltage distribution and sub-transmission sustained unplanned interruptions normalised by the associated length of supply network."

It is reported as faults per 100 kilometres of network length.

The failure rate in 97/98 was just over 12 faults/100km, which increased over time to 17 faults/100km for the 07/08 year (Figure 30). The main contributor to this increase has been the takeover of United Networks in 2002/03, which significantly increased the proportion of overhead lines on the network (which due to their exposed nature are more prone to interference). To counter further increases various initiatives have been launched. These include cable upgrades and a coordinated dig safe programme with local utility operators. It should be noted that the performance in the past three years has been significantly influenced by extreme weather events.

[8] Since the regulatory targets are based on historical network performance, it is likely that even absent regulatory intervention, Vector's internal targets would have been largely similar. These targets may however have been somewhat adjusted in light of customer price/quality trade off preferences.

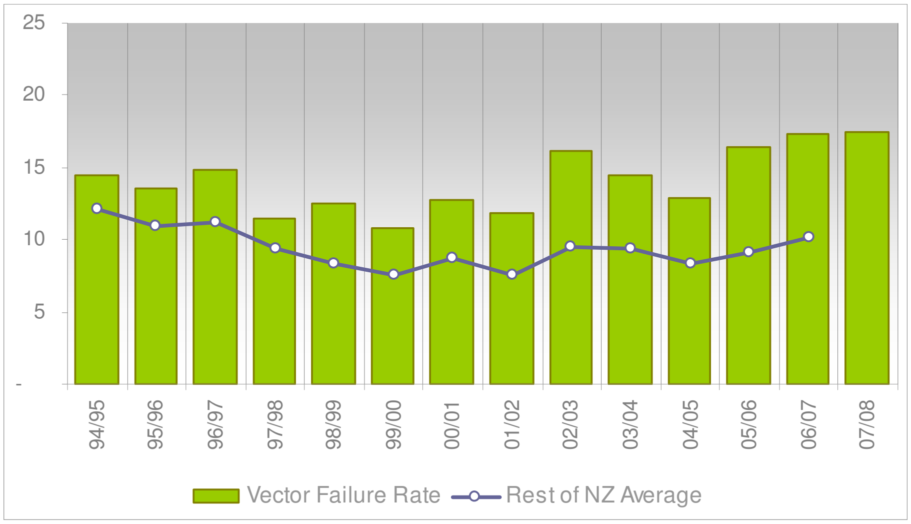


Figure 30 Network Failure Rate Time Series

Vector's network failure rate target is shown in Table 12.

Disclosure Year	08/09	09/10	10/11	11/12	12/13	+ 5 Years
Failure Rate (Faults/100km)	16	16	16	16	16	16

Table 12 Vector's Network Failure Rate Target

Health, Safety and Environmental

Vector's safety vision is to deliver world class network service where injury to employees, contractors, suppliers or the public is unacceptable. Vector is committed to world class safety performance, the maintenance of sound safety management systems and practices, and integrating health and safety into all that it does.

To support this, Vector's health and safety performance is closely monitored and clear performance targets are set. The results since 2003/04 are presented in Table 13.

Disclosure Year	03/04	04/05	05/06	06/07	07/08
Fatalities	0	0	0	0	0
Lost Time Injuries	2	1	5	1	2
Medical Treatments	23	55	51	65	35
First Aid Cases	34	18	43	35	64
Near Misses Incidents/Property Damage[1]	429	320	551	548	569
Lost Time Injury Frequency Rate	2.73	0.53	2.16	0.34	0.38

[1] We encourage near miss reporting by our FSPs.

Table 13 Vector's Health and Safety Performance

Health and safety management fits under Vector's strategic objective of operational excellence, and the target or standard for safety excellence is zero injuries. Vector is continuing to work with its FSPs and contracting partners to identify effective ways to further improve the safety of its electrical networks.

Vector's overall health and safety vision is to achieve zero lost time injuries.

Vector's environmental target is full compliance with all requirements from local and regional councils, and 100% avoidance of any incident causing material environmental harm.

4 NETWORK DEVELOPMENT PLANNING

In the context of this AMP, network development refers specifically to growth related projects; those projects which extend the Vector electricity network in newly developed areas or that extend the capacity or supply levels of the existing network to cater for load growth or changing consumer demand.

In preparing the network development plan, Vector acknowledges the effect of cyclical load on the network equipment's ability to handle the load above the respective nameplate ratings. Computer programmes are used to determine the cyclic ratings of major assets taking into account the environment in which they operate. Factors such as load profile, ambient temperature, ground moisture, wind speed, loading on assets in proximity etc are considered in determining the asset capacities for network development and operation purposes. The capacities of the major assets are documented in the respective files. Summer equipment ratings have also been introduced to acknowledge the different operating environment of the equipment and the different risks to the equipment.

4.1 PLANNING CRITERIA

Vector's approach to network development planning has been driven by:

- Investment strategies and service offering improved value to customers and appropriate return to shareholders
- Meeting network capacity requirements
- Customer needs, which vary by customer segment and are reflected by service level standards (and are continually trending towards higher reliability and improved PQ)
- Striving for least cost solutions (optimum asset utilisation) and optimum timing for capital expenditure
- Aligning risk management strategies with planning philosophy
- Continuously striving for innovation and optimisation in network design, and trialling new technology, such as remote switching technology, to improve network performance
- Encouraging non network and demand side solutions where practicable.

Vector's planning approach is based on meeting its security criteria as described in Tables 14 and 15.

	Type of load	Acceptable probability of loss of supply in a year due to sub-transmission	Restoration time
1	Predominantly residential substations	5%	For the southern region, any supply loss will be restored within 2.5 hours in urban areas and 3 hours in rural areas. For the northern region, any supply loss will be restored within 3 hours in urban areas and 6 hours in rural areas.
2	Mixed commercial/ industrial/ residential substations	2%	For the southern region, any supply loss will be restored within 2 hours. For the northern region, any supply loss will be restored within 3 hours.
3	Auckland CBD substations	0.5%	Any supply loss will be restored within 2 hours.

Table 14 Sub-transmission Network Security Standards

For the Auckland CBD achieving the security of supply standard (0.5% loss of supply probability) corresponds roughly with a switched n-2 deterministic security level.

	Type of load	Acceptable probability of loss of supply in a year due to back stopping shortfall	Restoration time
1	Overhead spurs supplying up to 1MVA urban area	100%	Total loss of supply upon failure. Supply restoration upon repair time.
2	Overhead spurs supplying up to 2.5MVA rural area	100%	Total loss of supply upon failure. Supply restoration upon repair time.
3	Underground spurs supplying up to 400kVA	100%	Total loss of supply upon failure. Supply restoration upon repair time.
4	Predominantly residential feeders	5%	For the southern region, any supply loss will be restored within 2.5 hours in urban areas and 3 hours in rural areas. For the northern region, any supply loss will be restored within 3 hours in urban areas and 6 hours in rural areas.
5	Mixed commercial/ industrial/ residential feeders	2%	For the southern region, any supply loss will be restored within 2 hours. For the northern region, any supply loss will be restored within 3 hours.
6	Auckland CBD feeders	0.5%	Any supply loss will be restored within 2 hours.

Table 15 Distribution Network Security Standards

There are three reasons for the variation between different categories of customers:

1. Reliability expectations of CBD, industrial and commercial customers are higher than residential.
2. Load profiles for different customer categories vary. Residential areas have peaks of typically less than three hours, hence the risk of an outage leading to the inability to supply all customers in a peak time is very small. Commercial and industrial areas have much longer peaks and hence a more stringent standard is applied.
3. The level of supply reliability that can be economically justified in an area is generally heavily dependent on the energy density level which measures the energy consumption per quantum of assets involved. Given the generally lower energy density in purely residential and especially rural areas it is not economically feasible to provide the same supply quality as in areas with higher consumption.

These standards align with Vector's customer service commitment. By differentiating service levels among different categories of customers Vector can tailor the service levels it provides.

Power Quality (PQ)

Some businesses, such as those in manufacturing and service industries, have a high reliance on disturbance free power supply. One of the objectives of PQ monitoring is to identify disturbances that could adversely impact on customer's equipment with the objective of identifying solutions.

The following strategies have been implemented to monitor and report PQ problems identified on Vector's network:

- PQ monitoring equipment has been installed at selected GXPs and zone substations
- An electronic mail system that automatically sends a PQ disturbance report in real time to customers
- A web based reporting system that makes real time and historical PQ information available for diagnosis of customer PQ issues
- Use of network modelling software and tools to predict the impact of PQ disturbances at customer premises
- The availability of portable PQ instruments to investigate PQ related complaints.

The information in PQ reports provides details on any event that caused voltage and current transients or voltage sags and swells in the network.

By drilling down into each report the daily maximum/average/minimum of voltage, current, frequency, power factor, voltage unbalance, voltage total harmonic distortion (THD) and current THD can be observed. The voltage sags captured by each monitor for the same period can also be viewed as a voltage sag magnitude duration chart.

Other PQ action at Vector includes:

- Installation of additional PQ monitoring instruments in the field. This is to gain increased knowledge of the quality of supply to customers

- Benchmarking the quality of supply on the network and monitor changes over time
- Offering support to customers by assisting with solutions to PQ problems
- Developing an automated link between network events such as faults and data captured on the PQ instrumentation.

4.2 PROJECT PRIORITISATION

Vector's general prioritisation sequence for including projects in its capital expenditure programme is as follows:

- Essential safety or legal compliance
- Customer initiated projects, network integrity projects, meeting capacity requirements
- Reliability and security of supply projects
- Other economically attractive investments.

Generally Vector would only invest in projects that provide an appropriate return to Vector's shareholders, but this requirement would be overridden where urgent essential safety standards have to be met, to ensure compliance with legal or regulatory requirements or to fulfil our commitment to delivering annual undergrounding project targets[9].

Customer driven growth projects generally result from the development of new subdivisions, commercial or industrial projects. Where possible, these projects are prioritised to meet customers needs. These customer priorities (where Vector has been advised in advance) are incorporated into Vector's project execution schedules. Related to customer driven projects are those that are implemented to ensure that Vector can meet the load capacity requirements on all parts of its network; in general no shortfalls in supply capacity would be tolerated.

Network integrity projects are those that address the continued effective operation of the distribution network and include renewal and refurbishment projects.

Reliability and security of supply projects are focused on ensuring that the required reliability standards on the network are met and that the security of supply standards are maintained. Projects are prioritised in accordance with the risk that they are intended to address, the outcome of the planning process identifies actual and potential network security breaches. These are assessed in accordance with Vectors risk matrix which considers the likely frequency and consequences of the breach ("frequency" is a measure of how often breaches of the security standards are likely to occur. The "consequences" are a measure of the health and safety, reputation, customer impact and financial risk to Vector as a consequence of not addressing the problem), The higher the risk assessment factor the higher the priority attached to a project.

Vector may also consider other asset investment projects if these are demonstrated to provide an acceptable rate of return to shareholders.

[9] Undergrounding projects are a requirement of Vector's majority shareholder, the Auckland Electricity Consumer Trust. Targets for these projects are included in the Trust Deed and Vector is under obligation to meet these.

4.3 DEMAND FORECAST

Figure 31 shows the forecast electricity demand across the total Vector network over the planning period. Historically the long term forecast for Vector's total network showed an average demand growth rate of 2% per annum. However, in view of the major current economic downturn in New Zealand (and internationally), we are anticipating a substantial slowing down in this growth rate as has been borne out by consumption figures recorded since November 2008. Growth forecasts were therefore adapted from those previously used in the 10 year capital planning model and in previous AMPs. For the next three years Vector is anticipating that residential consumption will remain constant while commercial and industrial consumption is expected to decline. This has been taken into account in the load forecast shown in Table 16.

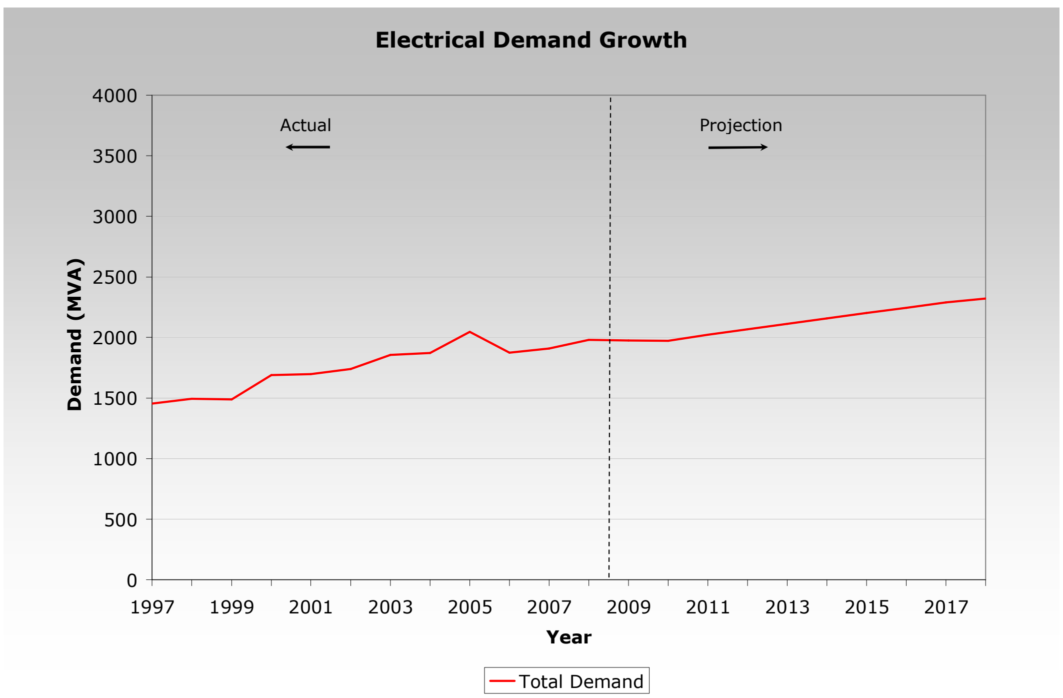


Figure 31 Forecast Maximum Demand

Short term maximum demand on Vector's network is primarily influenced by climate, particularly the severity of winter, and potentially summer due to an increase in air conditioning load. Medium term growth is driven mainly by population increases and commercial developments.

The forecasting technique used by Vector relies on historical zone substation and distribution feeder load data captured via SCADA and stored in PI historical storage. Individual demographics (at feeder level) such as population growth, customer type, economic growth, land usage and district plan changes, are applied to the load data to generate a demand projection over the planning period. Individual commercial developments and subdivisions are also factored in. The growth factor is calculated at both feeder and zone substation level.

A significant degree of uncertainty exists around commercial and industrial developments due to their reliance on local and international economic conditions. Current best estimates for load arising from expected developments are included in our 10 year forecast. This is reviewed annually taking into account the progress of these developments and updated information. As noted above, in view of a developing economic recession the load forecast for industrial and commercial consumers has been significantly reduced from previous expectations. The impact of the recession on future new developments is also considered.

The load forecast model takes into account any load transfers within the network, larger embedded generators, and network capacitors by adjusting them from the base year demand record prior to applying the growth factor. This allows the demand growth to be calculated without distortions. Once the demand profile has been produced, embedded generation and network capacitors are added back to the forecast to reflect the expected demand on the feeders and substations.

The output from this granular level load forecast can be used to determine a network wide growth figure.

Growth trends are reviewed annually. Historical zone substation and feeder load information gathered over the previous five years is used to determine the starting load for the forecast. This approach removes short term weather distortions as the objective is to capture the underlying long term growth rates.

Electricity distribution networks are designed to meet demand requirements in a safe and reliable manner. Given the dynamic nature of demand, and variances in demand patterns on different parts of our network, we continuously monitor the load on the network. Potential capacity constraints or security of supply breaches are avoided through taking early action. If, due to abnormal circumstances, an actual breach arises, immediate action is taken to eliminate this through contingency plans involving network switching, standby generation, etc. Longer term permanent solutions are then also developed and implemented.

In Table 16 it will be noted that in many instances full n-1 security levels were not met during peak demand periods in 2008. This is in accordance with Vector's security standards, as described in Section 4.1, which allow for a small likelihood of outages should a fault occur during peak demand periods[10] (it should also be noted that we only include this assessment against the deterministic standard since it is prescribed by the Commerce Commission in the Information Disclosure Requirements. The n-1 security does not reflect the security standard used by Vector).

Furthermore, in interpreting this table it should be noted that the transformer capacities used reflect the long term cyclic ratings. In reality, equipment can generally operate to a much higher capacity level (typically 50% higher) for a short period of time (typically two hours) without incurring any damage. This short term overload capacity is normally sufficient to meet peak demand periods which are typically of short duration and, if required, also allows Vector a window to transfer any excess load to neighbouring substations via the distribution network thereby maintaining supply continuity.

Limited shortfalls in backstopping capacity do however exist at some substations. This is assessed against the likelihood of outages arising and the duration of peak demand periods (which is normally a very low probability). Solution options are then developed and evaluated against the security standards. If the optimal solution to avoid potential breaches of our security standards is a network solution it will be included in Vector's network development programme. Criteria for prioritisation of projects for implementation are given in Section 4.6.

[10] Peak demand periods usually only occur for a very small percentage of the year and that these are normally of short duration, especially in predominantly residential areas.

