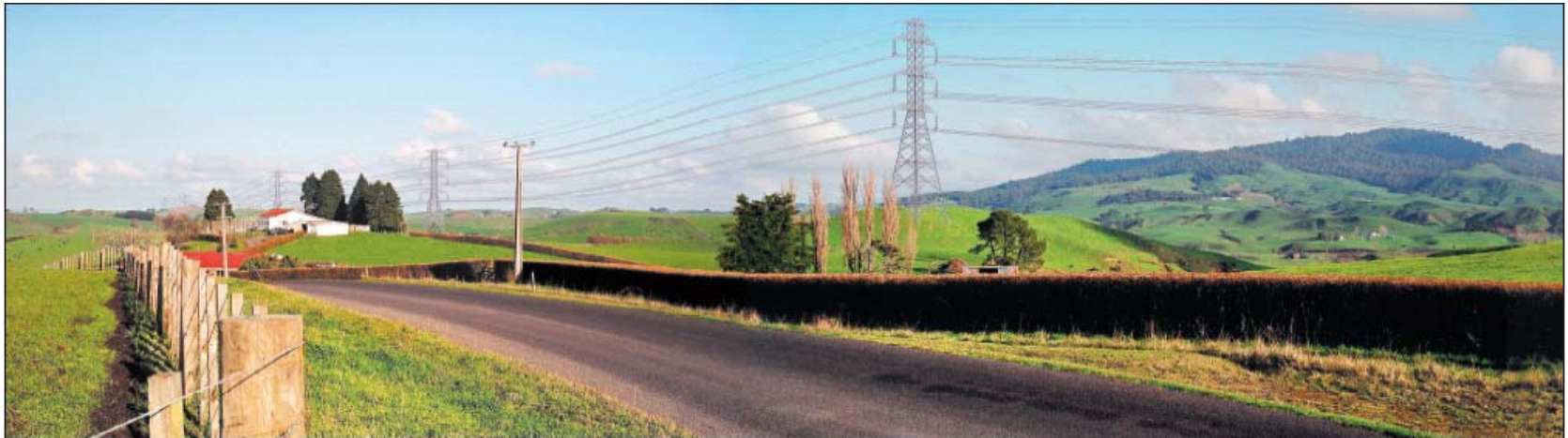


The National Grid – building for the future



Ian Burgwin

National Grid Asset Manager, Transpower New Zealand Ltd

TRANSPOWER



- Gone through the approval stage, now into build mode
- Chair and Chief Executive team restored Vector after the Auckland CBD crisis in 1998

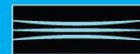
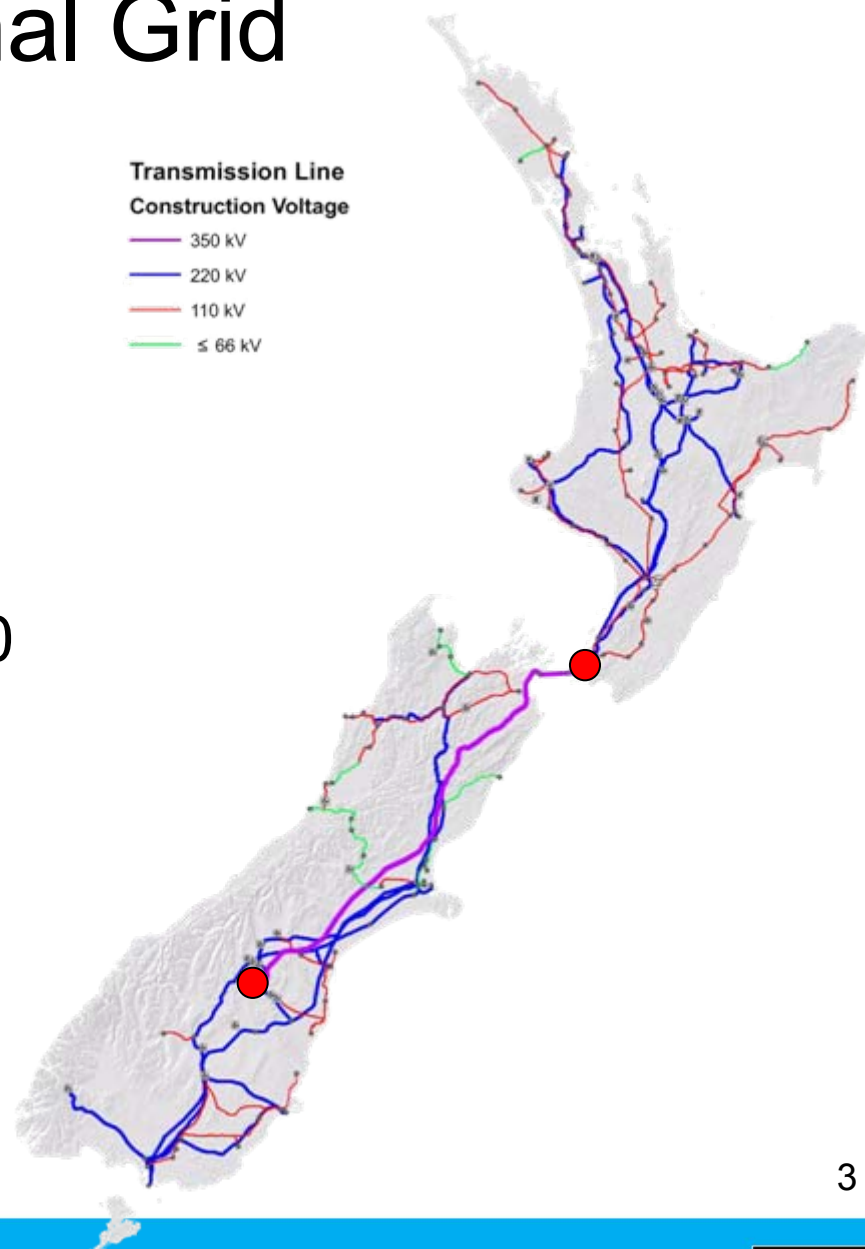


