

The grid in the 21st century



Patrick Strange
Chief Executive, Transpower New Zealand Ltd

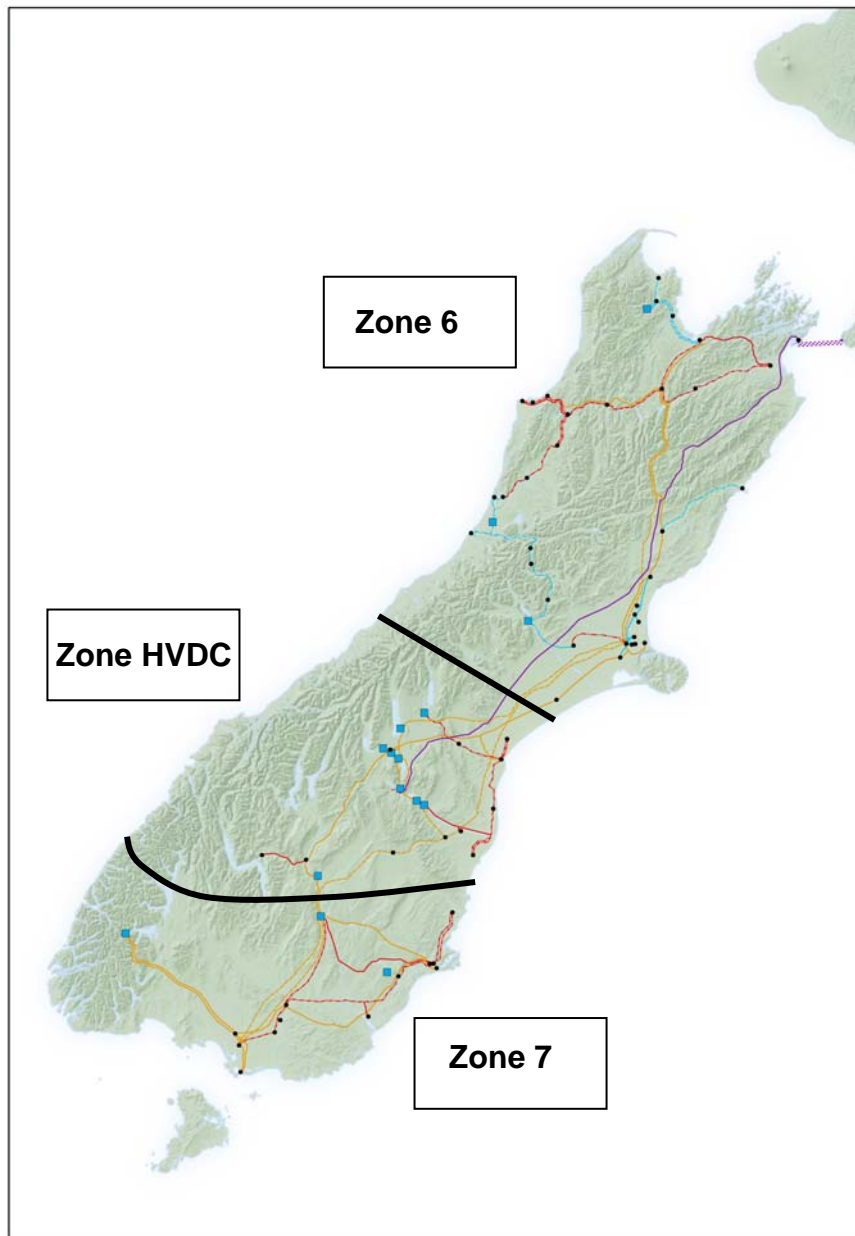
TRANSPOWER

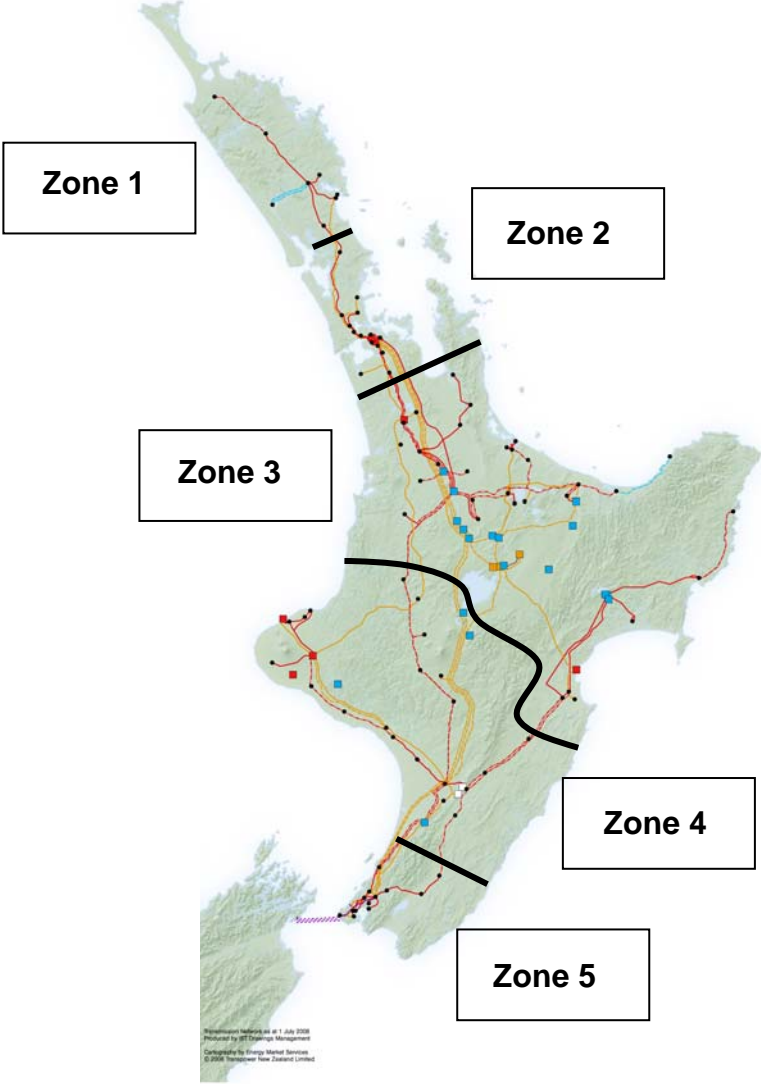




- What is the role of the grid in the 21st century?
- What can we learn from the recent Auckland outages?







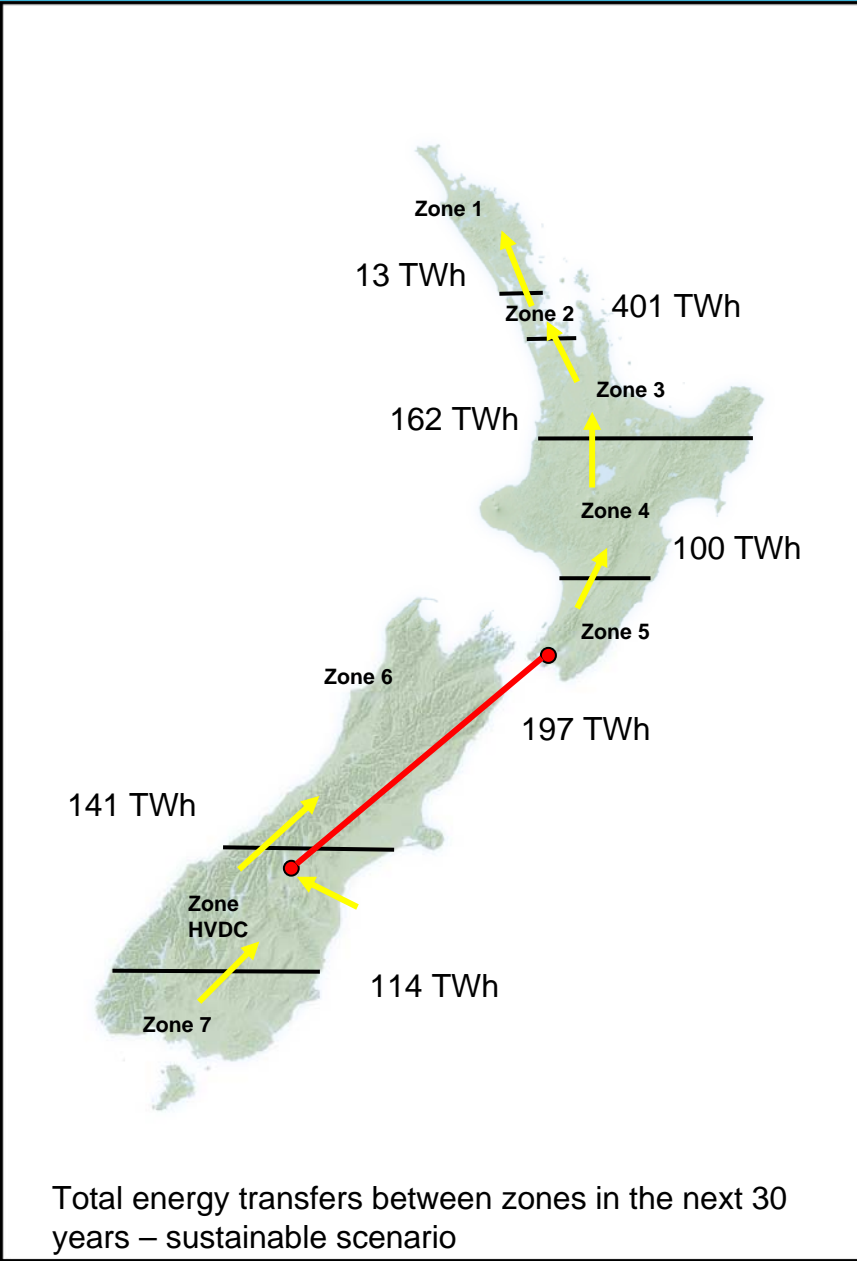
Sustainable scenario Average growth rates pa	
Zone 1	1.9%
Zone 2	2.1%
Zone 3	1.4%
Zone 4	0.8%
Zone 5	1.2%
NI	1.6%
Zone 6	1.2%
HVDC	1.4%
Zone 7	0.4%
SI	0.8%

Table 1 – 2008 SoO demand forecast – average growth rates for sustainable scenario