Substation	Transformer ONAN Capacity	Voltage	Transformer ONAF/ODAF/ OFAF Rating	Cyclic Rating	Actual 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Meets n-1 security in 2008
Atkinson Road	2*10	33kV		24	18.1	18.5	18.4	18.4	18.6	18.9	19.1	19.3	19.6	19.8	20.1	20.4	N
Auckland Airport	2*20	33kV	2*25	59	14	16.5	18.8	23.7	29.6	31.7	33.9	36.1	38.2	41.2	44.3	46.1	Y
Auckland Hospital	1*10	22kV		12	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	N
Avondale	2*15	22kV	2*20	48	26.6	28.2	28.1	27.9	28.3	28.6	29	29.3	29.7	30	30.4	30.7	N
Bairds	2*20	22kV	2*20	48	23.1	20.5	20.2	19.9	20.2	20.6	21	21.4	21.7	22.1	22.4	22.8	Y
Balmain	1*12.5	33kV		12	8.7	9.1	9	9	9.1	9.2	9.3	9.5	9.6	9.7	9.8	10	N
Balmoral	2*12	22kV		24	14	13.7	13.6	13.6	13.7	13.8	13.8	13.9	14	14.1	14.2	14.2	N
Belmont	2*12.5	33kV		28	13.4	13.4	13.4	13.3	13.5	13.6	13.7	13.8	14	14.1	14.2	14.3	Y
Birkdale	2*12.5	33kV		30	22.8	23.8	23.8	23.7	23.8	24	24.2	24.3	24.5	24.7	24.9	25	N
Brickworks	1*12.5	33kV		13	8.5	9	8.9	9	9.1	9.3	9.4	9.6	9.7	9.9	10.1	10.2	N
Browns Bay	2*12.5	33kV		28	13.9	16.5	16.4	16.4	16.8	17.2	17.7	18.1	18.6	19.1	19.6	20.1	Y
Bush Road	2*12	33kV	2*24	42	26.8	29	28.5	28.1	29	29.9	30.8	31.7	32.7	33.6	34.7	35.7	N
Carbine	2*15	33kV	2*20	42	24.1	24.1	23.7	23.2	23.6	23.9	24.3	24.7	25	25.3	25.6	25.9	N
Chevalier	2*18	22kV		31	17.7	18.1	18	18	18.2	18.4	18.6	18.8	19	19.2	19.4	19.7	N
Clevedon	1*5	33kV		6	2.8	3.3	3.3	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4	4.1	N
Coatesville	1*11.5	33kV		12	9.1	9.5	9.4	9.4	9.5	9.7	9.9	10	10.2	10.4	10.6	10.8	N
Drive	2*15	33kV	2*20	48	30.2	30.7	30.4	30.1	30.3	30.5	31.1	31.6	32.1	32.6	33.1	33.4	N
East Coast Road	1*12.0	33kV		24	14.9	16.1	15.9	15.8	16.1	16.4	16.6	16.9	17.2	17.5	17.8	18.1	N
East Tamaki	2*15	33kV	2*20	48	16	16.2	16.0	15.9	16.0	16.2	16.4	16.6	16.8	17.0	17.2	17.4	Y
Forrest Hill	1*12.5	33kV		15	13.4	14.1	14.1	14	14.2	14.3	14.4	14.5	14.7	14.8	14.9	15	N
Freemans Bay	1*15 + 1*18	22kV	1*20 + 1*18	31	17.8	25.5	25.1	24.8	25.2	25.6	26.1	26.5	26.9	27.3	27.7	28.1	N
Glen Innes	2*12	22kV		24	16.5	17.5	17.3	17.2	17.5	17.9	18.2	18.6	18.9	19.3	19.6	20	N
Greenmount	2*20+1*12	33kV	3*20	71	42	40.8	40.2	39.6	40.6	41.7	42.8	43.9	45	46.2	47.4	48.6	Y
Hans	2*15	33kV	2*20	43	22.8	21.8	21.5	21.1	21.5	21.9	22.3	22.7	23.1	23.4	23.8	24.2	Y
Hauraki	1*12.5	33kV		13	8.5	9.1	9.1	9.1	9.2	9.4	9.6	9.8	10	10.2	10.4	10.7	N

Substation	Transformer ONAN Capacity	Voltage	Transformer ONAF/ODAF/ OFAF Rating	Cyclic Rating	Actual 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Meets n-1 security in 2008
Helensville	2*7.5	33kV		18	12.8	13.6	13.6	13.6	13.9	14.2	14.5	14.8	15.2	15.5	15.8	16.2	N
Henderson Valley	2*12.5	33kV	2*14	28	21.8	21.7	21.7	21.7	22.1	22.5	22.9	23.3	23.7	24.1	24.5	25	N
Highbury	1*12.5	33kV		15	10.4	10.8	10.8	10.8	11	11.1	11.3	11.5	11.6	11.8	11.9	12.1	N
Hillcrest	2*12	33kV		48	22.1	22	22	22	22.3	22.6	22.9	23.2	23.5	23.8	24.1	24.4	Y
Hobson 110/11kV	2*25	110kV		60	31.2	31.2	31.2	33.5	34.4	35.3	36.2	37.1	38	38.9	39.8	31.2	N
Hobson 22/11kV	1*10+1*12	22kV	2*15	33	15.8	16.3	16.1	15.9	16.3	16.7	17.2	17.6	18	18.5	18.9	19.3	Y
Hobsonville	2*12.5	33kV		32	21.2	22.4	22.4	22.4	22.8	23.2	23.5	23.9	24.3	24.7	25.1	25.5	N
Howick	3*20	33kV		62	38.4	38.6	38.4	38.3	38.5	38.7	38.9	39.1	39.3	39.5	39.6	39.8	Y
James Street	2*12.5	33kV		32	22.4	23	23	23	23.3	23.5	23.8	24	24.3	24.5	24.8	25.1	N
Keeling Road	1*15	33kV	1*24	24	9.9	11.4	11.4	11.4	11.6	11.8	12.1	12.3	12.5	12.7	13	13.2	N
Kingsland	2*15	22kV	2*20	48	23.3	24.5	24.2	24	24.7	24.9	25.2	25.5	25.8	26.1	26.4	26.7	Y
Laingholm	2*7.5	33kV		17	10.9	9.3	9.3	9.3	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	N
Lichfield	2*20	110kV		48	6.9	6.9	6.9	7.2	7.6	8	8.3	8.7	9	9.4	9.8	10	Y
Liverpool	3*15	22kV	3*20	72	44	48.3	45.9	44.9	46	47.1	48.3	49.5	50.5	51.6	52.7	53.8	Y
Mangere Central	2*16.5	33kV	2*20	57	29.6	29.5	29.2	28.9	29.5	30.2	30.8	31.5	32.2	32.8	33.5	34.2	N
Mangere East	2*15	33kV	2*20	46	25.2	25.8	25.7	25.5	26.0	26.6	27.1	27.7	28.2	28.8	29.3	29.9	N
Mangere West	2*30	33kV		71	18.7	18.8	19.2	19.7	20.2	20.7	21.3	21.9	22.3	22.8	23.3	23.8	Y
Manly	2*12.5	33kV		30	21.8	23.5	23.5	23.5	24.3	24.9	25.4	26	26.7	27.3	28	28.7	N
Manukau	2*15+1*16.5	33kV	3*20	56	29.5	30.7	30.5	30.2	31.2	32.2	33.3	34.4	35.4	36.5	37.6	38.7	Y
Manurewa	3*16	33kV	3*20	71	54.3	54.4	54.2	53.9	54.7	55.5	56.4	57.2	58.0	58.8	59.6	60.5	N
Maraetai	2*15	33kV		24	6.3	4.4	4.4	4.4	4.6	4.8	5	5.3	5.4	5.6	5.8	6	Y
McKinnon	1*20 + 1*12	33kV	1*19	24	16.8	18.8	18.8	18.8	19.7	20.6	21.6	22.6	23.7	24.8	26	27.3	N
Mcleod Road	1*12.5	33kV		16	11.7	12.6	12.6	12.6	12.7	12.8	13	13.1	13.3	13.4	13.6	13.7	N

Substation	Transformer ONAN Capacity	Voltage	Transformer ONAF/ODAF/ OFAF Rating	Cyclic Rating	Actual 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Meets n-1 security in 2008
McNab	3*20	33kV		57	42.6	39.7	39.4	39	39.4	39.7	40.1	41.2	42.4	42.8	43.1	43.5	N
Milford	1*12.5	33kV	1*14	14	10.1	10.6	10.6	10.6	10.7	10.8	11	11.1	11.3	11.4	11.6	11.7	N
Mt Albert	1*12	22kV		14	9.5	9.9	9.7	9.5	9.6	9.7	9.9	10	10.1	10.2	10.3	10.5	N
Mt Wellington	2*15	33kV	2*20	48	23.1	24.8	24.4	24	24.5	25.7	27.8	29.9	30.5	31	31.6	32.2	Y
New Lynn	2*12.5	33kV		30	13.5	14	14	14	14.2	14.4	14.7	14.9	15.2	15.4	15.7	15.9	Y
Newmarket	3*15	33kV	3*20	70	37.5	42.3	41.8	41.2	44.5	46.1	49.5	52.1	54.7	57.3	59.9	61.7	Y
Newton	2*12	22kV	2*16	38	19.9	17.8	17.4	17.1	17.4	17.7	18	18.3	18.6	18.9	19.2	19.5	N
Ngataringa Bay	1*12.5	33kV		14	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8	8	8	N
Northcote	1*12.5	33kV	1*16	15	8.7	9.7	9.7	9.7	9.8	9.9	10	10.1	10.2	10.3	10.4	10.5	N
Onehunga	2*11	22kV	2*15	26	21.8	23.5	23.3	23.2	23.5	23.8	24.1	24.3	24.6	24.9	25.2	25.5	N
Orakei	2*14.5	33kV	2*18	43	23.9	24.2	24.2	24.2	25.4	26.7	27	27.4	27.7	28.1	28.4	28.8	N
Oratia	1*10	33kV		15	0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	N
Orewa	2*20	33kV		30	13.5	17.1	17.1	17.1	18	19	20.1	21.2	22.5	23.9	25.4	27	Y
Otara	2*15	22kV		35	23.5	22.9	26.3	26.4	27.7	29.0	30.5	32.0	33.6	35.2	37.0	38.8	N
Pacific Steel	2*25	110kV	2*40	80	62.4	64.7	67.1	69.5	71.9	74.2	76.6	79	81.4	83.8	86.2	88.5	N
Pakuranga	2*16.5	33kV	2*20	48	23	23.1	23.0	22.9	23.0	23.2	23.3	23.4	23.5	23.7	23.8	23.9	Y
Papakura	2*15	33kV	2*20	44	22.8	24.4	24.7	25.0	25.1	25.2	25.4	25.5	25.6	25.8	25.9	26.0	N
Parnell	2*12	22kV		26	11.5	10.6	10.4	10.2	10.3	10.5	11.3	12.2	12.4	12.5	12.7	12.8	Y
Ponsonby	2*9	22kV	2*12	27	15.4	16.5	16.4	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17	17.1	N
Quay	2*15	22kV	2*20	48	21.6	22.8	22.3	21.9	22.5	25.1	25.9	26.7	27.3	28	28.7	29.5	Y
Red Beach	1*20	33kV			12.4	12.7	12.7	12.7	13	13.4	13.7	14	14.3	14.7	15.1	15.4	N
Remuera	2*15	33kV	2*20	48	31.5	31.6	31	30.5	32.7	34.9	36.1	37.4	37.6	37.9	38.1	38.4	N
Riverhead	2*7.5	33kV		18	11.7	12.2	12.2	12.2	12.5	12.7	13	13.3	13.6	13.9	14.3	14.6	N
Rockfield	2*15	33kV	2*20	48	21	23.4	23.1	22.8	23.1	23.3	23.6	23.9	24.1	24.4	24.6	24.9	Y
Rosebank	2*16	33kV	2*21.5	52	23.3	23.4	23.2	22.9	23.1	23.4	23.6	23.8	24	24.3	24.5	24.7	Y
Sabulite Road	2*12.5	33kV		26	19	19.9	19.9	19.9	20.2	20.5	20.8	21.1	21.4	21.7	22	22.3	N
Sandringham	2*16	22kV	2*20	47	21.6	21.1	20.9	20.7	20.9	21.2	21.4	21.6	21.8	22	22.3	22.5	Y

Substation	Transformer ONAN Capacity	Voltage	Transformer ONAF/ODAF/ OFAF Rating	Cyclic Rating	Actual 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Meets n-1 security in 2008
Simpson Road	1*7.5	33kV		9	8.6	8.1	8.1	8.1	8.3	8.4	8.6	8.8	8.9	9.1	9.3	9.5	N
Snells Beach	1*7.5	33kV		9	5.8	5.9	5.9	5.9	6	6	6.1	6.2	6.3	6.4	6.5	6.6	N
South Howick	2*15	33kV	2*20	47	28.9	28.2	28.1	27.9	28.3	28.6	28.9	29.3	29.6	29.9	30.2	30.5	N
Spur Road	1*12.5	33kV		14	10.2	12.9	12.9	12.9	13.5	14.1	14.7	15.3	16	16.7	17.4	18.2	N
St Heliers	2*15	33kV	2*17.5	42	20.2	20.6	20.4	20.2	20.4	20.5	20.7	20.8	21	21.2	21.3	21.5	Y
Sunset Road	2*12.5	33kV		30	17.5	18.8	18.8	18.9	19	19.2	19.4	19.6	19.7	19.9	20.1	20.3	N
Swanson	1*12.5	33kV		15	12.4	13.4	13.4	13.4	13.7	14	14.3	14.7	15	15.3	15.6	16	N
Sylvia Park	2*20	33kV		48	10	13.9	13.6	13.4	14.4	14.4	14.5	14.6	14.6	14.7	14.8	14.8	Y
Takanini	2*15	33kV		36	17.8	18.7	18.9	19.1	19.5	19.9	20.3	20.8	21.2	21.6	22.0	22.4	N
Takapuna	1*24	33kV		24	8.9	8.9	8.9	8.9	9	9.2	9.3	9.5	9.7	9.8	10	10.2	N
Te Atatu	2*12.5	33kV		28	18.5	19.2	19.2	19.2	19.5	19.8	20.1	20.4	20.8	21.1	21.4	21.7	N
Te Papapa	2*15	33kV	2*20	46	21	23.8	23.4	23	24.2	24.5	24.9	25.2	25.5	25.8	26.1	26.5	Y
Torbay	1*12.5	33kV		13	9.5	9.7	9.7	9.7	9.8	10	10.2	10.3	10.5	10.7	10.9	11	N
Triangle Road	2*10	33kV		24	20.4	19.9	19.9	19.9	20.5	21	21.5	22.1	22.7	23.3	23.9	24.5	N
Victoria	2*20	22kV	2*20	40	23.8	22.7	22.3	21.9	22.4	23	23.5	24.1	24.6	25.1	25.7	26.2	N
Waiake	1*12.5	33kV		15	9.9	10.3	10.3	10.3	10.4	10.5	10.6	10.8	10.9	11	11.1	11.3	N
Waiheke	2*12.5	33kV		30	9.3	9.8	9.7	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.3	Y
Waikaukau	1*7.5	33kV		9	8	7.3	7.3	7.3	7.4	7.6	7.7	7.8	8	8.1	8.3	8.4	N
Waimauku	1*7.5	33kV		8	6.6	7.1	7.1	7.1	7.3	7.4	7.6	7.7	7.9	8.1	8.3	8.5	N
Wairau	2*12.5	33kV	1*16+1*12.5	32	17.9	19.5	19.5	19.5	19.8	20	20.2	20.4	20.6	20.8	21	21.2	N
Warkworth	3*7.5	33kV		27	16.1	16.1	16.1	16.1	16.3	16.5	16.7	16.9	17.1	17.4	17.6	17.8	Y
Wellsford	2*7.5	33kV		18	8.2	8.7	8.7	8.7	8.8	9	9.1	9.2	9.3	9.5	9.6	9.7	Y
Westfield	3*15	22kV		52	25.8	27.6	27.3	26.9	27.3	27.7	28.1	28.5	28.9	29.2	29.6	29.9	N
White Swan	3*15	22kV		39	31.6	29.7	29.1	28.5	28.8	29.1	29.4	29.8	30.1	30.4	30.7	31	N
Wiri	3*20	33kV		70	41.5	43.6	44.2	43.6	44.8	46.2	47.6	49.1	50.4	51.7	53.1	54.6	Y
Woodford	1*12.5	33kV		16	10.1	9.9	9.9	9.9	10	10.1	10.3	10.4	10.5	10.7	10.8	11	N

Table 16 Vector's Zone Substations, Capacity and Expected Load

4.4 DISTRIBUTED GENERATION

Vector's Policy

Vector does not own any network connected generation other than to support its own facilities. However, processes are in place to allow the connection of distributed generation by other parties. The uptake on this has been slow and is generally associated with providing customers with increased supply reliability capability rather than to export energy to the wider distribution network (the main reasons for the slow uptake appear to be the high capital costs of renewable generation, high cost of operating diesel generators, and the lack of a suitable market to reimburse customers for their costs).

Vector's policies and procedures for the application for installation and connection of distributed generation are in accordance with the requirements of the Electricity Governance (Connection of Distributed Generation) Regulations 2007 (refer Vector Website http://www.vectorelectricity.co.nz/about/distributedgeneration.php).

For potential DG greater than 10kW Vector encourages potential applicants to involve Vector during the early stages in an applicant's investigation process (refer Vector website http://www.vectorelectricity.co.nz/pdf/DG_Greater_than_10kW_Brochure_V1_Dec07.pdf).

Impact of Distributed Generation on Vector's Network Development Plans

There are some issues related to connecting distributed generation to the electricity distribution network. A significant detrimental impact is the additional fault level contribution and subsequent fault level headroom containment. As a result of such generation at some Vector zone substations the associated distribution networks are operating close to the equipment fault ratings.

An example of the impact of distributed generation on network development plans is the planned reinforcement of Otara substation. This requires the newly extended 11kV bus section to be split operated because of the high fault level. Normally Vector would have operated zone substation 11kV bus sections closed to improve the security of supply to customers.

Distributed generation has also resulted in some positive outcomes especially where generation output is constant (or has a constant output component). This constant capacity component can then be considered in the network security assessment, deferring the need for network reinforcement.

4.5 VECTOR POLICIES ON NON NETWORK SOLUTIONS

Vector is continually considering alternatives to sole network solutions to meet customer requirements. However, with the exception of distributed generation, non network opportunities so far investigated have generally not been sufficiently economically viable or technically robust to justify an investment. Some non network solutions are being adopted or trialled and other developments are being monitored, with a view to be an early adopter (rather than first mover) of new technology, once international evidence indicates that the technology is viable and reliable. Among the solutions adopted to avoid network investment, or that are being monitored are:

- Load shifting

  This option allows the transfer of load between adjacent zone substations by moving distribution feeder open points to optimise network performance (improve voltage, reduce losses, enhance security and reliability, etc) or minimise the time to carry out manual field switching in the event of a fault. This activity is generally carried out following a load flow study to understand the consequences of the action. The issues are the need to maintain sufficient backstop capability to supply customers in accordance with security standards and contracted service levels.

- Load shedding

  Audio frequency load control is used to manage load following network faults and notionally defer capital expenditure for heavily loaded network feeders. The latter deferral is only marginally successful due to the wide variations in load from year to year and the heightened risk level arising from operating network equipment close to maximum capacity. The issues with load control are aged assets and the risk of stranding if these are replaced with similar technology. Smart meters with suitable communications protocol are predicted to replace ripple relays but their roll out is not expected to be completed until 2013 (see further discussion below).

- Renewable solutions

  Photo-voltaic (PV) cells, wind driven micro turbines and solar water heating all offer the potential for customers to reduce energy purchases from the grid. Currently PV cells are too expensive for widespread uptake by new home owners but the cost of these cells is progressively reducing. Solar water heating lends itself to be included in the construction of new homes. Micro wind turbines have not yet proved economically viable.

  These solutions will contribute to a reduction in overall energy consumption within a house but it is questionable whether they impact significantly on the household maximum demand (as opposed to energy) when viewed from a network provider perspective. Networks are traditionally constructed to meet diversified maximum demand although revenue from residential customers is predominantly based on energy. Even if various devices may reduce household demand at any one time, during the inevitable periods where they are not available the external supply network still has to be able to deliver the full requirement of the household. The challenge is to permanently reduce demand, thereby reducing reticulation costs. This will involve energy storage solutions which are generally not yet economically viable.

  Renewable solutions within the distribution networks are not expected to have a major impact on demand in the commercial/industrial sector since the capacities of such devices are generally not sufficient to meet the demand needs of these customers and may be impractical to erect.

