New Zealand – A world leader in Renewable Energy?

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Purpose and Agenda

Purpose

To understand the roles for renewable energy in New Zealand and how that might be delivered.

Agenda

1. Why the world is turning to renewable energy
2. What New Zealand companies are doing to develop wind, solar and battery storage
3. What could this mean for New Zealand PLC and New Zealand businesses

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Infratec

- Installs solar PV and battery energy storage across the Pacific and New Zealand
- Thought leading consultancy work across the world
- MFAT, ADB and World Bank Sponsored Work
- www.infratec.co.nz

Dr Andrew Crossland CEng FEI

- Development and Specialist Consultant, Infratec
- Work across business development and operations
- Also Associate Fellow of Durham Energy Institute, Durham University, UK
- https://www.linkedin.com/in/afcrossland/

"Delivering innovative renewable energy solutions to create positive impacts for communities, businesses and the planet"

Why Renewable Energy?

A Global Perspective

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Three Drivers for Renewable Energy

1. Sustainability

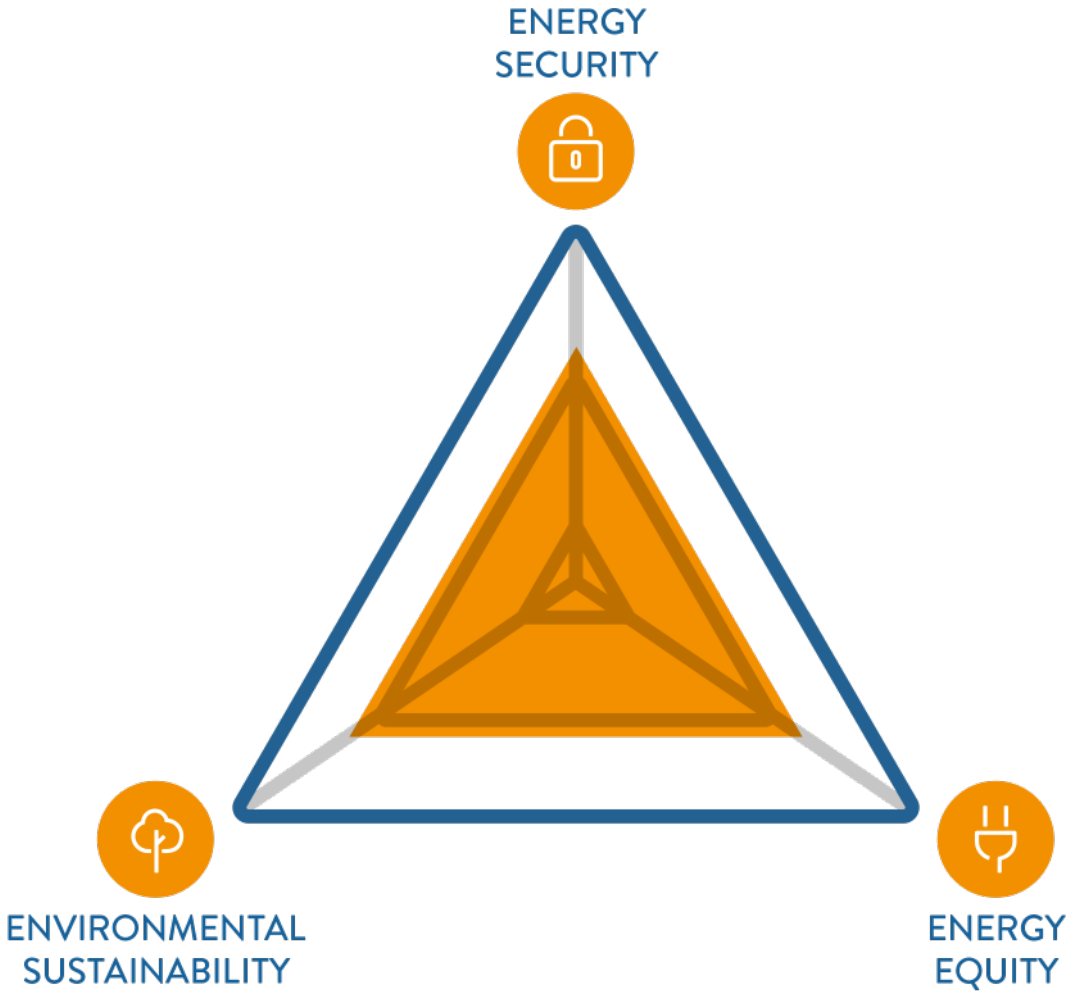
- Decarbonising the entire energy system from planes through to our fridges