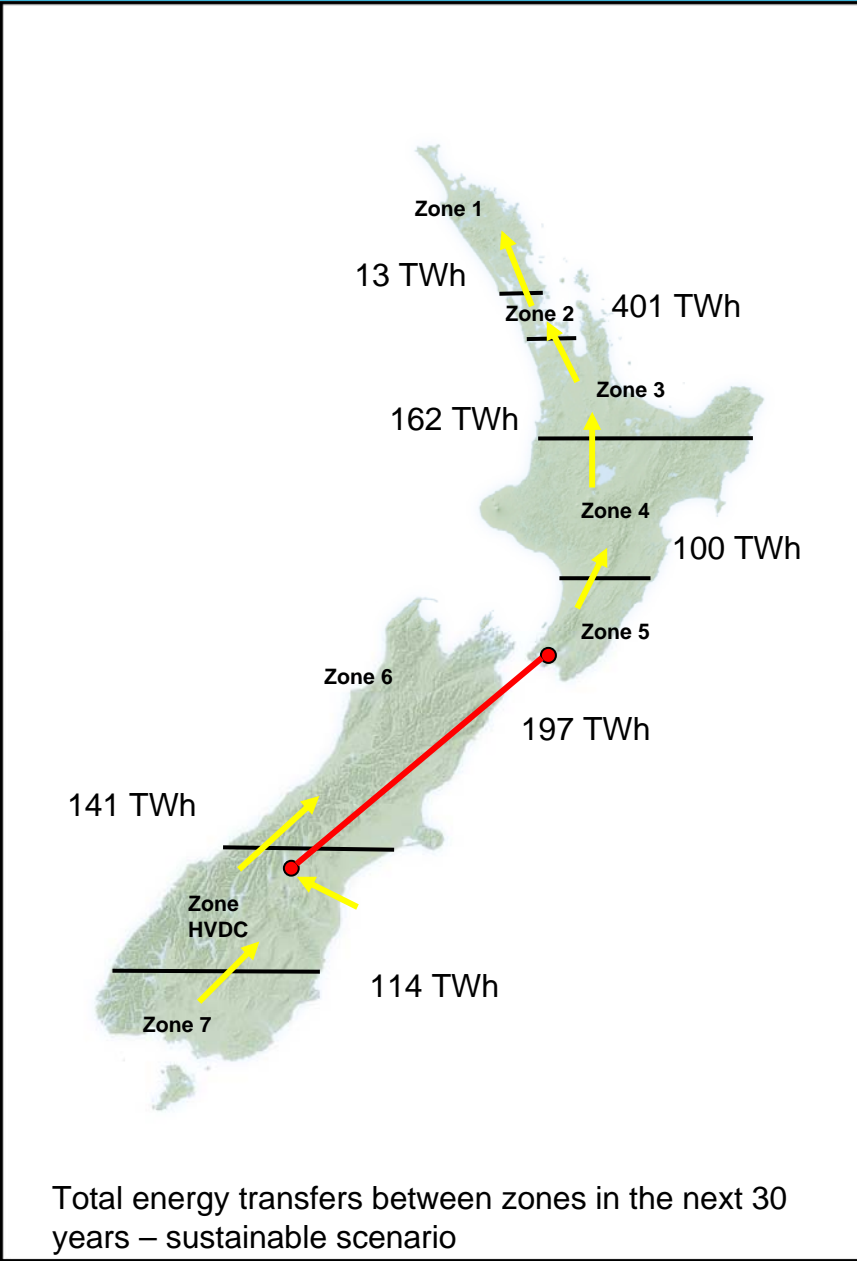
Sustainable Scenario		
Regional allocation of demand forecast		
	% load 2011	% load 2040
Zone 1	3	4
Zone 2	24	30
Zone 3	22	22
Zone 4	7	6
Zone 5	7	7
NI	63	69
Zone 6	15	14
HVDC	6	5
Zone 7	16	12
SI	37	31





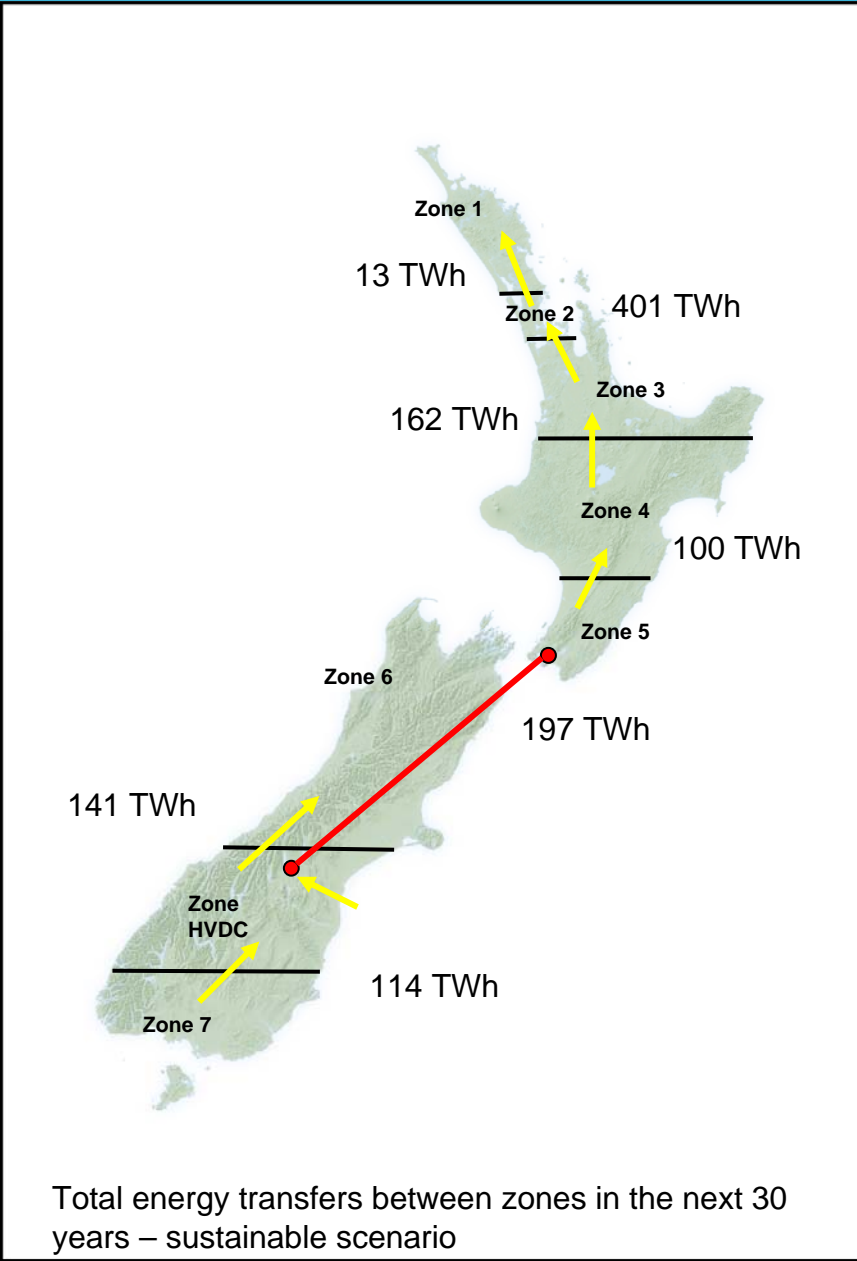
Zone x to y (TWh)	2011	2020	2030	2040
7 to HVDC	1.2	3.5	4.4	5.5





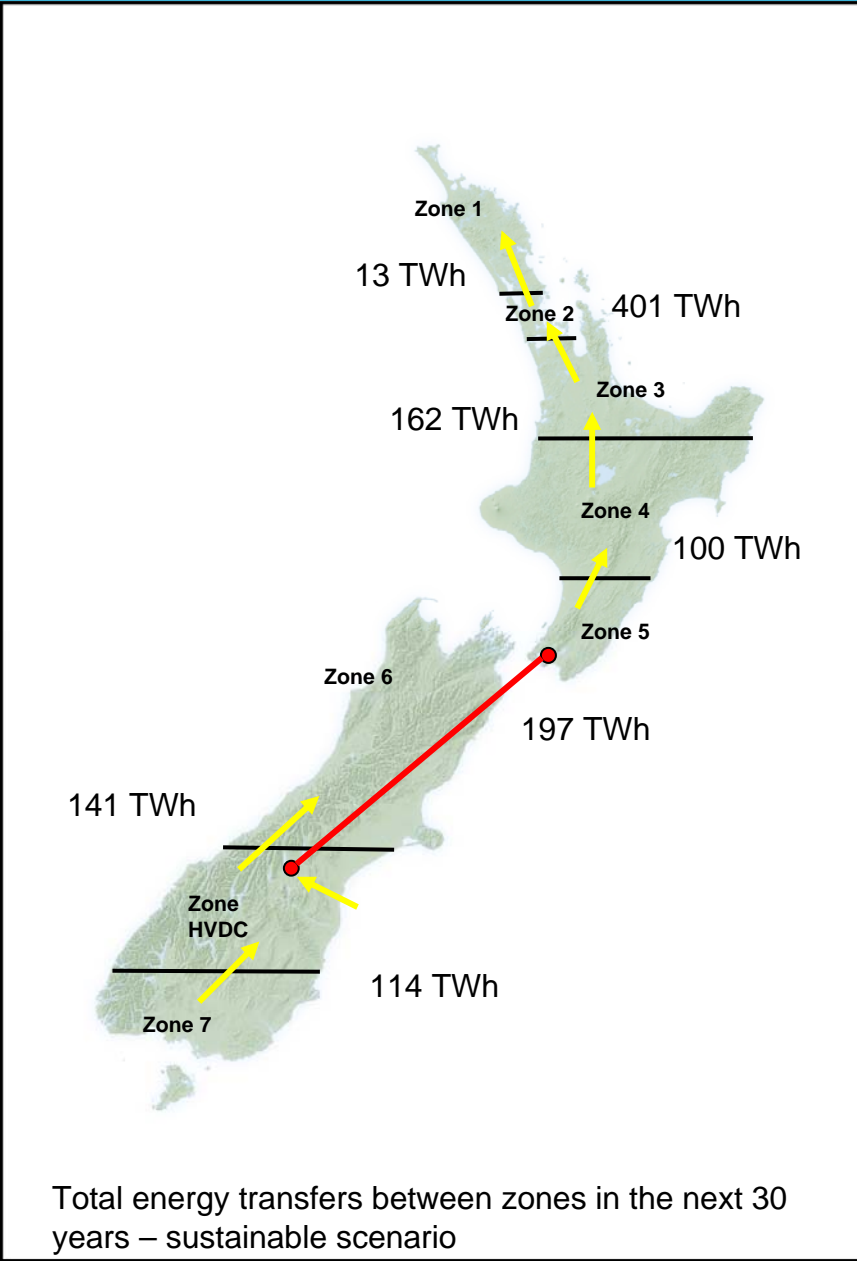
Zone x to y (TWh)	2011	2020	2030	2040
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5





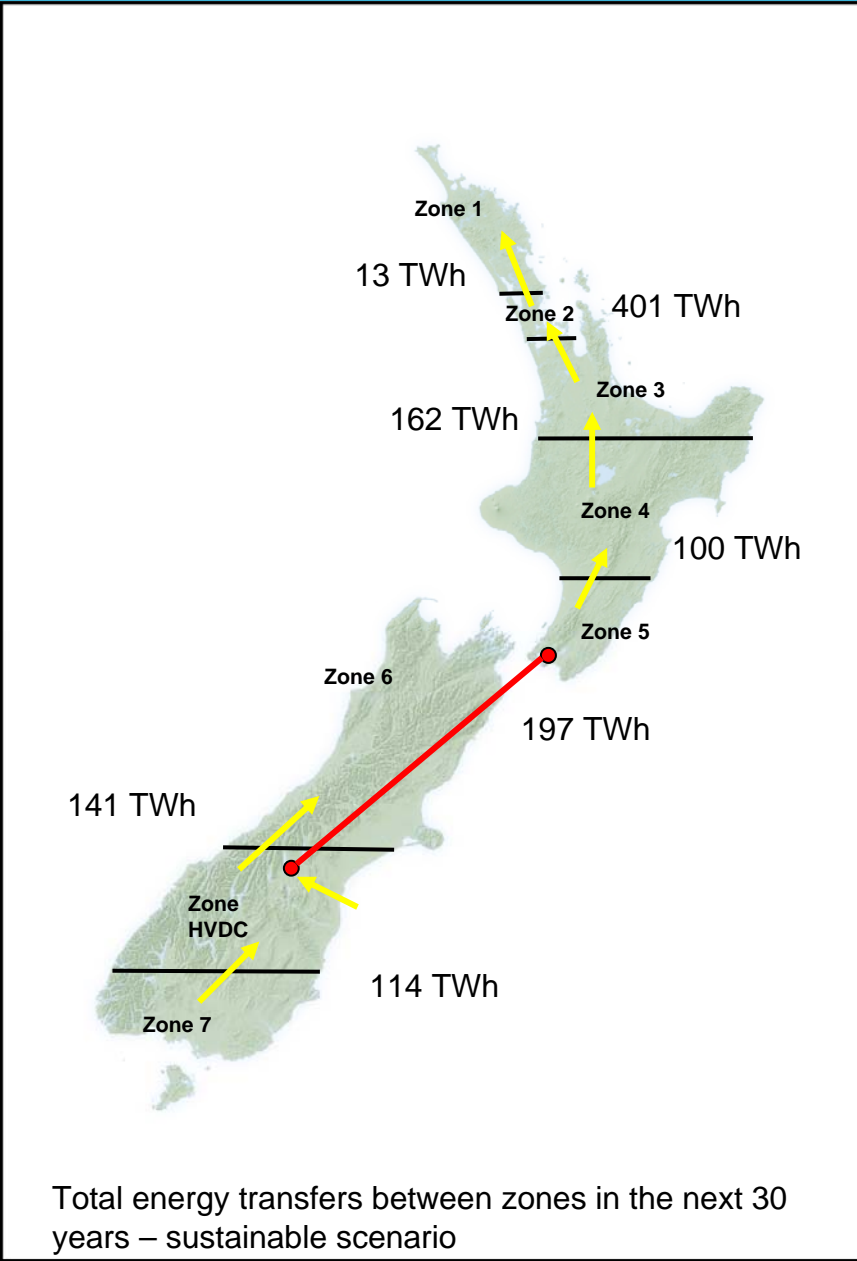
Zone x to y (TWh)	2011	2020	2030	2040
HVDC to 6	5.0	5.4	4.3	4.0
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5





