

The State of the National Grid

**Energy Federation of New Zealand
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TRANSPOWER



Outline

- State of the grid
- Challenges we face
- Future plans



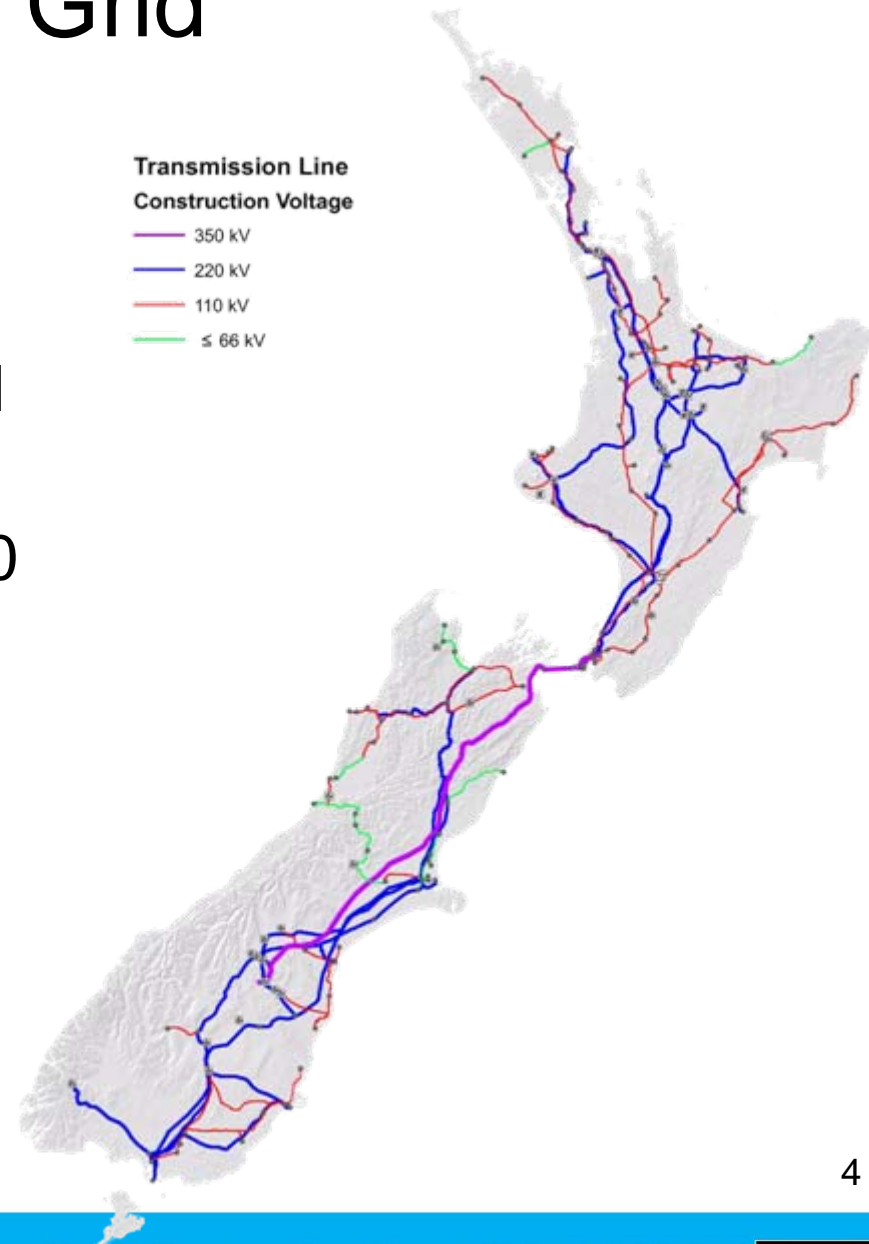
Transpower – what we do

- Plan, build and maintain the national grid
- Operate the system in real time



The National Grid

- 11,800km of high voltage lines, 178 substations
- 41,000 towers and poles on and over 45,000 properties
- 1,000 power transformers; 2,300 circuit breakers etc
- \$2.5 billion worth of total fixed assets
- Assets are located in all 86 Regional, District and City Councils



Real time operations

- A 24x7 operation
- Two System Operations Control Centres running as a single “virtual” centre.
- 28 staff - two years qualification training plus four weeks training annually
- 3 Regional Operating Centres (switching centres)
- Defence in depth strategy for tools and systems.