- Load aggregation

  Load aggregation offers an opportunity to contract "sheddable" customer load (and generation) to make it available at times of network constraint. Aggregation is carried out by third parties who would contract with Vector to guarantee a minimum quantity of sheddable load. We will be engaging with aggregators to develop a model that can operate in the distribution environment and then test its workability.

- Smart metering

  Regulatory drivers to achieve metering accuracy will, over time, cause the largely mechanical domestic electricity meters to be replaced. This is expected to happen over the next five years. Smart meters are seen as the likely replacement. Through the ability of the meter owner to communicate in real time with the smart meter it is possible to monitor the customer's load in each half hour time segment throughout the day and adjust tariffs in accordance with network events. When network demand is high a high electricity tariff at the meter may encourage customers to reduce load. The effectiveness of this type of demand side management will depend on the make up of the tariffs to ensure both customers and the utility may benefit.

A factor counting against widespread use of smart meters may be competition between various industry participants to access their customers' controllable load. This would dilute the benefit of load control, disincentivising further investment.

- Future technology options

  A number of technology options are being investigated for possible future application to enhance the utilisation of network assets and as embedded generation options. These include plug-in hybrid electric vehicles, micro combined heat and power, energy storage systems, fuel cells, gas generators, solar power, solar water heating, etc. Vector will monitor the development and market opportunities in these areas and introduce them to its network at an appropriate time.

As an alternative to large network investment, or to defer large network investments, Vector considers the installation of generation to make up the security shortfall and has applied this in the past. Most network loads have a daily and seasonal variability thereby providing the potential for peak load security breaches to be solved by mobile or temporary generation. Decisions in this regard are based on economic assessments, comparing the cost of generation with that of network reinforcement, and adopting the most favourable solution (we also use temporary generation solutions in areas where networks are being renewed, or where serious outage conditions exist, but this is considered an operational rather than non network solution).

4.6 NETWORK DEVELOPMENT PROGRAMME

Areas within the Vector network that are at risk of supply security breaches are being addressed through efficient capital expenditure. Prior to capital investment the following options are considered:

- Increased asset utilisation through advanced automation or dynamic equipment ratings
- Load management including demand-side management
- Level of acceptable risk
- Asset performance improvement
- Customer requirements and customer based solutions
- Capex/opex optimisation.

Projects are prioritised in accordance with the following criteria:

- Safety, regulatory or environmental issues
- Risk and consequences of project deferral
- Impact on customers

- Project deferral opportunities based on other options
- Rate of return on investment
- Performance and operation of the network
- Synergies with other projects.

A capex programme is compiled based on:

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

Within the network investment assessment process, the impact of projects on the expected network reliability and security of supply are also considered.

A list of Vector's significant capital projects planned for the next 10 years is contained in Sections 4.6.1, 4.6.2 and 4.6.3. Note that due to the uncertainty of outcomes created by the current economic conditions and regulatory environment surrounding asset investment, some of the currently identified projects may be deferred as more information becomes available.

Vector's network development plan will also be heavily influenced by the December 2008 interim decision by the Electricity Commission to withhold approval of Transpower's proposed cross-isthmus 220kV cable until 2016. Currently the 10 year plan provides for new GXPs at Hobson substation in the Auckland CBD and Wairau substation on the North Shore. These are essential supply points to meet the security of supply requirements in these economically critical areas. Should this decision remain in force, Vector will be revising its current 10 year development plans and may have to make substantial changes to current investment plans to ensure appropriate security levels can be maintained. Discussions about this are ongoing and planning for these future investments has not been finalised at the time of publication of this AMP and cannot be until the Electricity Commission's final decision is known.

For commercial reasons, project budgets have been summarised according to broad cost bands (between $1 million and $5 million, and > $5 million). Projects costing less than $1 million, and minor 11kV reinforcement projects, have not been individually listed.

"Committed" projects are those which have been approved through internal governance processes and have been assigned a budget with part of the budget committed. Those projects with a "proposed" status have yet to be approved and are still considered to be in the planning stage.

The "timescale" against each of the projects indicates the target commissioning date but may be subject to reprioritisation and approval through the Vector governance processes.

The following Figures 32, 33 and 34 show the proposed major projects on the Vector network planned for the next 10 years.

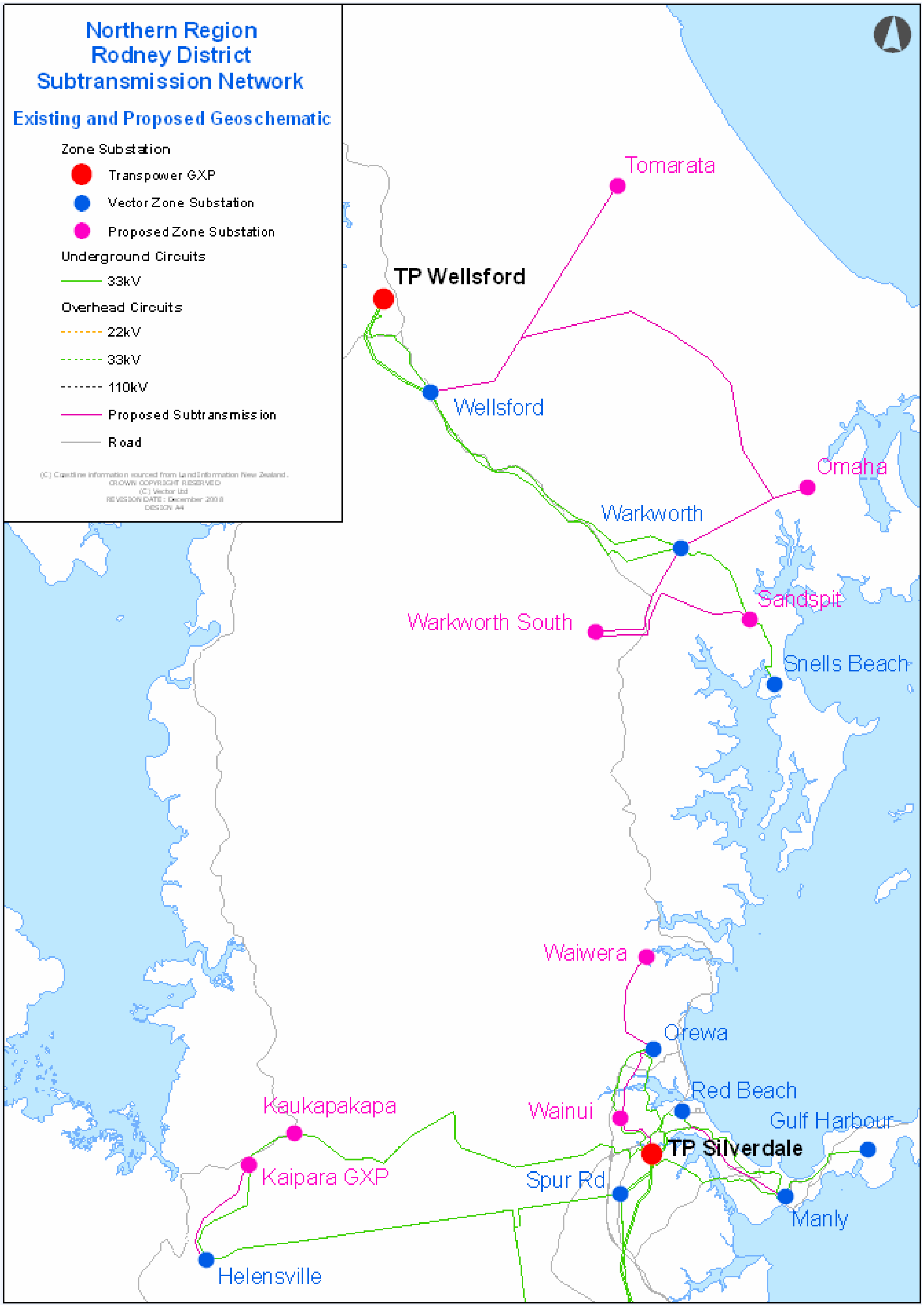


Figure 32 Proposed Projects in the Northern Region (Rodney)

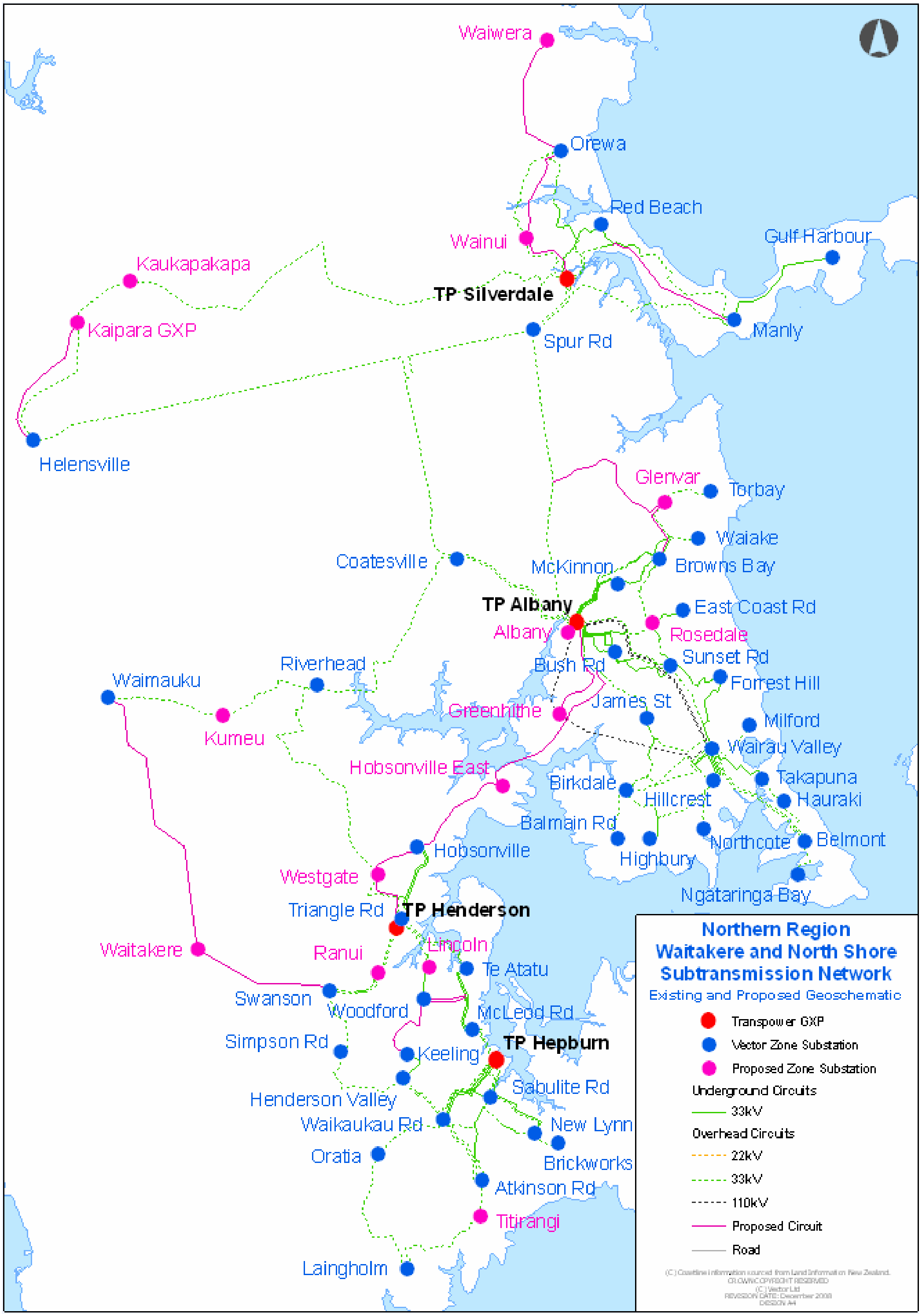


Figure 33 Proposed Projects in the Northern Region (North Shore and Waitakere)

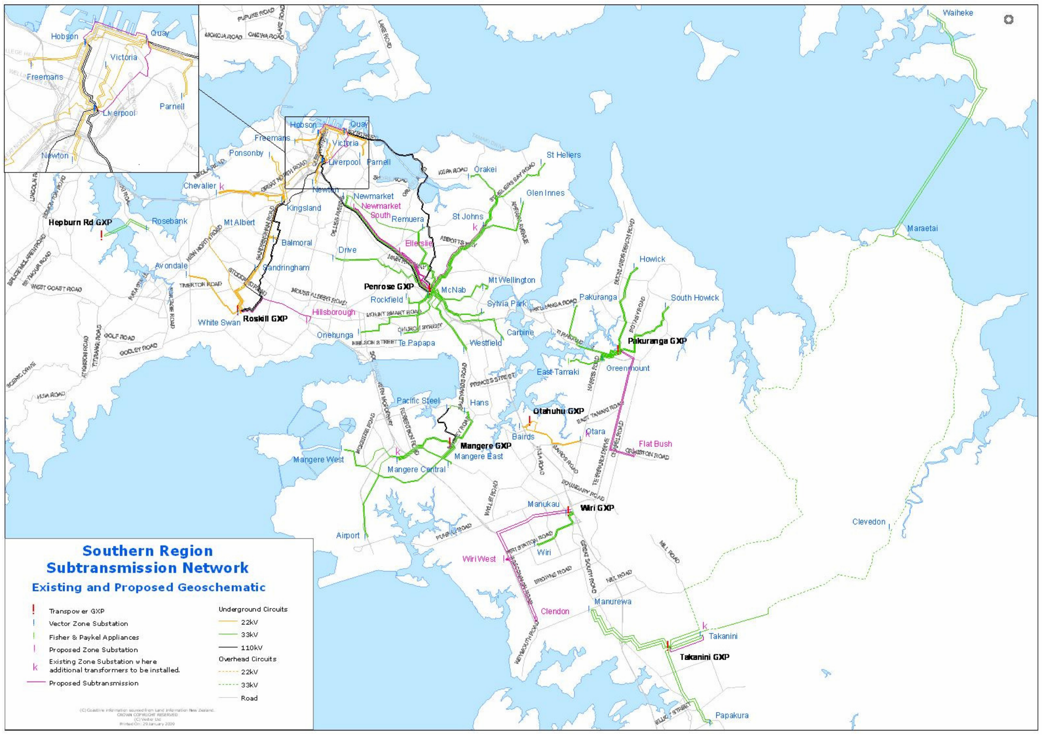


Figure 34 Proposed Projects in the Southern Region

4.6.1 PROJECTS CURRENTLY UNDER WAY OR PLANNED TO START

A1: Auckland CBD

Project	*Auckland CBD 11kV to 22kV load transfer and 22kV extension*	
Driver	*Growth*	
Timescale	*Ongoing*	
Status	*Committed*	*Estimated capital $1-5 million per annum*

An investigation was carried out on the most appropriate voltage for the distribution network in the Auckland CBD. The conclusion was that the most economic voltage for the load density in the CBD was 22kV and a project was set up to progressively upgrade the distribution voltage from 11kV to 22kV.

Following the completion of the 22kV backbone distribution network selected load will be transferred from the existing 11kV network to the new 22kV network as a means of relieving the heavily loaded existing 11kV network and to replace the ageing equipment that is in poor condition. New 22kV cables will be installed extending from existing 22kV backbone to enhance connectivity between 22kV distribution feeders. This project will maintain the supply capacity and security in the Auckland CBD.

A2: Highbrook Area

Project *Highbrook Industrial Subdivision Stage 3D*
Driver *Growth*
Timescale *2009*
Status *Committed* *Estimated capital $1-5 million*

When the new Highbrook subdivision was first investigated the options of reticulating at 11kV or 22kV were investigated. It was decided that 22kV was the most economic voltage and the subdivision proceeded on this basis. Development of the Highbrook subdivision is now almost complete. The 22kV switchboard is installed and it is supplied by two new 22kV cables laid from Otahuhu GXP providing an n-1 capacity of 25MVA. Six 22kV open ring feeders are laid from this substation for the reticulation of the Highbrook industrial subdivision. The final stage 3D of the development is in progress and scheduled to be complete in early 2009.

A3: Te Papapa Area

Project *Carter Holt Harvey Te Papapa feeder reinforcement*
Driver *Growth*
Timescale *2009*
Status *Proposed* *Estimated capital $1-5 million*

The Carter Holt Harvey plant in Te Papapa is a major load which requires a secure supply. It is currently supplied by two dedicated 11kV feeders which have been de-rated significantly following a cable rating reassessment. This is due to the load growth over the years on the 33kV cables supplying Te Papapa zone substation and other 11kV feeders, all of which are installed in the same trench. Following the cable de-rating there is now a backstop capacity shortfall upon the loss of one of the two feeders. This project proposes to install an additional cable and double up the two existing cables to restore the secure supply to this customer.

A4: North Shore Area

Project *Install 33kV cable and a second transformer to Forrest Hill substation*
Driver *Growth*
Timescale *2009*
Status *Committed* *Estimated capital >$5 million*

There are two issues around this project. The first is the security at Forrest Hill substation itself. The second is the security at the Wairau 33kV bulk supply point. The proposed project will help resolve both problems.

The load at Forrest Hill substation has exceeded the oil natural air natural (ONAN) rating of the transformer and reinforcement is required. Various options were investigated including the building of a new zone substation in the area. However, the conclusion was that the most economic solution was to reinforce the existing substation with a second transformer. The additional capacity at this substation will allow offloading of adjacent substations, in particular Wairau substation which is heavily loaded. It will also provide additional 11kV backstopping for Milford substation.

The load on the Wairau 33kV bulk supply point is operating near its n-1 capacity. The loss of the 110kV double circuit line at high load times would mean that there would be insufficient capacity on the remaining circuit to supply the substation's load. One option is to reinforce the supply to this substation by constructing a new

110kV circuit from Albany. Another option is to reinforce the substation at 220kV as proposed as part of the cross- isthmus upgrade in conjunction with Transpower. This second option is the preferred option and various projects have been implemented to transfer load away from Wairau to keep within the security standard and acceptable risk level.

The installation of a 33kV cable from Sunset Road to Forest Hill will allow load to be transferred from Wairau substation to Albany forestalling upgrades of Wairau in anticipation of the 220kV upgrade.

A5: Whangaparaoa Area

Project	*Establish Gulf Harbour zone substation*	
Driver	*Growth*	
Timescale	*2009*	
Status	*Committed*	*Estimated capital >$5 million*

Demand on the Whangaparaoa Peninsula has been growing steadily and backup supplies are limited due to its geographic layout. The existing supply to Gulf Harbour is from long 11kV feeders from Manly substation. Options investigated for reinforcing the area included installing additional 11kV feeders from Manly or establishing a new zone substation at Gulf Harbour. Given that Manly substation was already heavily loaded it was not desirable to add more load onto this substation and the preferred option was to establish a new zone substation at Gulf Harbour. A 33kV cable (operated at 11kV) was laid to Gulf Harbour a few years ago in anticipation of the new zone substation. The new zone substation is currently close to commissioning stage.