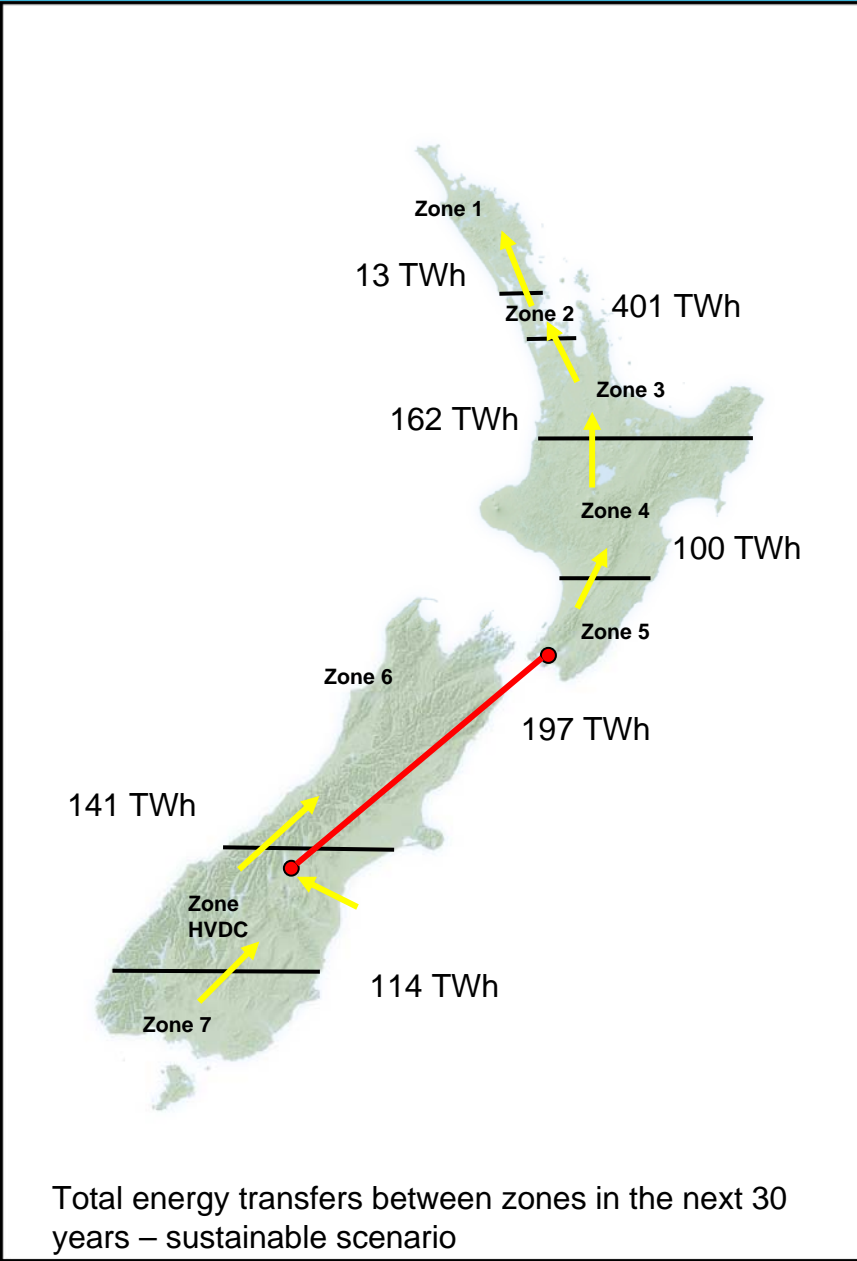
Zone x to y (TWh)	2011	2020	2030	2040
5 to 4	1.0	2.4	4.0	6.0
HVDC to 6	5.0	5.4	4.3	4.0
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5





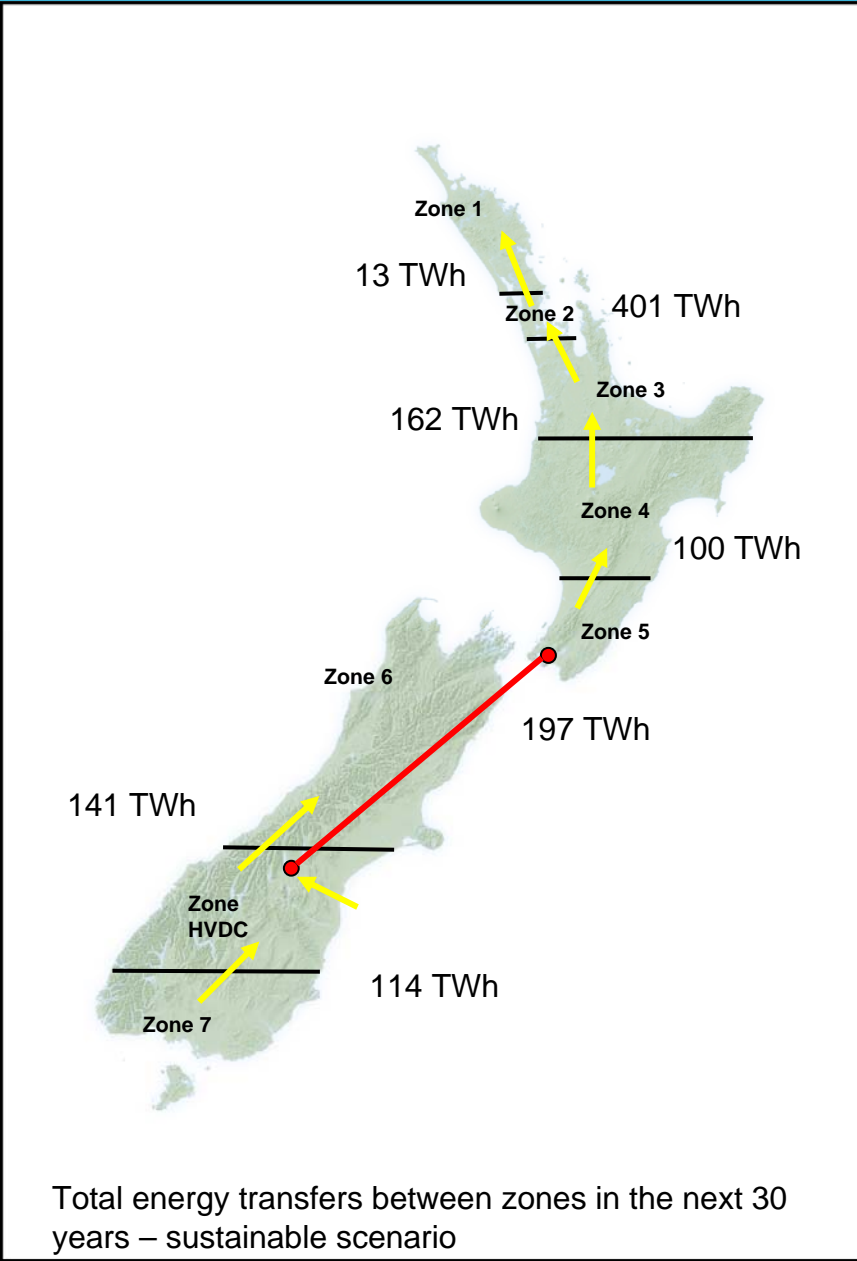
Zone x to y (TWh)	2011	2020	2030	2040
4 to 3	3.0	5.0	6.0	8.0
5 to 4	1.0	2.4	4.0	6.0
HVDC to 6	5.0	5.4	4.3	4.0
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5





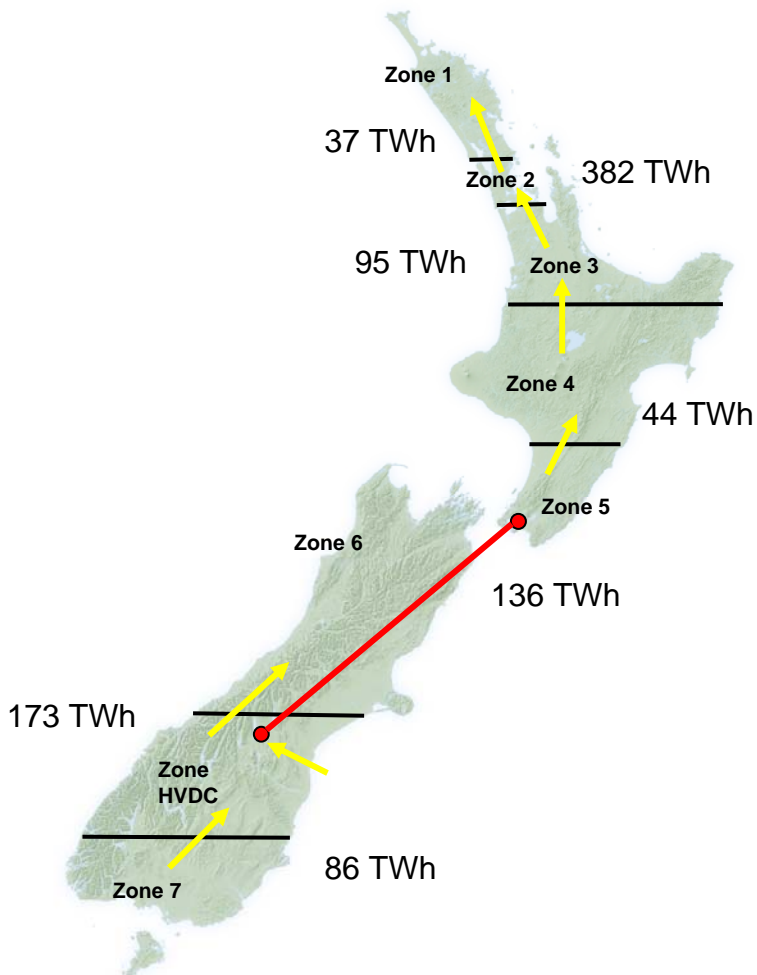
Zone x to y (TWh)	2011	2020	2030	2040
3 to 2	9.0	12.0	14.0	17.0
4 to 3	3.0	5.0	6.0	8.0
5 to 4	1.0	2.4	4.0	6.0
HVDC to 6	5.0	5.4	4.3	4.0
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5





Zone x to y (TWh)	2011	2020	2030	2040
2 to 1	1.4	0.4	-0.3	-0.3
3 to 2	9.0	12.0	14.0	17.0
4 to 3	3.0	5.0	6.0	8.0
5 to 4	1.0	2.4	4.0	6.0
HVDC to 6	5.0	5.4	4.3	4.0
HVDC to NI	4.0	5.6	7.4	9.0
7 to HVDC	1.2	3.5	4.4	5.5