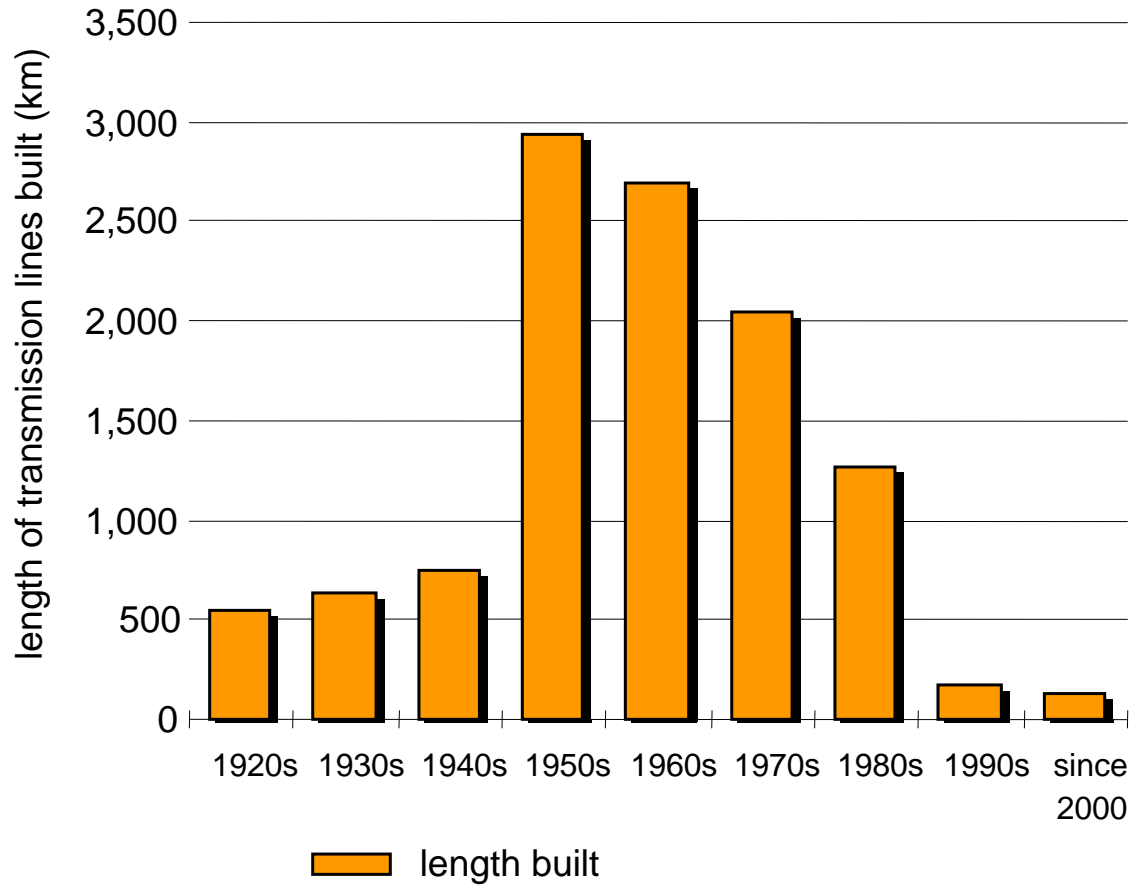


Financials

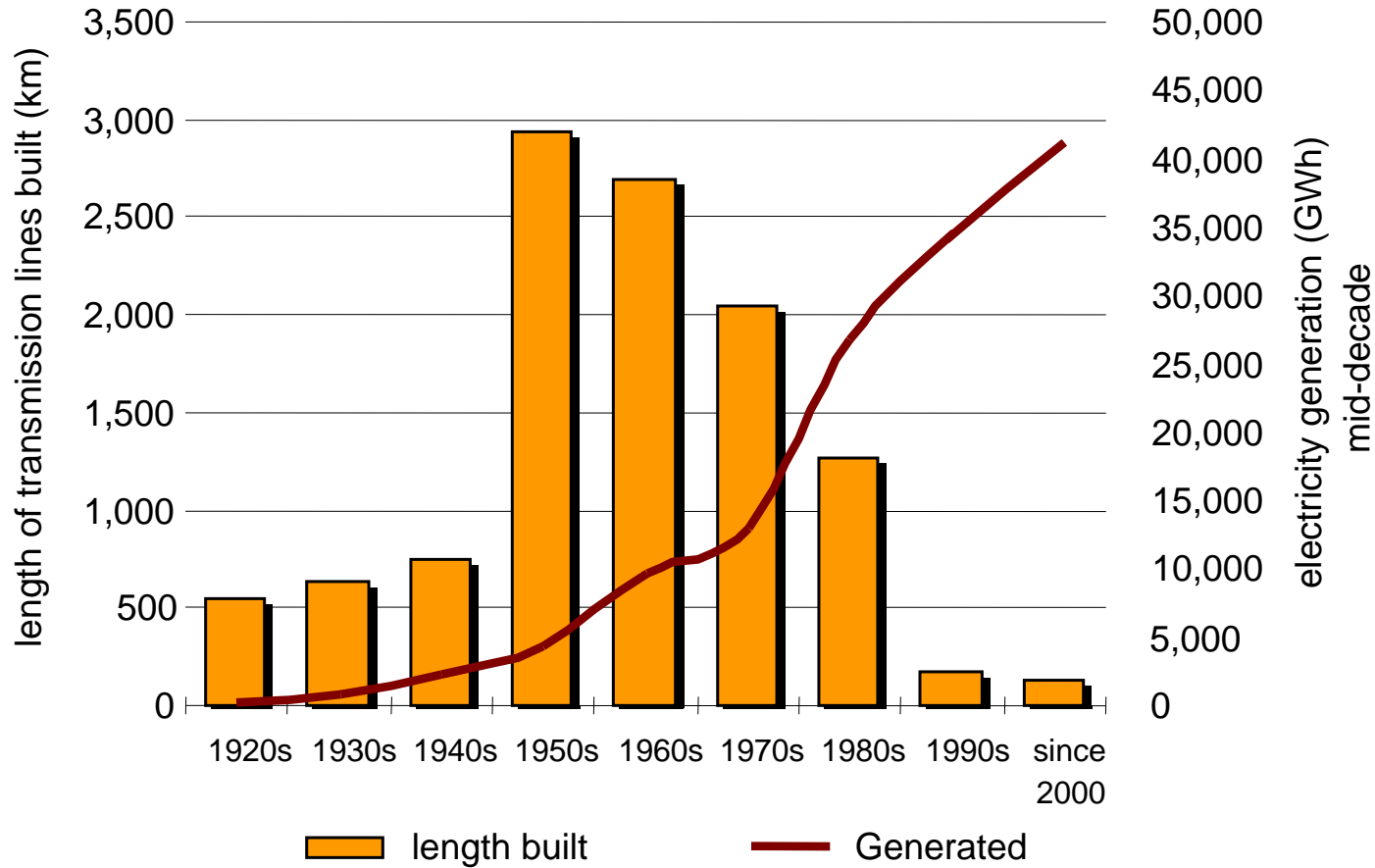
	Total Revenue (m)	Opex (exc finance & depreciation) (m)	Capex (m)	Replacement Capex (m)	Staff Numbers (FTEs)	Contractors	Net Profit (after tax) (m)
2007-08	642	255	339	64	534	1000 approx	108



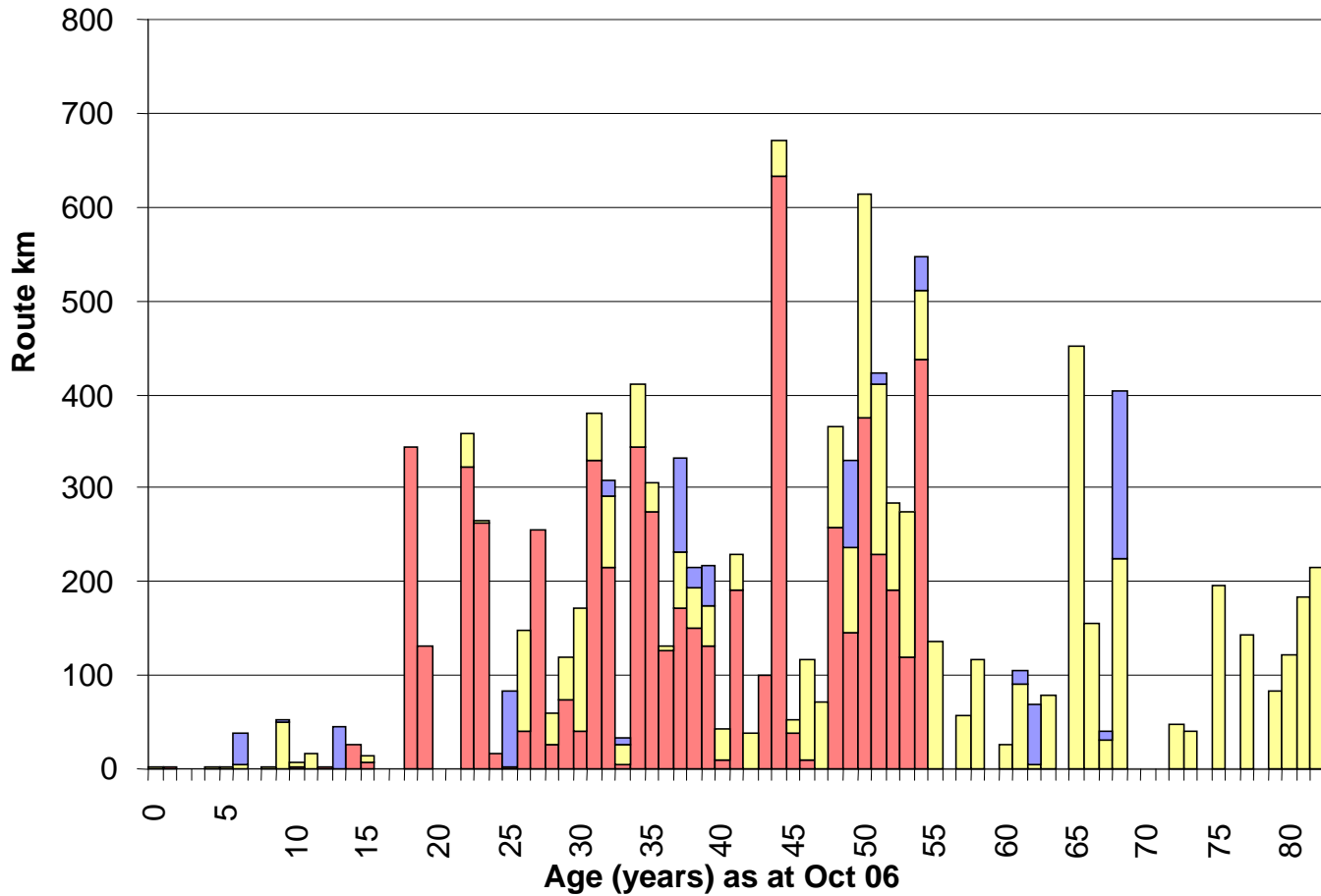
No significant investment since 1970s



But demand is increasing...