TRANSPower

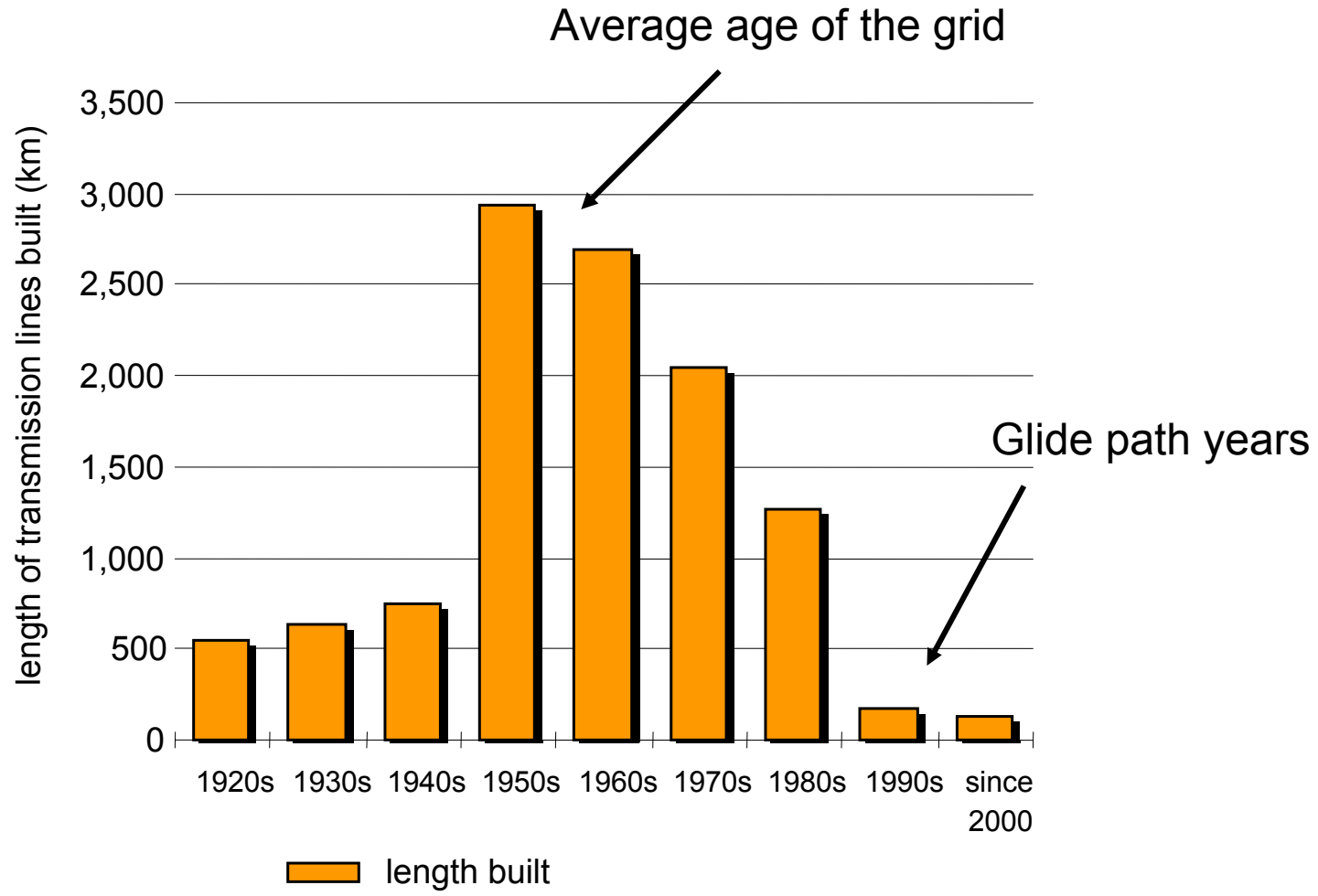


The National Grid

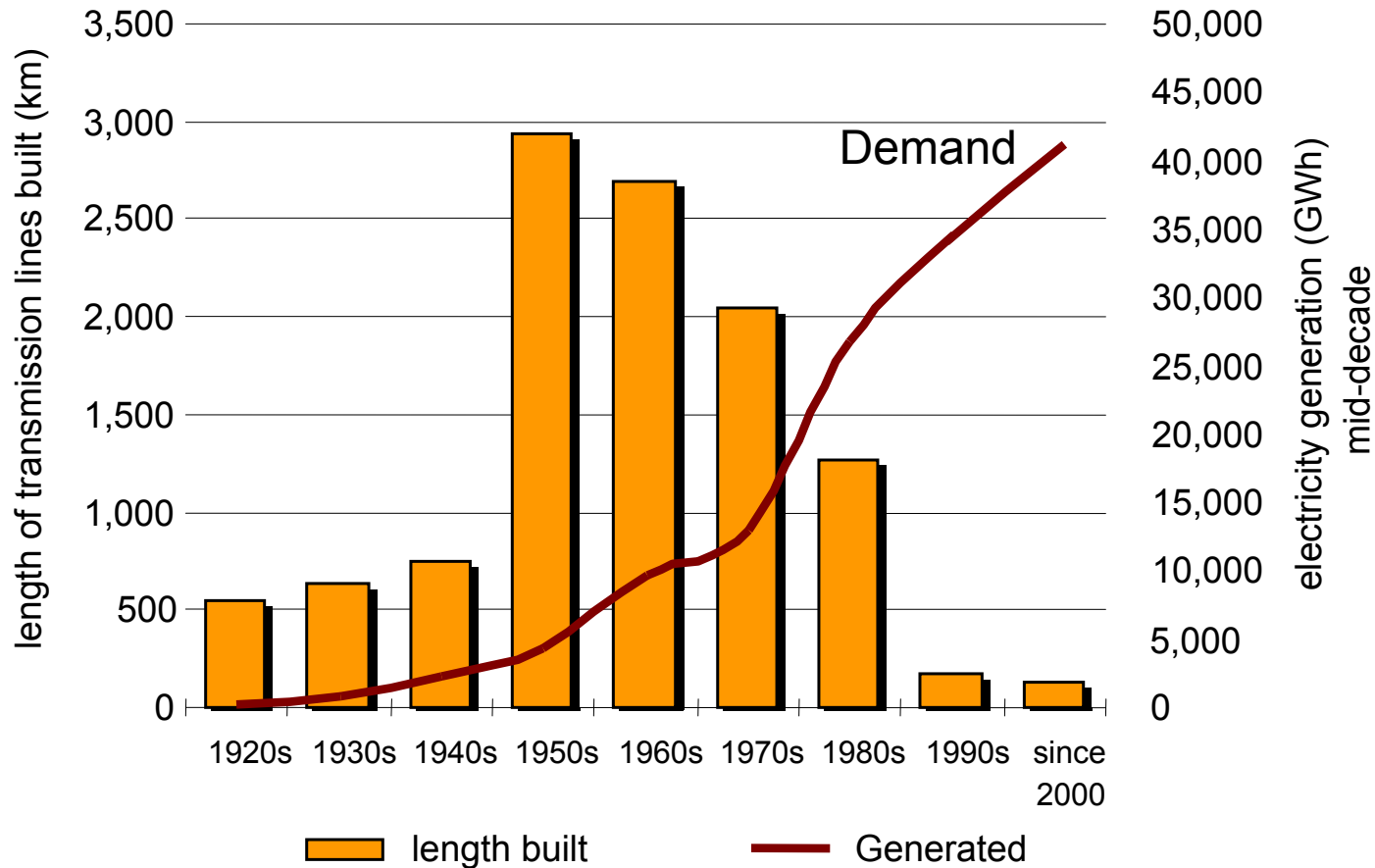
- 11,800km of high voltage lines, 182 sub/switching stations
- 41,000 towers and poles
- 1,000 power transformers; 2,300 circuit breakers etc
- Assets are located in all 85 Regional, District and City Councils



No significant investment since 1970s

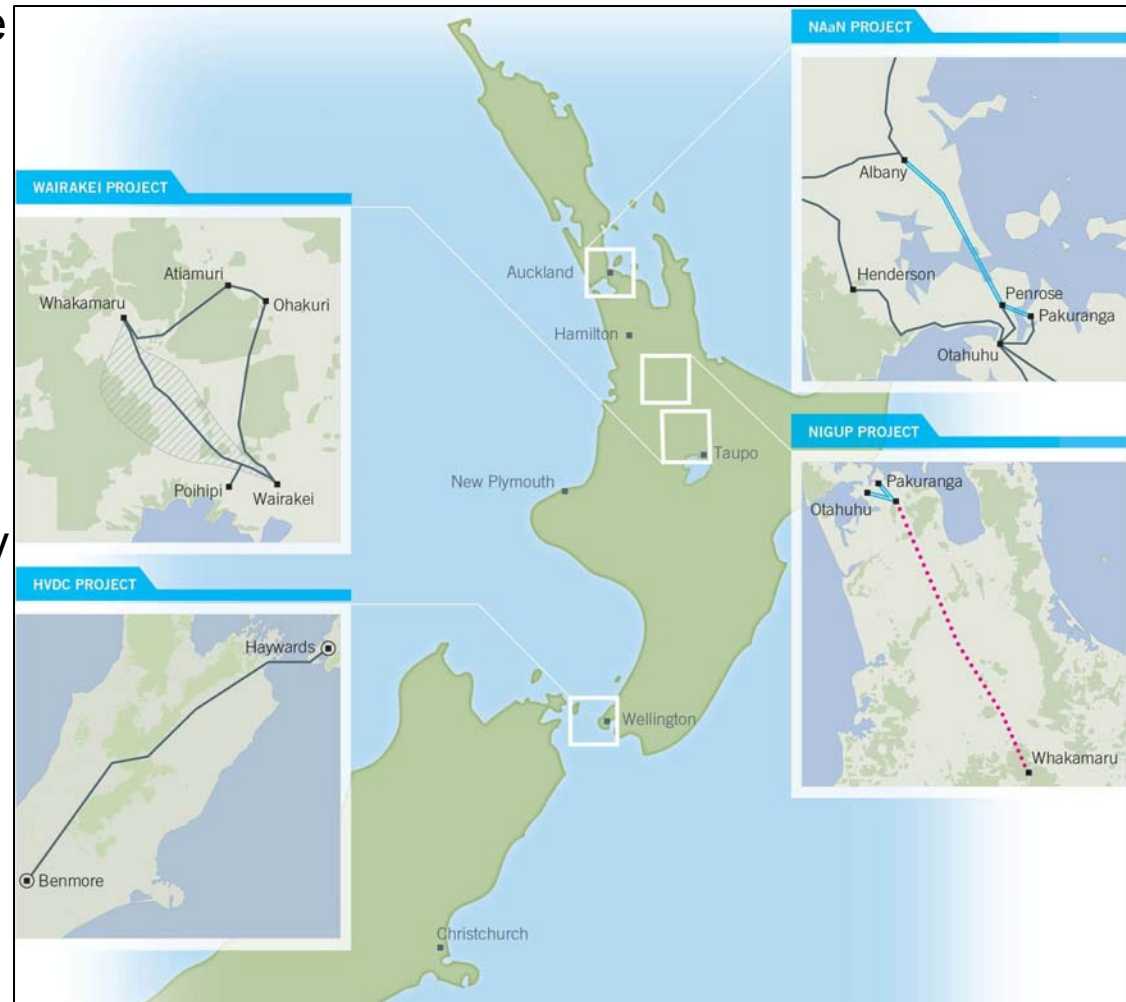


But demand is increasing...



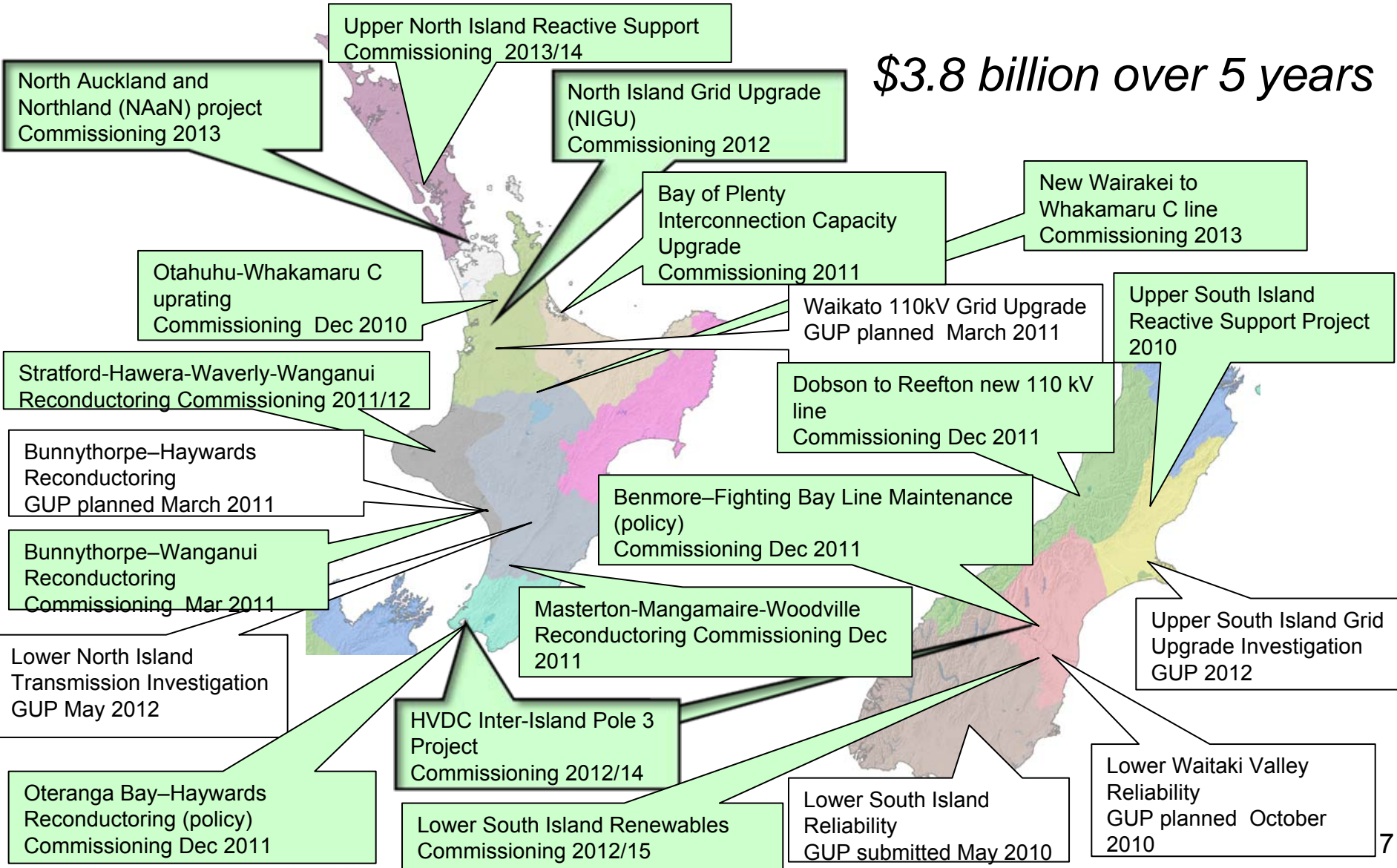
Grid upgrades

- Major projects
 - NIGUP 400kV (capable) line from Whakamaru-to-Pakuranga (\$824m) - 2012
 - HVDC Pole 3, replacement of Pole 1 (\$672m) – 2012
 - NAaN reinforcement for Auckland/Northland (\$473m) - 2013
- Other projects
 - Otahuhu substation diversity (\$99m) – June 2010
 - Wairakei Ring (\$141m) - 2013
- Many other smaller upgrades across the country, either recently completed, underway or planned
- Approximately \$3.8 billion to be spent in the next 5 years