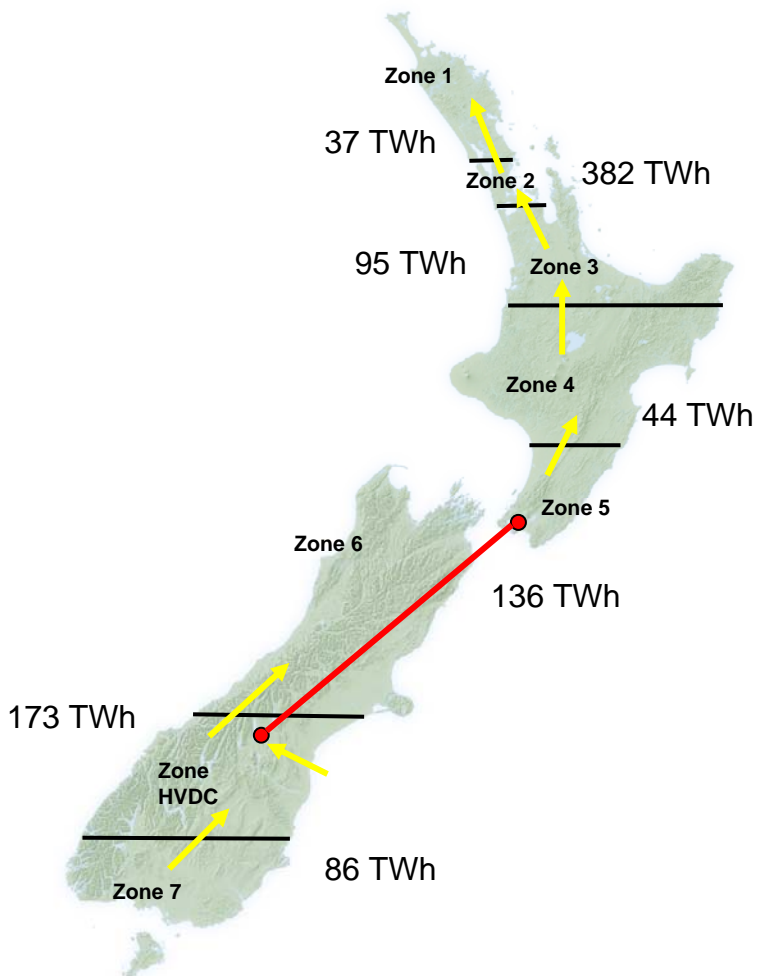




Total energy transfers between zones in the next 30 years – demand side scenario

Zone x to y (TWh)	2011	2020	2030	2040
HVDC to NI	3.8	4.4	4.6	5.2

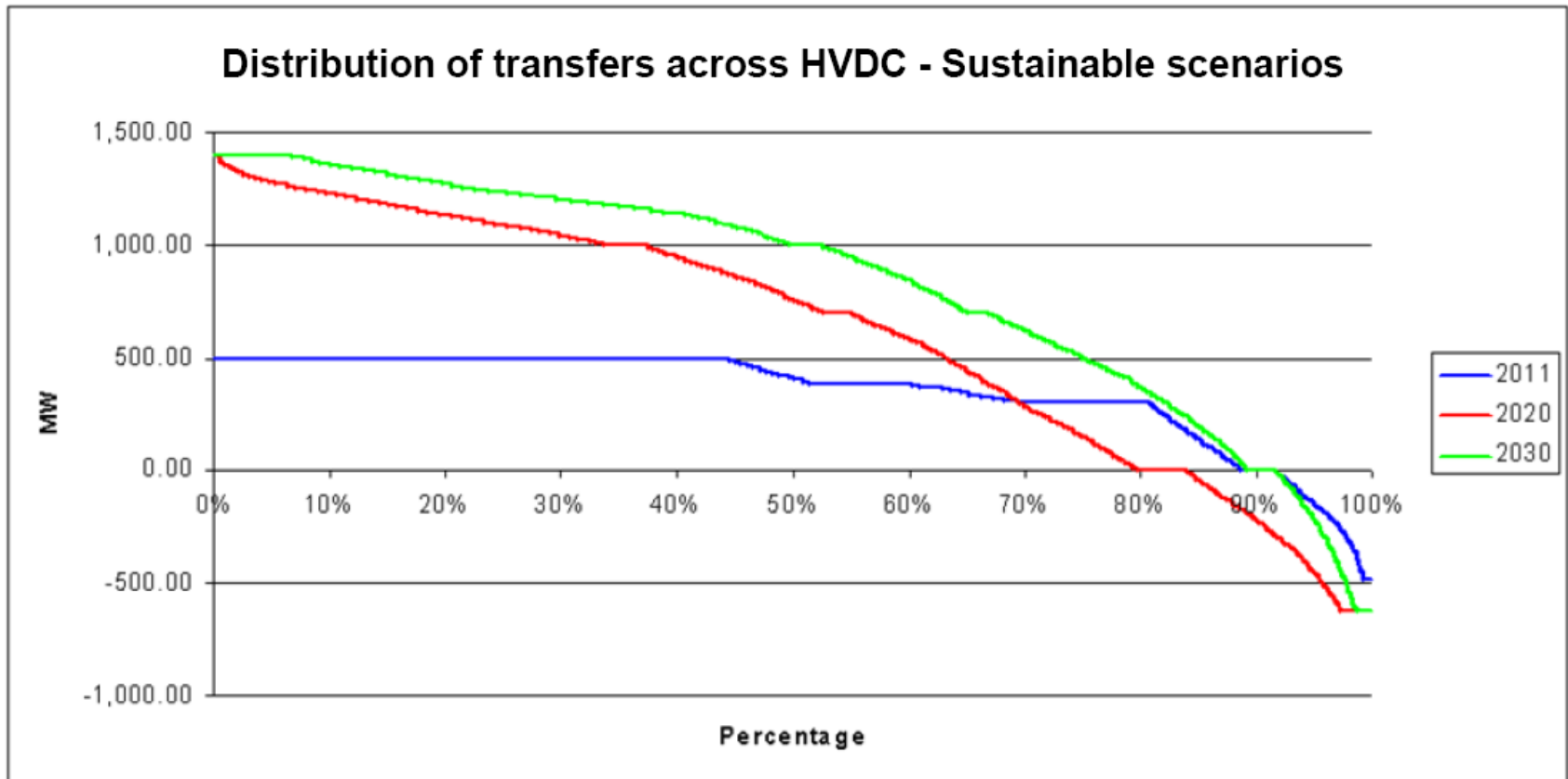




Total energy transfers between zones in the next 30 years – demand side scenario

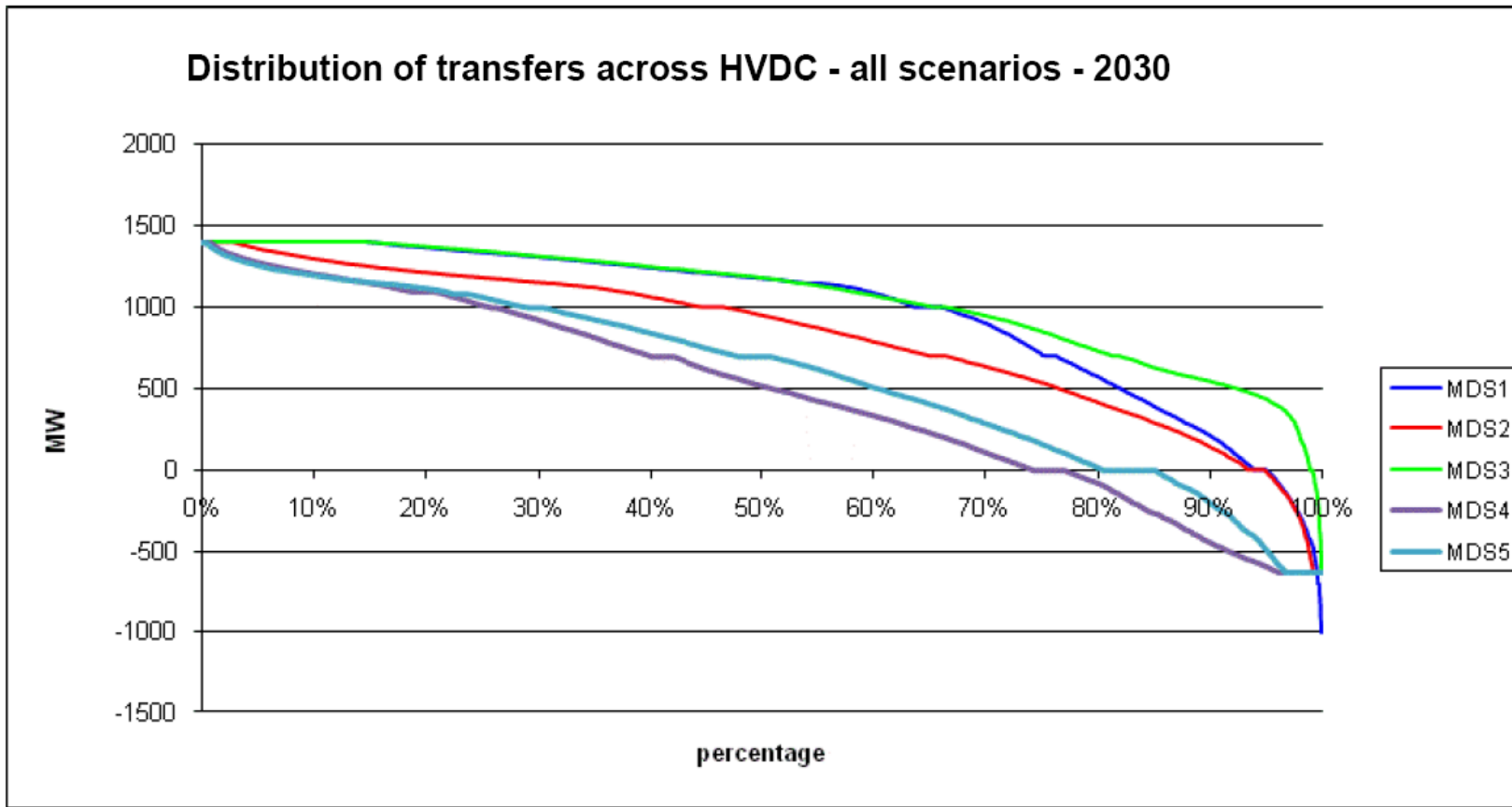
Zone x to y (TWh)	2011	2020	2030	2040
3 to 2	9.0	12.0	14.0	17.0
HVDC to NI	3.8	4.4	4.6	5.2





Distribution of transfers across the HVDC, sustainable scenario





Distribution of transfers between HVDC Zone and Zone 6, for all generation scenarios, in 2030 only