2. Energy Equity and Cost

- Reducing the costs of electricity to drive economic growth.
- Stabilising prices for consumers and energy businesses

3. Energy Security and Resiliency

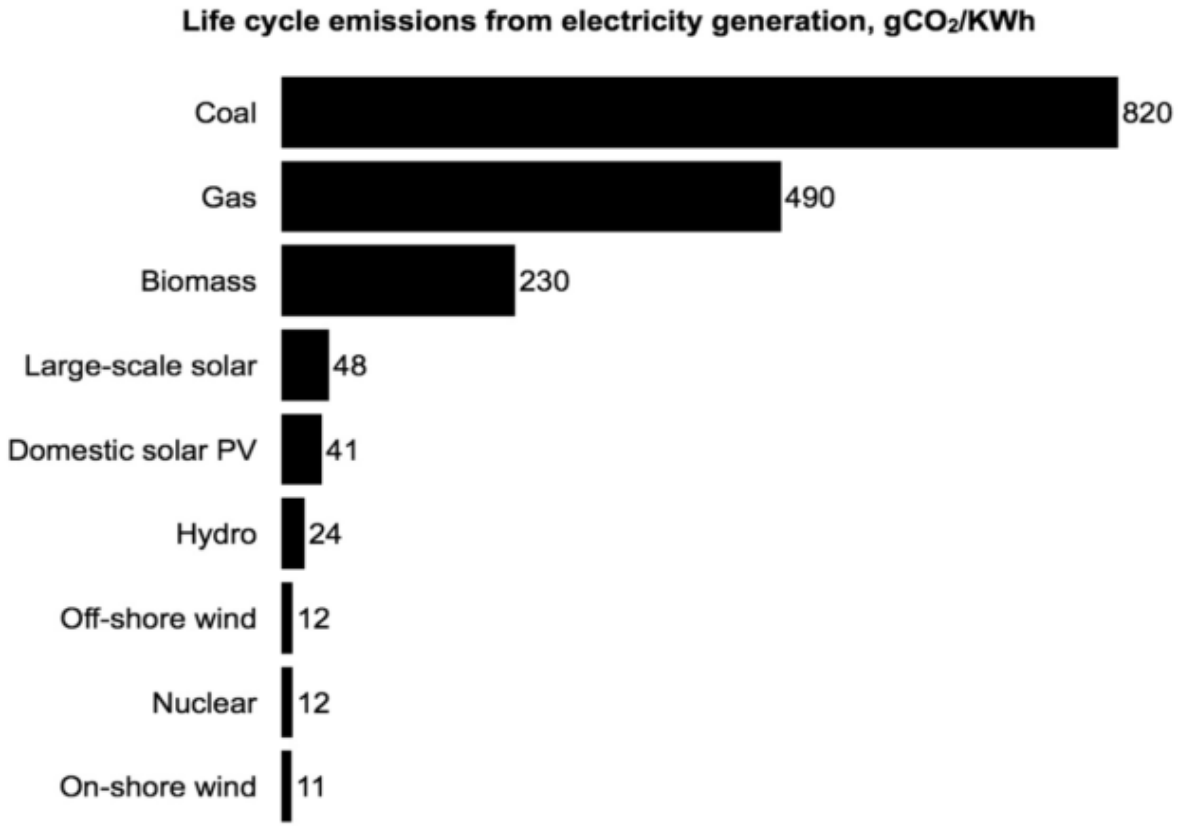
- Reducing reliance on foreign sources of energy
- Making the energy system more robust



Clean Electricity is… clean

- The carbon emissions associated with all life stages of clean electricity sources are far below that of fossil fuels
- No local pollutants, no impact on air quality
- Very fast build times compared to other forms of electricity generation
- Positive environmental benefits can be achieved e.g. duel uses for land, grazing, bee keeping etc.
- These are key reasons for their popularity

74%	think we should use solar "as much as possible"
70%	agree that "In the near future, we should produce 100% of our electricity from renewable energy sources such as solar and wind"