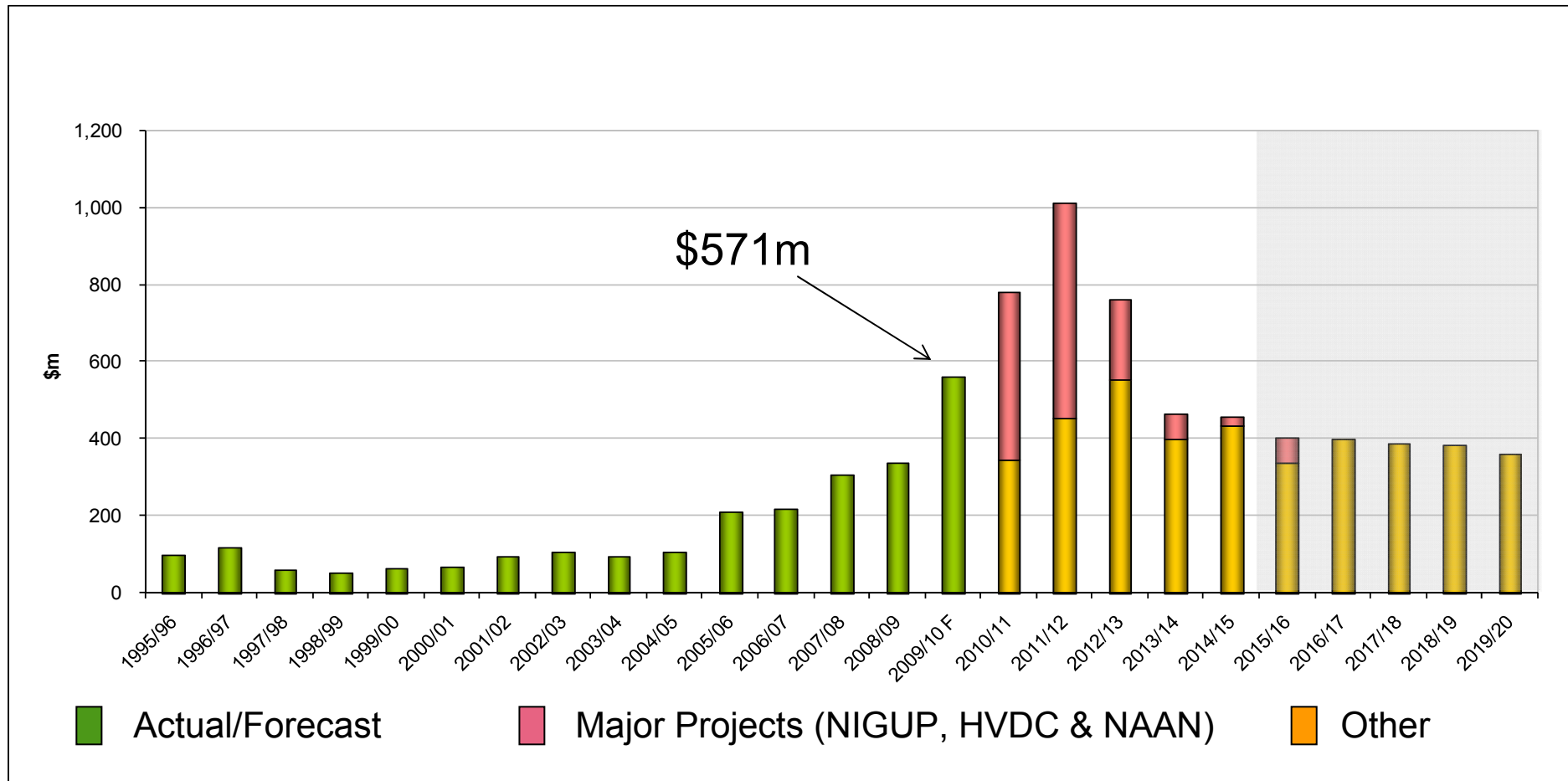


Reinforcement

\$3.8 billion over 5 years

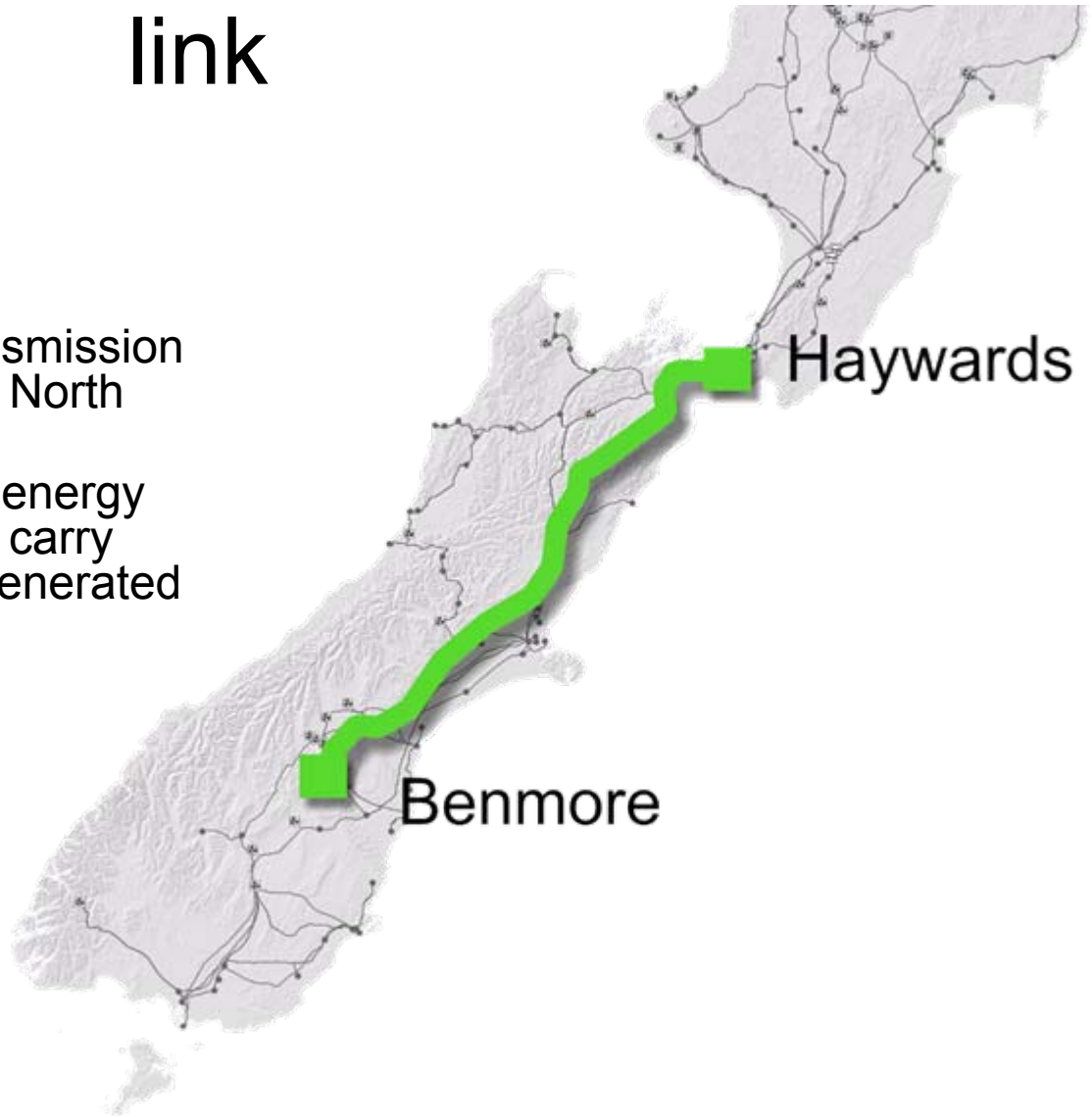


Transpower capex



High Voltage Direct Current (HVDC) link

- The HVDC inter-island link:
 - is critical for New Zealand
 - is the only high voltage transmission link between the South and North Islands
 - balances the distribution of energy between islands, helping to carry electricity from where it is generated to where it is needed.



Existing HVDC link

**Pole 1 – Mercury Arc Valves
(1965)**



**Pole 2 – Thyristors
(1992)**

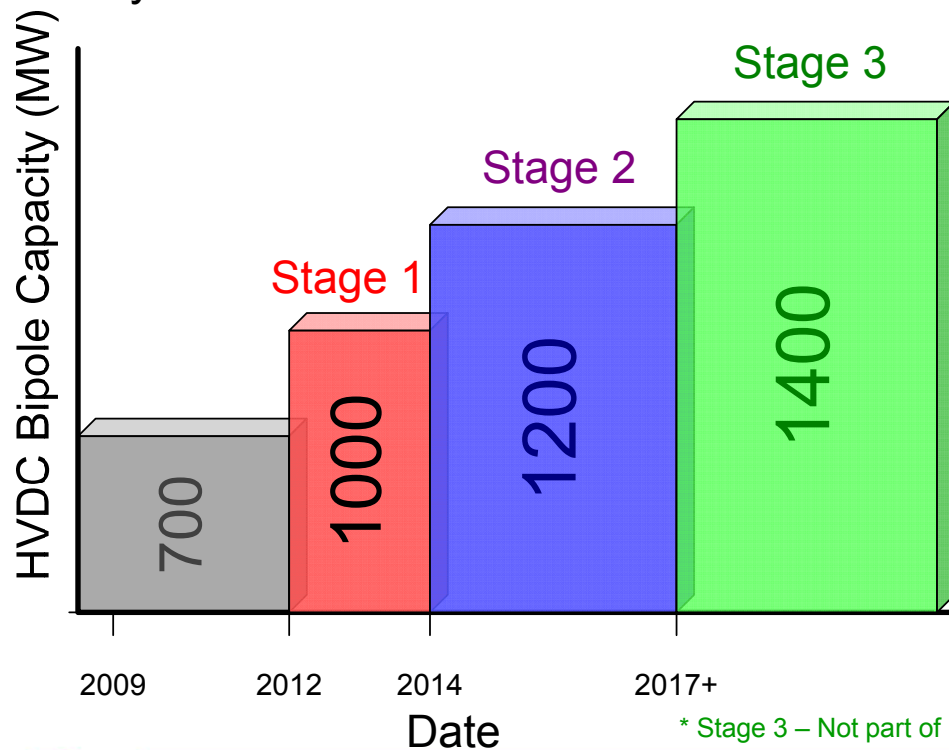


Pole 3



HVDC Pole 3 Project

- Pole 1 is now 45 years old and it's core technology is obsolete
- EC approval to replace Pole 1 was received Sept 2008
- Contract for converter station equipment and buildings awarded Oct 2009
- The new pole, called Pole 3, will comprise new state-of-the art equipment (thyristor valves) – 700MW nominal rating
- The project will be implemented in stages
- Construction underway



* Stage 3 – Not part of EC Approval (2017 or beyond)