- The grid is going to transport more and more energy across New Zealand



Sydney outages

Thousands lose electricity in Sydney area

27 Jan 10

Power restored to 14,500 Sydney homes

26 Mar 09

**Lightning strikes homes as storm
hits NSW**

04 Feb 10

**Sydney CBD hit by another
power outage**

28 April 09



Auckland traffic



Substation failure hits hospitals, businesses

74,000 customers are left without power after Penrose transformer breaks down

Auckland chaos over power cut

Businesses lose millions during power outage

Huge power cut hits north

Forklift at fault

Farmer fires up power firm

Blackout as farmer 'blocks' repairs

Transpower hits flak over power cut

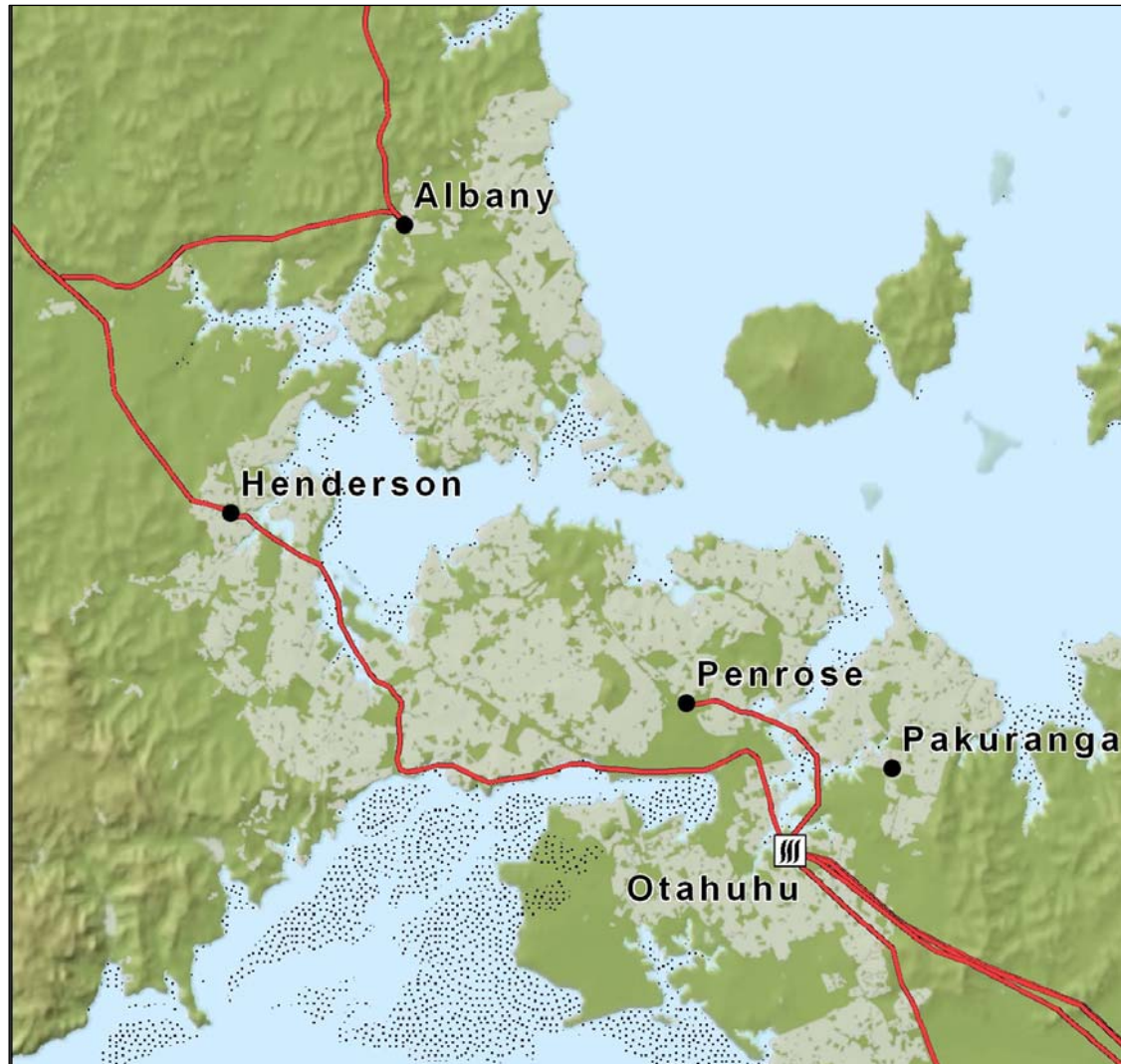


Auckland outages...

- **1.10pm 3 February 2009** – transformer failure while system reconfigured for maintenance. Cuts supply to 74,000 consumers in Auckland
- **08.00am 30 October 2009** – forklift carrying container hits the line, causing loss of supply to 280,000 consumers in North Auckland and Northland
- **2.17pm and 2.45pm 25 January 2010** – two of our major transmission lines that feed Auckland trip. Fire under lines reported. Effects supply to 60,000 consumers in Auckland



North Auckland and Northland – today





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





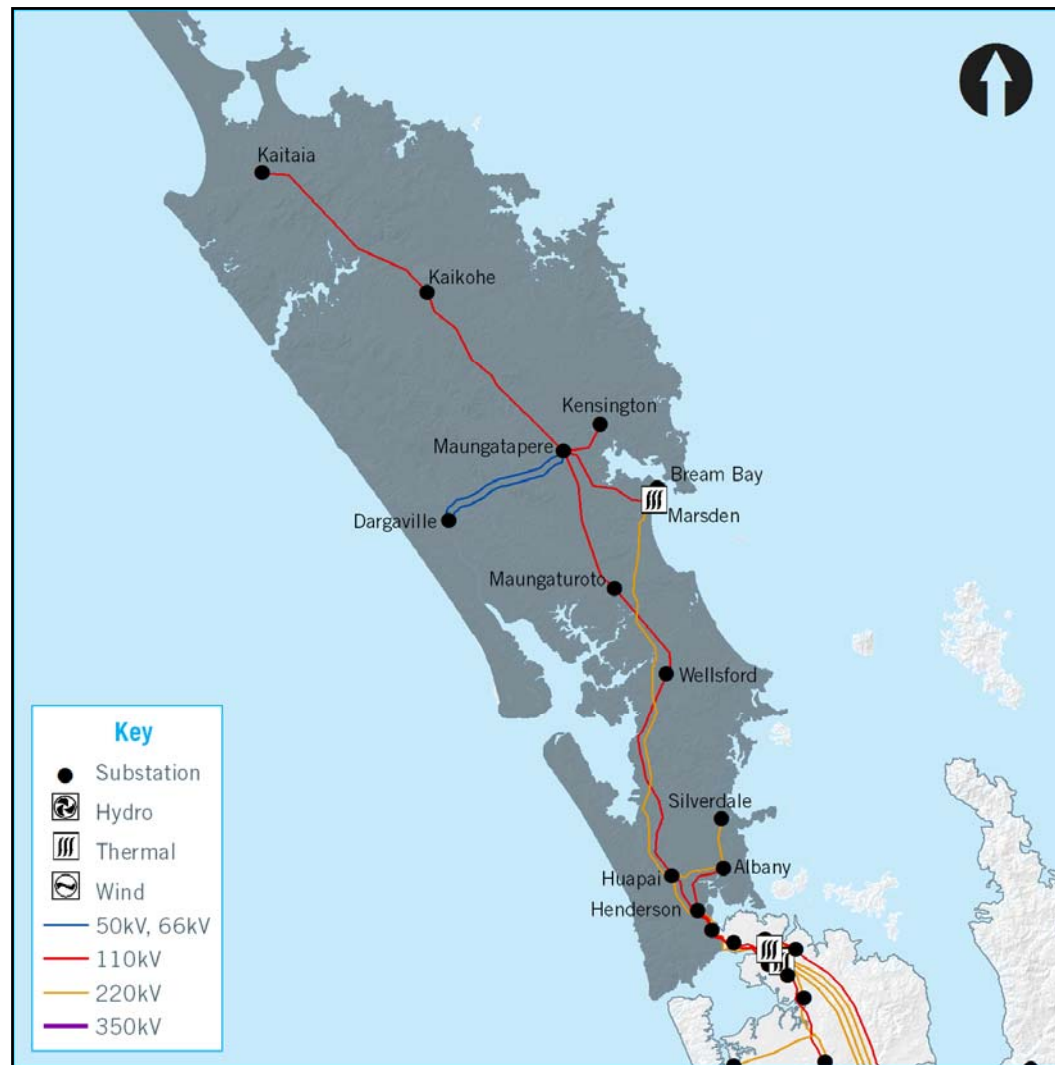
Metrobox container storage yard, Onehunga



