

Building and Operating a Resilient Renewable Electricity System

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research group



Resilience

The definition of resilience adopted by the UK Cabinet Office in the 2011 *Natural Hazards and Infrastructure* report:

“Resilience is the ability of assets, networks and systems to anticipate, absorb, adapt to and / or rapidly recover from a disruptive event.”

The UK Government describes the energy policy challenge as having to balance three interconnected and competing demands (the energy trilemma) such that it:

“Keeps the lights on, at an affordable price while decarbonising the power system”.



Public policy goals don't go away

In a broader sense we see five enduring public policy goals for the sector that wax and wane in importance :

- Security of supply
- Recognition of consumer social minimums
- Environmental responsibility
- Efficient market transactions
- Efficient investments



Current state of resilience

Each country has its own unique resilience as a result of its:

- Endowment of renewable energy sources
- Historic investment in generation, transmission and distribution
- Regulatory and market systems
- Progress along the liberalisation path*
- Government resolve

The changing landscape

Challenge:

- To increase levels of renewable energy from current levels (decarbonisation, displacement, sustainability, consumer choice)
- Accommodate the transformation underway to higher levels of distributed generation and demand management
- Sustain, and maybe improve, level of resilience in the face of change
- Maintain investment in infrastructure

A resilient system needs efficient investment and market transactions

It needs:

- Generation capacity. To be economically efficient it needs price signals
- Transmission and distribution capacity
- Secure fuel supply
- Adequate ancillary services
- Fit for purpose system operations
- A technical ability to respond and recover from disruption
- Cost reflective pricing to consumers

New Zealand

- Abundant renewable energy sources
- Experience with hydro variability
- Diversity in recent renewable development
- Developed ancillary service markets
- Regulatory certainty (Statutory objective.)
- Separate TX/DX and contestable markets
- Locational marginal wholesale prices
- Full retail contestability
- Time of use “smart” meters