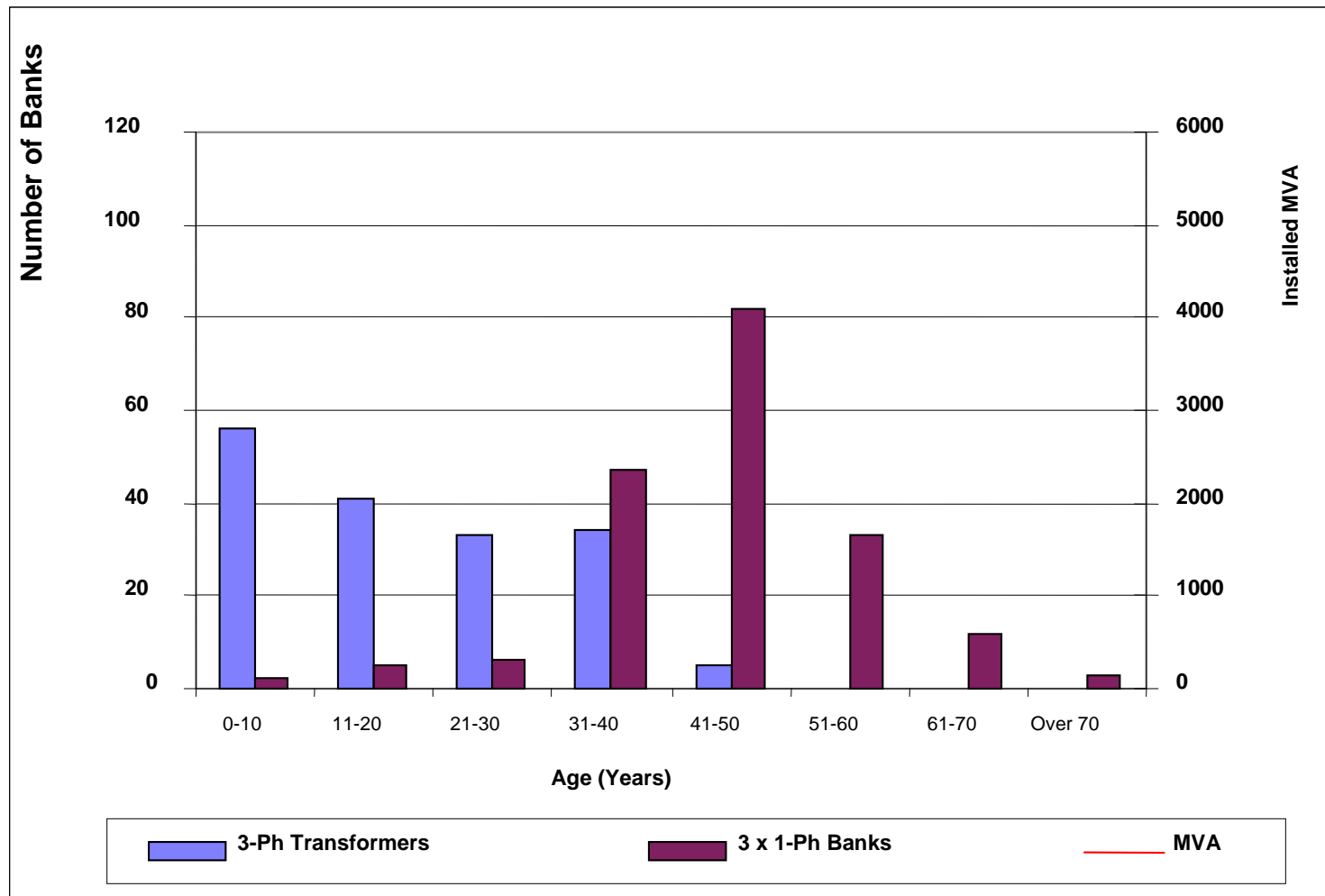
Transmission Line Age



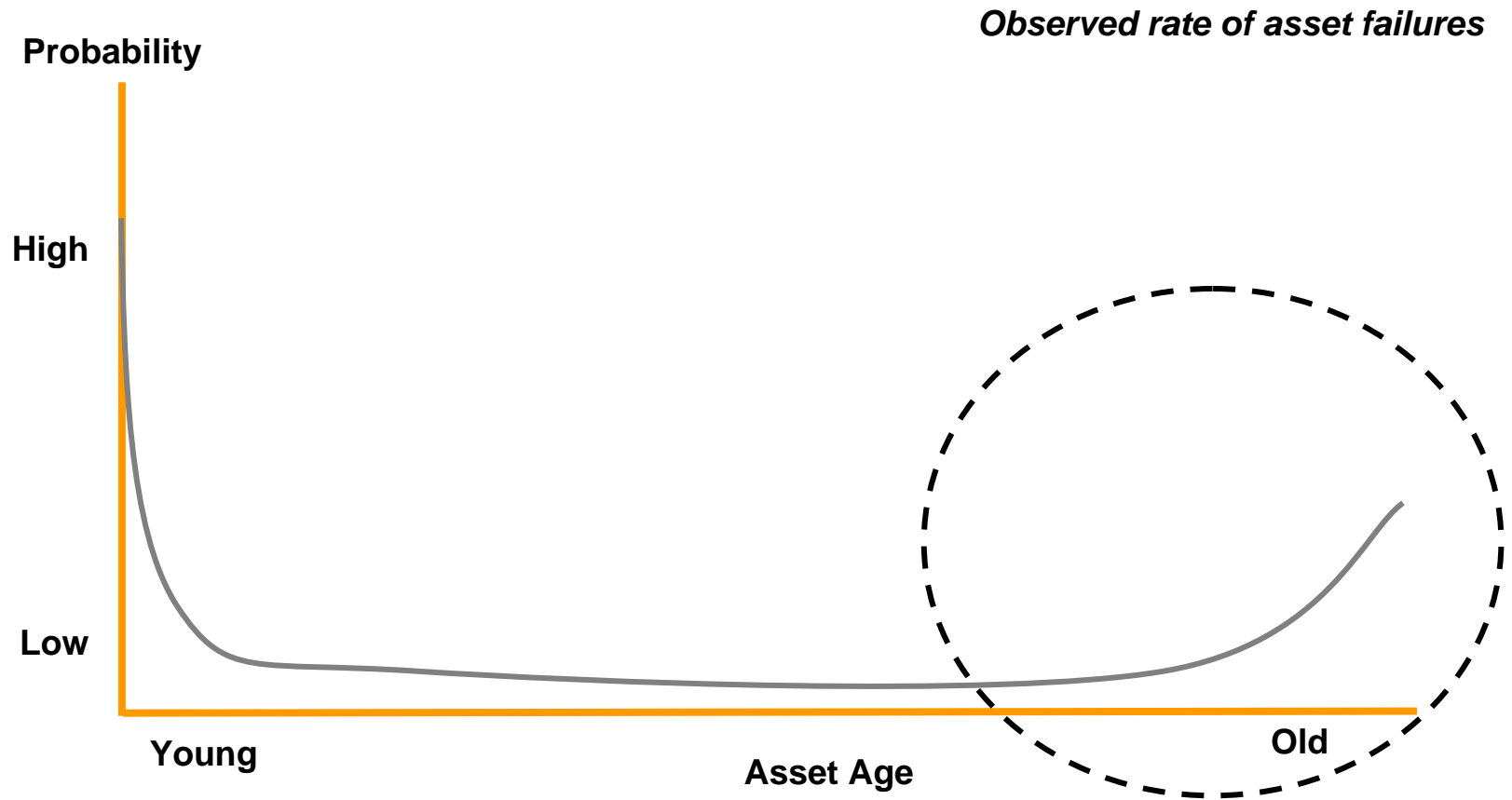
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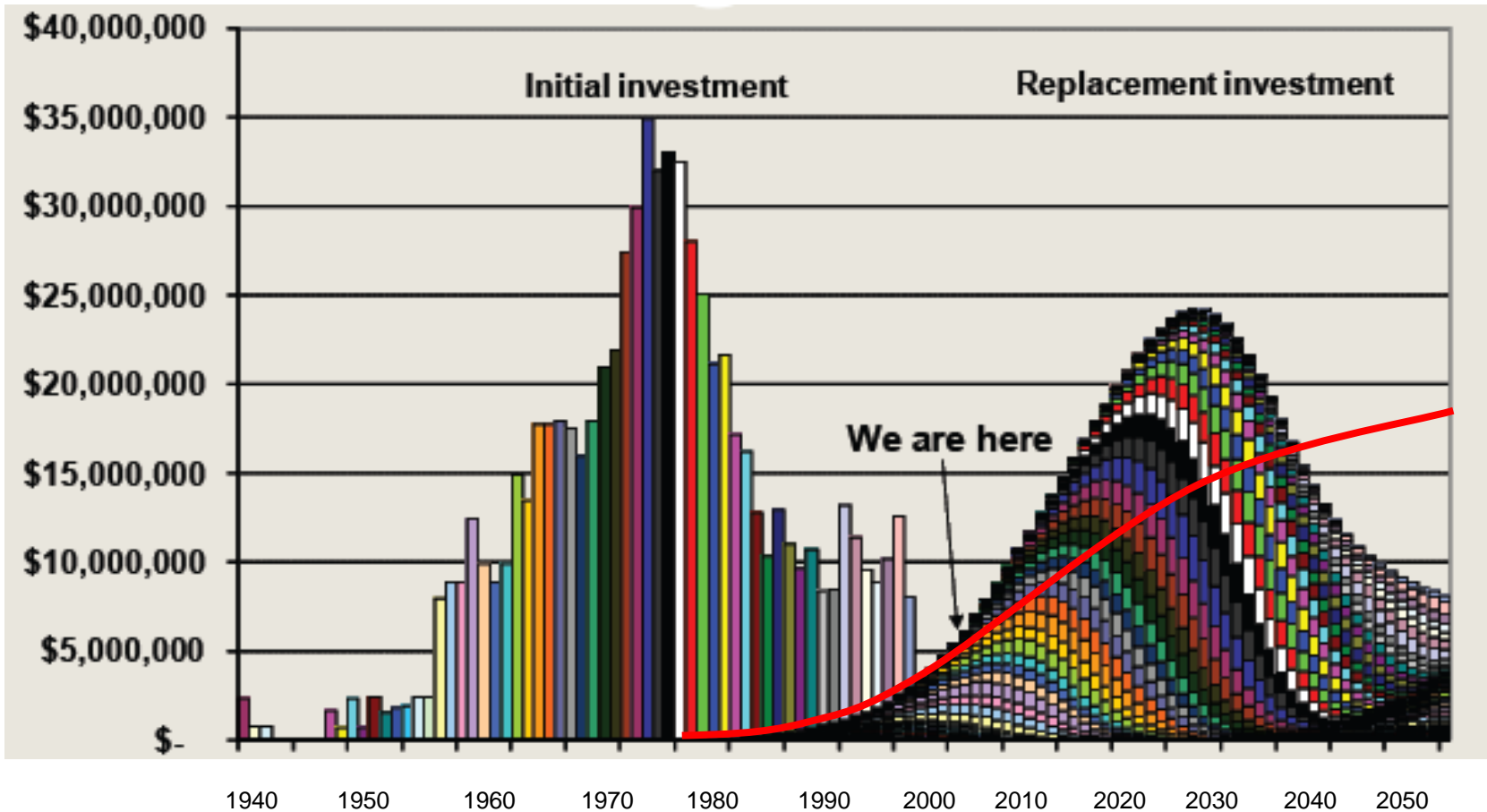
Power transformer age (in service banks)