A6: Roscommon Manurewa Area

Project	*Clendon zone substation*	
Driver	*Growth*	
Timescale	*2010*	
Status	*Committed*	*Estimated capital >$5 million*

Clendon zone substation is required to offload the heavily loaded Manurewa substation and will also be used to relieve Wiri zone substation. For this project the following options were considered to meet the load requirement:

- Option 1. Construct one new zone substation at Wiri West to meet the load requirements of both Wiri West and Manurewa West.
- Option 2. Construct two new zone substations; one at Clendon and the other at Wiri West. Wiri West will be deferred until load demand necessitates its construction.

Option 2, which provides a significantly more robust and secure network, is the preferred option.

Clendon substation will consist of two 20MVA transformers and the target commissioning is before winter 2010.

This new substation will be supplied at 33kV from Wiri GXP. Large size 33kV cabling will be installed allowing a possible future 33kV Wiri West and Clendon ring network. Vector is installing ducts for two 33kV feeders to supply Clendon in conjunction with two major roading projects (Cavendish Drive upgrade and SH20 extension). This coordination minimises the construction impact of cabling the 33kV from Wiri GXP through to Clendon.

A7: Ponsonby and Chevalier Areas

Project *Uprate Ponsonby and Chevalier substations to 11kV*
Driver *Growth*
Timescale *2010*
Status *Committed* *Estimated capital >5 million*

Ponsonby and Chevalier substations are currently the last substations operating at 6.6kV within Vector's network. Marginal load increases have pushed a number of 6.6kV feeders above their security limits. Options for resolving the problem included installing additional 6.6kV feeders from the existing substations or uprating the voltage from 6.6kV to 11kV. As a significant portion of the equipment in the area is rated for 11kV operation, uprating the network voltage from 6.6kV to 11kV is a cost effective solution particularly as it increases the capacity of the existing network and offers enhanced security through interconnection with the adjacent 11kV network.

A new 33-22/11kV transformer will be installed at Chevalier substation to replace the existing 22/6.6kV transformers. The dual voltage specification for the transformer is to prepare the substation to be upgraded to 33kV in the long term. All 6.6kV rated distribution transformers will be replaced with 11-6.6kV dual ratio units. Short lengths of new 11kV cables will be installed to enhance connectivity between the network to be upgraded and the adjacent existing 11kV network. As only a single transformer will be installed at Chevalier, a fast switching scheme will be installed to achieve fast load transfer via the 11kV network if there is an outage at Chevalier substation. The existing Ponsonby transformers are already dual rated and hence do not need to be replaced.

A8: Ranui Area

Project *Establish Ranui zone substation*
Driver *Growth*
Timescale *2010*
Status *Committed* *Estimated capital >$5 million*

The Swanson area continues to develop and the Swanson zone substation is approaching full capacity. In addition the load continues to grow in the Ranui area which is currently supplied from Triangle Road substation. Reinforcement is required and various options were investigated.

In the southern part of this area, the Swanson, Simpson Road, Keeling Road and Woodford Avenue substations, which currently supply this area, all have a single transformer. Installation of a second transformer at these substations was looked at but was rejected in favour of distributing the capacity and establishing new substations at Waitakere and Ranui. This option has the advantages of allowing the 33kV network to be extended to Waimauku and also being able to offload the four substations mentioned above.

In the northern part of the area, Triangle Road substation has two small transformers. The option of installing larger transformers was looked at but rejected in favour of new substations at Ranui and Westgate.

The new zone substation will shorten up the 11kV feeders, improving SAIDI and also offload adjacent substations at Swanson, Triangle Road, Simpson Road, Keeling Road and Woodford Avenue substations.

A9: Auckland CBD

Project	*Establish Liverpool to Quay 110kV cable and reinforce 110/22kV transformation at Quay*	
Driver	*Replacement*	
Timescale	*2010*	
Status	*Proposed*	*Estimated capital >$5 million*

Additional 110/22kV transformer capacity is required in the CBD. It is proposed to install a 110kV cable from Liverpool to Quay to supply the new transformers. This project is part of the overall Auckland CBD plan to establish an additional 110kV infeed into the CBD and connect the three 110kV substations via a 110kV ring thereby providing a robust 110kV network befitting a CBD. The short term benefits are mitigation of the aged Penrose–Quay 110kV cable risk, and ageing Liverpool 110/22kV transformer risk, while keeping the Hobson site available for the eventual GXP development.

A10: Auckland CBD

Project	*22kV switchboard at Quay*	
Driver	*Growth*	
Timescale	*2010*	
Status	*Proposed*	*Estimated capital $1-5 million*

As part of the reinforcement to Quay substation (Project A9) additional 22kV switchgear is required. This new switchgear will enable the connection of the additional 110/22kV transformers and also additional 22kV feeders.

A11: St Johns Area

Project	*Establish St Johns zone substation*	
Driver	*Growth*	
Timescale	*2010*	
Status	Committed	Estimated capital >$5 million

St Johns substation is currently a 33kV switching station. Development of the Mt Wellington quarry and growth surrounding the Auckland University's Glen Innes Campus has established the need for additional network capacity in this area.

Options investigated included reinforcing the adjacent Glen Innes substation. However, the size of the quarry subdivision made this impractical. The establishment of St Johns zone substation is a cost effective solution which will provide the capacity and security to meet the long term growth for the area.

A12: Hillsborough Area

Project	*Establish Hillsborough zone substation*	
Driver	*Growth*	
Timescale	*2010*	
Status	*Committed*	*Estimated capital >$5 million*

The Hillsborough area is currently supplied by three zone substations at Onehunga, The Drive and White Swan. Onehunga substation in particular is very heavily loaded and in need of reinforcement. Various options were investigated including upgrading the Onehunga substation with new and larger transformers, 11kV switchgear and 33kV cables. However, this upgrade would help only Onehunga substation and would do little to relieve The Drive and White Swan substations which have several 11kV feeders nearing capacity. After analysing the options it was decided that the best long term solution for supply to the area was to establish a new zone substation in Hillsborough. This new substation will offload Onehunga substation and the 11kV feeders from the White Swan and The Drive substations.

This substation was originally scheduled to be commissioned by the end of 2008. However, it has been delayed to 2010 due to New Zealand Transport Authority's SH 20 project.

A13: Auckland CBD

Project	*22kV distribution extension to Tank Farm from Hobson*	
Driver	*Growth*	
Timescale	*2010*	
Status	*Proposed*	*Estimated capital <$1 million*

Two 22kV distribution feeders were installed in 2007 from Hobson substation to Fanshawe Street picking up load along Fanshawe Street. This project is to extend the feeders towards the Tank Farm to supply the proposed major development there.

The alternative of supplying the new development from existing 11kV feeders is not a viable solution due to the heavy loading of the 11kV network.

4.6.2 PROJECTS PLANNED FOR YEARS 2011-2014

A14: Greenhithe/Hobsonville Area

Project	*Install a 33kV cable between Greenhithe and Hobsonville*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Committed*	*Estimated capital $1-5 million*

The area between the proposed Greenhithe substation and Hobsonville substation is growing and is expected to develop considerably over the next few years. This is a result of the new motorway construction making the area attractive for development and land being made available for development. It is planned to install a new 33kV circuit between Greenhithe substation and Hobsonville substation. This circuit will provide a 33kV backstop to the new Greenhithe substation described in A20 below. It will provide interconnection between the Albany and Henderson GXPs and provide more flexibility in supplying the network.

A15: Titirangi Area

Project	*Establish Titirangi zone substation*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Committed*	*Estimated capital >$5 million*

The Titirangi area is currently supplied from Laingholm and Atkinson Road substations. Atkinson Road substation is very heavily loaded and requires reinforcement. Options investigated included replacing the existing transformers at Atkinson Road with larger units. However, the benefits of establishing a new substation at Titirangi outweigh the alternative options. These benefits include improved reliability to a semi rural area by shortening up the 11kV feeders. This project has been delayed by local opposition to the proposed location of the substation.

A16: Otara Area

Project	*Install a third transformer at Otara substation*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Committed*	*Estimated capital >$ 5 million*

It is proposed to install a third transformer at Otara zone substation to meet the forecast capacity shortfall due to the following developments:

- A new 5MVA customer requirement in Ormiston Road
- To support the emerging Flat Bush Town Centre load.

The Otara zone substation currently comprises two 15MVA 22/11kV transformers and three 22kV supply cables from Transpower Otahuhu GXP. Two of the supply cables are currently operated in parallel. This project will reconfigure the three cables with each supplying a separate transformer. The capacity of the third transformer will be 20 MVA 22/11kV.

The following options were considered for this project:

- Option 1. Reinforce the Otara zone substation with a third transformer
- Option 2. Establish a new zone substation at Flat Bush with three variations
- Option 3. Relieve Otara zone substation by cascade load transfers on to Bairds, Manukau and Greenmount substations.

Option 1 was selected since it is the technically superior and lower cost solution compared to the other options.

A17: Rockfield Area

Project	*11kV feeder reinforcement Rockfield area*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Proposed*	*Estimated capital $1- 5 million*

The load in the area is predominately commercial/industrial. The existing 11kV feeders supplying the area are heavily loaded and expected to run out of backstop capacity in a few years due to load growth. This project proposes to install a new feeder from Rockfield substation and rearrange the network in the area to solve the problem. Options to install the new feeder from McNab substation or proposed Ellerslie new substation will also be investigated.

A18: Te Papapa Area

Project	*Te Papapa area 11kV reinforcement*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Proposed*	*Estimated capital $1- 5 million*

Load growth has caused a security breach in the Te Papapa area. This project proposes a new 33kV circuit, initially operated at 11kV, to reinforce the network, as part of the long term plan to reinforce Onehunga substation.

The alternative is to install a new 11kV feeder. Analysis shows it is not a cost efficient solution for long term.

The project was initiated due to new load proposed by a commercial customer in 2007. The customer has since changed its development plans. As a result this project has been deferred to 2011. A minor project has been carried out to meet the customer's short term requirements.

A19: Greenhithe Area

Project	*Establish Greenhithe zone substation*	
Driver	*Growth*	
Timescale	*2011*	
Status	*Committed*	*Estimated capital >$5 million*

The Greenhithe area was largely rural but this is rapidly changing as a new motorway is developed through the area and residential subdivisions are developed. This area is supplied by long 11kV feeders from remote zone substations which are very heavily loaded and require reinforcement. Extending the 11kV network does not provide sufficient security of supply or an economic solution to the issue. It is proposed to establish a new zone substation on an existing site to supply the load to this developing area.

A20: Mangere Area

Project	*Install a third transformer at Mangere Central*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital >$1- 5 million*

There were three 33/11kV 20MVA transformers in service at this substation. When the load decreased at this site, (airport load was transferred to a dedicated substation at Auckland International Airport Limited), one of these transformers was relocated. Substantial industrial development is occurring to the north of Auckland International Airport. The plan is to reinstate the third transformer by 2011 to supply this new load.

A21: Auckland CBD

Project	*Install 110kV cables between Hobson and Quay substations*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital >$5 million*

As part of the long term plan for the reinforcement of the Auckland CBD it is proposed to install two 110kV cables between Hobson substation and Quay substation. These cables are required to maintain the security of supply to the CBD. As part of this project it is planned to replace the existing 110/22kV transformers with newer 110/22kV transformers. The existing transformers have reached the end of their life.

A22: Waimauku Area

Project	*Install a second transformer and construct a new 33kV line to Waimauku zone substation*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital >$5 million*

The area around Waimauku substation is growing, with plans to accommodate 6,000 people. To enable a secure supply to this new population it is planned to install a second transformer at this substation. To maintain security of supply to the substation it is also planned to construct a new 33kV line from the new Waitakere substation (A40) to Waimauku.

A23: Birkdale Area

Project	*Uprate 33/11kV transformer at Balmain*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital $1-5 million*

The load on the Balmain substation has reached the point where reinforcement is required. Given that the substation has sufficient backup capacity on the 11kV network if the transformer is lost, it is proposed to uprate the existing transformer and 11kV tails to enable the substation to increase its output to around 16MVA from the current 12.5MVA.

A24: Swanson Area

Project	*Establish Waitakere zone substation*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital >$5 million*

The Swanson area continues to develop and the Swanson zone substation is approaching full capacity. This substation has several very long rural feeders with poor reliability. A new zone substation at Waitakere will offload Swanson substation and allow for ongoing growth in this area. The new substation will allow some of the long 11kV feeders to be shortened, improving network performance.

Once completed, it is planned to extend the 33kV line from this substation to Waimauku (project A22), providing sub-transmission security to both substations.

A25: Waitakere Ranges Area

Project	*Install new 11kV cable to Piha*	
Driver	*Growth*	
Timescale	*2012*	
Status	*Proposed*	*Estimated capital $1-5 million*

The load at Piha has grown to the stage where voltage problems are occurring at peak load times. A voltage regulator has been installed on the line but problems are still experienced from time to time. To provide a long term solution to the problem it is proposed to install a new 11kV cable along the Piha Road. This new cable will be supplied from the recently commissioned Oratia substation. The new substation is closer than the existing supply and will have a lower load. This means that the low voltage issues will be resolved for the foreseeable future.

A26: Flat Bush Area

Project	*Establishment Flat Bush zone substation*	
Driver	*Growth*	
Timescale	*2013*	
Status	*Proposed*	*Estimated capital >$5 million*

The developing Flat Bush township with city centre and high density multi storey residential has a planned population of 40,000. The demand is conservatively estimated in excess of 30MVA and will require a new zone substation (Flat Bush zone substation).

Several 11kV feeder reinforcement projects have been completed to free up capacity to meet the short term load requirements and to enable the establishment of Flat Bush substation to be deferred. The option of establishing a new zone substation close to the future load centre is the preferred long term solution mainly due to the large load that on its own justifies a dedicated zone substation and the placement of the new zone substation as close as possible to the load centre to optimize 11kV cable requirements.

This project is to purchase land for the substation. The substation itself will not be commissioned until 2017.

A27: Kaukapakapa Area

Project	*Establish Kaukapakapa zone substation*	
Driver	*Growth*	
Timescale	*2013*	
Status	*Proposed*	*Estimated capital $>5 million*

Helensville substation is heavily loaded and has limited 11kV backstopping due to its rural location and distance from adjacent substations. Off loading is required to improve the security of supply to the area.

In addition, the load on the Helensville 11kV feeder to Kaukapakapa continues to show steady increase and is approaching its full load capacity. The 11kV feeder is very long and has experienced poor reliability and voltage quality.

This project is to resolve the loading on Helensville and this long rural feeder by establishing a new zone substation at Kaukapakapa. The substation will provide capacity to offset the load increases, allow offloading of Helensville substation, and partition the 11kV feeder to improve its performance statistics and backstop the adjacent zone substations.

A28: Warkworth Area

Project *Reinforce the Warkworth 33kV circuits*
Driver *Growth*
Timescale *2013*
Status *Proposed* *Estimated capital $1-5 million*

Load on the existing two 33kV lines supplying Warkworth is approaching their capacity limit and reinforcement is required.

Options considered include:

- Reinforcing the existing 33kV lines
- Establishing a new 33kV line.

The preferred option is to upgrade an existing 11kV line so it can operate at 33kV. This will provide three 33kV lines to Warkworth with improved route diversity and also allow for future substations at Tomarata, Omaha, Sandspit and Warkworth South.

The Warkworth area continues to grow with several major subdivisions being proposed in various parts of the network. To supply this load growth, additional zone substations will be required. Timing is dependent on when the developments occur.

A29: Massey North Area

Project *Establish Westgate zone substation*
Driver *Growth*
Timescale *2013*
Status *Proposed* *Estimated capital >$5 million*

Recently rezoning of land north of the Westgate shopping centre and through to the Hobsonville airbase, and the construction of the Greenhithe motorway, have meant that growth in this area will expand rapidly over the next few years. A new town centre is planned to be constructed by 2012. The existing substations in the area are already fully loaded and will not be able to supply the new loads. It is planned to establish a new zone substation at Westgate (site currently being investigated) which will offload the nearby substations of Triangle Road and Hobsonville.

A30: Rosedale Road Area

Project *Establish Rosedale zone substation*
Driver *Growth*
Timescale *2013*
Status *Proposed* *Estimated capital >$5 million*

Significant development is taking place in new industrial subdivisions located in the Rosedale area. A new zone substation in the vicinity of Old Rosedale Road is proposed to share the load increase in the Albany basin that would otherwise be fed from Mckinnon substation and enhance the network capacity in the Rosedale area. The new substation also allows a higher level of backstopping to local feeders.

Options considered include:

- Installation of a second transformer at East Coast Road substation

- Establishment of a new substation in Rosedale Road.

Analysis has shown that the establishment of a new zone substation in Rosedale Road is the most cost effective long term option.

A31: Highbury Area

Project	*Install a second transformer at Highbury substation*	
Driver	*Growth*	
Timescale	*2013*	
Status	*Proposed*	*Estimated capital <$1 million*

Load forecasts for the Highbury area indicate that additional transformer capacity will be required to maintain the security of supply to this area. After looking at various reinforcement options it has been decided that a second transformer at Highbury is the most cost effective option.

A32: Henderson Area

Project	*Reinforce 33kV lines and install second transformer at Keeling Road and Woodford substations*	
Driver	*Growth*	
Timescale	*2014*	
Status	*Proposed*	*Estimated capital >$5 million*

To ensure the security of supply is maintained is this area it is necessary to reinforce both the Keeling Road substation and the Woodford substation with additional transformers. To improve the network security a 33kV tie line between the Woodford and Keeling Road substations is proposed in addition to an interconnection with Hepburn GXP. Currently these substations are supplied by single circuit 33kV radial lines. The new configuration will create a 33kV ring from the Hepburn Road GXP.

A33: Glenvar Area

Project	*Establish Glenvar zone substation*	
Driver	*Growth*	
Timescale	*2014*	
Status	*Proposed*	*Estimated capital >$5 million*

The area around Long Bay is being developed into residential subdivisions over the next few years. The existing substation at Torbay does not have enough capacity to supply these new subdivisions. Options included installing additional capacity at Torbay substation. However, this substation is supplied by a spur cable and security of supply would become an issue. The alternative being proposed is to construct a new substation in Glenvar Road. This new substation will supply part of the new subdivisions and also reinforce other parts of the network, particularly Browns Bay substation and also Spur Road substation. A 33kV ring will be created as part of this project to provide alternative feeds into the area.

A34: Warkworth Area

Project *Establish Warkworth South zone substation*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital >$5 million*

The load in the Warkworth area continues to grow as the area develops. A third 7.5MVA transformer was recently installed at Warkworth substation to provide a secure supply to the area. However, the bulk of the new load is developing in the industrial part of Warkworth which is about 5km from the existing substation. The 11kV feeders supplying this area are becoming heavily loaded and require reinforcement. Options investigated include installing additional 11kV feeders from the existing substation or establishing a new zone substation. There are a number of issues associated with installing new 11kV feeders such as a lack of space in the substation for additional switchgear, building new overhead lines and the distance involved. The 11kV reinforcement option is a short term option.

In the long term a new substation will be required and Vector already owns a site in this area. Preliminary works are being carried out to install 33kV ducts as part of the State Highway 1 widening.