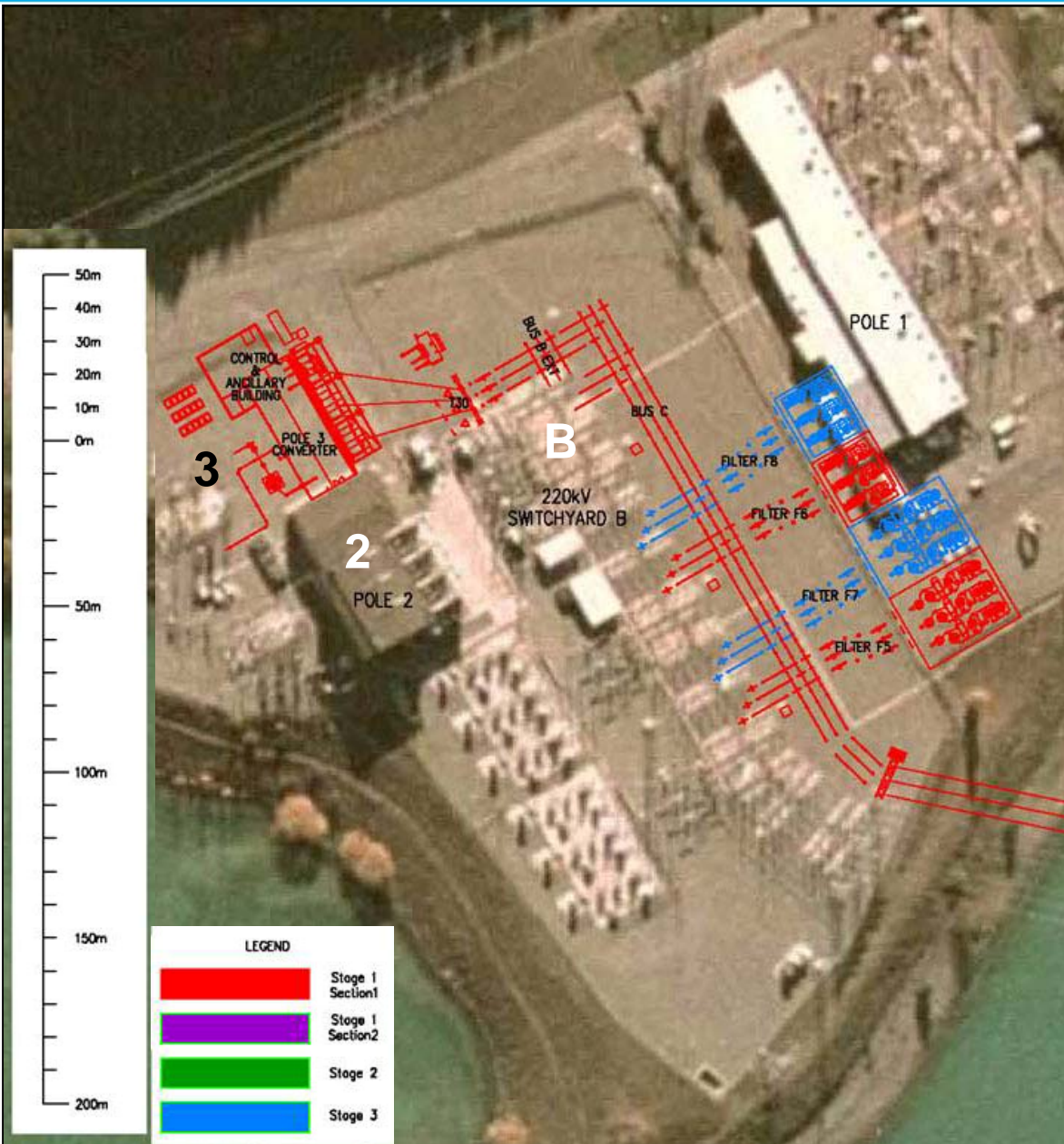


Benmore

Locations for New Equipment



Benmore



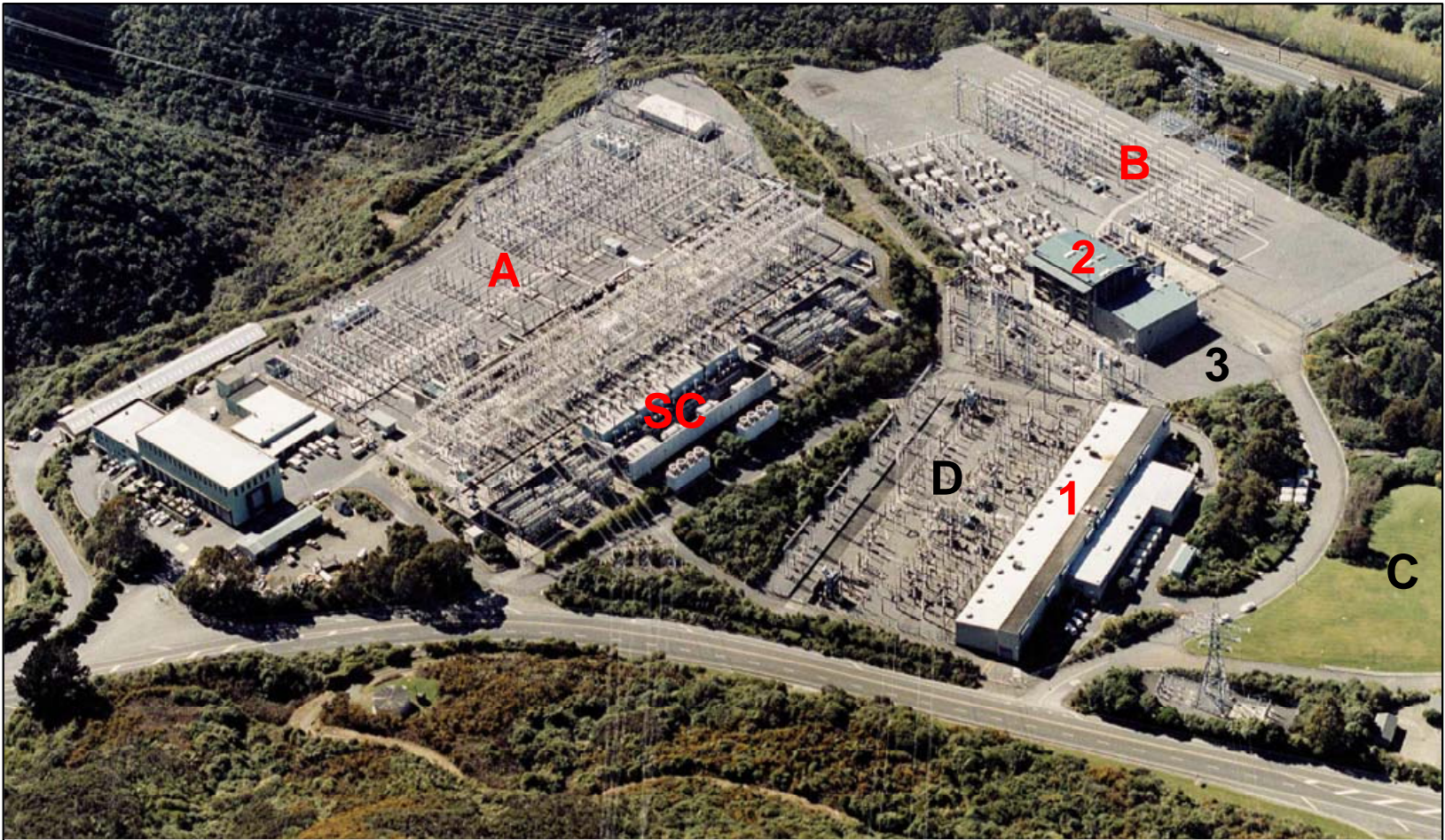
- Preparation of Site
 - Site Improvement Works
 - Removal of Pole 1
- Stage 1 (1000 MW)
 - AC Switchyards – extension of 220 kV busbars
 - Valve Hall and Thyristor Valves
 - Converter Transformers
 - DC Switchyards
 - AC Harmonic Filters - 220 kV
 - Control building and controls
 - new Pole 3
 - upgrade Pole 2
 - new Bipole & Station

Future (not yet approved):

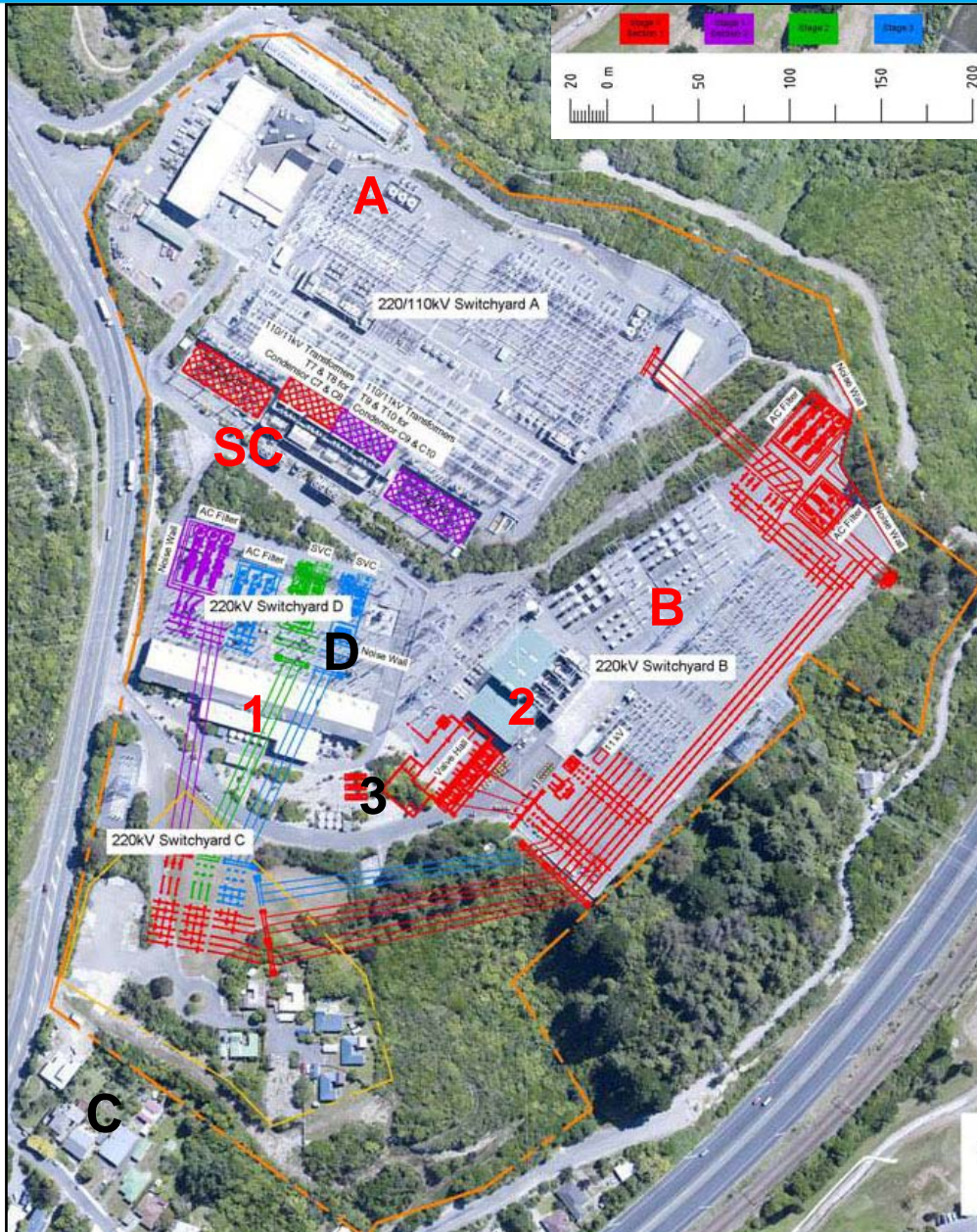
- Stage 3 (1400 MW)
 - AC Harmonic Filters - 220 kV



Haywards locations for new equipment



Haywards



- **Preparation of Site**
 - Site Improvement Works
 - Switchyard C
 - Removal of Pole 1 (Swyd D)

- **Stage 1 (1000 MW)**
 - AC Switchyards
 - Valve Hall and Thyristor Valves
 - Converter Transformers
 - DC Switchyards
 - AC Harmonic Filters
 - Control building and controls
 - Station Services
 - 2 x Synchronous Condenser Unit Transformers

- **Stage 2 (1200 MW)**
 - Statcom
 - 2 x Synchronous Condenser Unit Transformers