The New Zealand case

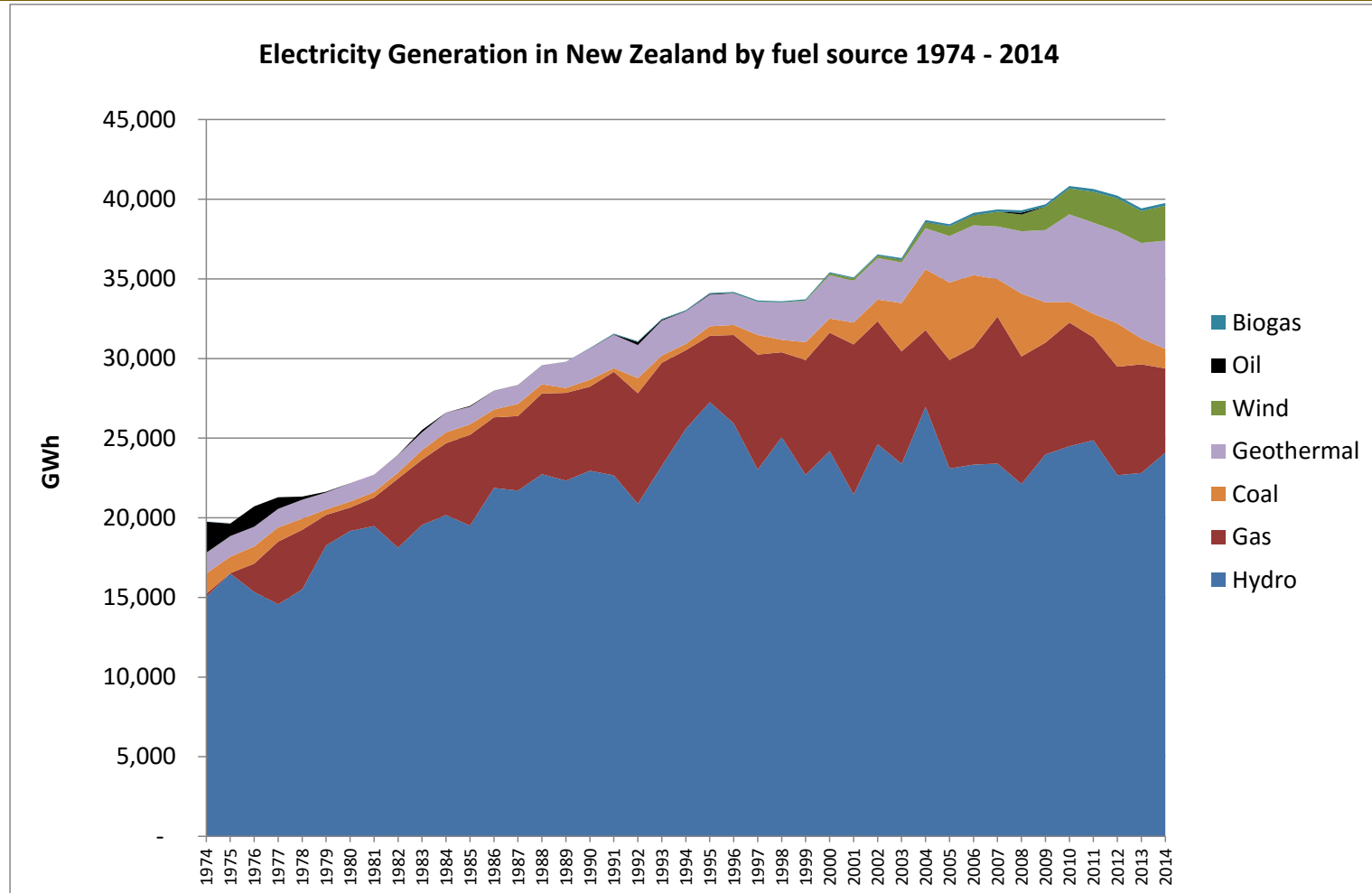
4th in percent renewable generation in developed countries after Iceland, Norway and Brazil

Iceland is an island nation with 100% renewable electricity in a 17.5 TWh system. New Zealand is also an island nation with 80% renewable in a 40.0 TWh system