A35: Ellerslie Area

Project *Establish Ellerslie zone substation*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital >$5 million*

Commercial development on Ellerslie Racecourse land coupled with general load growth in the Greenlane area has resulted in the need for increased network capacity. A new zone substation is proposed for this area. Based on load growth forecasts the alternative option of 11kV network reinforcement from the adjoining substation is not a viable long term solution. A site has been bought for the proposed new substation.

A36: Auckland CBD

Project *Extend 22kV switchboard at Hobson*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital $1-5 million*

As part of the long term plan for the CBD it is proposed to install additional 22kV switchgear at Hobson substation. This is to enable connection of existing 22kV capacity and also provide additional 22kV circuits for the 22kV distribution network.

A37: Wairau Valley Area

Project *Install new 33kV and 11kV switchgear*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital $1-5 million*

The existing substation is approaching full capacity and larger transformers need to be installed. In addition there is no space in the existing switchroom for additional 11kV switchgear for new 11kV feeders. The existing 33kV switchgear is outdoor switchgear and is approaching the end of its economic life. The preferred option is to construct a new building for both the 11kV and 33kV switchgear as part of the redevelopment of the site for the future 220kV cross- isthmus project.

A38: Manly Area

Project *Reinforce 33kV supply to Manly substation*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital >$5 million*

Manly substation is currently supplied at 33kV by two 33kV circuits from the Silverdale GXP. When the new Red Beach substation was constructed in 2007 provision was made to extend the 33kV cable from Red Beach through to Manly. The load on Manly and Gulf Harbour substations is reaching the point where the loss of one 33kV circuit will overload the remaining 33kV circuit. This project will extend the 33kV cable to Red Beach through to Manly to reinforce the 33kV supply.

A39: Northcote Area

Project *Reinforce 33kV supply to Northcote substation*
Driver *Growth*
Timescale *2014*
Status *Proposed* *Estimated capital $1-5 million*

The load forecasts for Northcote substation indicate that the load on this substation will exceed the capacity of the 11kV network to backup. This project will look at options for reinforcing the 33kV supply to Northcote.

4.6.3 PROJECTS PLANNED FOR YEARS 2015-2019

Table 17 summarises the projects planned from 2015 through to 2019 to maintain supply security in the Vector electricity network.

No	Project Description	Year	Cost
A40	Orewa – third 33kV supply	2015	> $5m
A41	Sandspit – establish new zone substation	2015	> $5m
A42	Newmarket South – establish new zone substation	2015	$>5m
A43	Takanini – install third 33/11kV transformer	2015	$<5m
A44	Hobson – replace 2x110/22kV transformers	2015	$>5m
A45	Glen Innes – uprate voltage from 22kV to 33kV	2016	$1-5 m
A46	Freemans Bay – 11kV feeder reinforcement	2016	$1-5 m
A47	Warkworth – establish 33kV southern ring	2016	> $5m
A48	Orakei – 11kV feeder reinforcement	2016	$1-5 m
A49	Hobsonville East – establish zone substation	2016	>$5m
A51	Hans – install third 33/11kV transformer	2016	$1-5 m
A52	Quay – install third 110/22kV transformer	2016	$1-5m
A53	Tomarata – establish zone substation	2016	$1-5m
A54	Chevalier – install second 33/11kV transformer	2017	$1-5 m
A55	Newmarket - reinforce 11kV to ex Lion Breweries site	2017	$1-5 m
A56	Quay – install 110kV switchboard	2016	>$5m
A57	Flat Bush – establish new zone substation	2017	$>5m
A58	Wiri West – establish new zone substation	2017	>$5m
A61	Waiwera – establish zone substation	2017	>$5m

No	Project Description	Year	Cost
A62	Albany – establish zone substation	2018	>$5m
A63	Te Atatu – upgrade 33/11kV transformers	2018	$1-5m
A64	Hobson West – establish zone substation	2018	>$5m
A65	AIAL – third 33kV circuit	2018	<$5m
A66	Onehunga – uprate to 33kV supply	2018	> $5m
A67	Hillsborough – reinforce zone substation	2018	$>5m
A68	Wainui – establish zone substation	2018	>$5m
A69	Ellerslie – install second 33/11kV transformer	2018	$1-5m
A70	Avondale North – establish zone substation	2019	> $5m
A71	Westfield - 11kV feeder reinforcement	2019	$1-5 m
A72	Westfield – uprate voltage to 33kV	2019	<$5m
A74	Bairds – install third 33/11kV transformer	2019	<$5m
A75	Tamaki – establish zone substation	2019	>$5m
A76	St Johns – reinforce 33kV supply	2019	>$5m
A77	Kumeu – establish zone substation	2019	>$5m

Table 17 Projects Planned for Years 2015-2019

4.7 FORECAST EXPENDITURES

Refer to Section 8.1.

5 ASSET MANAGEMENT PLANNING

5.1 MAINTENANCE PLANNING POLICIES AND CRITERIA

Vector's overall philosophy on maintaining network assets is based on four key factors:

1. Ensuring the safety of consumers, the public and the network operators.
2. Ensuring reliable network operation.
3. Achieving the optimal trade off between maintenance and replacement costs. That is, replacing assets only when it becomes more expensive to keep them in service. Vector therefore does not adopt purely age based replacement programmes, which is less cost effective.
4. Integration (alignment) of asset management practices given we are a multi utility asset manager.

Vector has developed maintenance standards for each major class of asset it owns. These detail the required inspection, condition monitoring and maintenance tasks together with the frequency at which these are required. The goal of these standards is to ensure that assets can perform safely and efficiently to their rated capacity for their full normal lives and beyond (where economically appropriate). Data and information needs for maintenance purposes are also specified.

Based on these maintenance standards each of Vector's maintenance contractors develops an annual maintenance schedule for each class of asset in its area of responsibility to ensure that all assets are appropriately inspected and maintained.

These asset maintenance schedules are aggregated to form the overall annual maintenance plan which is implemented once it has been signed off by Vector. Progress against the plan is monitored monthly.

Defects identified during the inspections are recorded in the contractors defect database with a copy being kept by Vector. Contractors prioritise the defects for remedial work based on risk and safety criteria. Work necessary in less than three months is undertaken immediately as corrective maintenance while work that can be carried out over a three to twelve month period is placed in the corrective maintenance or asset replacement programme. Work not required within 12 months is generally held over for the future.

Vector also undertakes block replacement programmes. If, during inspection or maintenance work, it is found that a large number of defects occur within a confined geographic area these may be considered for block replacement, attacking all the problems at once even if individually they may not have warranted immediate replacement or repair. In doing so, substantial long term cost savings are achieved by avoiding repeated contractor reestablishment in the same area over a relatively short period. This approach also minimises the disruption to consumers over time.

Root cause analysis is normally undertaken as a result of faulted equipment. If this identifies performance issues with a particular type of asset, and if the risk exposure warrants it, a project will be developed to carry out the appropriate remedial actions. The asset and maintenance standards are also adapted based on learning from such root cause analyses.

5.2 MAINTENANCE PROGRAMMES BY ASSET CATEGORIES

5.2.1 OVERHEAD NETWORK

Maintenance of the overhead network is a mix of reactive (based on faults) and condition monitoring to drive the preventive maintenance programmes.

Planned maintenance standards are under continual review and are adjusted from time to time to reflect improvements. At present our standards include:

- Annual visual line patrol of poles and hardware checking for safety issues and hardware about to fail, including clearance checking to meet the Electrical Code of Practice
- Five yearly condition assessments of wood poles using ultrasonic methods and top load analysis to determine the serviceability of the poles
- Five yearly detailed visual inspection of all poles, towers and hardware. A top load analysis is carried out on all heavily loaded concrete poles as a serviceability check
- Proactive vegetation management and local council vegetation management agreements in line with the Tree Regulations
- Five yearly measurements of earth sites
- Three yearly ABS visual inspections and manual operation tests. A thermovision camera is used to check the contact and connections under load.
- Nine yearly visual inspections of SF_6 switches including operation and gas pressure checks
- Five yearly inspection and testing of reclosers and sectionalisers

- Five yearly inspection and testing of fault passage indicators including battery replacement.

Corona camera inspections have been carried out on some 33kV insulators and several 11kV feeders with unknown faults.

A problem has been identified with some types of 11kV expulsion drop out (EDO) fuses that are overheating and have the potential to catch fire. This appears to be caused by the different metals used at the pivot point on the fuse holder, causing seizing and preventing the fuse holder from falling. This is being monitored and if warranted a replacement programme will be put in place.

One brand of 400V service fuses has been overheating and failing caused by water in the jumper leads migrating into the fuse holder. This type of fuse is no longer used and is replaced when found through replacement programmes or when they fail.

A safety risk has been identified with old connectors and a replacement programme has been implemented. A number of sample tests were carried out on low voltage connectors and many were found to be at the end of their life. The programme to replace all low voltage connectors was started two years ago and the main aim is to have all connectors along main lines replaced by the end of 2009.

Changes to the Electricity Act that require distribution companies to continue supply of electricity beyond 2013 are being considered by parliament. Pending finalisation of the respective legislation strategies will be developed to enable continuation of electricity supply in an economic manner to Vector customers where a supply from the distribution network may be uneconomic.

5.2.2 SUB-TRANSMISSION CABLES

Due to the criticality of these cables to the overall system security and reliability of the network regular inspection and condition monitoring activities are undertaken. These include:

- Regular route patrols, with enhanced frequency in parts of the Auckland CBD, to identify any potential problems on that part of the network
- Proactive work with external FSPs to prevent third party damage
- Annual cable termination inspections and thermographics
- All gauges and transducers associated with pressure cables checked at six monthly intervals
- Serving tests conducted every two years to confirm the integrity of the cables outer sheaths
- Online and off line partial discharge testing undertaken on cables where a previous fault history indicates potential problems.

Over and above routine maintenance all fluid filled and pressurised gas cables are continuously monitored via the centralised SCADA system to provide early warning of falling cable pressure. Associated leaks can be rectified before an electrical failure has the chance to occur.

Maintenance related issues centre predominantly around gas leaks and serving faults. These are repaired as and when they are identified. The fault history is used as an input into the cable retirement decision making process.

5.2.3 DISTRIBUTION CABLES AND ACCESSORIES

Distribution Cables

Maintenance of the underground cable network is limited to visual inspections of cable terminations undertaken in conjunction with the overhead inspections. The cables are operated to failure and then repaired or sections replaced as necessary.

In the early 1970s natural polyethylene insulated 11kV cable was installed on the Auckland network. This type of cable has a high fault history and the current policy is to repair the cable when it faults, to restore supply, then to take steps to replace the cable in a programmed manner.

Pillars and Pits

Pillars and pits are visually inspected at three yearly intervals. The pillar inspection includes a loop impedance test to check the condition of the connections from the fuses to the source.

Where practicable, damaged pillars are repaired, otherwise a new pillar or a pit is installed depending upon the circumstances.

5.2.4 POWER TRANSFORMERS

Routine inspection and condition monitoring include:

- Annual dissolved gas analysis
- Monthly visual checks for moisture, oil levels and leaks, and fan operation
- Annual thermal imaging of terminations and connections
- Annual tap changer activity signature analysis (TASA) condition assessment
- As required, transformer condition assessment (TCA) as an alternative to dissolved gas analysis.

The timing for the transformer refurbishment is scheduled based on dissolved gas analysis (DGA) and condition assessment results. Transformers scheduled for relocation are refurbished as part of the move where their condition and assessed remaining technical life make this an economic option. To improve the decision accuracy associated with major refurbishment the polarisation depolarisation current (PDC) method, a non invasive test to determine the moisture content of the winding insulation, is being used.

5.2.5 CIRCUIT BREAKERS

In general, preventive maintenance on Vector's switchgear consists of the following:

- All switchgear is visually inspected monthly or quarterly for leaks and general condition depending on history and type (some circuit breakers require more frequent inspection than others)

- Thermographic examination is undertaken on all switchboards annually
- Kelman profile testing and non invasive partial discharge location and monitoring is carried out on a two year cycle
- Major maintenance on the switchgear including inspection and testing of circuit breakers on an eight year cycle and testing of protection relays and systems on a two and four year cycle
- Condition assessments (either on a scheduled basis or as a result of routine inspection or equipment fault operation).

Through this process, assets which have been identified for replacement are the Reyrolle Type C CB's (due to age and ongoing operational issues), English Electric type OLX switchboards and 33kV ORT2 CBs. The Motorpol supplied 36PV25 (Crompton and Grieve) circuit breakers are under review for inclusion on the replacement list. Results have shown very low or no gas pressure in the circuit breaker poles and action is being taken to regas all of these CBs. Their ongoing condition will be closely monitored.

5.2.6 ZONE SUBSTATION BUILDING

Routine monthly or quarterly zone substation inspections include the building and other assets such as lighting, fire systems, security systems, fans, heaters and safety equipment. The grounds and ripple injection spaces are also maintained to ensure access security, condition and safety.

Where appropriate, annual building warrants of fitness inspections are carried out and any defects rectified.

5.2.7 POWER SYSTEM PROTECTION

Electromechanical relays are tested on a four year basis. Solid state relays of the Nilstat ITP type are tested on an annual basis to monitor the condition prior to replacement.

Numerical relays are equipped with self diagnostic functions but international experience has shown that not all protection relay faults can be detected by the self monitoring functions. Vector has adopted the Conference Internationale des Grands Reseaux Electriques (CIGRE) Study Committee B5 (Protection and Automation) recommendations for testing numerical protection relays. The testing schedule is shown in Table 18.

Test	Test Description	Interval
Function check of the protection (without test equipment)	The function check is to include: • Comparison of the quantities "current" and "voltage" with the displays • Tripping test by initiating a Trip command • Reading out and analysis of the event memory • Check of the protection local and remote fault indications	Two years
Protection Test (with test equipment)	The Protection Test is to include: • Check of one measuring point of the input quantities "current" and voltage" both for each phase, neutral and for each measuring range by comparison with the display • Check of the function of all binary inputs and outputs Interface test consisting of: • Reading out and analysis of the indication and fault recording memory using PC interface • Reading out of all setting parameters and comparison with the initially set parameters • Check of the protection local and remote fault indications	Four years
Parts Replacement	Back up battery replacement	Ten years

Table 18 Protection Relay Test Schedule

5.2.8 SUBSTATION DC AUXILIARY

Maintenance for the VRLA batteries is based on the recommendations of IEEE–1188 (IEEE Recommended Practice for Maintenance, Testing and Replacement of Valve Regulated Lead Acid Batteries for Stationary Applications).

5.2.9 SCADA

The SCADA system offers in-built self diagnostic capabilities flagging any defects to the control room staff. Existing SCADA RTUs do not have full back up and maintenance is based on failure.

A number of the RTUs have reached the end of their technical life and are programmed to be replaced under future replacement works.

5.2.10 ENERGY AND POWER QUALITY METERS

Planned maintenance is based on a four yearly inspection cycle carried out in conjunction with the protection relays. As these devices are intelligent any malfunction is notified promptly to the master station enabling remedial actions to be undertaken as necessary.

5.2.11 DISTRIBUTION TRANSFORMERS

Transformers are inspected for defects at intervals as shown in Table 19 (these intervals are continually reviewed to ensure maximum effectiveness).

Distribution substation preventive maintenance	Inspection cycle
Earthing system inspection and testing	5 year
Enclosure inspection	12 month/4 year
Equipment inspection	3 year/6 month
Remote function inspection and testing	12 month/Nil
Switchgear service	8 year
Transformer load reading	3 year/nil

Table 19 Distribution Transformer Test and Inspection Schedule

Onsite repairs, such as oil top up, replacement of bolts, minor rust treatment and paint repairs, are generally minor. Where it is uneconomical to complete onsite and the asset poses a safety or reliability risk before the next inspection cycle the asset is replaced and where economic, refurbished and returned to stock.

The main cause of transformer failure is mechanical (not electrical) summarised as two subgroups:

- Some transformers installed between 1998 and 2001 have been identified as prematurely rusting. This is estimated to be about 2% of the population.
- Ground mounted transformers of approximately 25 years old have increased risk of non compliance due to excessive rust or oil leaks. This is estimated to be 5% of the population.

These transformers are being systematically replaced in accordance with our current renewal programmes.

5.2.12 GROUND MOUNTED DISTRIBUTION SWITCHGEAR

Switchgear is visually inspected every three years with a full service every eight years. The full service includes both electrical testing and mechanical service. Currently the Live Tank Oil Sampling (LTOS) methodology is being evaluated and depending on results this may replace the eight year service. Magnefix switchgear is selectively cleaned every three years following visual inspection. Minor defects, such as oil top up, replacement of bolts, minor rust treatment and paint repairs, are generally repaired onsite. Where it is unsafe, uneconomic or impractical to complete repairs onsite the asset is replaced.

5.2.13 MOBILE GENERATOR CONNECTION UNIT

Routine inspections and maintenance are carried out in accordance with the maintenance standards for each type of equipment used. When the MGCUs are not in use they are connected to a LV supply to keep the batteries fully charged.

5.2.14 POWER FACTOR CORRECTION PLANT

The capacitor banks installed inside zone substations are subject to an annual service schedule which includes checking the operation of equipment, cooling fan operation and earthing, cleaning primary equipment and filters, and a visual inspection of all components.

A four yearly major service cycle is also undertaken which covers secondary injection on SPAJ140 and SPAJ160 relays, checking the operation of LOGO and RVS units, IR and ductor tests on SF_6 CB, IR on vacuum switches, capacitance measurements and primary injection on reactors.

Overhead capacitor banks have a 12 monthly visual inspection and an eight year major maintenance refurbishment.

5.3 ASSET RENEWAL AND REFURBISHMENT PROGRAMMES BY ASSET CATEGORIES

5.3.1 OVERHEAD NETWORK

There is a mix of replacement strategies due to the diverse range of assets on the overhead network and of differing criticality.

Bulk Asset Replacement

Areas for a bulk replacement of overhead assets are determined by mapping equipment defects found during asset condition surveys, equipment failures, and reviewing asset age profiles. The number of customers affected by outages arising from equipment failures assists in prioritising areas. Once an area has been identified (through having a substantial number of assets at the end of their economic lives), bulk asset replacement in the region commences. Equipment with less than five years remaining life is generally then replaced in the selected areas (unless conditions assessment dictates otherwise). It is found that this is an economically sound approach, through avoiding repeated contractor reestablishment in one area. At the same time inconvenience to consumers is also minimised.

Steel Towers

A two year programme to refurbish the steel towers is about 75% complete. This consists of corrosion abrasive blasting and the replacement of any severely damaged members. The entire structure is painted providing a low maintenance period of at least 20 years. At the end of this period maintenance will consist of cleaning and repainting.

Poles

Poles are tested for their serviceability as set out in HB C(b)1:2006 and AS/NZS 4676:2000. Wood poles are also tested using ultrasound method. Any pole not meeting serviceability requirements is programmed for replacement.

Crossarms and Hardware

Crossarms are identified for replacement from detailed line inspections. Crossarms installed before 1990 were of class two and tended to have a life of up to 40 years. Class three crossarms installed in the 1990s are found to be in need of replacement after 20 years. Only class one or two are now installed on the network. Crossarm replacements are a particular focus in the northern region.