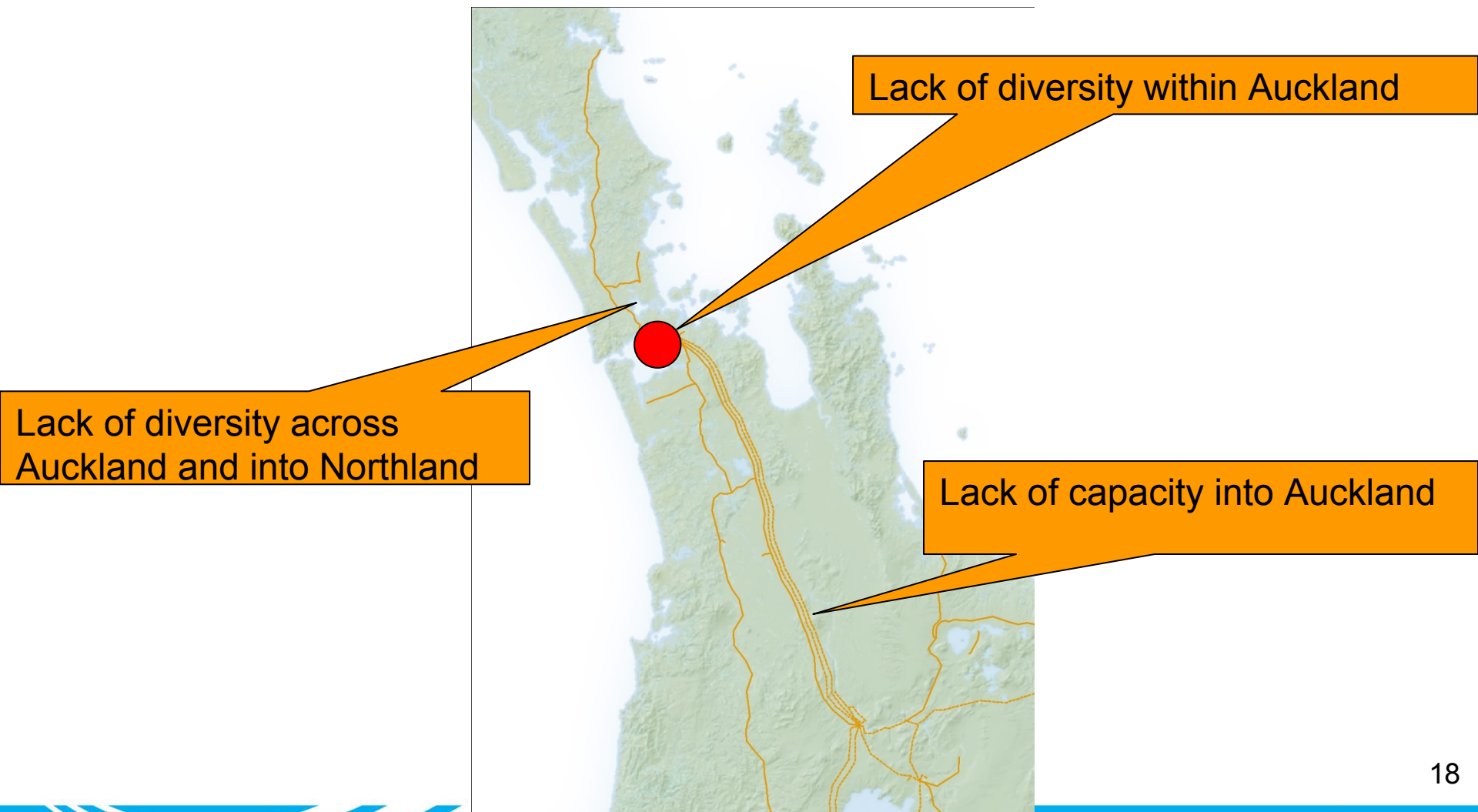
- **Stage 3 (1400 MW) (not yet approved)**
 - AC Switchyards
 - AC Harmonic Filters
 - Stacom



Benmore and Haywards construction works

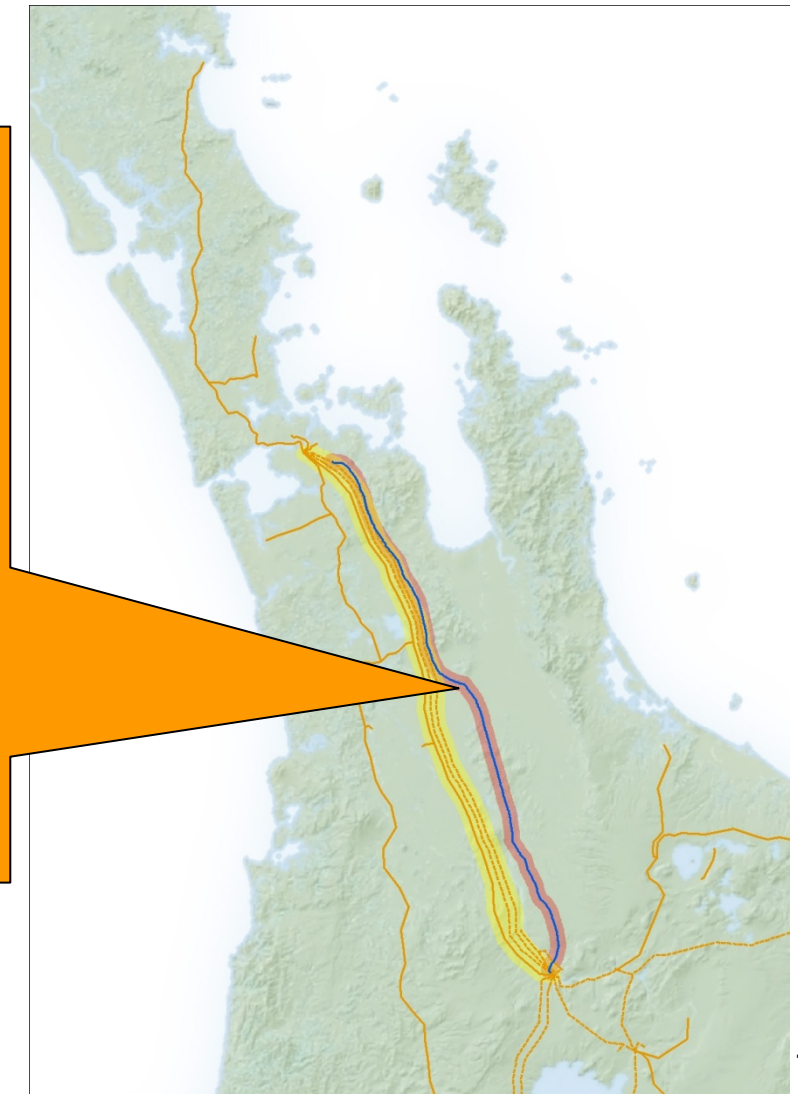


The issues for Auckland



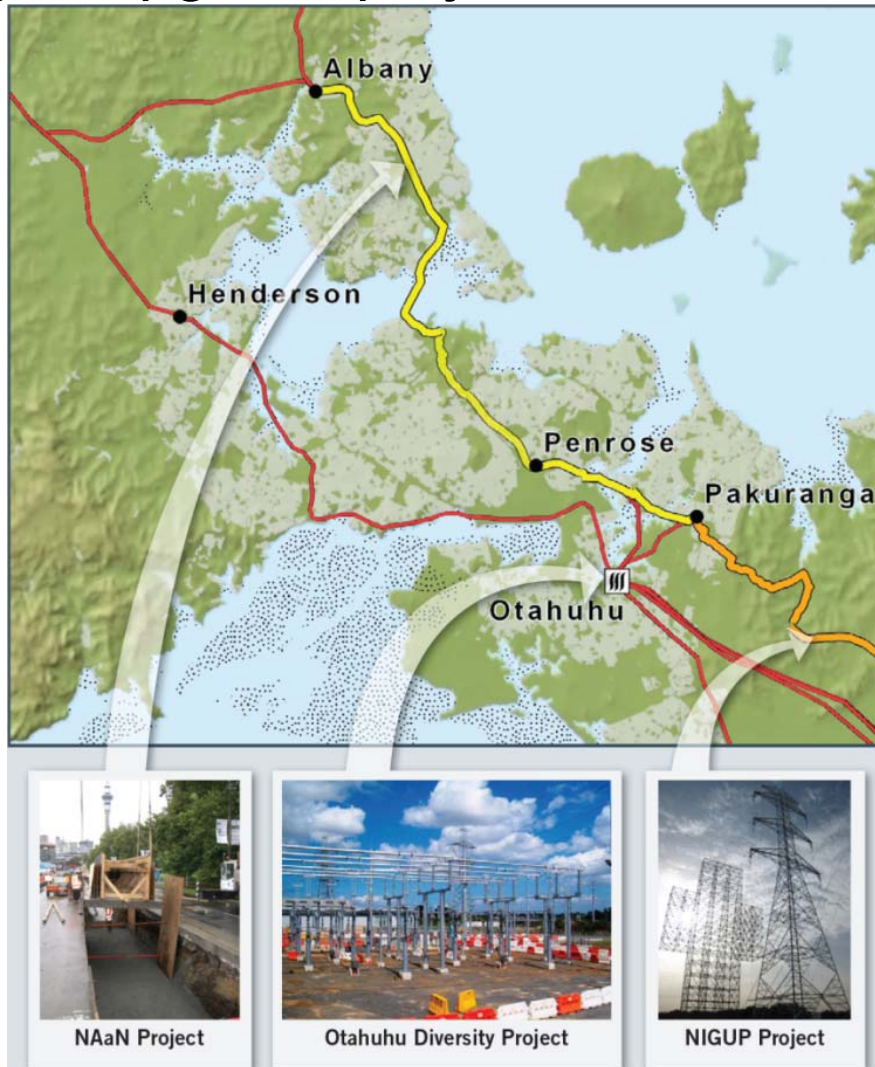
Increasing capacity into Auckland

- North Island Grid Upgrade (\$824m, 2012)
- Otahuhu-Whakamaru A, B, C thermal uprating (\$25m, 2006-09)
- Albany SVC (\$21m, 2008)
- Ohinewai switching station (\$27m, 2008)
- Drury switching station (\$24m, May 2010)
- Plus contingency projects



Securing transmission for Auckland

Three major grid upgrade projects in the Auckland area:



30 October 2009 outage





Metrobox container storage yard, Onehunga



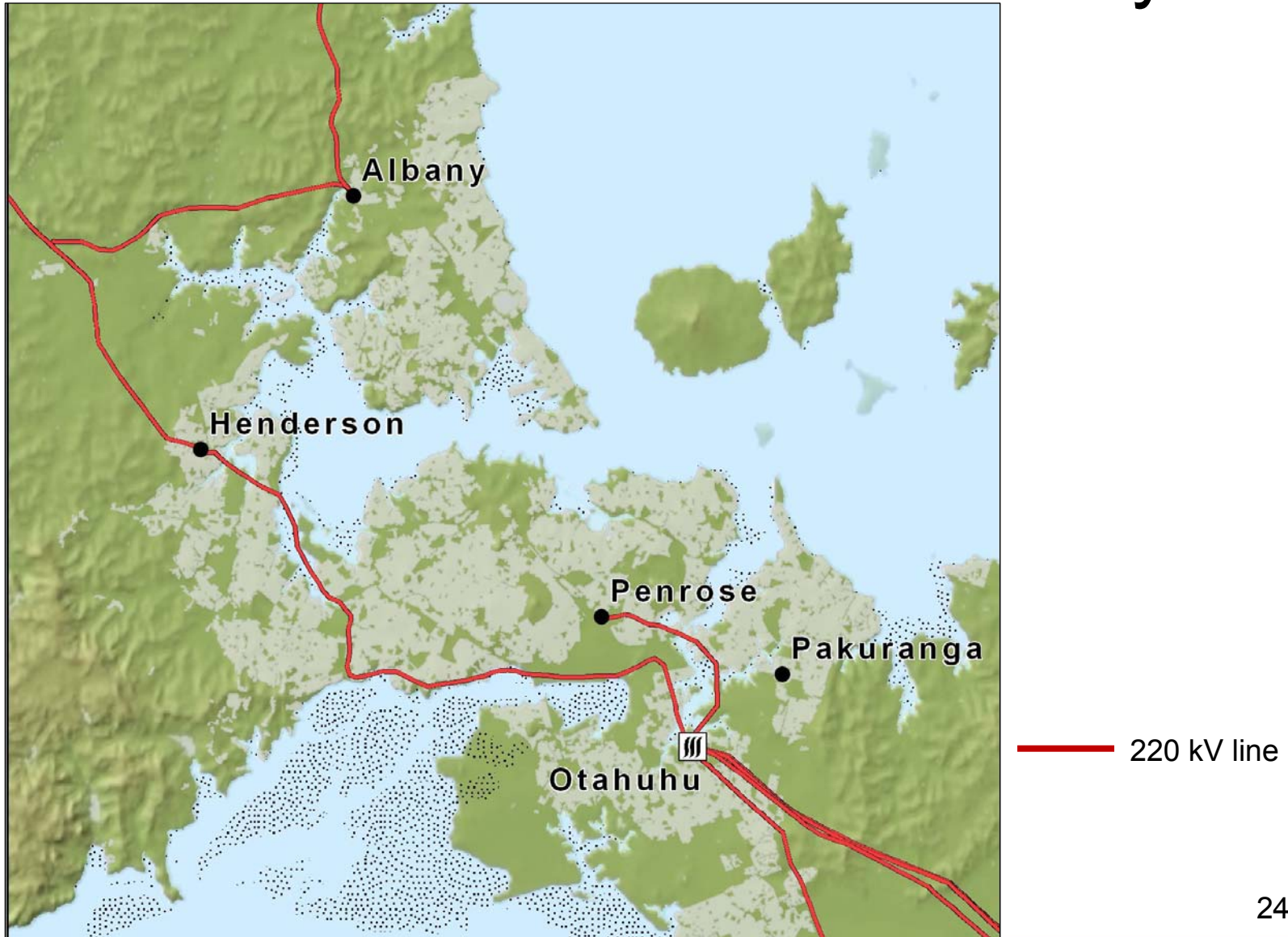
Underbuild



Long 174d 54m 5.7s
HLY-OTA A Str 198



North Auckland and Northland – today



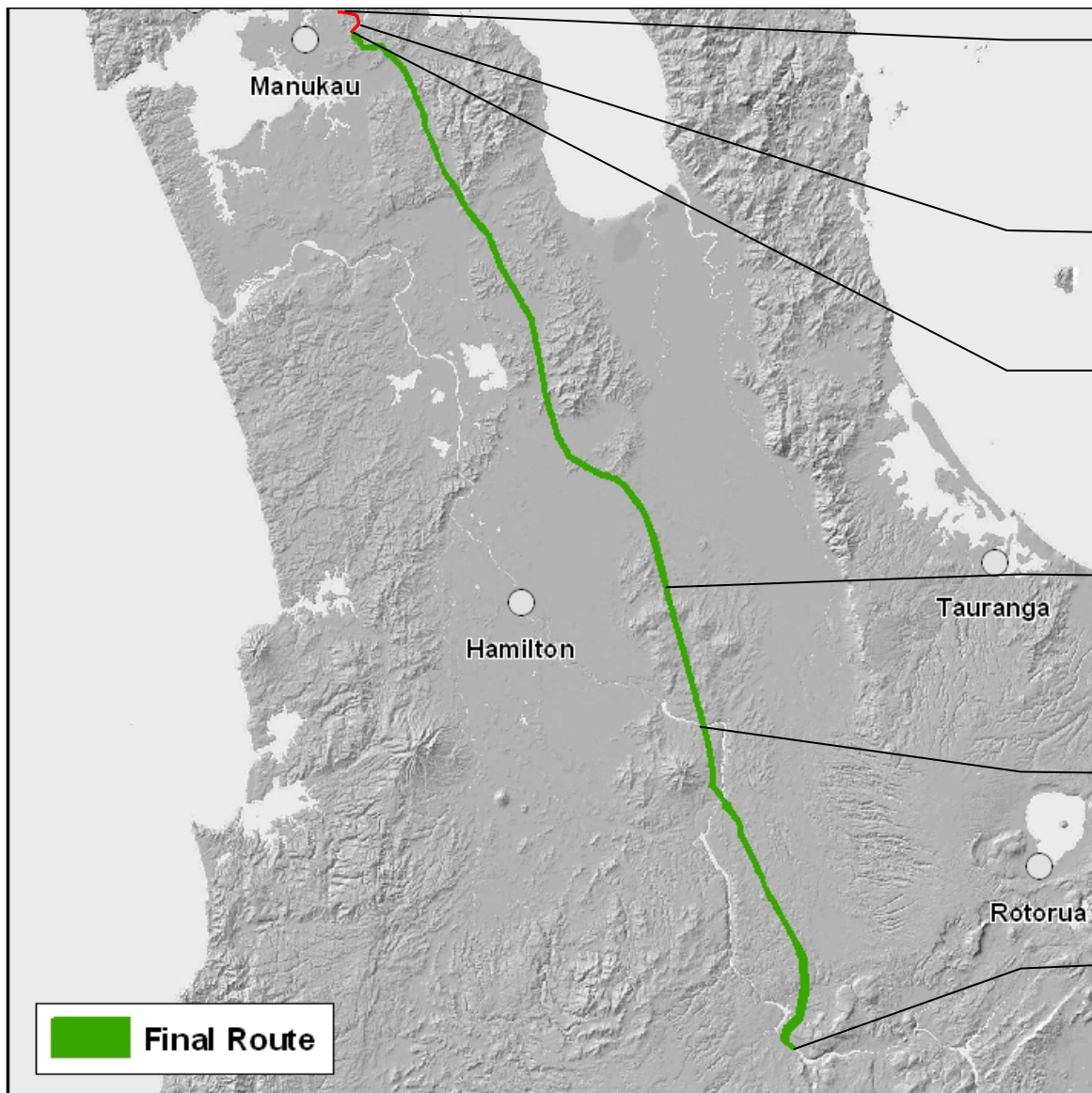
North Auckland and Northland – after NAaN and NIGU



Need for NIGUP

- Need for the line due to strong growth in the grid – investigation began in 2003
- Peak demand in upper NI to continue growing
 - forecast to grow 2.8% for the next 10 years (national average 2.1%)
 - Equivalent to adding Whangarei size city every year
- Auckland generation not an alternative for sustainable generation
 - Approx 70% of the region's power is supplied by generation south of Bombay
 - Transmission is therefore vitally important
- Most of the existing lines were built in the 1950s and 60s
 - now nearing capacity





Existing Pakuranga substation rebuilt at 220kV & connected to Otahuhu by operating existing OTA-PAK line at consented 220kV.

11km double circuit underground cable.

New Brownhill substation, initially cable termination, switching station in 2022, 400kV substation in 2034

185km 400kV construction lattice steel tower line, operated initially at 220kV.

7 x 400kV capable monopole towers at Waikato river crossing

New bay at Whakamaru substation
New substation 800m north of existing Whakamaru substation connected by tie line to Whakamaru line.

NIGUP Timeline

- Planning and consultation 2004-2009
- Build phase began Feb 2010
- Commissioning of line targeted autumn 2012

First NIGUP tower erected April 2010



Cable routes



Landowner process

- 318 properties in total directly affected by overhead transmission lines and a further 25 affected by underground cable routes.
- Consultation continues to obtain easements by negotiation
- Transpower now has agreements in place for access to 85% of the properties on the line route
- Compensation for easements will be consistent with the principles of the Public Works Act
- Landowner approach intended to be respectful and fair
- Transpower initiated a Community Care Fund approach for community based mitigation



NAaN project history

Date	Milestone
1998	Auckland 'blackout' prompted reviews. North Auckland and Northland considered for reinforcement with a second route.
2002	Preparatory work for cabling commences.
2005	Transpower obtains interim approval to install cable ducting in the CBD and North Shore.
2007	Ducting installation completed for two circuits.
Sept 2007	First NAaN proposal submitted to Electricity Commission - Electricity Commission seek further information.
May 2008	Amended NAaN proposal submitted.
Dec 2008	Electricity Commission decline proposal.
Mar 2009	Additional evidence in support of proposal presented.
May 2009	Electricity Commission approves \$473 million project.