The bath tub effect



Replacement capex 1999



Source: Benchmark Economics and Castalia: ISCR Seminar, 27 May 2008 Wellington



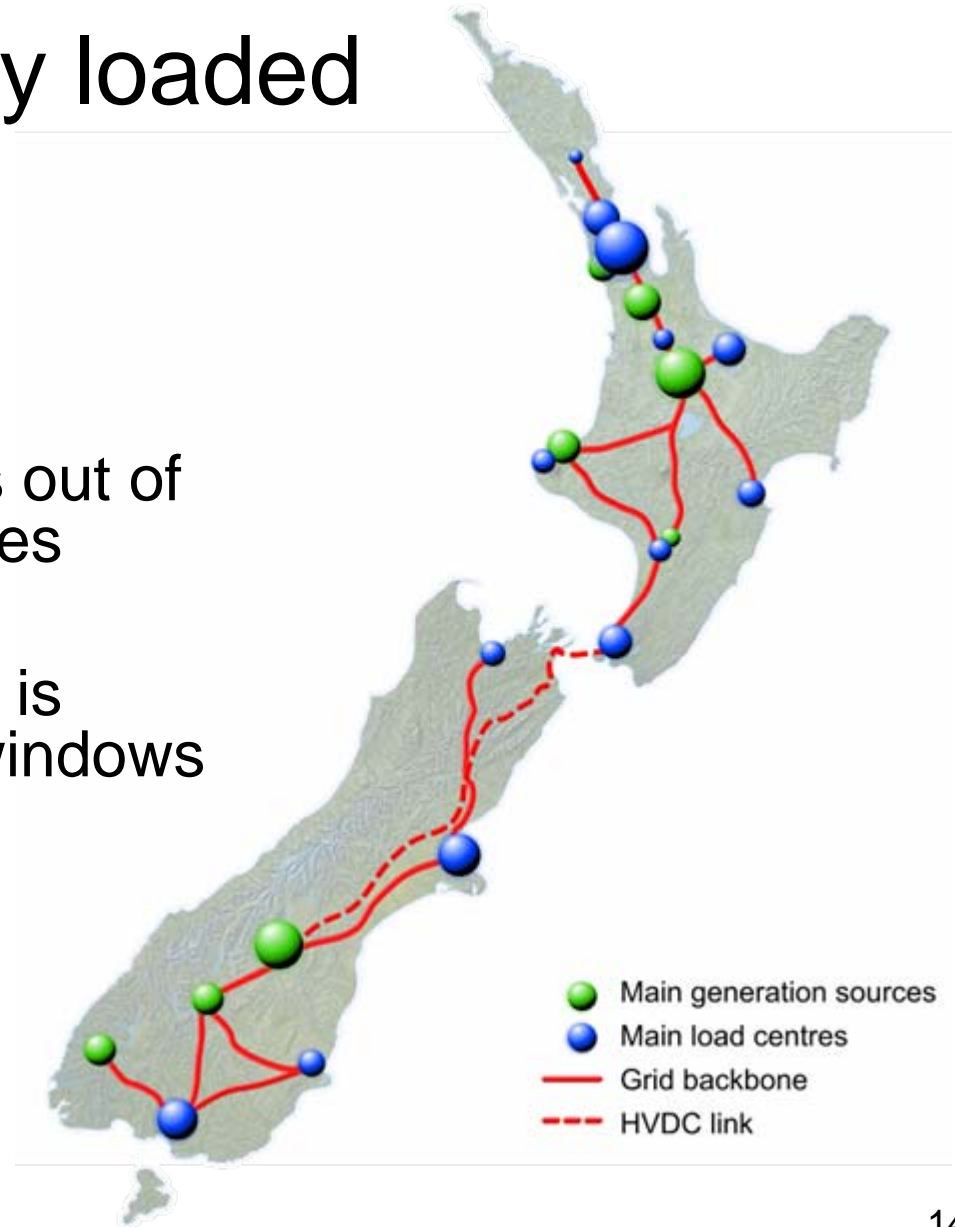
The DuPont review commissioned by Transpower highlighted the need to:

- Dramatically increase our replacement capex
- Review and standardise our maintenance practice
- Ensure we retain our intellectual property and asset knowledge so we can hold reliability at current levels while we get our replacement programmes underway
- Ensure our strategic spares are adequate



The grid is highly loaded

- Constraints are frequent
- It is difficult to take assets out of service for planned outages
- Flatter annual load shape is narrowing maintenance windows



Summer demand, as percentage of peak

- Great Britain 70 percent
- North Island 78
- South Island 86



Maintenance Window (<80 percent load)

- Great Britain ($N - 2$) 18 weeks
- South Island ($N - 1$) 1997 10 weeks
- South Island 2007 5
- North Island 2007 13



Getting lines out for upgrading is becoming a real issue...



Outage window statistics

- 11,582 outages arranged for all work types in the 2007/08 year
- 5,680 “Removal from Service” Outage Windows arranged in the 2007/08 year
- 1,511 moved during the 2007/08 year (27%)



Ageing assets is one of the biggest challenges facing Transpower

- Our transmission asset base is ageing – many of our towers, transformers, circuit breakers are over 40 years old (and some are older than 70 years)
- Although much of this equipment will still be good at 70, some of it won't be and we don't know which ones
- Also loading on the network is rising, placing further stress on these assets, and making the network less tolerant of faults



Our operability headroom is also being eroded

- Dry winters and asbestos closures are not part of the planning scenarios!
- Stuff happens
- We are losing the resilience of the grid to respond to this



And the existing assets won't meet tomorrow's needs...

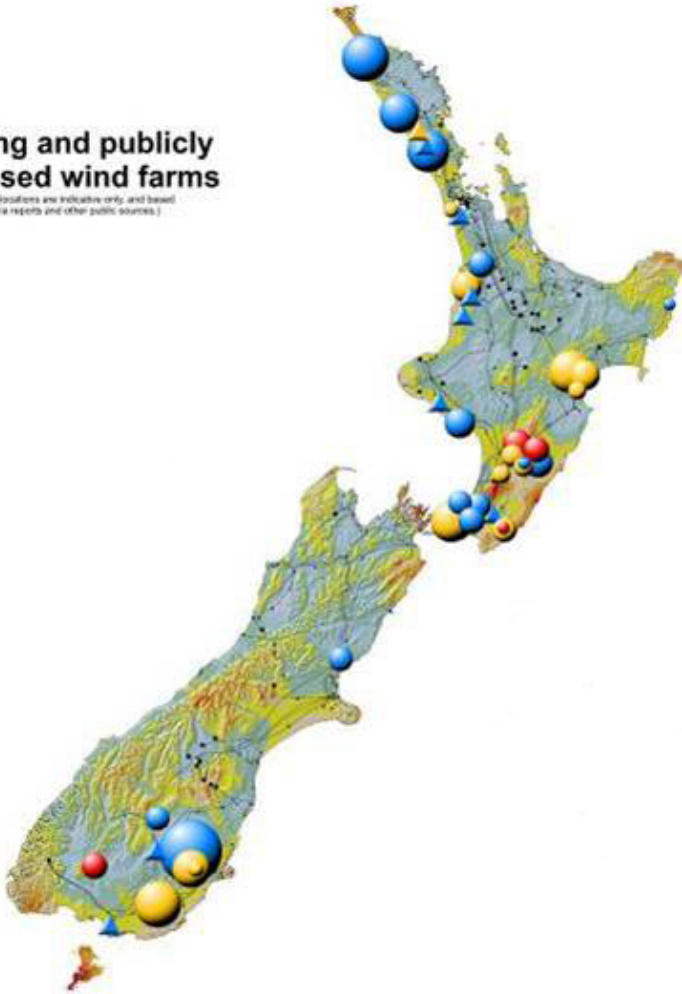
- New Zealand needs at least 150 MW of new generation each year (enough to power a Dunedin sized city of 50,000 people)
- Under a renewables, carbon tax scenario, much of the new generation will be remote from the load centres



Wind

Existing and publicly discussed wind farms

(Sites and locations are indicative only and based on media reports and other public sources.)