Pin type insulators are no longer used for 33kV and 11kV insulators. All replacements are of the solid core post type as they provide a higher level of reliability in polluted environments and lightning prone areas.

Conductors

Conductors are programmed for replacement based on condition assessments and analysis of fault history. Numbers of joints per span or signs of damage are used to determine the need for replacement. 11kV spur lines of 16mm^2 copper are being replaced with AAAC conductors and fused where possible.

Air Break Switches

Air break switches are replaced based on condition assessments. All replacements are SF_6 switches.

Reclosers

A number of the older oil filled reclosers are now at the end of their technical and economic life. These are being replaced with vacuum reclosers.

Programmes of Work

Refurbishment and replacement of assets on the overhead network is an ongoing programme with budget allocated for each year. Work packages are developed by each of Vector's FSPs based on results from the condition inspections and network performance.

5.3.2 SUB-TRANSMISSION CABLES

Sub-transmission cable replacement is determined by a combination of condition and performance assessments relating to the risk of loss in functionality, analysis of failure and defect rates, associated costs of repair, failures and condition tests.

The proposed sub-transmission cable replacement programme over the next 10 years is detailed below. However, the priority of any particular replacement project may change as improved condition information becomes available, performance expectations change or changes to the network design and configuration cause a reassessment.

The following is a list of projects being considered for replacement:

- Replace both Balmoral 22kV solid cables

- Replace both Sandringham 22kV solid cables
- Replace both Parnell 22kV solid cables
- Replace both Ponsonby 22kV gas/solid cables
- Replace both Chevalier 22kV oil/solid cables
- Replace the Liverpool to Quay 22kV gas cable
- Replace the Takanini to Maraetai 33kV oil cables
- Replace both Onehunga 22kV solid cables.

5.3.3 DISTRIBUTION CABLES AND ACCESSORIES

Distribution Cables

Cable replacements are determined based on a combination of fault history and frequency together with tests completed as part of fault repairs. Cable replacements will be targeted on cables exhibiting high fault rates particularly the natural polyethylene insulated 11kV cables.

Cable Terminations

Cable termination replacement is driven by visual inspection and analysis of fault rates. The exceptions to this are 11kV cast metal terminations where analysis of fault rates together with a risk assessment has resulted in a decision to proactively replace them with heat shrink terminations.

Pillars and Pits

Pillars are generally replaced following faults or reports of damage. Pillars with a high likelihood of future repeat damage by vehicles are replaced with pits. Older pillars are being targeted for planned replacement as repair becomes impractical or uneconomic. Some particular types of pillar have been/are being replaced proactively because they have been assessed as presenting an unacceptable safety risk.

Anticipated distribution cable and pillar replacement projects over the next 10 years are detailed below:

- Continued proactive programme replacement of cast iron cable terminations
- Replacement of natural polyethylene 11kV cables that have faulted during the year
- Continued replacement of natural polyethylene cables
- Complete breadbox and mushroom pillar replacement project
- Replace concrete pipe pillars
- Continue targeted replacement of cables that are showing high fault rates
- Replace metal pillars that were fitted with mild steel components.

5.3.4 POWER TRANSFORMERS

Transformer asset replacement is based on a combination of non invasive and invasive condition assessment. Components that have deteriorated beyond acceptable parameters are taken out of service for a detailed inspection while tests conducted on the oil and winding insulation give an indication of probable life expectancy of the transformer. A decision is made on refurbishment or replacement based on the functionality and performance requirements of the asset.

The following is a list of projects over the next 10 years:

- Two transformers are programmed for major refurbishments, being one 110kV transformer from the Wairau substation and one Atkinson Road substation 33kV transformer
- Budgetary provision has been made to replace one transformer in 2010/11
- Budgetary provision has been made to replace three transformers during the 2012-2017 period.

5.3.5 CIRCUIT BREAKERS

The timing for the replacement of circuit breakers is based on condition, performance, ratings and industry related information but can also be the result of non electrically related drivers such as site relocation or decommissioning, safety considerations and building code regulations such as fire protection requirements. A risk matrix has been developed that identifies priority CBs for replacement.

Projects identified for implementation over the next 10 years include:

- Complete the 11kV English Electric type OLX switchboard replacement at Triangle Road substation
- Complete the 11kV Ferguson Palin switchboard replacement at McNab substation
- Replace the 33kV Reyrolle type ORT2 outdoor CBs at Wellsford (CBs P132 and P136) and Warkworth (CBs P106, P280, P130)
- Replace the 11kV English Electric type OLX/South Wales switchboard at Helensville substation
- Continued replacement of the 11kV English Electric type OLX, South Wales and GEC/Brush oil type switchboards (Browns Bay, Atkinson Road, Balmain, New Lynn, Hauraki, Laingholm and Sabulite Road to be considered)
- Replacement of 11kV South Wales, AEI and Brush/GEC switchboards (Maraetai, Westfield, Onehunga, Orakei, Manurewa and Pakuranga substations to be considered)
- Replacement of zone substation switchgear as identified by condition and risk ratings
- Continued replacement of oil type circuit breakers across the networks based on condition and risk assessment.

5.3.6 ZONE SUBSTATION BUILDINGS

The zone substation building refurbishment programme includes tasks such as roof replacement, exterior and interior painting, security and fencing improvements to maintain the assets in good condition on an as needed basis.

This work is done as part of an ongoing seven year programme.

5.3.7 POWER SYSTEM PROTECTION

Replacement programmes are generally based on relay condition and or failure analysis. At the time of replacement the opportunity is taken to upgrade the protection schemes to meet the current standards.

The planned protection relay replacement programme over the next 10 years is:

- Zone substations supplied from the Hepburn GXP protection and control replacement/upgrade
- Manukau substation; protection and control replacement/upgrade
- Zone substation and network supplied from GXP Henderson; protection and control replacement/upgrade
- Zone substation and network supplied from GXP Wellsford; protection and control replacement/upgrade
- Ongoing protection and control replacements/upgrades across all networks as identified by asset condition monitoring.

5.3.8 SUBSTATION DC AUXILIARY

In all networks batteries are replaced, using valve regulated lead acid (VRLA) batteries, as they fail or based on condition assessment results.

5.3.9 SCADA

Vector has embarked on a planned replacement programme of the RTUs with 10 RTUs replaced annually per region. The SCADA integration strategy enables Vector to deploy standard RTUs (for example, from Foxboro or Serce) as the replacements across the networks.

5.3.10 ENERGY AND PQ METERS

These assets have a technical life of 15 to 20 years. They will be scheduled for replacement based on service history, reliable operation and age. Replacement will be considered from 2014 depending on performance.

5.3.11 DISTRIBUTION TRANSFORMERS

Transformer replacement is determined from condition criteria accessed during regular inspection. Any transformer failure is investigated as to cause and a cost/benefit decision made to repair, refurbish, replace or scrap the asset.

The refurbishment and replacement of transformers is an ongoing programme with budget allocated each year. Work packages are developed by each of Vector's FSPs based on the results of condition inspections.

5.3.12 GROUND MOUNTED DISTRIBUTION SWITCHGEAR

Switchgear replacement is based on condition and availability of components for repair. Any switchgear failure is investigated as to cause and a cost/benefit decision made to repair, refurbish, replace or scrap the asset.

As part of Vector's continual improvement process the use of oil filled switchgear has been reviewed and other types of switchgear investigated. The result has been a change in specification and implementation of SF_6 and vacuum switchgear in selected locations.

Refurbishment and replacement of switchgear is an ongoing programme with budget allocated each year. Work packages are developed by each of Vector's FSPs based on results from the condition inspections.

5.3.13 MOBILE GENERATOR CONNECTION UNIT

As the two MGCUs are relatively new there are no plans for any refurbishment or asset replacement at this time.

5.3.14 POWER FACTOR CORRECTION UNIT

Replacement decisions are based on condition, age, location, criticality and performance. Replacement expenditure may be required on the switched overhead units. These switches have a stated mechanical life of 10,000 operations but there is no planned replacement programme at this time.

5.4 FORECAST EXPENDITURES

Refer to Section 8.1.

6 RISK MANAGEMENT

6.1 RISK MANAGEMENT POLICIES

Risk management at Vector is an integral part of the asset management process. The consequences and likelihood of failure or non performance, current controls to manage these, and required actions to mitigate risks, are all documented, understood and evaluated as part of the asset management function.

Risks associated with the assets or operations of the network are evaluated, prioritised and dealt with as part of the asset maintenance, refurbishment and replacement programmes, and work practices. The acceptable level of risk will differ depending on the criticality of electricity supply to different categories of customers, communities willingness to accept risk and the circumstances and the environment in which the risk will occur. This analysis ranges from high frequency but low impact events, such as tree interference, through to low probability events with high impact such as the total loss of a zone substation for an extended period.

Risks associated with assets are managed at Vector by a combination of:

- Reducing the probability of failure through the capital and maintenance work programme and enhanced work practices
- Reducing the impact of failure through the application of appropriate network security standards, robust network design supported by contingency and emergency plans.

Vector's contingency and emergency planning is based around procedures for restoring power in the event of a fault occurring on the network, and is detailed in Section 6.3 below.

6.2 RISK ACCOUNTABILITY AND AUTHORITY

6.2.1 VECTOR BOARD RISK AND ASSURANCE COMMITTEE

The board oversees the management of risk for Vector as part of its overall corporate governance responsibilities. To this end there is ongoing dialogue on risk related issues between the board and management as the board executes its governance responsibilities including the management of the electricity business network and assets.

To assist in the execution of these responsibilities the board risk and assurance committee (BRAC) review risk and assurance across Vector. Key aspects of this role include endorsing the risk context under which Vector operates, and overseeing the Internal Audit and Insurance Programmes.

The BRAC meets at least four times a year to review the group's risk context, key risks and key controls, which include the internal audit and insurance programmes. The management of the electricity business network and its assets is a subject of review in this context.

6.2.2 EXECUTIVE RISK COMMITTEE

Reflecting the importance of risk management to the overall management of Vector, an executive risk and assurance committee (ERAC) is also in place. The ERAC reports through to the full executive and to the BRAC. It monitors and oversees the implementation of appropriate and consistent risk management policy and practice across Vector by:

- Developing and maintaining, for the board's review and approval, a risk management policy consistent with the company's objectives
- Overseeing and monitoring the implementation of risk management and assurance processes to ensure compliance with the risk management policy.

The ERAC meets six weekly. It reviews risk management policy and its implementation as well as key risks. These include those risks faced in the electricity business and cover those relating to the network assets and the policies and practices required to manage them.

A key to the delivery of assurance for Vector is the internal audit programme managed at a corporate level although directly reporting through to the BRAC.

The aim of the programme is to consider:

- The extent to which Vector's controls are in place and functioning effectively such that the company's assets are safeguarded and effectively used, reliable business systems and processes are in place, and that the company is compliant with applicable laws and regulations

- Opportunities for improving Vector's established policies, structures, accountabilities, processes and reporting mechanisms in support of the company's business goals.

6.2.3 NETWORK AND ASSET RISK MANAGEMENT

The management of the electricity networks and their assets is fundamentally underpinned by risk management principles. The asset investment unit oversees network asset management strategy and performance and includes the development of standards for the electricity network and its component assets.

The service delivery unit manages the operational delivery of the strategy. This includes delivery in the field of the requisite levels of maintenance and capital expenditure so the network meets the stated reliability, safety, environmental and performance standards. The unit also manages the safe and reliable operation of the network to predefined levels.

Both the asset investment and service delivery units have an integrated view of risks being managed and their respective responsibilities in doing so.

This encompasses:

- Identifying and monitoring risks and their management regularly, including the effectiveness of controls and progress of treatments
- Maintaining up to date risk registers which clearly identify risks, the ownership of the risks, possible outcomes and mitigation measures
- Reporting these risks, controls and treatments to the ERAC and BRAC as appropriate.

Regular risk meetings are held at all levels of the organisation, and within the asset investment and service delivery groups, at which the existing risk registers are reviewed, potential risk scenarios discussed and new risks are identified for inclusion in the risk registers (along with the appropriate mitigation measures).

6.3 RISK MANAGEMENT PROCESS AND ANALYSIS

6.3.1 RISK MANAGEMENT PROCESS.

The Vector risk management process is based on the risk management standard AS/NZ4360 2004.

The criticality of risk is determined on the basis of "likelihood" and "consequences" of the event associated with the risk occurring. The combination of these two is used to prioritise the level of controls to manage the risk. The most significant risks have visibility through to the ERAC and to the BRAC.

The risk management process adopted by Vector is shown in Figure 35 below.

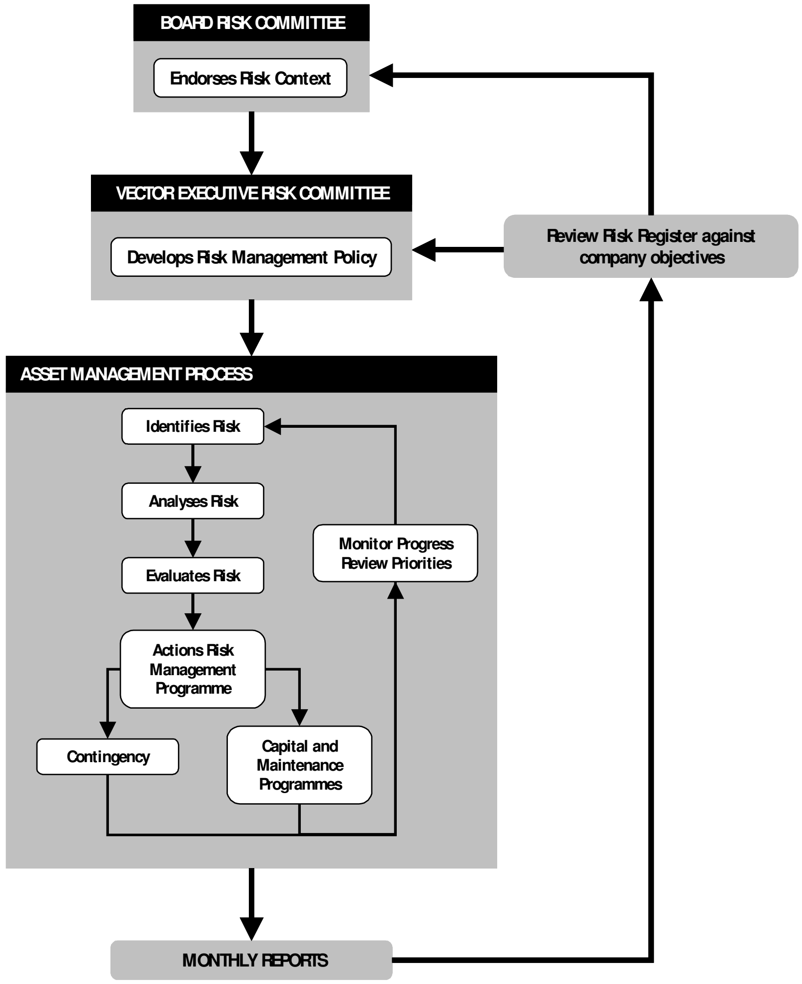


Figure 35 Vector's Risk Management Process (Based on AS/NZ4360)

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

- Risks to the business are identified, understood and works prioritised to mitigate the effects are in place
- Practices that could cause injury, loss of supply, environment or reputation damage, legal or regulatory non compliance or financial loss are understood, documented, managed and reported.

6.3.2 RISK IDENTIFICATION AND ANALYSIS

The risks are evaluated against the risk matrix shown in Figure 36 below.

Risk Assessment

	Minor	Moderate	Serious	Major	Catastrophic
Frequent	H	H	VH	E	E
Likely	M	H	VH	VH	E
Possible	L	M	H	VH	VH
Unlikely	L	M	M	H	VH
Rare	L	L	L	M	H

Risk Assessment Using Consequence And Likelihood

L = Low	Red = Board Attention
M = Moderate	Orange = Executive Attention
H = High	Green = Management Attention
VH = Very High	
E = Extreme	

Figure 36 Vector's Risk Prioritisation Matrix

Risks which have catastrophic or major risk consequences include risks which could lead to loss of life, damage to the environment, loss of supply, financial loss or overall significant sustained loss of reputation of a magnitude sufficient to impact negatively on the company. In this quadrant the company is addressing low frequency type of events.

Risk Management Programme

Vector's operational risk registers identify risks and capture their management at different levels of detail and at different levels of responsibility; a tiered approach. These are routinely reviewed and reported on. Their findings are reflected in Vector's asset planning outcomes.

The Vector internal audit programme is an important process to establish assurance around controls and the programme is overseen by the BRAC.

The AMP and asset management practices are reviewed periodically by an independent expert third party as part of this overall assurance approach. Recent reviews, while including possible enhancements, have been favourable.

6.3.3 OPERATIONAL RISK MANAGEMENT PROCESS

Table 20 lists 10 key risks showing the absolute risk classification and the risk classification with controls and treatments in place. The treatments are current approved projects that further reduce the risk classification cost effectively. These risks are managed at various levels, as appropriate, within the business.

Risk Description	Absolute Risk Classification	Controlled Risk Classification
Inability to identify network operational issues due to poor/corrupted field data	Very High	High
Assets fail leading to loss of supply	Extreme	Moderate
Breach of Health and Safety in Employment Act 1992	Extreme	High
Failure to comply with Electricity Act 1992 related to safety requirements	Very high	Low
Loose neutral connections causing risk of public injury or death	Very high	Moderate
Significant damage to the environment leading to penalties and reputational damage.	High	Moderate
Unauthorised entry and deliberate third party action (vandalism, terrorism) causing injury or damage to asset at unsecured zone substation	High	Moderate
Unauthorised entry and deliberate third party action (vandalism, terrorism) causing injury or damage to SCADA assets reducing network control visibility inhibiting ability to respond to an incident.	Very high	Low
Damage to assets by third party contractor leading to loss of supply and/or injury	High	Moderate

Table 20 Key Risks and Classifications

6.4 EMERGENCY RESPONSE AND CONTINGENCY PLANS

6.4.1 CONTINGENCY PLANS

For all major feeders, the network is designed to allow reconfiguration by switching so that supply can be restored through an alternative path if there is a failure or a need to shift load. Distribution switching may be carried out remotely via SCADA at all zone substations and selected distribution sites. Vector has an ongoing programme to increase the number of remotely operated distribution high voltage switches. This enables faster restoration by not having to send field staff to operate switches.

In the event of a supply failure on any feeder the control room staff undertake network analysis and restores power to as many customers as possible by a combination of remote switch operations from the control room and instructing field staff to manually operate field switches.

The control room also has pre-prepared contingency switching plans for major outages such as complete loss of a zone substation.

There are 224 contingency plans for the Auckland region. Generally these relate to events that have a “very high” or “extreme” classification within the risk matrix (see Figure 36) which corresponds with the loss of a zone substation or critical sub-transmission feeder. These contingency plans are reviewed at least once a year.

Emergency Plans

Vector has developed a number of plans to cover emergency situations. These plans are reviewed and updated regularly to ensure currency. Examples of the plans are:

- Crisis Management Plan
- Major Incident Plan
- Storm Response Plan
- Civil Defence Plan
- Pandemic Plan
- Priority Notification Procedures
- Total Loss of a Zone Substation Plan
- Loss of Transpower Grid Exit Plan (Transpower Plan)
- Call Centre Continuance Plan
- Control Room Disaster Recovery Plan.