North Auckland and Northland (NAaN) project



37kms of 220 kV
underground cable from PAK
to ALB

Vector access agreement
June 2010

Release cable tender
December 2010

Award cable tender
October 2011

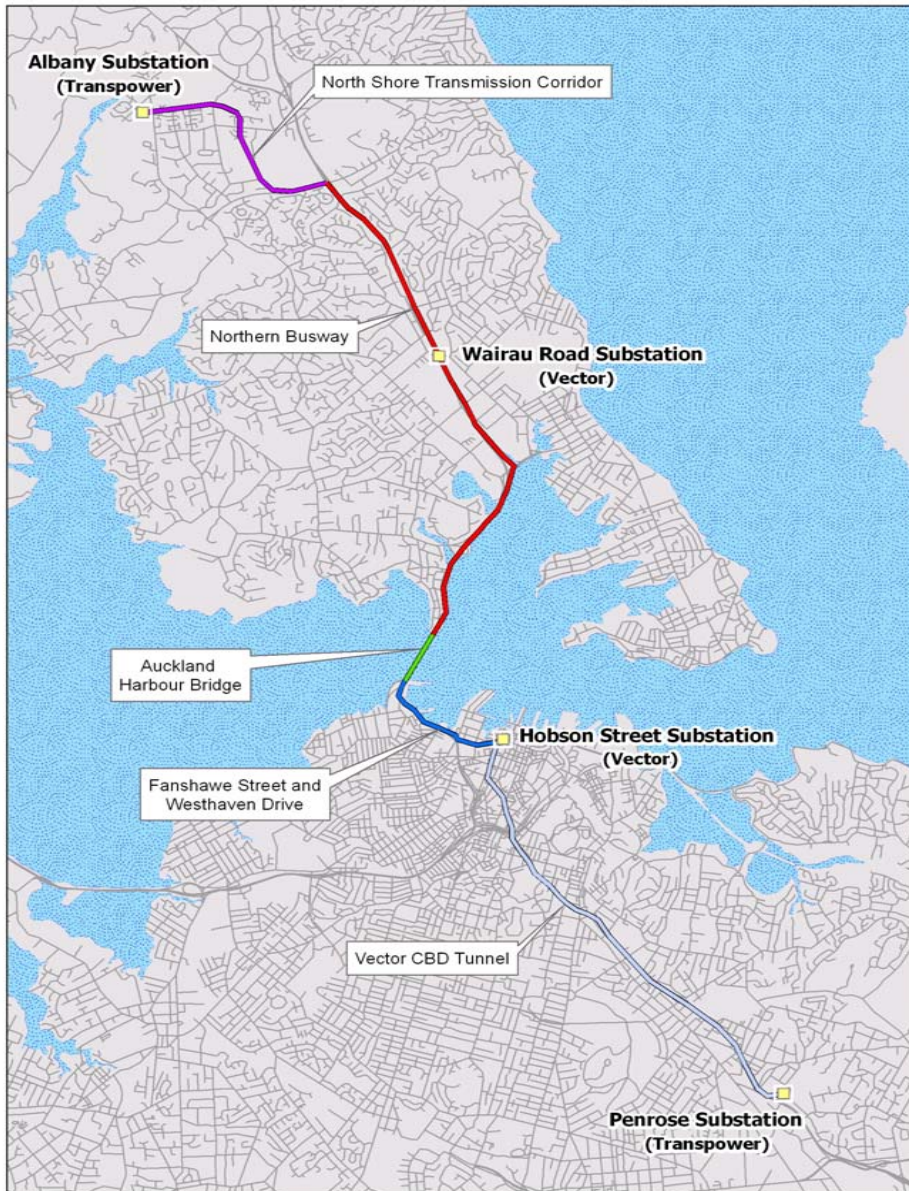
Cable installation begins
February 2012

Substation construction
begins
April 2012

NAaN project operational
June 2013



Penrose to Albany



Transpower invested in the ducts and in securing access to this route

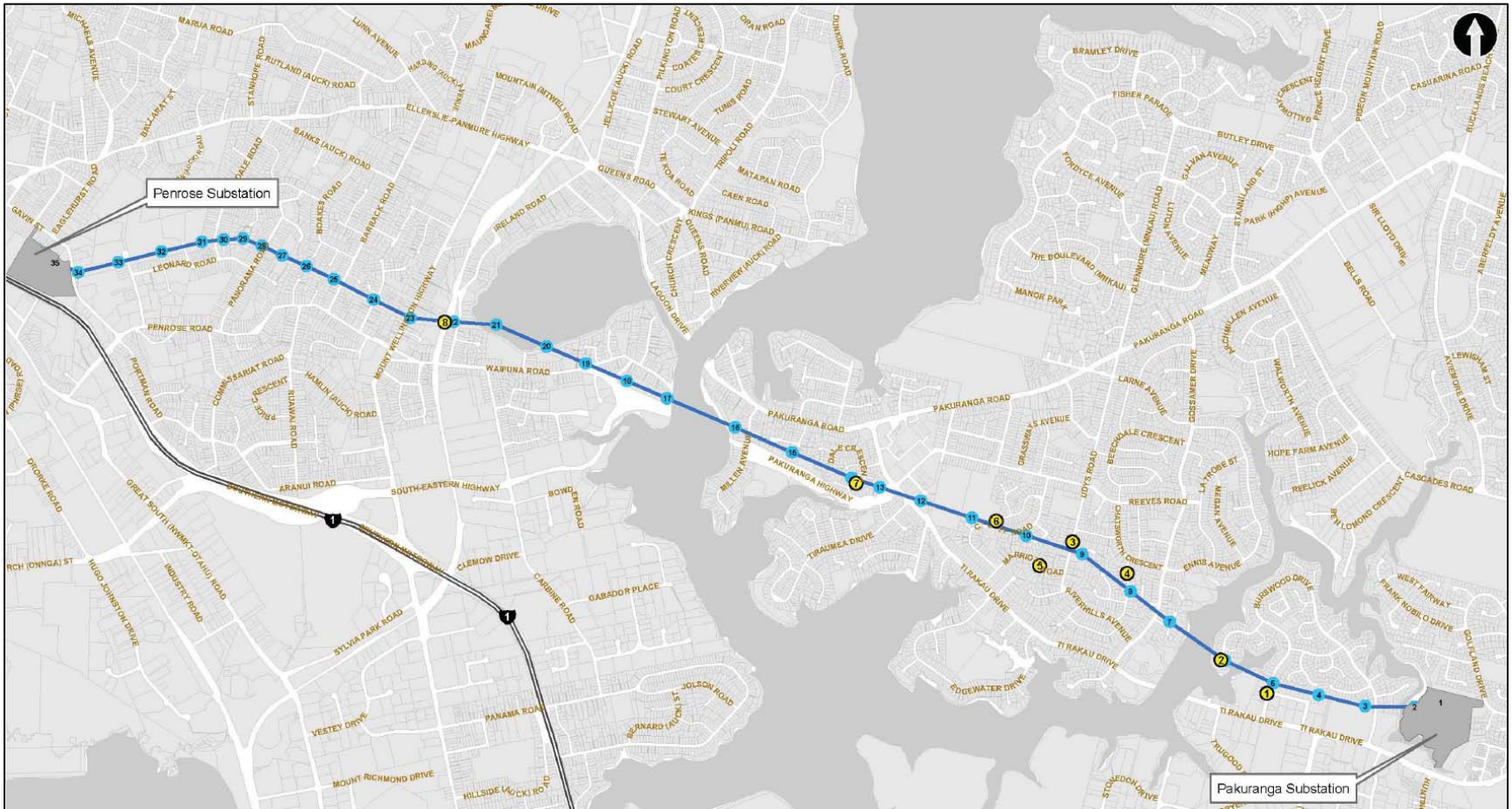
Preparatory work commenced in 2002
- Cable ducts installed for **two** cables

Ducting finished in 2007

Most of the route is consented



Pakuranga to Penrose 'A' line removal



Commissioned 1940, 8.5kms to be removed



Pakuranga to Penrose 'A' line removal

Before removal



After removal



Otahuhu Substation Diversity Project

- Build 220 kV GIS facility, physically separate from existing switchyard, and underground 220 kV lines crossing existing switchyard
- Will provide diversity to NZ largest load centre and strengthen resilience to HILP events
- Project worth \$99m
- Approved by EC Aug 2007
- Ground breaking work started in Jan 2008
- Commissioned June 2010