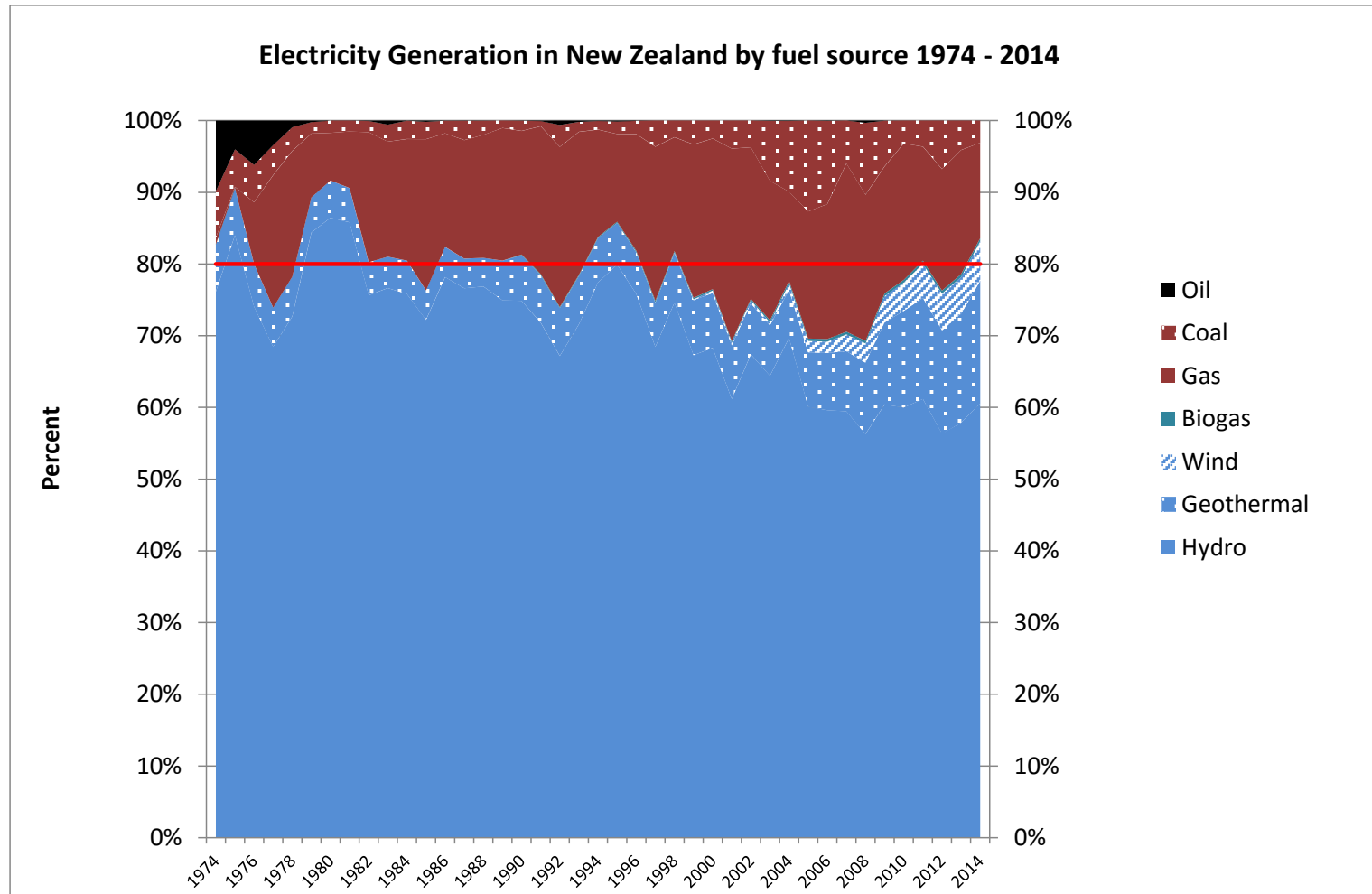
5th in the world for geothermal capacity after the US, Philippines, Indonesia and Mexico

15th in the world for wind capacity at 6.5%. The top 4 wind producers (based on capacity) are: Denmark (36%), Portugal (24%), Ireland (22%) and Spain (22%)