6.4.2 DISASTER RECOVERY

The Vector Network control centre has a fully operational disaster recovery site located at Massey, west of Auckland. Regular evacuation exercises are held to ensure that evacuation of the control centre can proceed at any time.

6.4.3 MAJOR INCIDENT TEAM

A major incident team exists comprising senior staff whose role is to oversee the management of potential loss of and restoration of supply following a significant event.

The team is experienced and undertakes exercises periodically, at least annually.

6.4.4 CIVIL DEFENCE AND EMERGENCY MANAGEMENT

Vector is required under the Civil Defence and Emergency Management Act 2002 (CDEM) to be "able to function to the fullest possible extent, even if this may be at a reduced level, during and after an emergency" and also to have plans for functioning during and after an emergency.

A business continuity plan for Vector is in place. Vector is also a member of the Auckland Engineering Lifelines Group (AELG) and through this membership keeps abreast of development in the CDEM area to ensure it is fully prepared for an emergency.

Vector has in place emergency response plans for major events and a National Civil Defence Emergency Management Plan that sits above these plans for use in the event of a declared civil defence emergency.

6.4.5 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 new equipment is introduced to the network an evaluation is made of the necessary spares required to be retained to support repair of any equipment failures.

6.4.6 AUTOMATIC UNDER FREQUENCY LOAD SHEDDING

Vector is required under the Electricity Governance Rules to provide automatic under frequency load shedding (AUFLS) capabilities in two blocks of 16% each of the total load at all times to maintain grid security. Load shedding will occur automatically under specified system frequency excursion situations. The load groups are reviewed regularly to ensure the required capability is maintained and the priorities are appropriate. Certified tests are carried out regularly to ensure Vector can meet its load shedding obligation when called upon.

6.4.7 HEALTH AND SAFETY

Vector's Policy is to:

- Provide a safe and healthy work place for all staff, contractors, the public and visitors
- Ensure health and safety considerations are part of all business decisions
- Monitor and continuously improve our health and safety performance
- Communicate with staff, contractors, customers, and stakeholders on health and safety matters
- Operate in a manner that minimises health and safety hazards
- Encourage safe and healthy lifestyles, both at work and at home.

To achieve this Vector will:

- As a minimum, meet all relevant legislation, standards and codes of practice for the management of health and safety
- Identify, assess and control workplace hazards
- Accurately report, record and learn from all incidents and near misses
- Establish health and safety goals at all levels within the company, and regularly monitor and review the effectiveness of the health and safety management system
- Consult, support and encourage participation from staff on issues that have the potential to affect their health and safety
- Promote the company's leaders, employees and contractors understanding of their health, safety responsibilities relevant to their roles
- Provide information and advice on the safe and responsible use of Vector's products and services
- Suspend activities if safety would be compromised
- Take all practicable steps to ensure contractors work in line with this policy.

6.4.8 ENVIRONMENTAL POLICY

Vector's environmental policy states its commitment for managing the environmental aspects of its businesses taking account of legislation and standards. Vector will conduct its operations in such a way as to respect and protect the natural environment. Vector is committed to continual and progressive improvement in environmental performance and will provide sufficient, competent resources and effective systems at all levels of the organisation to fulfil this commitment. Vector requires all employees and contractors working for Vector to manage their employees and work for Vector in line with this policy.

The policy is to:

- Ensure environmental considerations are part of all business decisions
- Meet or exceed all relevant environmental legislation, regulations or codes
- Participate and work with government and other organisations to create responsible laws, regulations, standards and codes of practice to protect the environment
- Monitor and continuously improve our environmental performance
- Operate in a manner that minimises environmental and social impacts
- Take appropriate action where there is a negative impact on the environment and a material breach of the Resource Management Act
- Communicate with employees, contractors, customers and other relevant stakeholders on environmental matters.

To achieve this Vector will:

- Plan to avoid, remedy or mitigate adverse environment effects of our operations
- Focus on responsible energy management and will practice energy efficiency throughout all our premises, plant and equipment where it is cost effective to do so.

The long term operational objectives of Vector are to:

- Utilise fuel as efficiently as practicable
- Mitigate, where economically feasible, fugitive emissions and in particular greenhouse gas emissions
- Wherever practicable use ambient and renewable energy
- Work with our customers to maximise energy efficiency.

6.4.9 HEALTH, SAFETY AND ENVIRONMENTAL PRACTICES

All Vector employees and contractors working for Vector are responsible for ensuring their own and others' safety by adhering to safe work practices, making appropriate use of plant and equipment (including protective clothing and equipment) and promptly reporting incidents, near misses and hazards.

Vector's safe work practices manual defines the essentials necessary to maintain an incident free environment. These practices reflect the basic approach necessary for Vector and our FSPs to identify and eliminate incident causes.

All FSPs working for the company are required, as a minimum, to comply with these safe work practices whilst carrying out any work on the network. FSPs are also required to report all employee incidents to Vector together with their investigations and corrective and preventive actions.

As part of the focus to continually improve health, safety and environmental performance, Vector has instituted safe teams and a safety leadership team as a task force to encourage all staff, both Vector and FSPs, to voice their opinion on health, safety and environmental standards, raise concerns and suggest improvements.

Vector has undertaken a number of audits of its health and safety systems and processes using internationally recognised health and safety practitioners over the last nine years as part of our continuous improvement programme.

Vector's progress on health and safety over the July 2007 to June 2008 12 month period is shown in Figure 37.

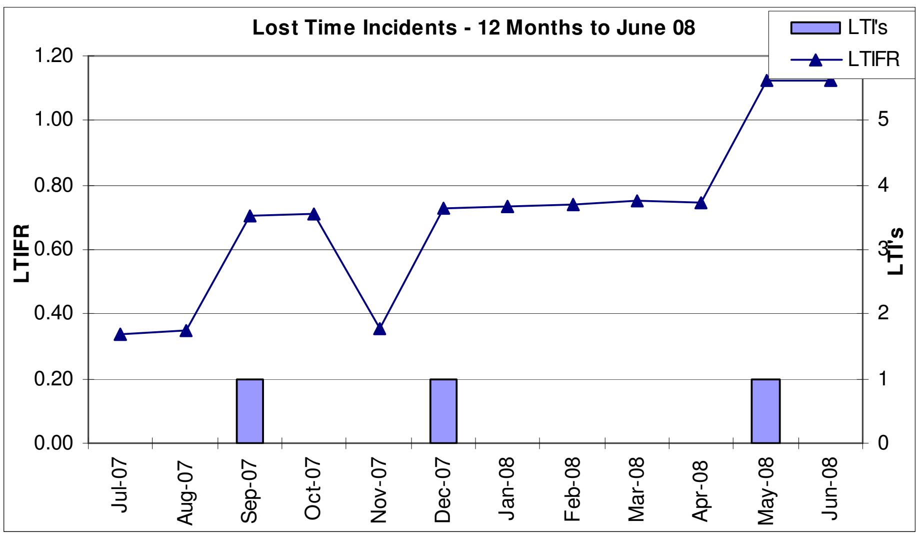


Figure 37 Network Safety Performances

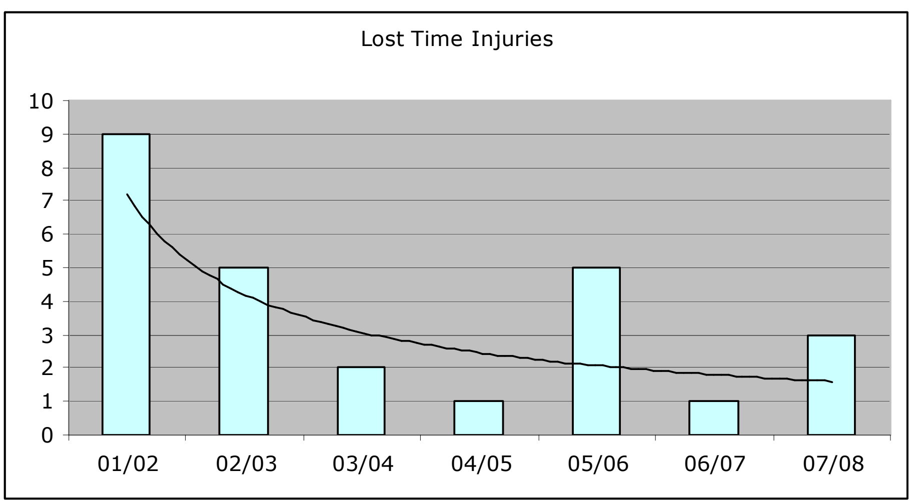


Figure 38 Lost Time Injuries Chart

Figure 38 shows the lost time statistics at Vector for the last seven years. While there are fluctuations, the trend continues to reduce as Vector and its FSPs work towards eliminating lost time injuries.

Vector monitors electricity related public safety and staff/contractor safety incidents. These incidents are reviewed monthly to ensure lessons are captured and where appropriate captured in our own safety programmes.

With respect to overall community safety, Vector offers a free cable location and residential isolation services.

A public safety awareness communications programme on electricity has been undertaken, an example of which is the "Stay Safe" schools programme which was successfully rolled out in 2005. Since conception, 170 schools have been visited and 48,000 children have been through the programme, designed to raise children's awareness of the hazards of electricity.

Environmental Practices

Vector also puts significant emphasis on environmental management. Following the Pattle Delamore Partners Ltd audit and successful action close out, Vector continues improving its environmental management in partnership with our FSPs.

Vector's safe work practices manual includes minimum acceptable standards on environmental management focusing on eliminating damage.

As part of the continuous improvement programmes Vector's environmental management system is regularly reviewed to ensure it is fit for purpose.

Environmental incidents are reported, recorded and investigated with any learnings and improvements shared across our FSPs at the safety leadership forum.

7 EVALUATION OF PERFORMANCE

7.1 REVIEW OF PROGRESS AGAINST PLAN

Network capital expenditure for the year ending March 2008 was $128 million. This is within the upper and lower ranges forecast in the 2007 AMP. Deviations from the plan, together with key reasons, are outlined in Table 21 below.

ID	Name	2007 date	New date	Reason for deferment
2	Highbrook development	2007	2009	Delayed by customer
3	Te Papapa 11kV	2007	2009	Customer development delayed
4	Waikaukau 33kV	2007	2009	Deferred due to economic downturn
5	Forrest Hill zone s/s	2008	2009	Delayed commissioning
6	Gulf Harbour zone s/s	2008	2009	Delayed commissioning
7	Clendon zone substation	2009	2010	Revised growth forecast leading to deferral
8	Pt Chev uprating	2008	2010	Equipment delivery delay, scope change
9	Ranui zone s/s	2009	2010	Revised growth forecast leading to deferral
12	St Johns zone s/s	2008	2010	Revised growth forecast leading to deferral
13	Hillsborough zone s/s	2009	2010	Consenting issues delayed the project
15	Greenhithe 33kV cable	2008	2011	Revised growth forecast leading to deferral

ID	Name	2007 date	New date	Reason for deferment
16	Titirangi zone s/s	2009	2011	Customer engagement
17	Otara zone s/s		2011	Replaces Flatbush, project 27
20	Greenhithe zone s/s	2008	2011	Revised growth forecast leading to deferral
21	Mangere Central zone s/s	2011	2012	Revised growth forecast leading to deferral
22	CBD - 110kV switchboard	2009	2012	Issues arising from Cross-Isthmus project
23	Waimauku zone s/s	2010	2012	Revised Transpower growth forecast leading to deferral
25	Waitakere zone s/s	2009	2012	Revised growth forecast leading to deferral
27	Flat Bush zone substation	2009	2017	Refer to Otara project 17
28	Kaukapakapa zone s/s	2009	2013	Revised growth forecast leading to deferral
29	Warkworth 33kV	2008	2013	Revised growth forecast leading to deferral
30	Westgate zone s/s	2009	2013	Revised growth forecast leading to deferral
31	Rosedale zone s/s	2010	2013	Revised growth forecast leading to deferral
33	Keeling Road zone s/s	2010	2013	Revised growth forecast leading to deferral
34	Glenvar zone s/s	2009	2014	Subdivisions deferred
36	Ellerslie zone substation	2009	2014	Revised growth forecast leading to deferral
42	Sandspit zone s/s	2010	2015	Revised growth forecast leading to deferral
43	Newmarket South zone s/s	2010	2015	Revised growth forecast leading to deferral
52	Hans s/s third Transformer	2010	2016	Revised growth forecast leading to deferral
65	Hobson West zone s/s	2012	2018	22kV distribution introduced
	Takanini West zone s/s	2010	-	Replaced

Table 21 2007 AMP Deviations

7.2 COMPARISON OF PERFORMANCE AGAINST TARGETS

For the 2007/08 return year:

- Vector's network performance target was 104.0 SAIDI minutes and 1.598 SAIFI interruptions
- Vector's actual network performance was 252.0 SAIDI minutes and 1.799 SAIFI interruptions (after removing the impact of extreme events, identified in terms of the IEEE Beta Method, our SAIDI performance was 103.8 minutes and our SAIFI performance was 1.666 interruptions).

The above target variance was the direct consequence of the July 10-16 storm which resulted in severe damage across Vector's Auckland networks. During this period of extreme wind intensity, up to 500 field staff worked around the clock to restore power, replacing over 80 power poles and restringing some 80km of damaged overhead lines.

During the height of the storm covering July 10-11 sustained wind speeds in excess of 95km/hr were recorded. In terms of network events and associated impact, Vector's control room and field staff encountered 130 simultaneous high voltage circuit faults interrupting supply to 76,000 connected customers making up approximately 15% of all customers served.

Vector's major incident team coordinated the event response engaging all available crews which allowed the majority of customers to be restored within 24 hours. Crews worked extremely hard under difficult conditions but some customers were not restored for more then a week due to the severity of network damage and access routes.

Applying the Commerce Commission's extreme event exclusion methodology the network performance impact from the July storm event was assessed at 148 SAIDI minutes. Adjusting this to the observed performance, the adjusted annual performance becomes 104 minutes. Figure 39 shows the number of customers affected and the number of HVEvents occurring during the storm of July 10-11 2007. Similarly, if a SAIFI adjustment is made for the storm event the adjusted SAIFI for 2007/08 was 1.666 interruptions.

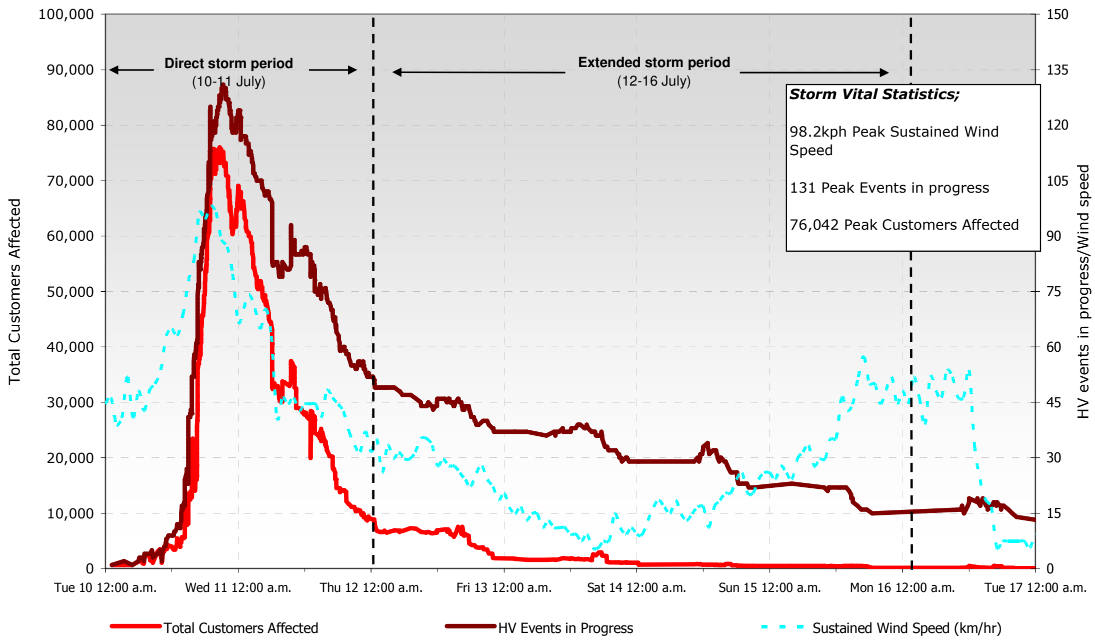


Figure 39 Statistics of Storm July 10-11 2007

7.3 GAP ANALYSIS

7.3.1 NETWORK DEVELOPMENT

While two projects experienced delays in commissioning, a number of the projects were deferred due to an anticipated recessionary slow down. The operating environment over the last 12 months has gone from rapidly increasing costs and long delivery times for overseas sourced components through to an economic recession which has stifled load growth and impacted significantly on growth capex expenditure.

Vector continues to remain sensitive to the environment in which it operates and continues to review not only the robustness of security projects but also project timing to ensure optimal capex spend without compromising security.

This variability in managing projects inevitably leads to greater uncertainty for our contractors, particularly around resourcing levels, which in turn can impact on Vector when capex expenditure is increased. This needs to be carefully managed.

Vector is continuing to improve its network standards to ensure optimal expenditure efficiency through design but still has some way to go in this area.

Progress is being made in reducing project implementation timeframes and improving overall contract management as a means of reducing construction costs and delivering reinforcement projects in a timely manner.

Apart from the initiatives identified above, Vector is reviewing its security standards to ensure they remain appropriate and aligned with good industry practice. The forecasting model is being reviewed with the aim of making it easier to use and requiring less planner intervention to derive the results.

Generally the planning process is robust, offering flexibility through regular reviews and opportunities for amendments to feed into the capex forecast as conditions change.

Independent expert reviews have endorsed our asset management strategies and practices. The conclusions were that Vector operates in accordance with good international practice. Some useful comments around continuous improvement were also given in these reviews, which are progressively implemented.

7.3.2 STRUCTURAL CHANGES UNDERTAKEN IN THE ASSET MANAGEMENT AREA

In the past year Vector has undergone very substantial internal structural changes in the manner in which it is creating and managing its assets. This was undertaken with the aim of improving its asset creation and management processes. The key improvement features adopted from an asset management perspective are discussed below.

End-to-End Project Delivery Process

Responsibility for asset investment planning and the implementation of capital projects is split at Vector. As part of a continual improvement process at Vector an enhanced end-to-end project delivery process has recently been developed, which is jointly managed by the asset investment engineering group and the service delivery capital programme group. To support this, a major investment in supporting project management software systems is currently being undertaken and several project coordination processes have been adopted.

Asset Information

Vector has a substantial volume of information about the extent, condition, performance, age and location of its assets. However, over time this information has been managed in a variety of systems including electronic databases, GIS systems, spreadsheets, process software, etc.

To address this issue a new asset information section was created within the asset investment group. The purpose of this group initially is to consolidate the diverse asset information systems into a cohesive, consistent whole and to establish policies for their future maintenance. This group will also be responsible for assessing and generating Vector's reports on asset performance.