- Many grid connected wind farm proposals, particularly lower North and lower South Islands
- Over 5,000 MW of grid connected wind farm proposals at various stages, particularly lower North and lower South Islands.



A number of major grid upgrade projects have already been submitted to the EC:

- Ohinewai switching station project (completed June 2008) Approved
- Upper South Island reactive support project (2009/10) Approved
- Otahuhu substation project (2009/10) Approved
- North Island grid upgrade project (2011) Approved
- West Coast upgrade project (2011) Approved
- HVDC upgrade project (2012/13) Approved
- North Auckland and Northland grid upgrade project (2013) Awaiting decision





New Ohinewai switching station

24



Many other projects underway

- 50+ projects in progress (projected to reach 100+ in 2009/10)
- Include new substations, duplexing, et cetera
- Also, automation and reactive support





New Atarau substation





New circuit Islington-Kikiwa

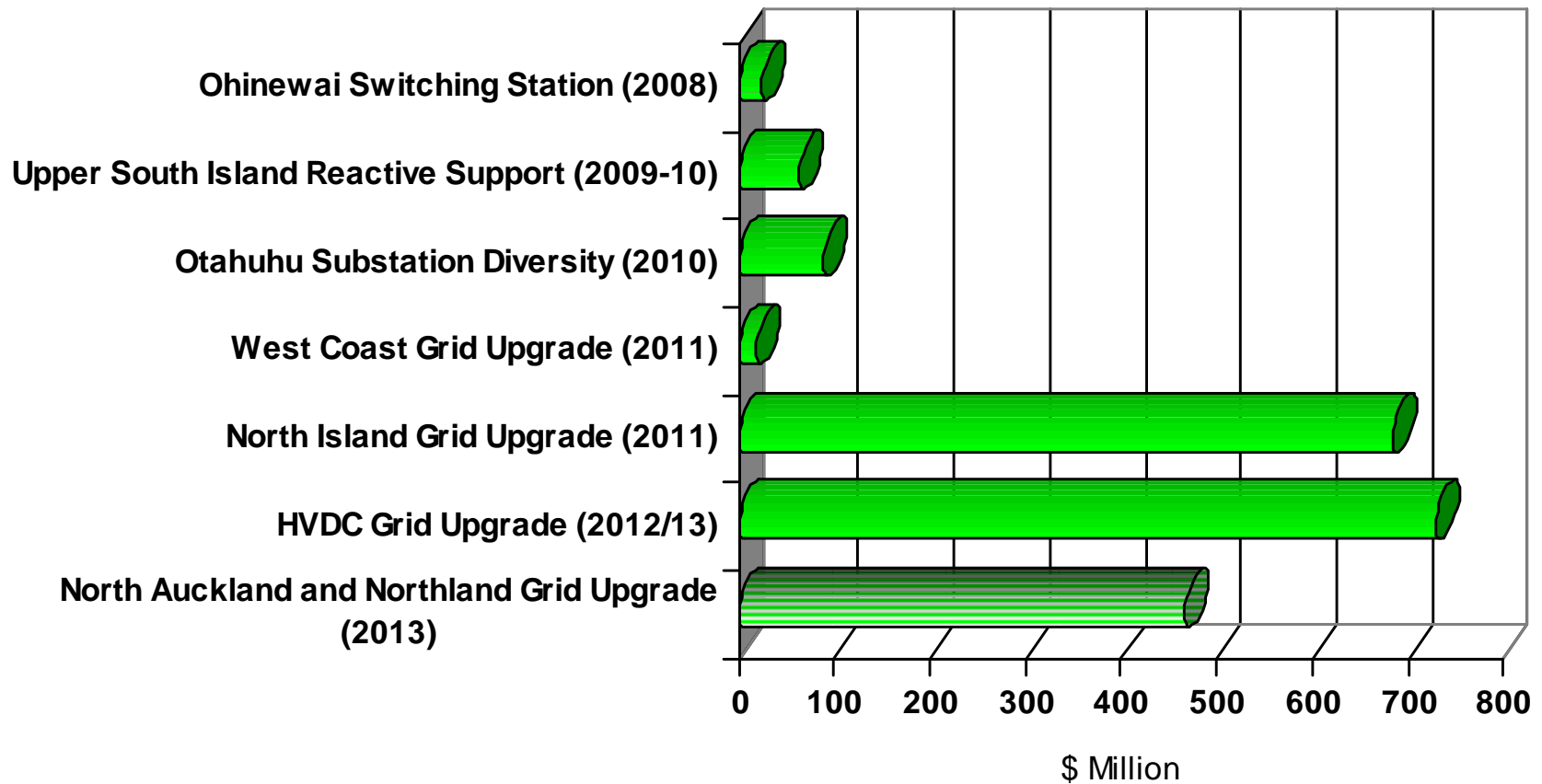




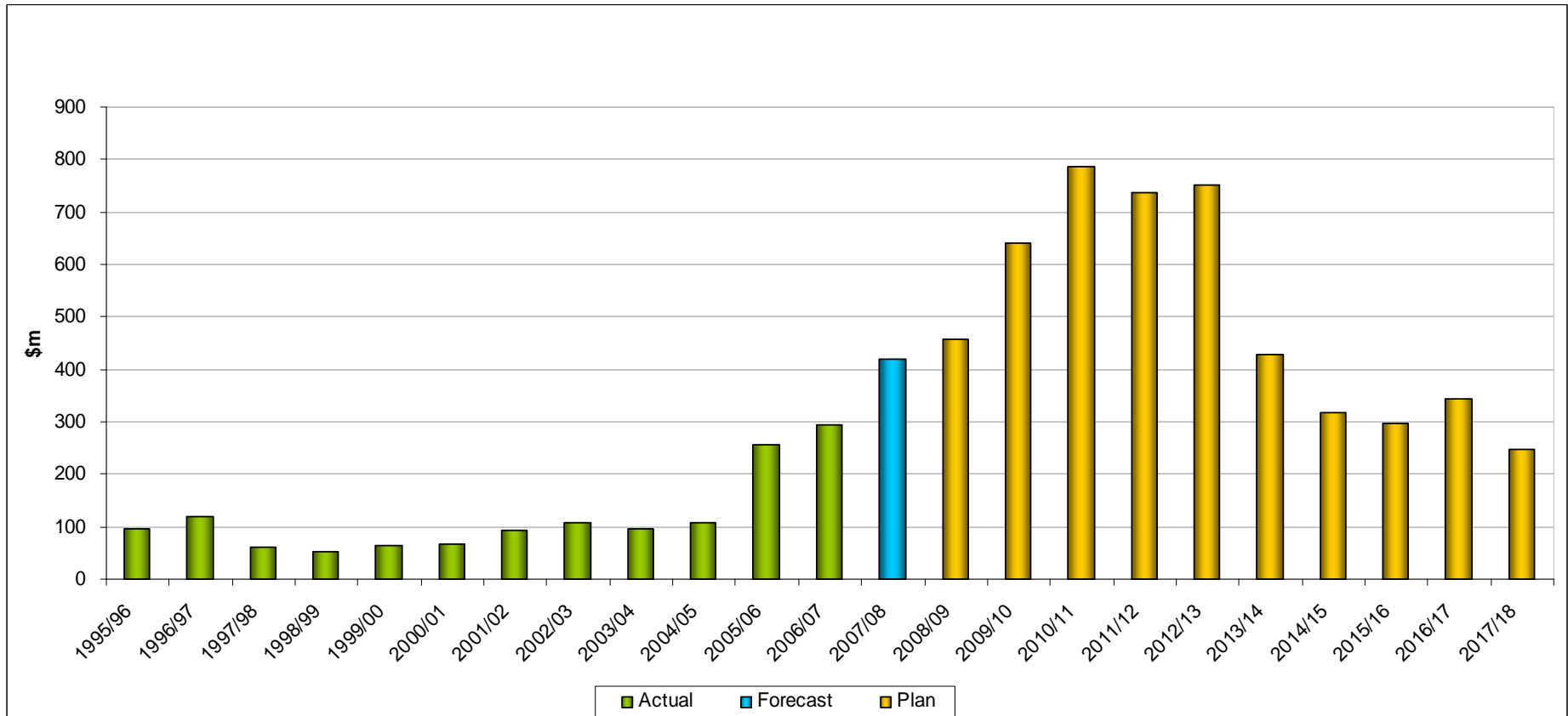
Roxburgh-Livingstone, wiring crews in action