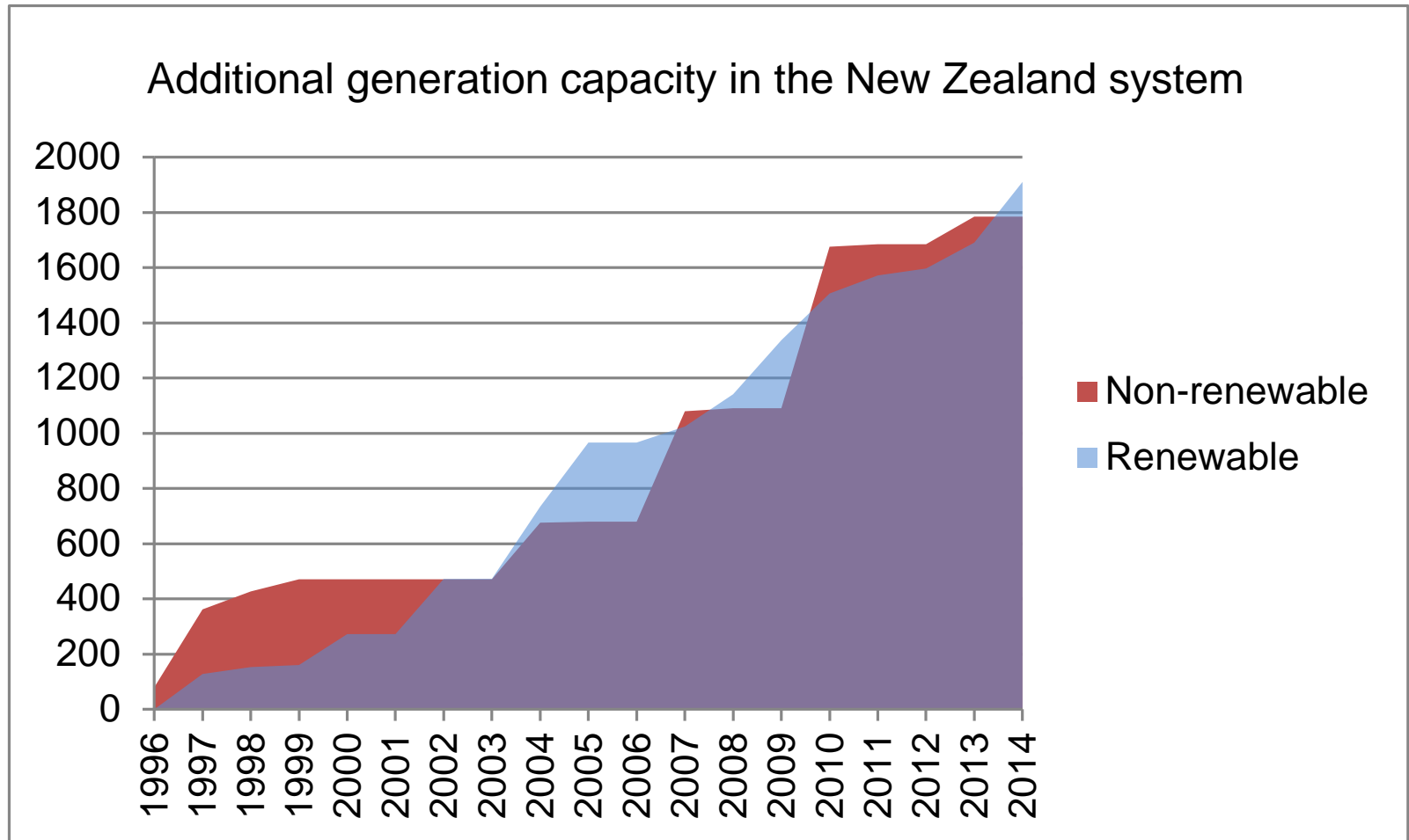
New Zealand's electricity generation mix