30 October 2009 outage



Affected area

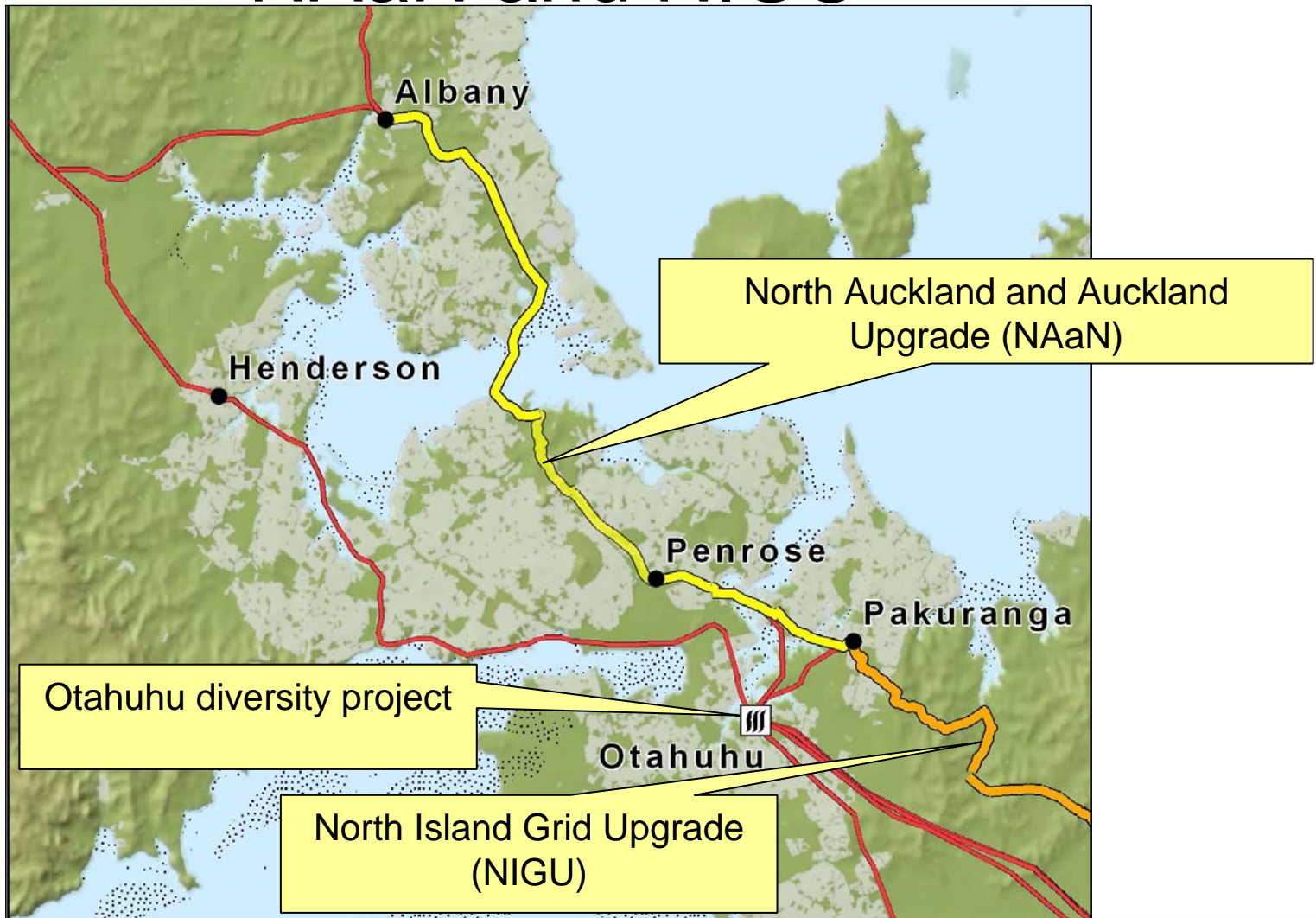


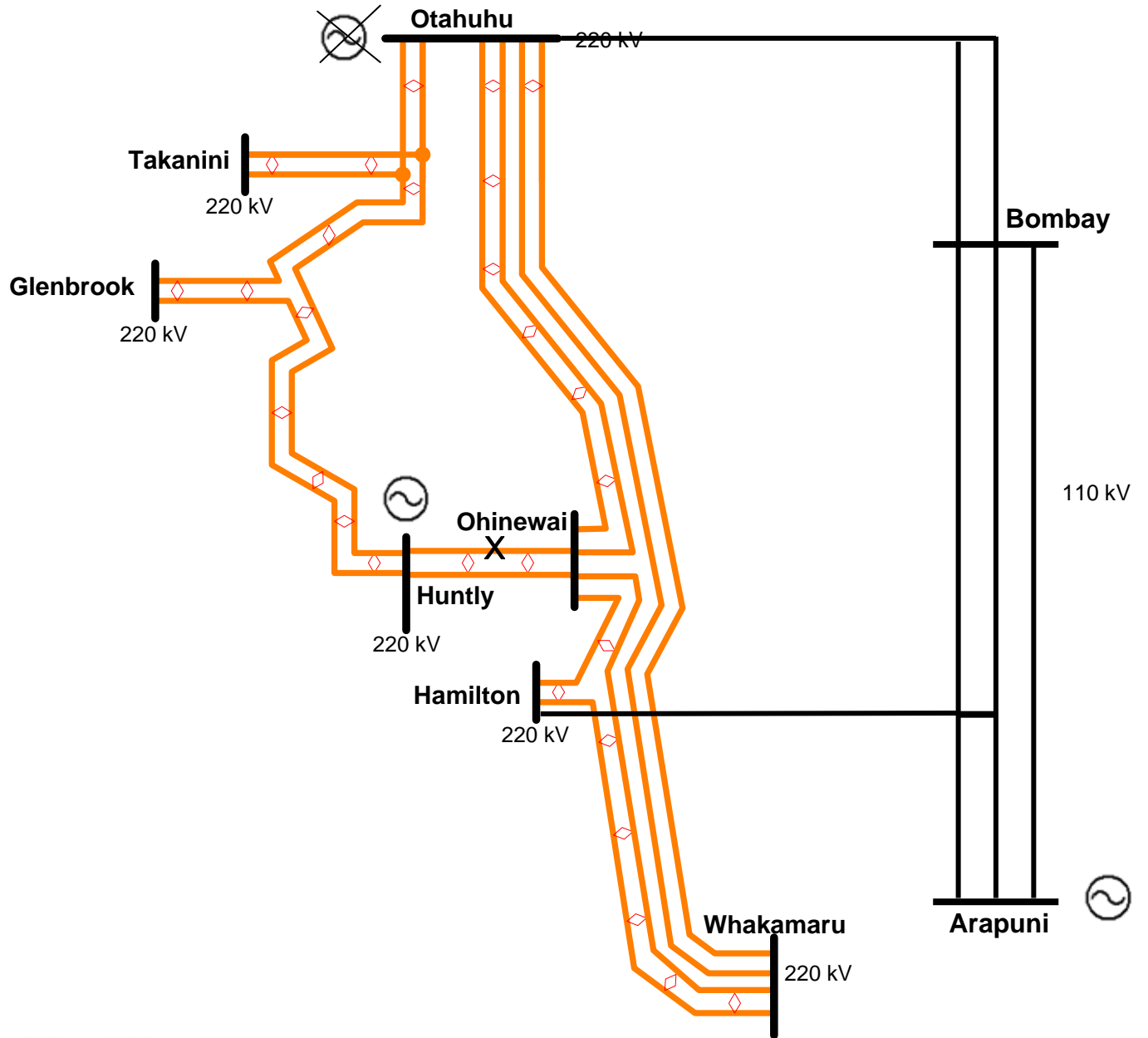
Mitre 10 fire, Onehunga – 8 Dec 2008

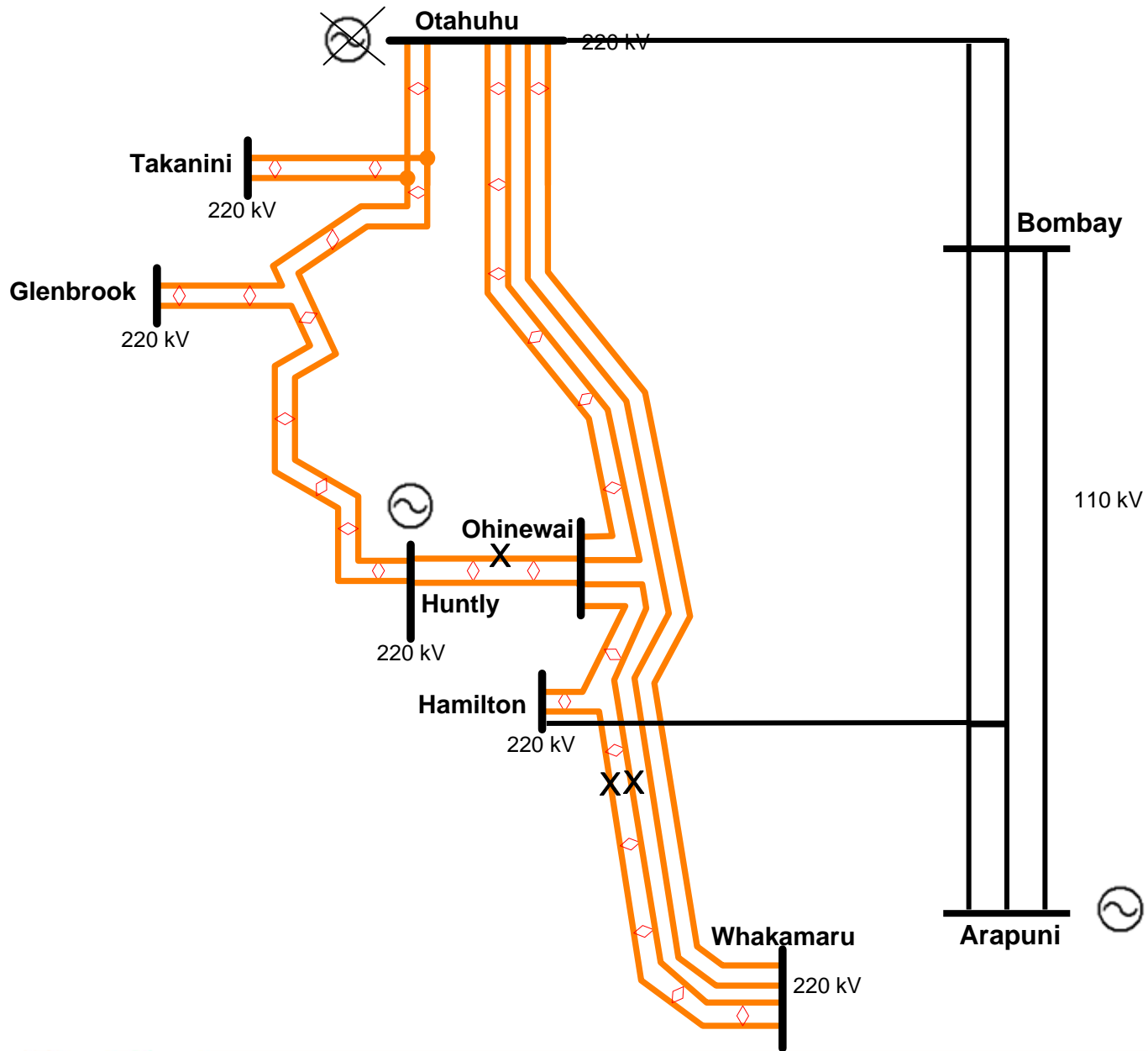




North Auckland and Northland – After NAaN and NIGU

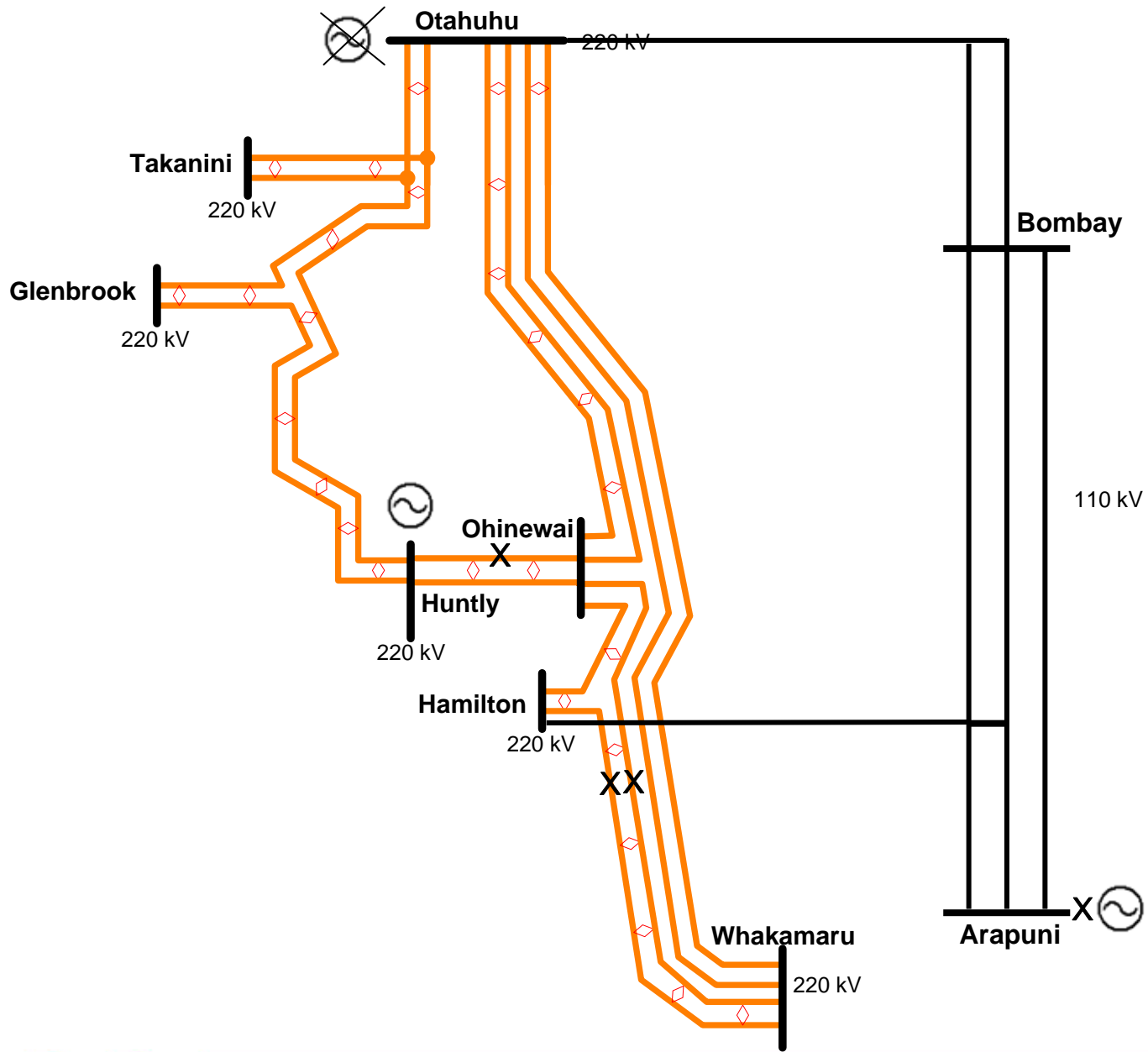


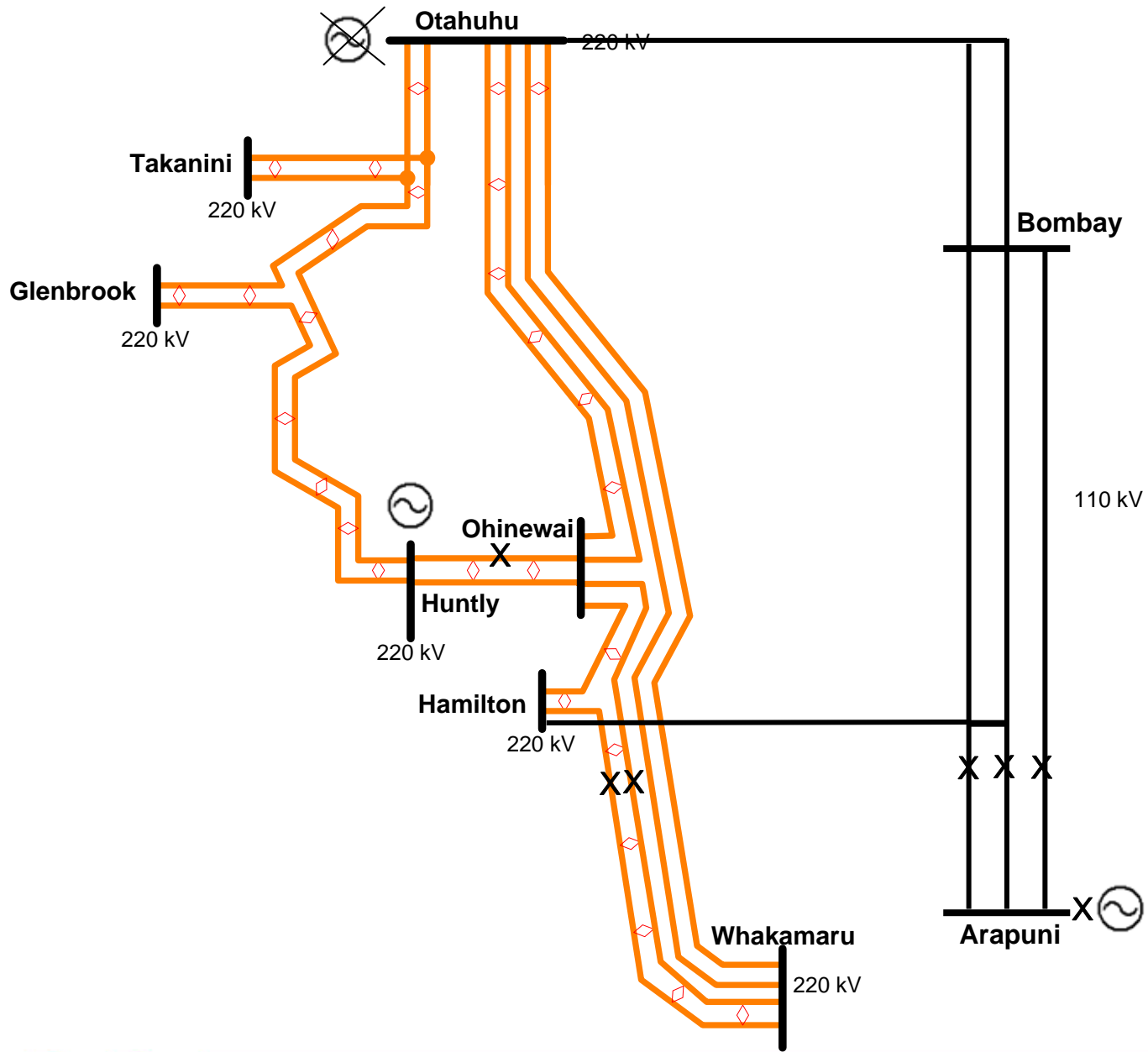


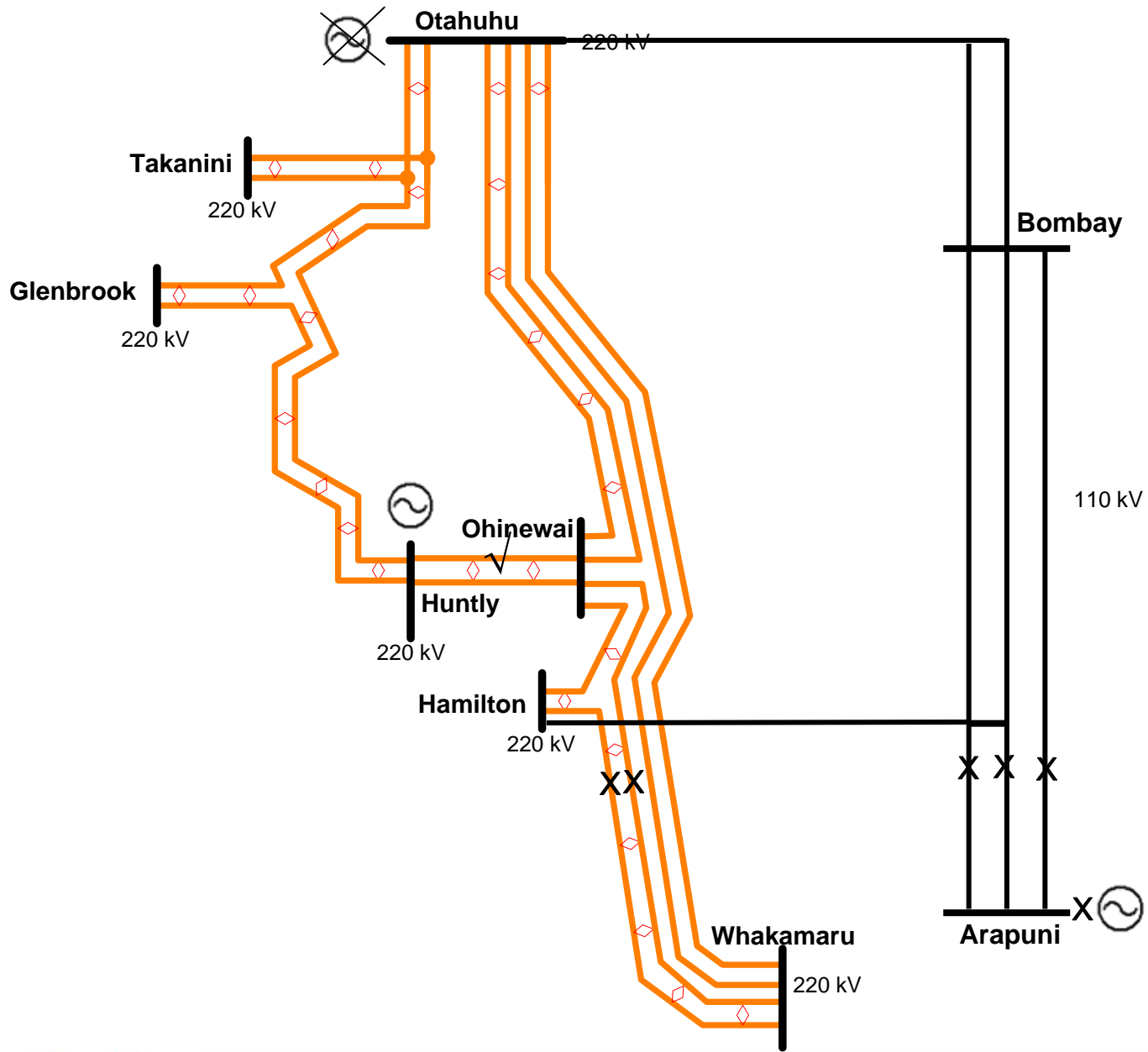


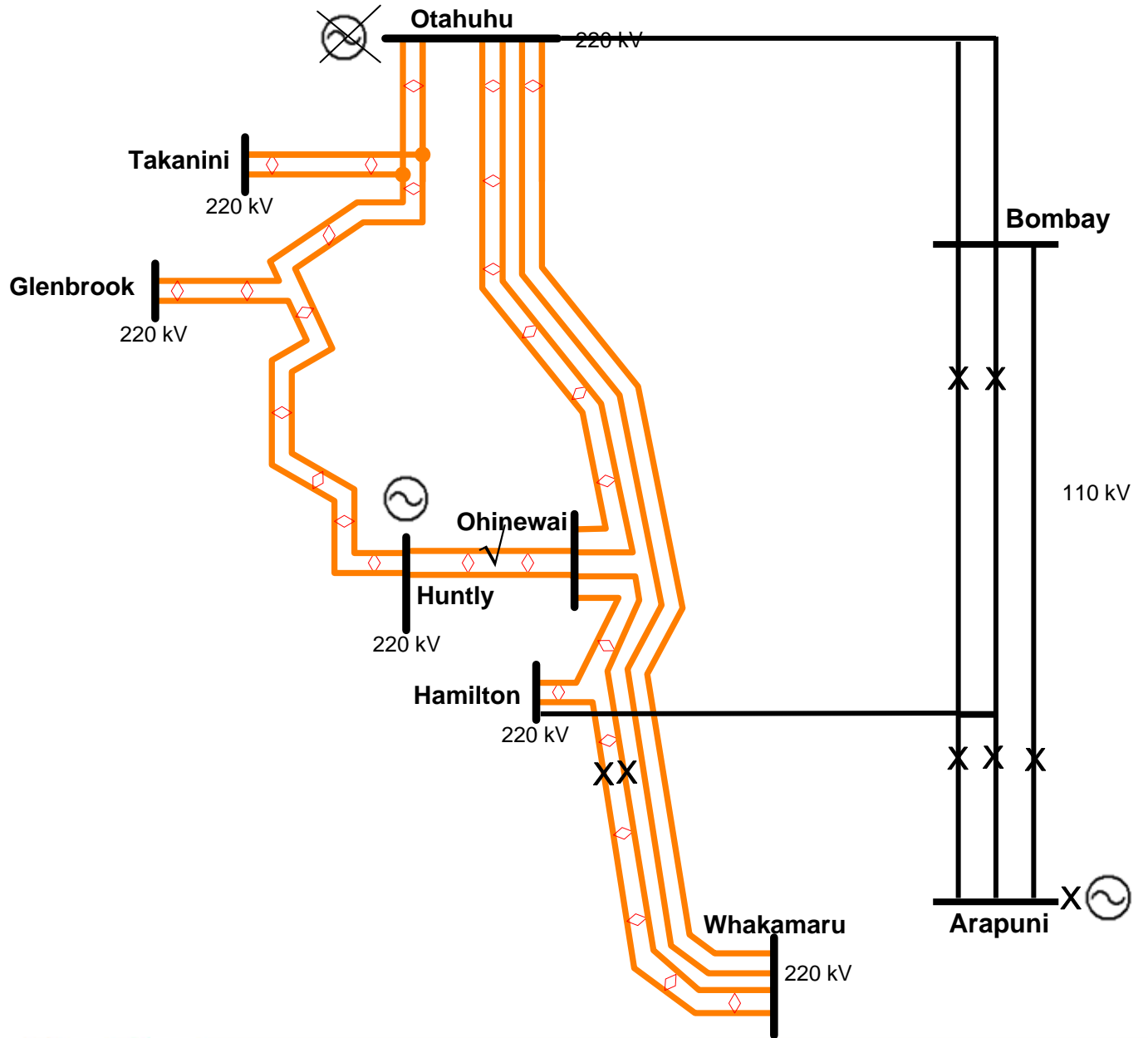