GIS substation at Otahuhu



Before

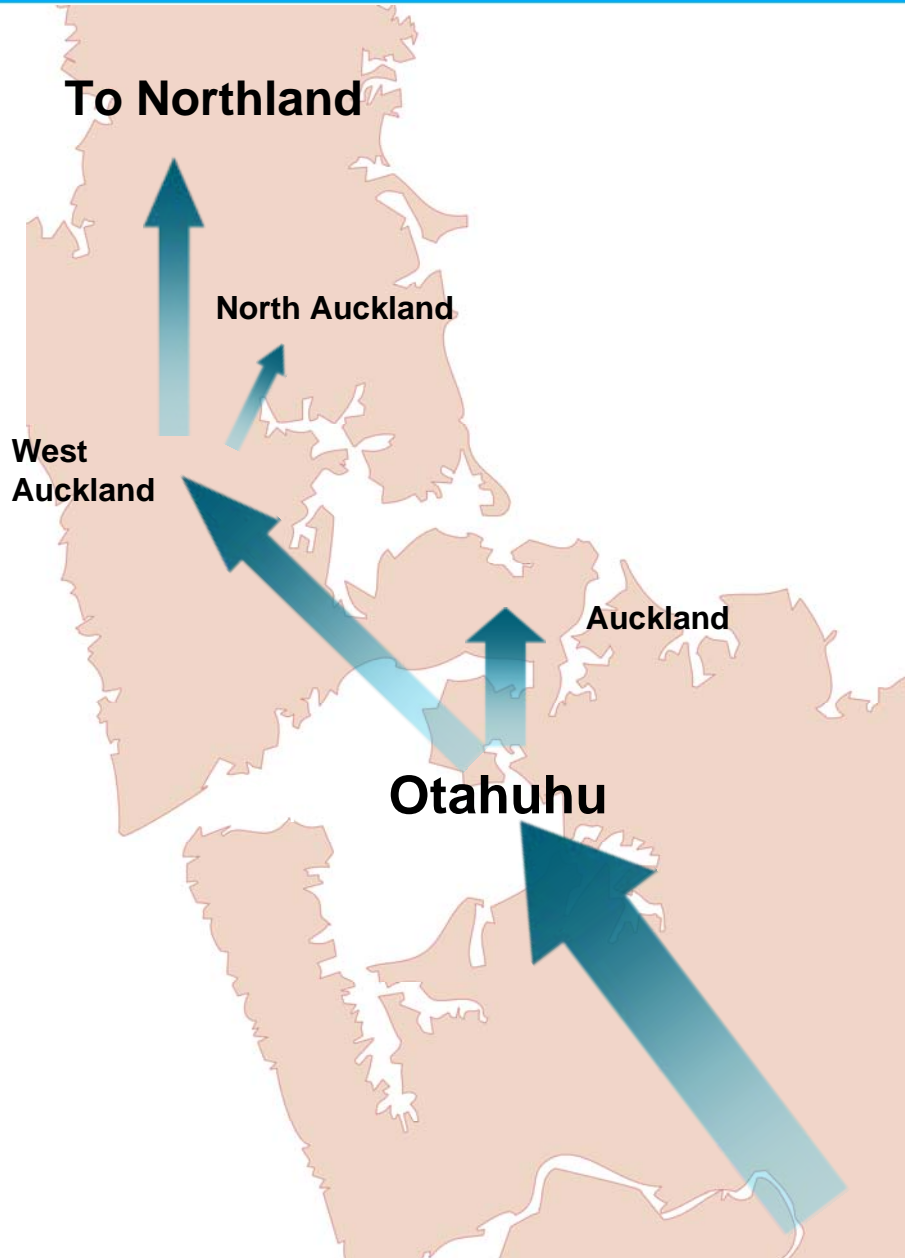


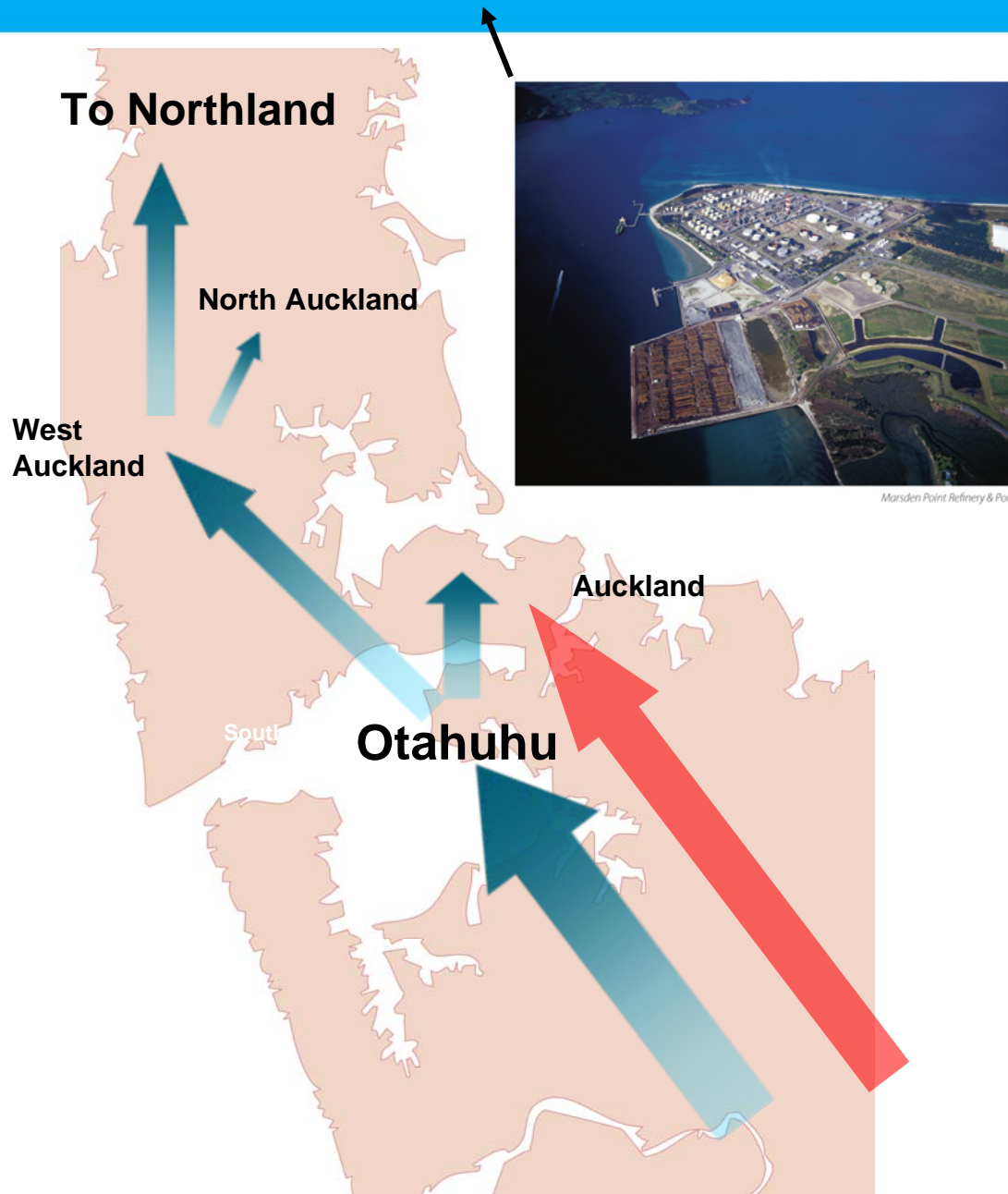
After



The grid in 2010

A 2nd Substation constructed at Otahuhu and lines split across the two substations





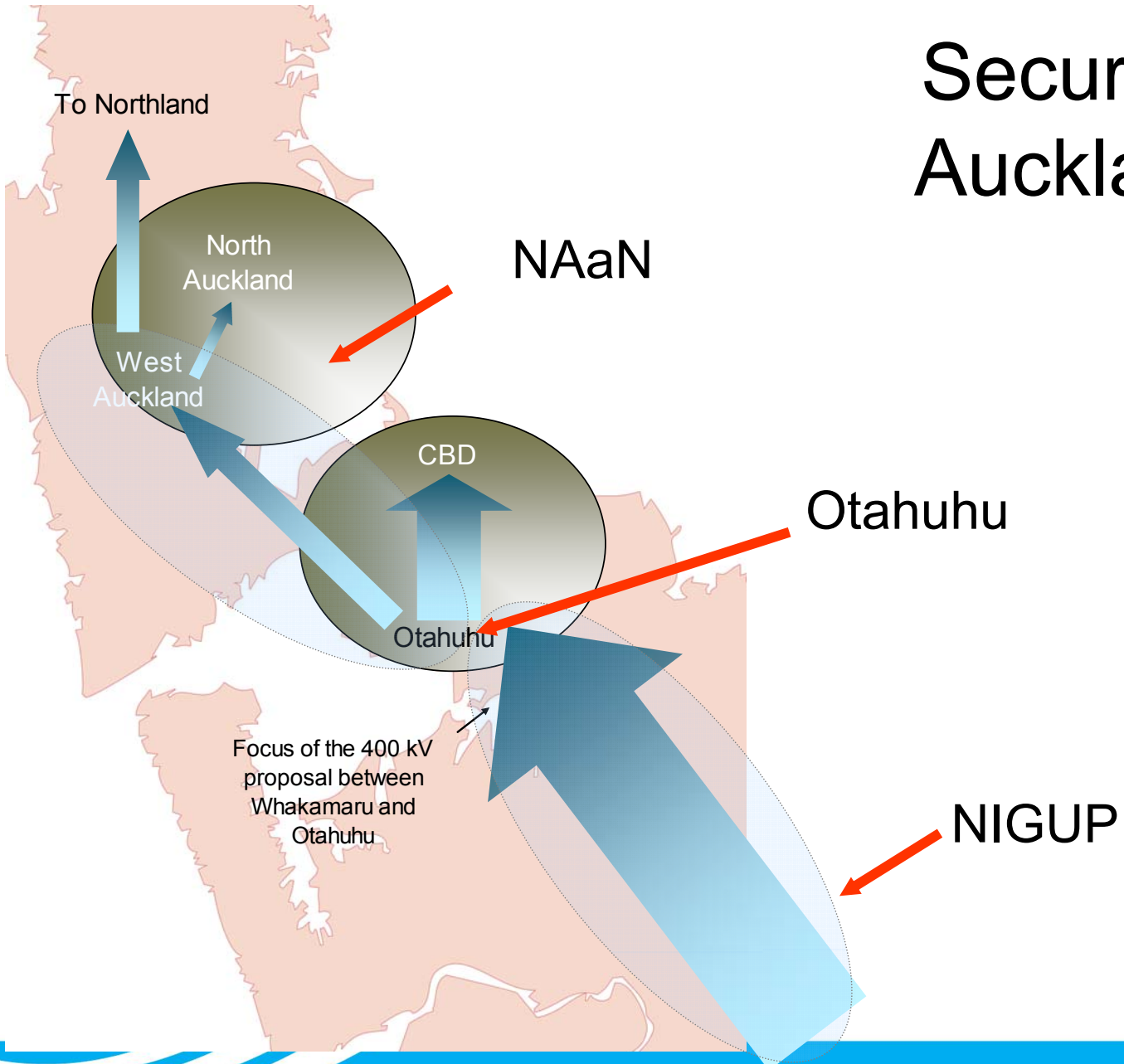
The grid in 2012

New 220kV/ 400 KV line into Auckland (terminating at Pakuranga)

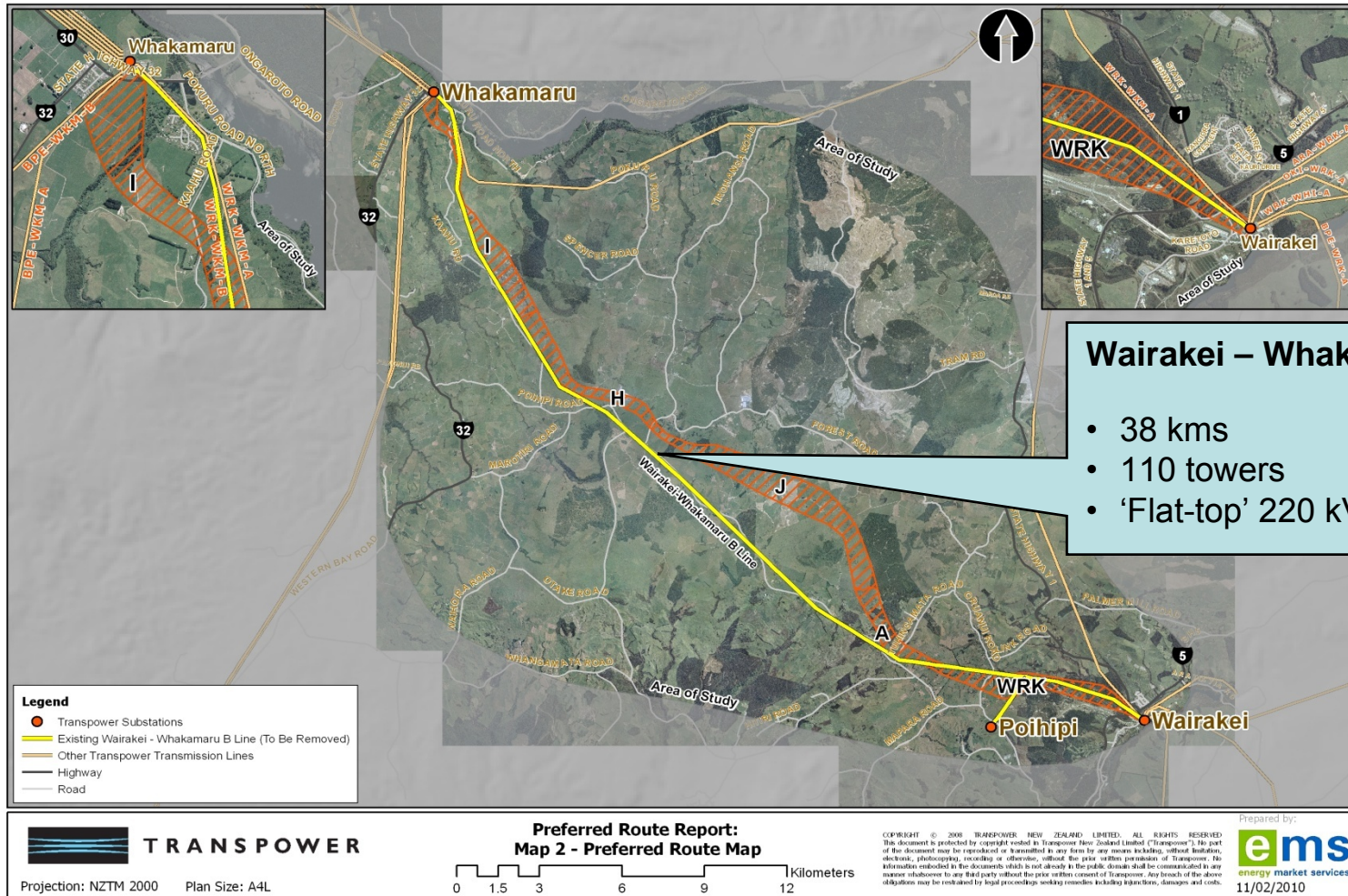
Start of the ring around Auckland



Securing Auckland



Wairakei Ring Reinforcement



The ring helps transfer bulk power northwards and southwards
Also helps supply the Bay of Plenty and Hawke's Bay regions



Wairakei Ring Reinforcement

- Worth up to \$141m, submitted to EC in Dec 2008 and approved in Feb 2009
- Involves building a new double circuit 220 kV line between Wairakei and Whakamaru by winter 2013
- Has been extensive engagement and consultation with potentially affected communities
- Feb 2010 Transpower released its preferred route for the new line
- New line will facilitate the connection of up to 1000 MW of new geothermal generation over next 5-7 years



Planned new geothermal generation

Location	Size (MW)	Company	Commissioning Date
Te Huka Binary Plant (Tauhara Stage 1)	23	Contact Energy	2010
Ngā Awa Purua (Rotokawa)	140	Mighty River Power	2010
Te Mihi	225	Contact Energy	2011
Ngā Tamariki	80	Mighty River Power	2012
Tauhara Stage 2	250	Contact Energy	2012
Rotoma	35	Rotoma no 1 Inc	?
Misc*	400		
TOTAL	1153		

* Source: NZ Geothermal Association



THE POLITICIAN



The DomPost 17 Feb 2009