\$2 billion worth of grid investments underway

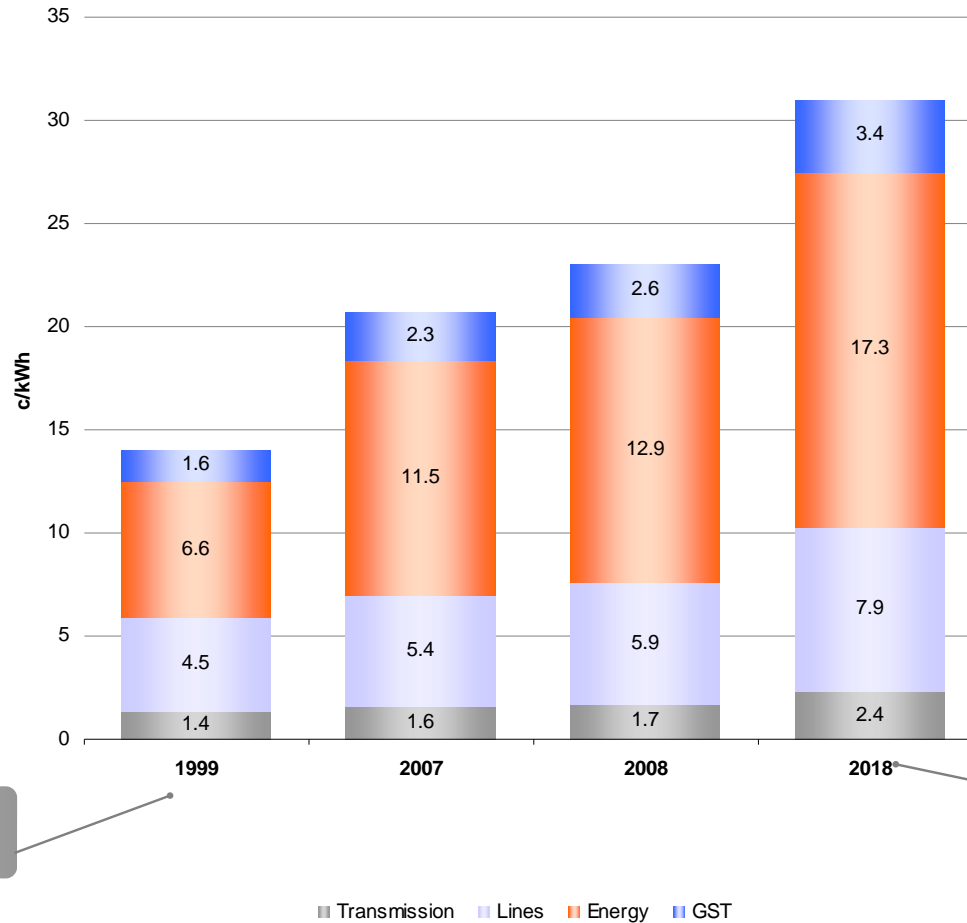


\$3 to 5 billion capex over the next 10 years to meet growing demand



Impact on price

Breakdown of a domestic consumer's bill
(c/kWh) - 1999 compared to 2018



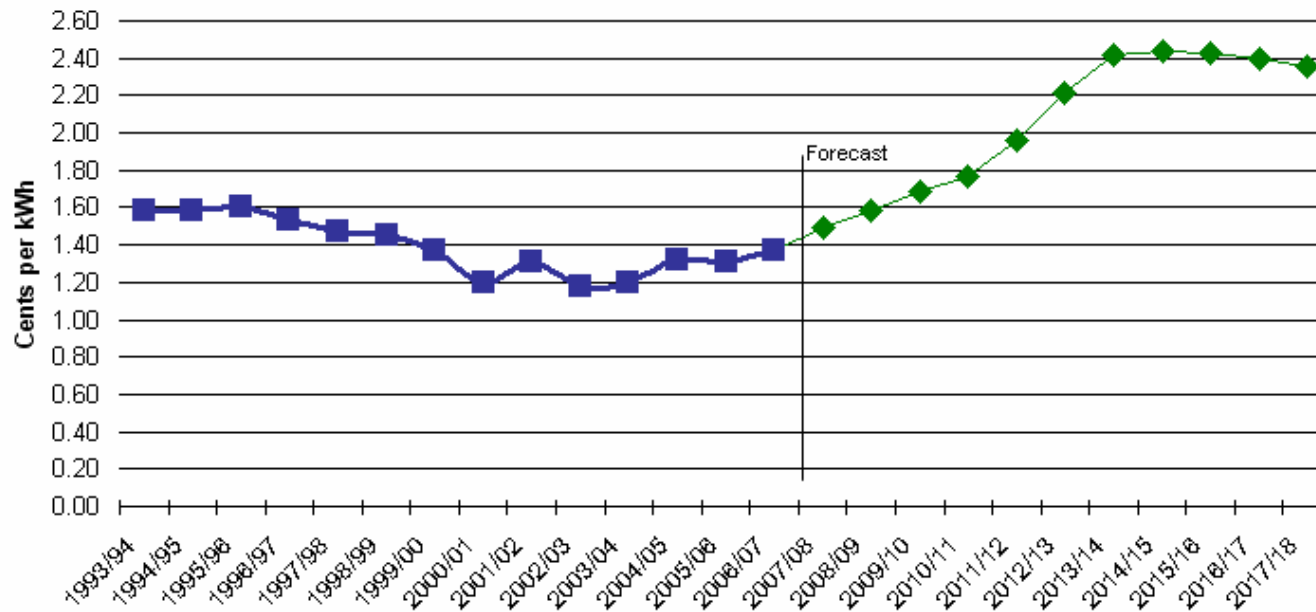
Transmission was 9.6% in 1999

Transmission est 7.6% in 2018

Illustrative breakdown of (nominal) prices for a 'typical' domestic consumer - sources principally MED Schedule of Domestic Prices (incumbent retailer), and published Transpower figures. The values for 2018 represent a scenario assuming 3%pa growth in energy and lines prices between 2008 and 2018.



Transmission Prices 1994-2018



*1994-2007 Nominal transmission prices derived from Transpower's actual transmission revenue divided by actual electricity transmitted. 2008-2018 nominal transmission prices derived from Transpower's forecast revenue divided by Transpower's forecast electricity to be transmitted.