25 January 2010 outage









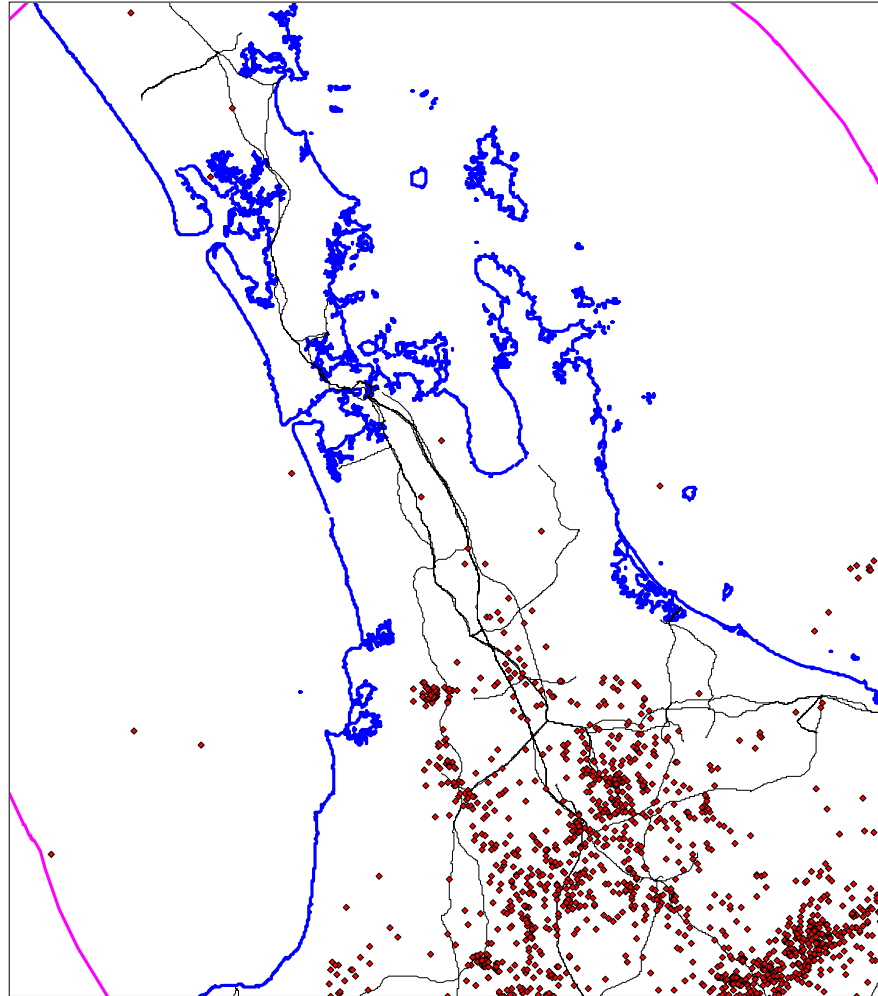




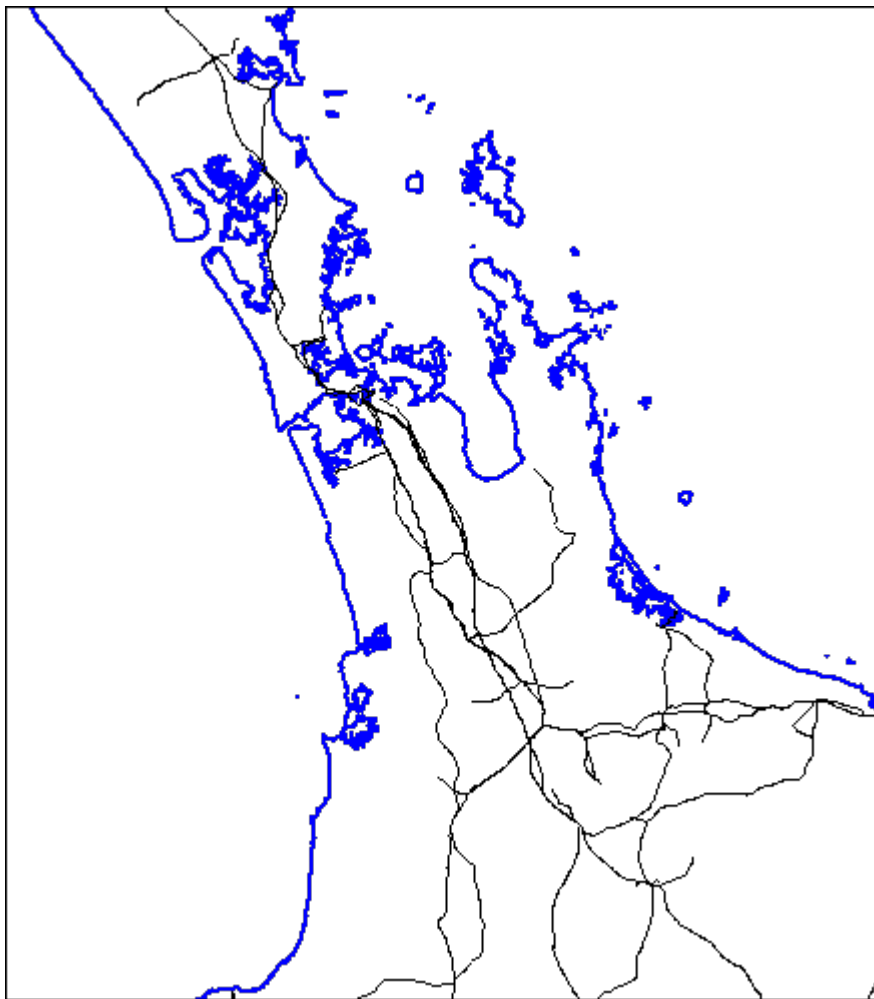




Lightning strokes – 25 January 2010

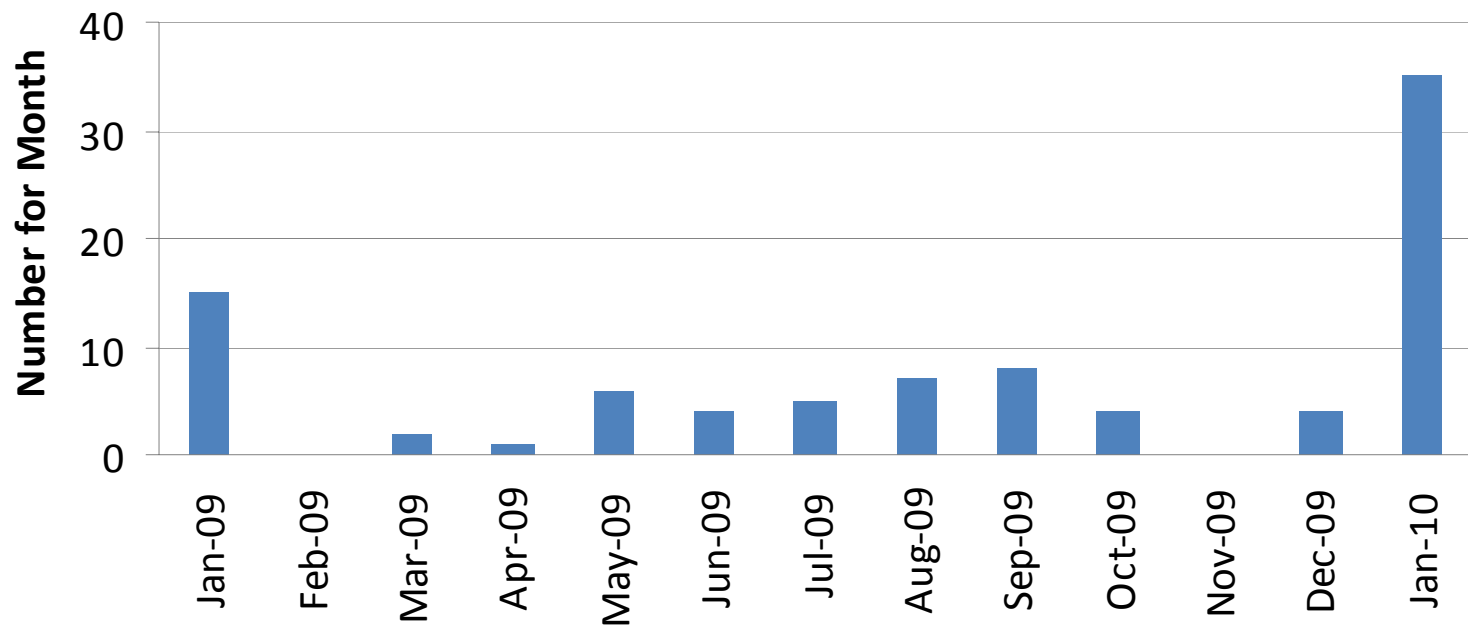


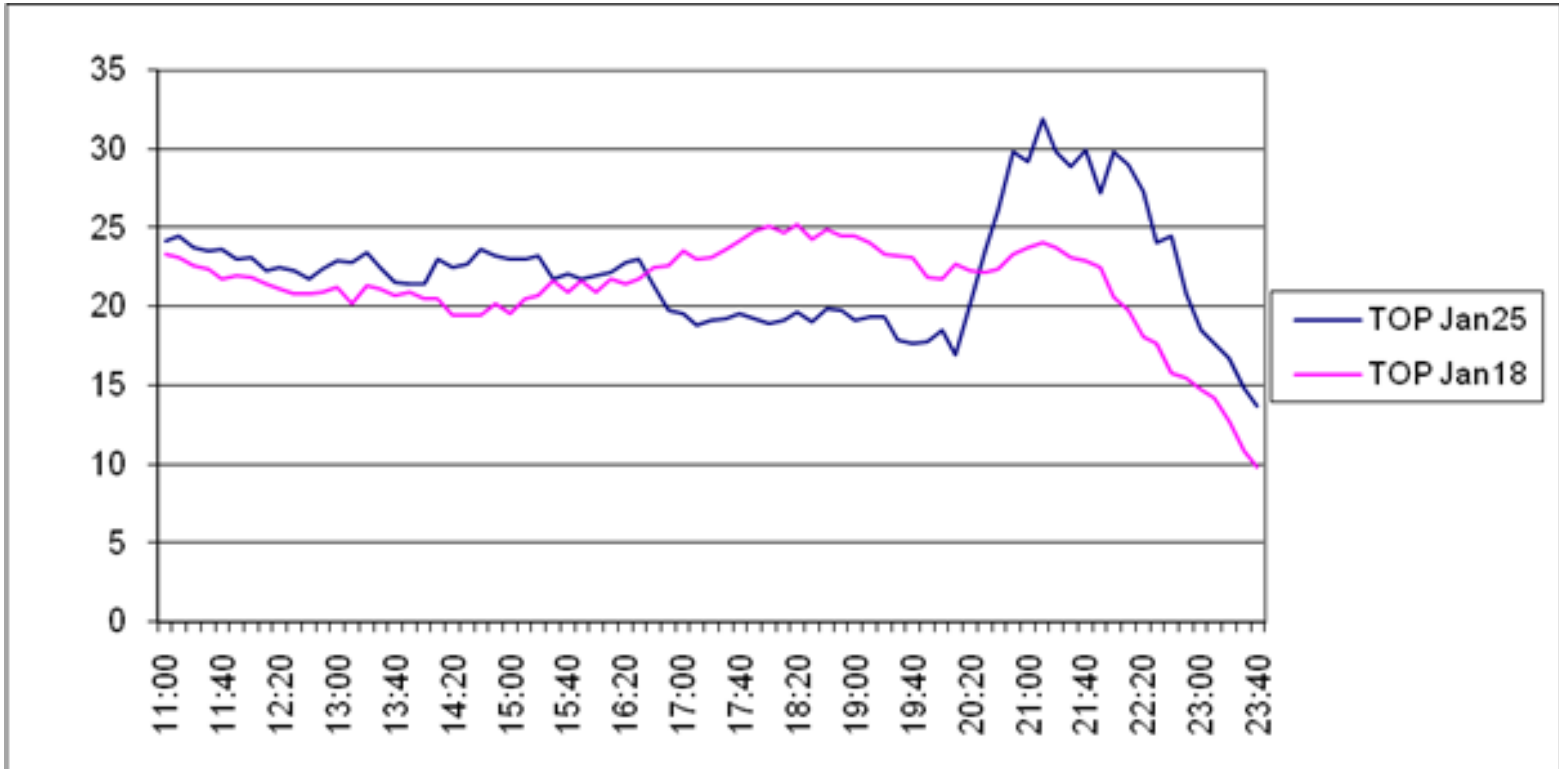
Lightning strokes – 10 February 10



Lightning Strikes Causing Circuit Trippings

91 in total





Auckland projects

Thermal Upgrades (OTA – WKM A, B)	\$13.5m	April 2008
Thermal Upgrade (OTA – WKM C)	\$7m	March 2011
Ohinewai Switching Station	\$24m	June 2008
Drury Switching Station	\$19m	March 2010
Otahuhu Substation	\$99m	June 2010
Penrose Substation Transformer	\$9m	March 2010
NIGUP 400 kV, Pakuranga Substation	\$824m	Autumn 2012
NAaN Cable and Substation	\$473m	2013/2014
HVDC Upgrade (Pole 3)	\$672m	Autumn 2012
Wairakei Ring	\$141m	Winter 2013
Many others smaller projects...		
	\$2.3 billion	





NZ Herald 1 February 2010