Asset Investment Strategy

Recognising that electricity distribution is likely to face several challenges and changes in the short to medium term future, a dedicated asset investment strategy section has been established within the asset investment group. This section is focused on assessing developments in electricity distribution and related areas to guide Vector's response in this regard. Our approach to non network solutions discussed in Section 4.5 forms part of this.

The strategy group also assists with the formulation of our longer term (typically three to 10 years and our 25 year expenditure programmes).

Relationship Management with other Service Providers and Authorities

Given the nature of electricity distribution services, Vector interacts on an ongoing basis with other utilities service providers (including ONTRACK, Transit New Zealand, Telecom, Vodafone, etc.) and authorities (including the local regional councils, city councils and management boards). Ensuring that the requirements of these various bodies are adequately reflected in our project implementation is an important and major part of Vectors asset investment initiatives. A strategic relationship section has therefore been formed under the asset investment group with the function of managing these relationships. In addition, this section will assist the asset creation process with obtaining resource consents, route designation, negotiating service crossings and other related functions.

8 EXPENDITURE FORECAST

8.1 FORECAST 10 YEAR CAPITAL AND OPERATING EXPENDITURE PROJECTION

Vector's forecast expenditure programmes are discussed below. As we operate to a June financial year all our budgeting and financial reporting activities align with the June year. However, the Information Disclosure Requirements require Vector to disclose its AMP and the respective expenditure information on a March year basis, as presented below. There are therefore minor time shift differences in the expenditure forecast disclosed in this AMP compared to the budget Vector operates to and figures that may be reported in our financial statements or elsewhere.

Due to the difference between the regulatory calendar and Vector's corporate planning cycle the board has not yet approved the 2009/10 budgets. The expenditure forecasts presented in this AMP are the best estimates available at the time of preparing this plan.

8.1.1 CAPITAL

Vector's capital expenditure forecast from 2009 to 2019 is contained in Table 22. This is our forecast of the expenditure that would be required to achieve Vector's customer, network and business goals and execute the asset management activities described in this AMP.

In view of the current economic slowdown being experienced in New Zealand (and internationally), and the associated electricity demand slow down, Vector has recently adapted its long term growth related expenditure budgets by deferring several previously planned projects by one to three years. This is reflected in Table 22, particularly in the period up to March 2011. The situation is being closely monitored however and should an early recovery be observed, or if the recession continues over a longer period, expenditure patterns will be adapted accordingly.

For the period 2012 to 2015 we have assumed that there will be a moderate asset development catchup period as growth is restored to normal patterns. This was smoothed out to reflect factors such as possible skills constraints and limits to contractor capacity.

Probable Forecast	Mar-09	Mar-10	Mar-11	Mar-12	Mar-13	Mar-14	Mar-15	Mar-16	Mar-17	Mar-18
Customer	$18.1	$9.9	$8.0	$12.4	$17.7	$22.8	$25.7	$26.3	$25.6	$25.4
Compliance	$4.2	$2.6	$1.6	$1.8	$2.1	$2.1	$1.9	$1.8	$1.7	$1.6
Growth	$33.3	$38.7	$29.7	$32.6	$43.6	$53.3	$57.4	$57.2	$48.5	$37.2
Integrity	$35.2	$34.1	$32.9	$37.0	$42.3	$45.7	$50.0	$52.2	$53.6	$51.3
Undergrounding	$11.6	$12.2	$12.2	$12.2	$12.2	$12.2	$12.2	$12.2	$12.2	$12.2
Performance	$2.3	$3.1	$3.6	$3.9	$4.0	$2.9	$2.1	$1.6	$1.5	$1.5
Quality	$0.0	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Reactive	$8.9	$8.0	$7.7	$8.7	$9.0	$9.0	$9.0	$9.0	$9.0	$9.0
Relocates	$7.5	$6.7	$5.5	$5.7	$6.0	$6.0	$6.0	$6.0	$6.0	$6.0
10 Year Plan Total	**$121.0**	**$115.3**	**$101.2**	**$114.5**	**$136.9**	**$154.2**	**$164.4**	**$166.4**	**$158.2**	**$144.3**

Table 22 Vector's Provisional Capital Expenditure Forecast 2009-2019 ($million)

Refer to Appendix 1 for the expenditure breakdown in the Commerce Commission's required format.

Vector currently operates in an environment of considerable uncertainty. Not only are we experiencing a major global credit crisis and economic recession of uncertain impact and duration but the regulatory regime within which Vector must operate is undergoing considerable change. While Vector believes that the proposed changes to the regulatory regime should bring greater clarity and therefore improve the environment for investment, until the regime is fully specified by the Commerce Commission uncertainty will prevail during this transition period. The Commission's 2010 threshold reset may therefore have a significant impact on Vector's expenditure levels.

Further considerable uncertainty exists around Transpower's proposed construction of the North Auckland and Northland cross-isthmus link. As noted in Section 4.6, the Electricity Commission's draft decision to reject Transpower's application for commissioning this crossing by 2013 will have a major impact on Vector's security of supply to the Auckland CBD as well as the North Shore commercial area. If the draft decision stands, and Vector is to ensure that our security of supply standards to the CBD are maintained, or to address the impact of low probability, high impact risks to the North Shore supply, Vector would have to incur major network expenditure which would otherwise have been avoided[11][12].

A decision on whether to make substantial investments can only be finalised (a) once the final Electricity Commission decision on the cross-isthmus link is made, and (b) when the investment implications arising from the 2010 threshold reset is understood. Given the lumpy nature of these possible investments it clearly adds considerable uncertainty to the forecast expenditure profile.
To reflect the large degree of uncertainty in the current economic conditions and around the regulatory framework and decisions within the 10 year planning period,

[11] In terms of Vector's current CBD reinforcement strategy, we would cooperate with Transpower to create new 220kV GXPs at Hobson substation in the Auckland CBD and at Wairau Park in the North Shore by 2013. This represents substantial efficiency gains over Vector's alternative bulk supply options, which involve installation of new 110kV circuits from existing GXPs and further expanding existing 110kV substations.
[12] The current capex estimate in Table 22 is based on Transpower's current NAaN proposal being approved by the Electricity Commission.

Vector forecasts an upper and a lower expenditure level as shown in Figure 40. This expenditure range differs from that set out in the 2007 AMP on the following basis:

- Expenditure on the Wellington network (which previously belonged to Vector) has been excluded
- Construction capacity in the Auckland region limits the maximum level of investment that could practically be achieved, especially in the short term
- A reassessment of spend on providing new customer connections and reinforcing the network to meet minimum customer requirements
- Vector's undergrounding programme in terms of the AECT Trust Deed is assumed to continue.

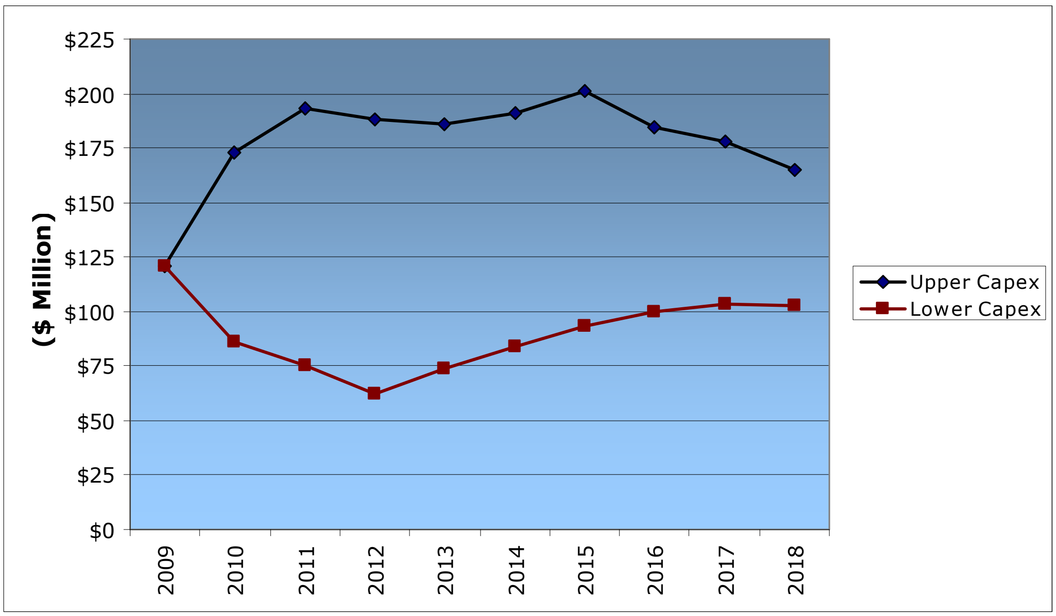


Figure 40 Forecast Capital Expenditure Range

The lower line represents minimum expenditure that Vector must commit in order to comply with its legal obligations, deal with known health, safety and environmental issues, and provide sufficient network capacity to just meet peak demands under normal conditions, but without necessarily maintaining security of supply under fault conditions. It includes the minimum essential expenditure on planned asset replacement, network performance improvement, customer growth (only where Vector is obliged to supply) relocation projects (where Vector is obliged) and security of supply based projects. As noted, the currently committed undergrounding programme is assumed to continue.

This expenditure profile is not sustainable in the medium and longer term and will result in increasing asset failure rates and breaching of Vector's security of supply criteria. This will manifest as a reduction in customer service levels (reduced reliability and extended outages due to lack of back stopping capability) and sharply increasing operational expenditure on fault response and customer complaints. Furthermore, this scenario represents a running down of our assets which will not only lead to deteriorating network performance but will also defer expenditure until a very substantial replacement requirement arises in the medium term future. Vector will therefore be very reluctant to embark on this profile and will only do so if excessive uncertainty and risks around achieving an acceptable return on investment dictate that this is the rational course of action.

The upper line represents expenditure levels that would allow us to achieve a substantial step improvement in network performance (as opposed to current forecast expenditure levels, which will maintain or gradually improve performance levels over time). This higher expenditure would enable Vector to:

- Effect major, rapid improvements in the quality of service (reliability) provided by the network
- Accelerate asset replacement rates to optimise the age profiles
- Underground selected parts of the network where external interference is currently impacting badly on reliability[13]
- Address the potential implications flowing from the cross-isthmus decision
- Reduce maintenance expenditure
- Bring forward security of supply related projects.

Achieving these improvements may provide a positive stimulus for economic activity in the Auckland region that could be achieved in the short term, and Vector would therefore be keen to pursue this expenditure profile if that was possible in terms of the 2010 price reset.

8.1.2 MAINTENANCE EXPENDITURE FORECAST

Vector's proposed maintenance budget for the 2009 year and the expenditure forecast to 2019 are listed in Table 23. A breakdown of the expenditure in the categories used to manage the FSPs is also given in the table.

	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
	Budget	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Total	**44.2 M**	**44.5 M**	**43.8 M**	**42.0 M**	**41.5 M**	**41.5 M**	**41.5 M**	**41.5 M**	**41.5 M**	**41.5 M**	**41.5 M**
Remedial Maintenace	13.6 M	13.7 M	13.5 M	12.9 M	12.8 M	12.8 M	12.8 M	12.8 M	12.8 M	12.8 M	12.8 M
Preventive Maintenance	7.3 M	7.4 M	7.3 M	7.0 M	6.9 M	6.9 M	6.9 M	6.9 M	6.9 M	6.9 M	6.9 M
Renewal Maintenance	9.2 M	9.2 M	9.1 M	8.7 M	8.6 M	8.6 M	8.6 M	8.6 M	8.6 M	8.6 M	8.6 M
KPI Bonus	1.7 M	1.7 M	1.6 M	1.6 M	1.6 M	1.6 M	1.6 M	1.6 M	1.6 M	1.6 M	1.6 M
Management Fee	3.7 M	3.7 M	3.7 M	3.5 M	3.5 M	3.5 M	3.5 M	3.5 M	3.5 M	3.5 M	3.5 M
Exceptional Maintenance	1.9 M	1.9 M	1.9 M	1.8 M	1.8 M	1.8 M	1.8 M	1.8 M	1.8 M	1.8 M	1.8 M
Value Added Services	6.0 M	6.1 M	6.0 M	5.7 M	5.7 M	5.7 M	5.7 M	5.7 M	5.7 M	5.7 M	5.7 M
Facilities Management	0.8 M	0.8 M	0.8 M	0.8 M	0.7 M	0.7 M	0.7 M	0.7 M	0.7 M	0.7 M	0.7 M

Table 23 Vector's Proposed 2009 Maintenance Budget and Expenditure Forecast to 2019

If the upper or lower capex scenarios discussed in Section 8.1.1 are adopted, this would have a direct impact on the maintenance expenditure, resulting in upper and lower range expenditure as reflected in Figure 41.

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[13] Vector has an ongoing undergrounding program, but the scope of this is based on meeting the AECT Trust Deed obligations, where the focus is on improving the network aesthetics for groups of consumers. For more discretionary undergrounding, the focus would rather be to reduce external network interference (such as car versus pole incidents) on parts of the network where this occurs frequently.

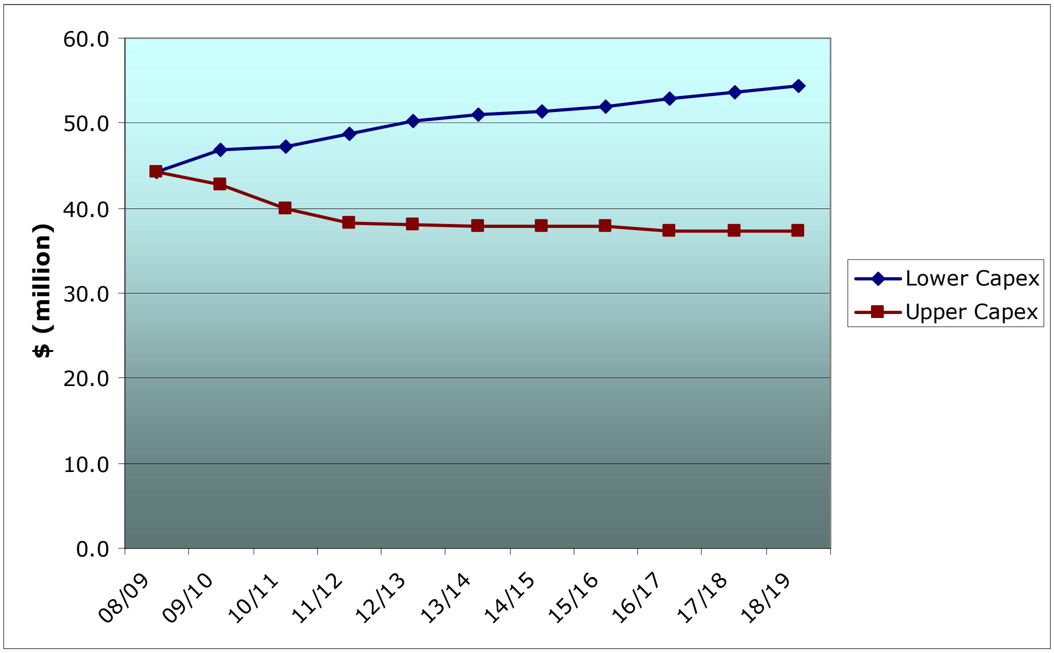

Figure 41 Forecast Maintenance Expenditure Range

Adopting the lower capex range, in which the general asset base would be allowed to age and no major network improvements would be implemented, would cause escalating fault and maintenance expenditure.

Should the high capex scenario be adopted, the average network age will decrease (higher proportion of new assets) and there will be substantially increased levels of network automation (as measured against the current provisional capex programme). The net effect of this is that the fault frequency should reduce (especially in the first three years), as well as maintenance costs. There will also be a reduced requirement for renewal maintenance.

8.2 RECONCILIATION OF ACTUAL EXPENDITURE AGAINST FORECAST

8.2.1 ACTUAL EXPENDITURE FOR EACH WORK EXPENDITURE CATEGORY AGAINST THE BUDGET

Table 24 compares the actual expenditure for each work expenditure category against the budget. The figures are based on the Vector financial year.

		07/08	08/09
		Actual	Budget
		50.3 M	42.1 M
Remedial Maintenace	RM	13.5 M	13.2 M
Preventive Maintenanc	PM	7.7 M	7.2 M
Renewal Maintenance	CM	9.5 M	8.9 M
KPI Bonus	KPI	1.7 M	1.6 M
Management Fee	MF	3.5 M	3.6 M
Exceptional Maintenan	ER	4.2 M	1.8 M
Value Added Services	VA	7.6 M	5.9 M
Facilities Management	FMC	0.7 M	0.8 M
Other Maintenance	Other	1.8 M	-0.9 M

Table 24 Actual Expenditure against Budget

Appendix 1 Asset Management Plan Expenditure Forecast and Reconciliation

	Jun-08	Mar-09	Mar-10	Mar-11	Mar-12	Mar-13	Mar-14	Mar-15	Mar-16	Mar-17	Mar-18
	Actual	Budget	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Customer connection	$22,964	$18,097	$9,944	$8,000	$12,409	$17,674	$22,835	$25,712	$26,250	$25,645	$25,426
System growth	$36,095	$33,316	$38,683	$29,738	$32,607	$43,561	$53,346	$57,388	$57,191	$48,499	$37,150
Asset replacement and renewal	$41,708	$44,058	$42,089	$40,574	$45,693	$51,311	$54,732	$59,011	$61,215	$62,563	$60,309
Reliability, safety and environmental	$4,347	$6,469	$5,680	$5,129	$5,821	$6,170	$5,045	$4,127	$3,545	$3,252	$3,170
Asset relocation	$7,920	$7,459	$6,676	$5,543	$5,720	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Subtotal - capex	$113,034	$109,400	$103,072	$88,985	$102,252	$124,717	$141,958	$152,238	$154,201	$145,959	$132,055
Underground	$10,255	$11,634	$12,200	$12,200	$12,200	$12,200	$12,200	$12,200	$12,200	$12,200	$12,200
Routine and preventive maintenance		$10,773	$10,793	$10,725	$10,517	$10,395	$10,256	$10,219	$10,317	$10,327	$10,338
Refurbishment and renewal		$13,452	$13,477	$13,392	$13,133	$12,980	$12,807	$12,760	$12,883	$12,895	$12,909
Fault and emergency		$19,937	$19,974	$19,848	$19,463	$19,236	$18,980	$18,911	$19,092	$19,111	$19,131
Subtotal – operation and maintenance		$44,162	$44,244	$43,965	$43,114	$42,611	$42,042	$41,889	$42,292	$42,334	$42,378

	Jun-08	Jun-08	
	Actual	Budget*	Variance*
Customer connection	$16,352		
System growth	$17,656		
Asset replacement and renewal	$23,931		
Reliability, safety and environmental	$2,256		
Asset relocation	$4,314		
Subtotal – capex	$64,508		
Underground	$5,328		
Routine and preventive maintenance			
Refurbishment and renewal			
Fault and emergency			
Subtotal – operation and maintenance			

* 2008 budget was not provided in the 2008 AMP