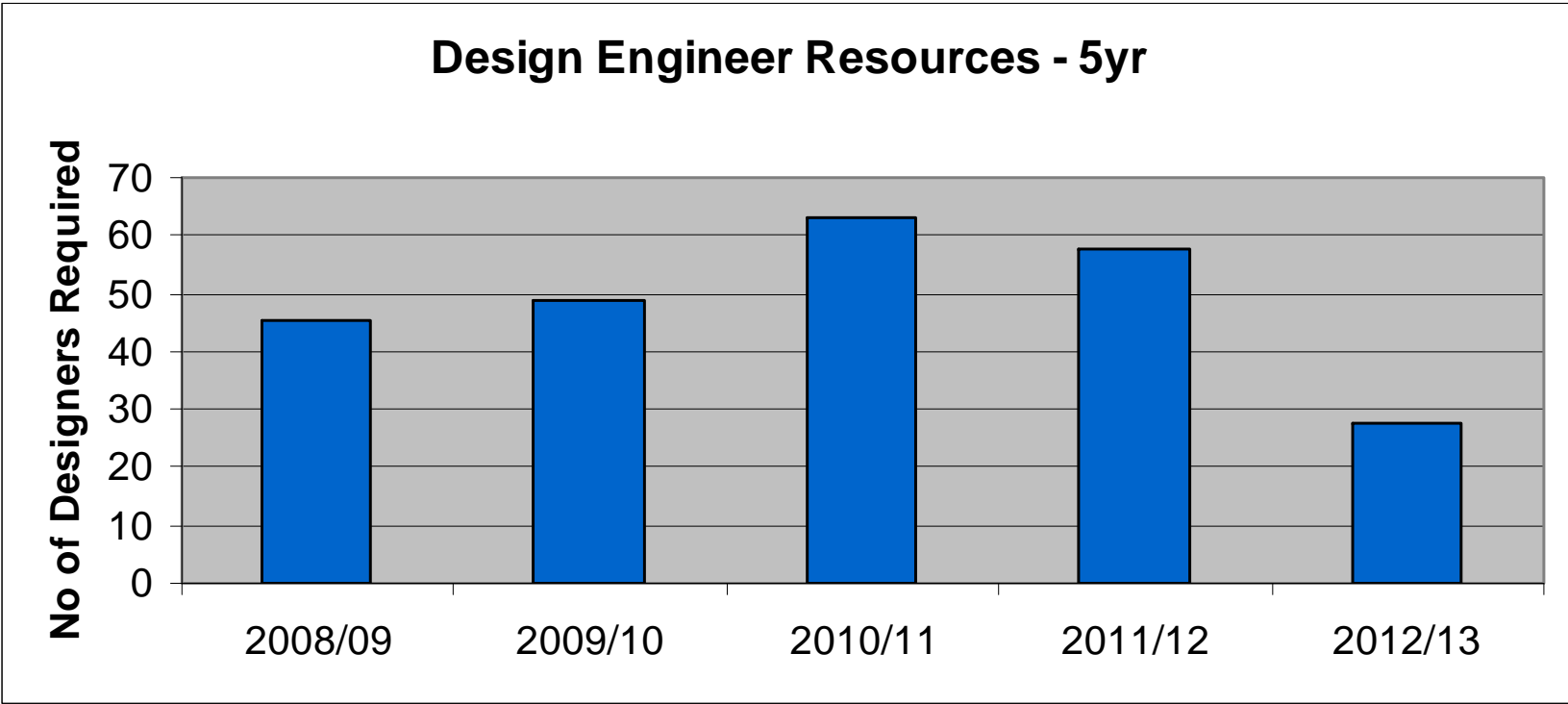


It's not just about assets...

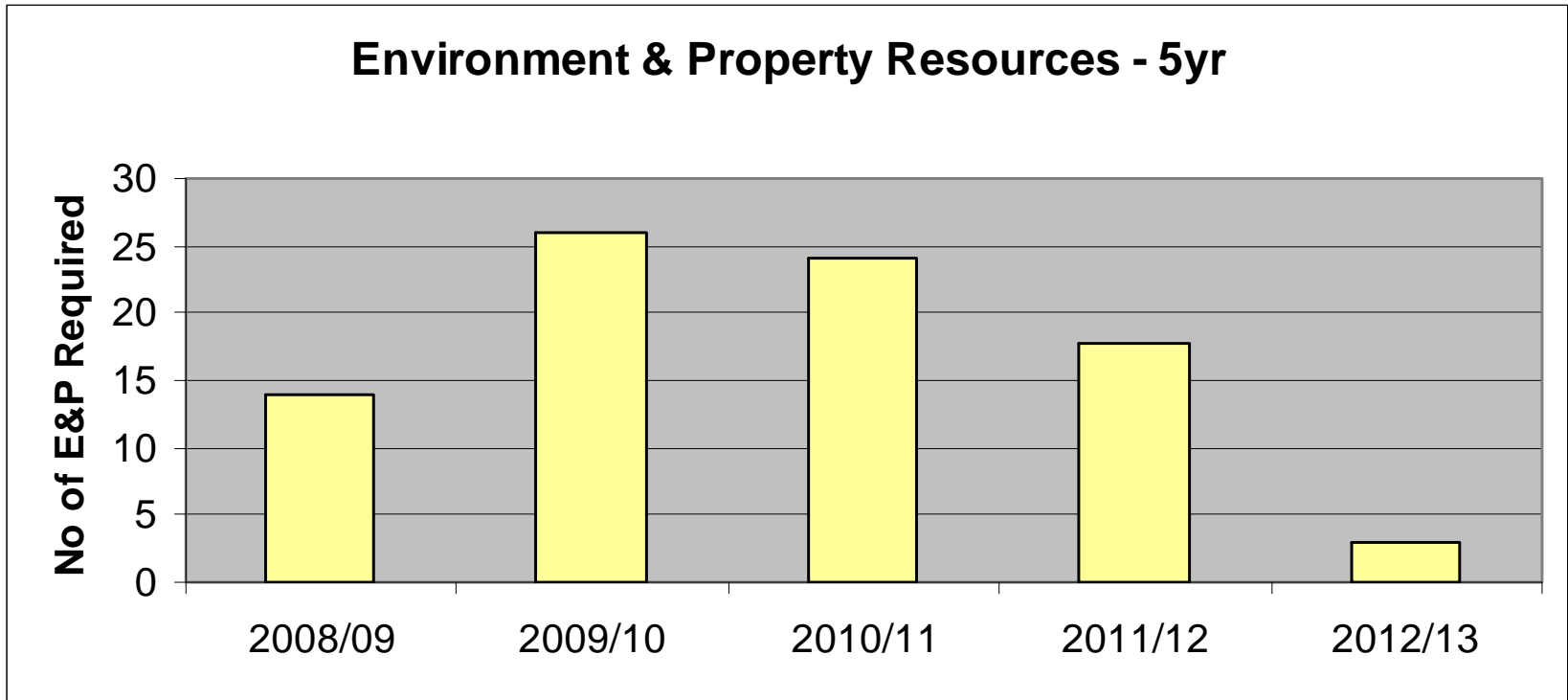
- In Grid Performance, 42 of 80 engineers are over 50!
- Since 2001, 53 engineering undergraduates have been recruited from the Universities of Auckland and Canterbury and put through our Graduate Programme
- Immigration and emigration also plays an important role