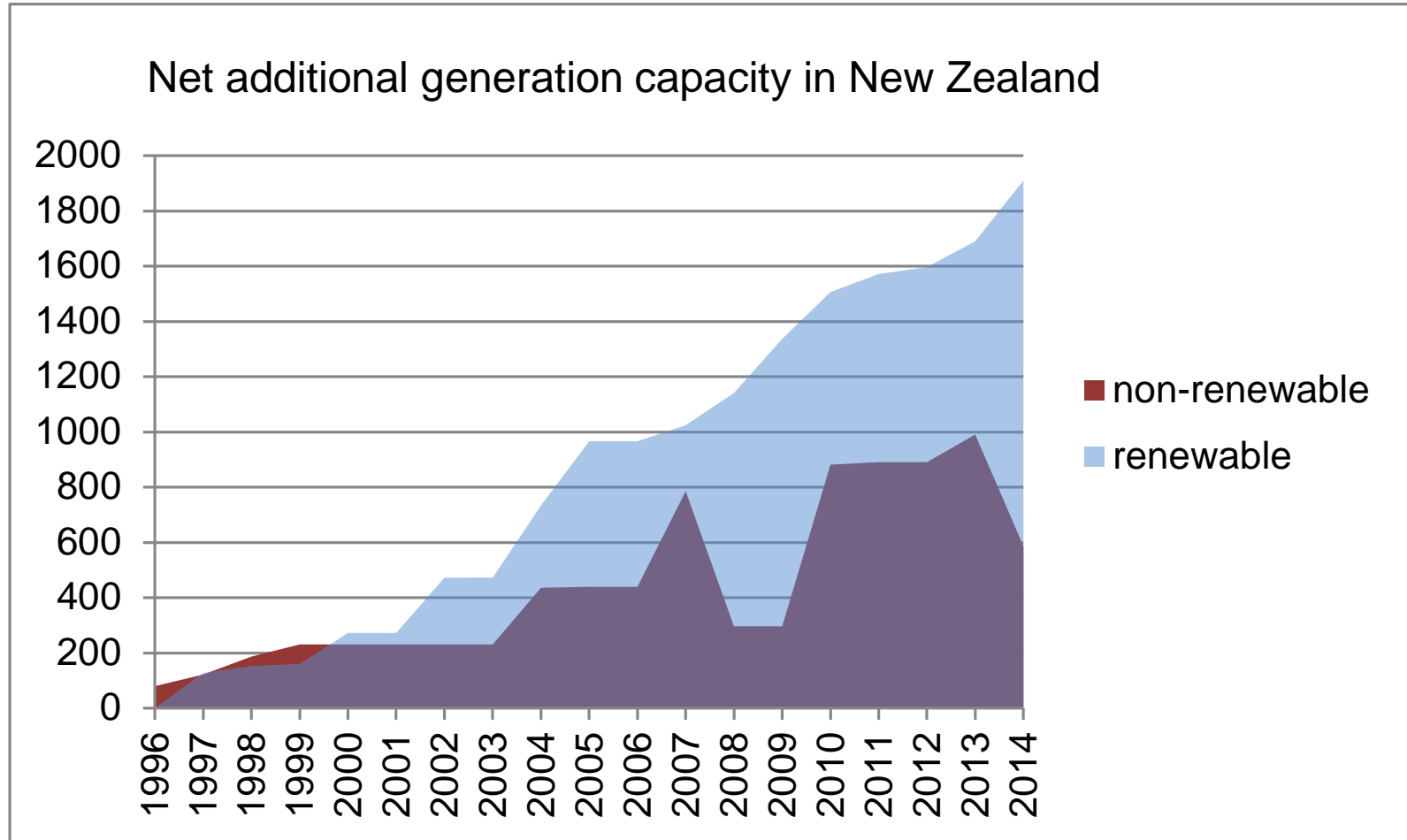
Renewable electricity generation



Renewable and non-renewable generation capacity build



Net renewable and non-renewable generation capacity additions



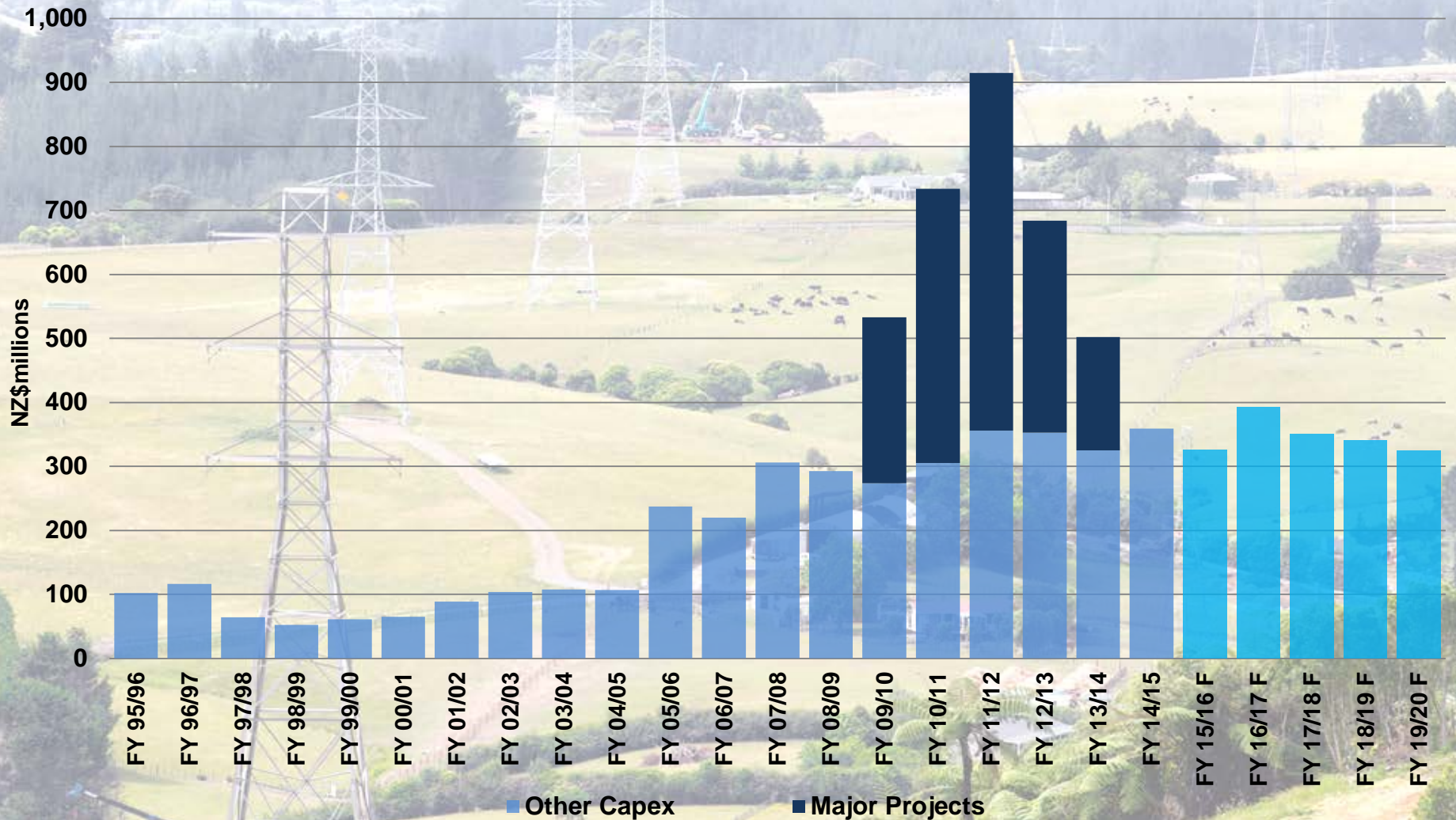
More renewable generation needed, maybe 1980MW baseload by 2025

	Annual electricity demand growth rate	
	0.4%	1.0%
2015 generation (GWh)	42927	42927
2025 generation (GWh)	44675	47418
90% renewable in 2025	40208	42676
Avg 2014+2015 renewable	34180	34180
GWh required for 90% in 2025	6028	8496
MW at 100% Capacity factor	688	970

Consented plant in New Zealand

Fuel source	Consented MW	Capacity factor	Contribution to 90% target (MW)
Diesel	23	40%	9
Gas	980	50%	490
Geothermal	298	90%	268
Hydro	677	50%	339
Tidal	211	50%	106
Wind	3649	35%	1277
TOTAL	5838		2489
Renewable	4835		1989

Capital expenditure



Panels

Panel I

Senior industry representatives from the Asia-Pacific region will highlight the particular issues that they face building and operating a resilient renewable electricity system and areas where exchange of experience could be of most value.

Panel II

Senior industry representatives from the Asia-Pacific region will:

- Summarise key issues facing countries building resilient power systems with increasing renewable generation
- Identify how current and evolving experience in these markets can most effectively be shared amongst interested parties
- Ensure support for collaboration amongst interested organisations going forward

Thank you



Toby Stevenson

+64 4 915 7616

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