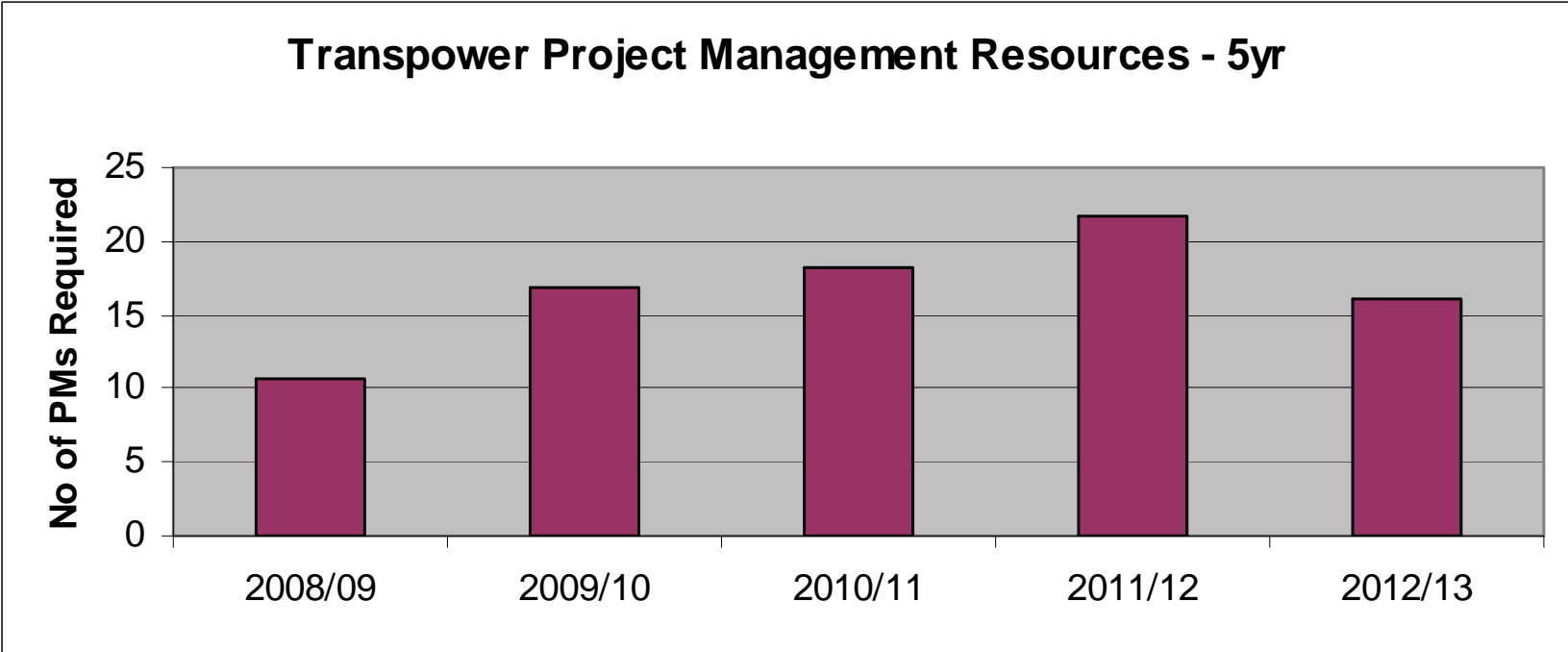
People



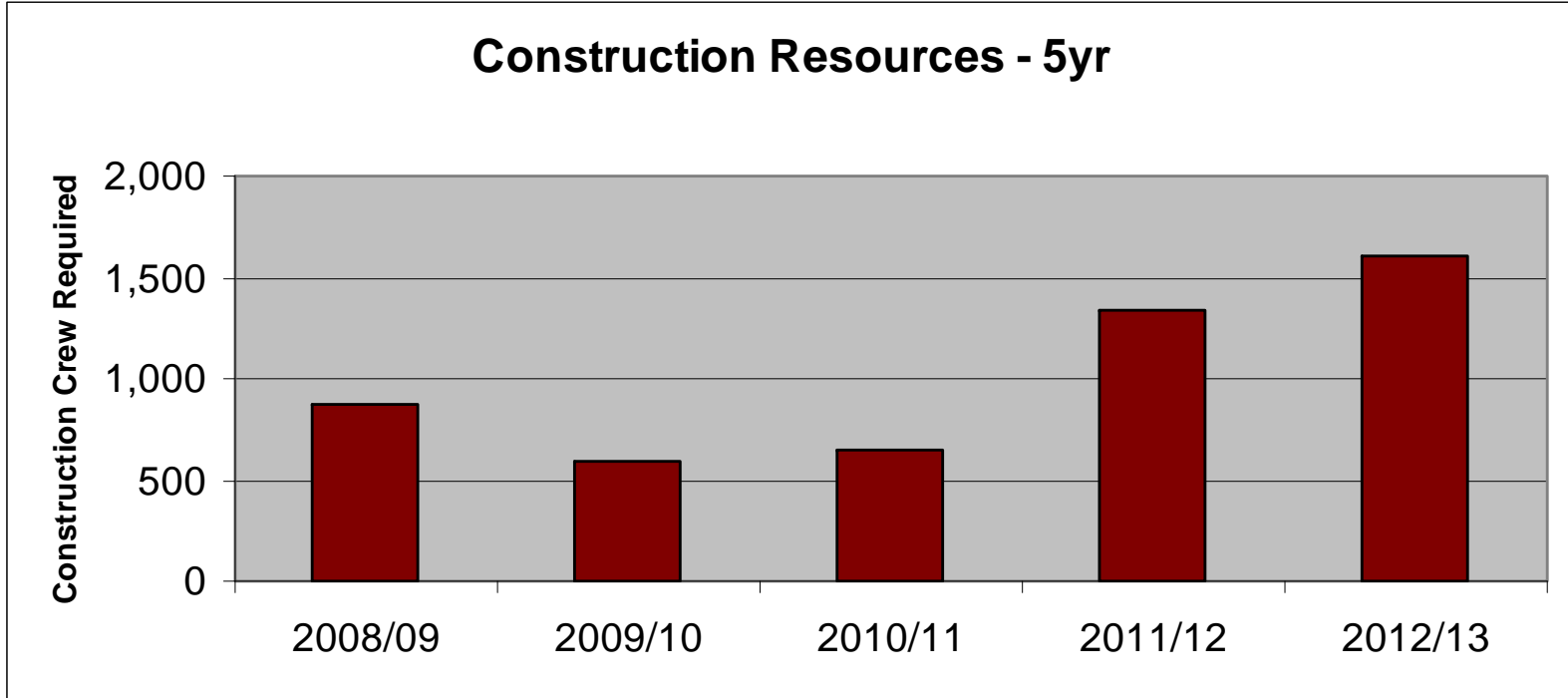
People



People



People

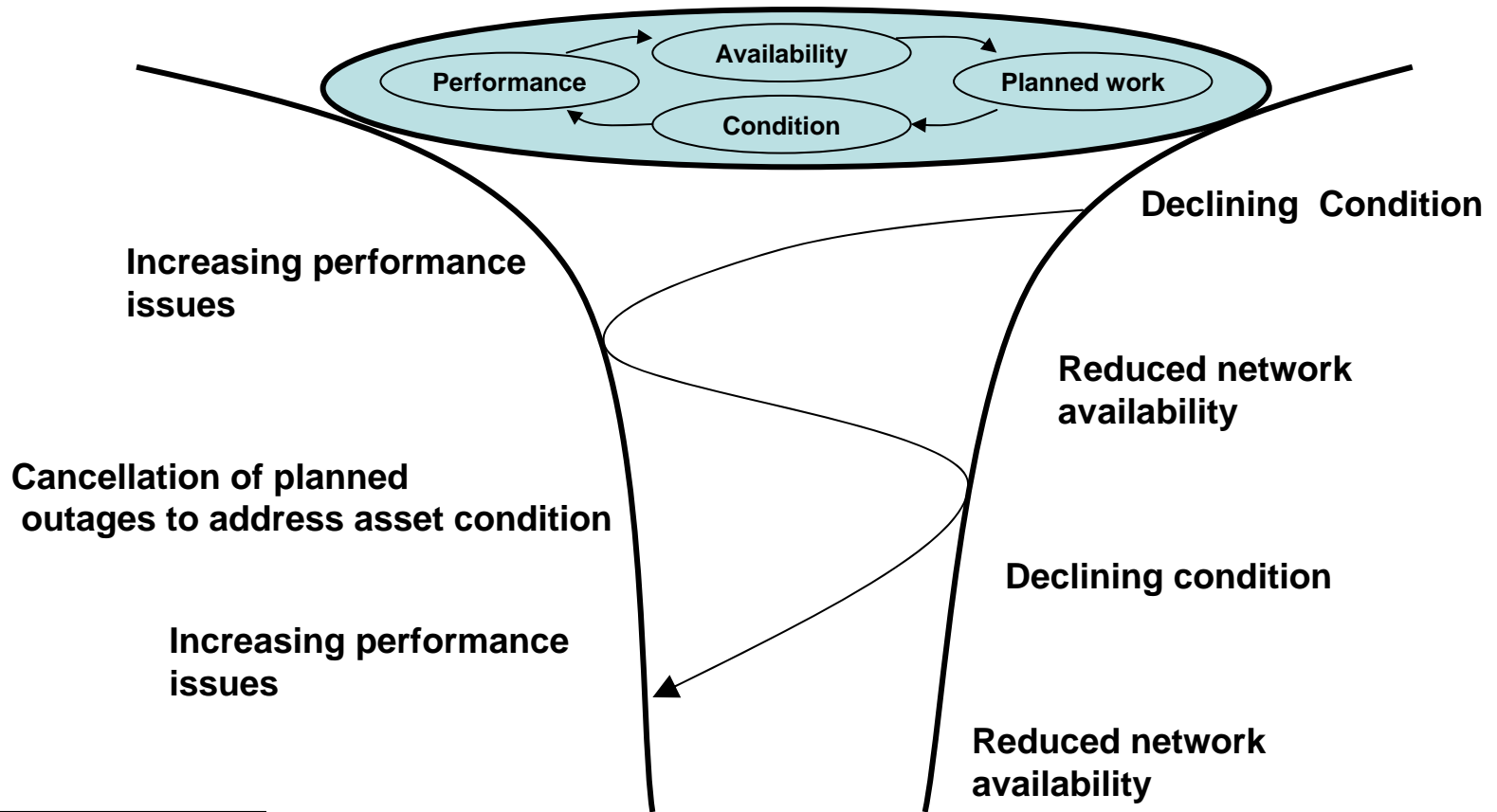


Toward the future

- How do we climb out of the funnel?
- Creating the platform for the future



The funnel



Source: National Grid UK



Climbing out of the funnel

- Asset management
- Strategic replacement and rationalisation of assets
- Informed strategic spares and incident response capability
- Working with the Electricity Commission and industry to streamline regulatory process



Creating the platform for the future

- Transmission 2040 – Grid Development Strategy
- To form a long term National Grid development strategy taking into account New Zealand's future social, environmental and economic requirements and long-term technology trends
- The T2040 document will provide a strategic and systemic roadmap to the future



The planner lives with uncertainty

*“We know we are going to get it wrong:
planning is minimising the impact of that.”*



The future

- Creating options
- Options can be physical – but even more so, they are technical
- The building blocks are long term – platforms, people and culture



We are underway!