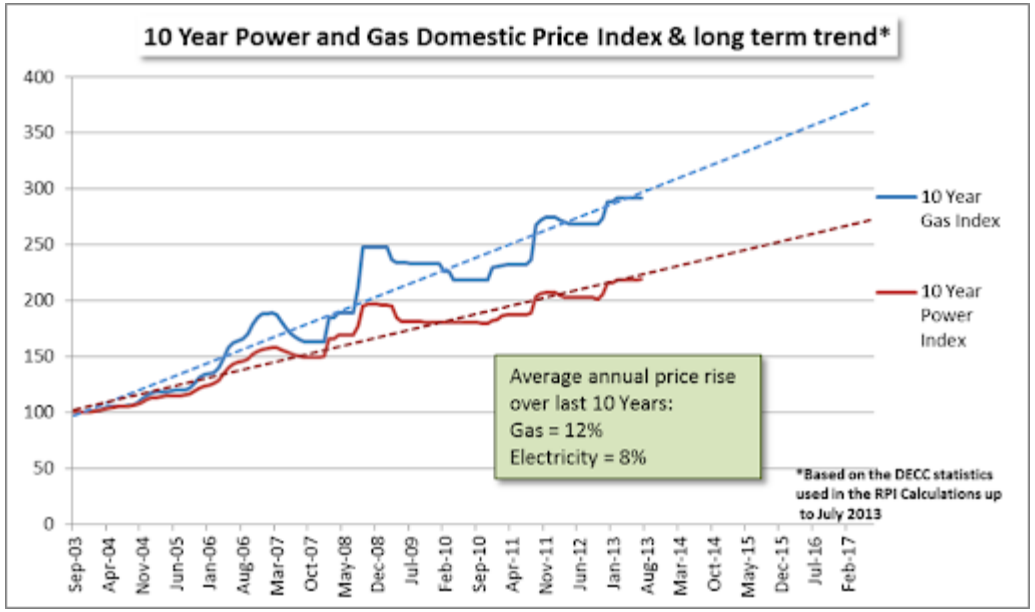


Source: IPCC Median Lifecycle Carbon emissions Considers manufacture, construction, operation, decommissioning

Energy markets and volatile, prices go up

Energy prices are not stable

New Zealand energy prices have been rising

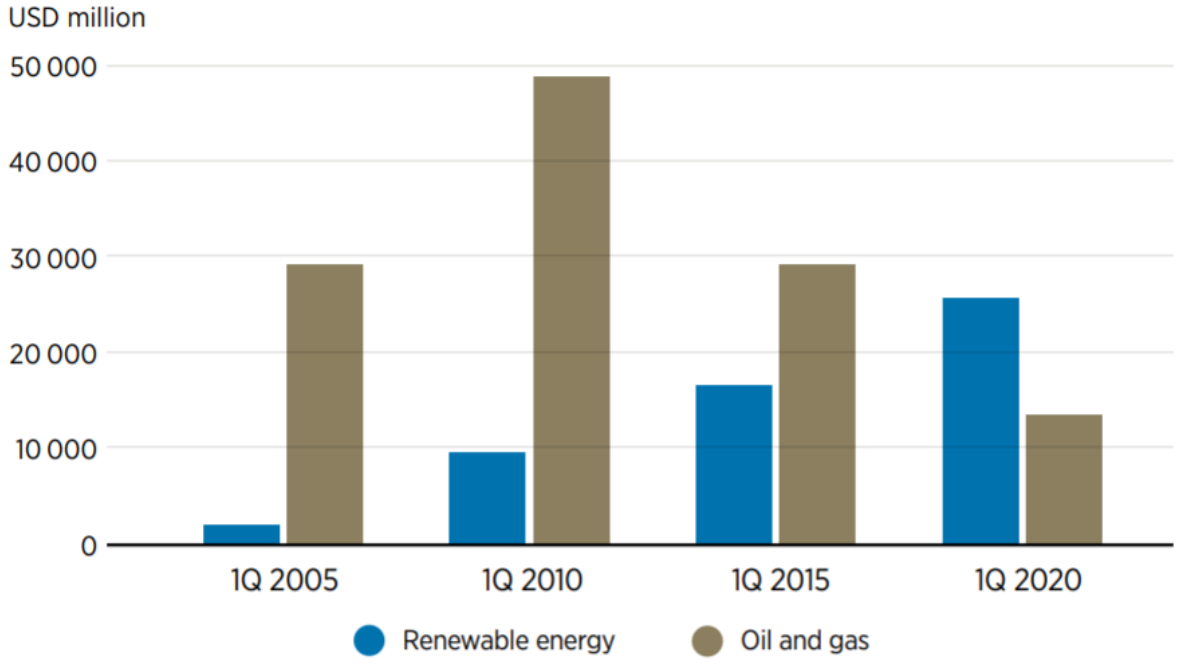


Investment in renewable energy outstrips oil and gas

"This year will be remembered as the point when the long-anticipated energy transition to a low-carbon future moved unequivocally from being a topic of debate to a shift of substance."
Financial Times, July 2020

"There is enough solar power installed around the world to run New Zealand 20x over"

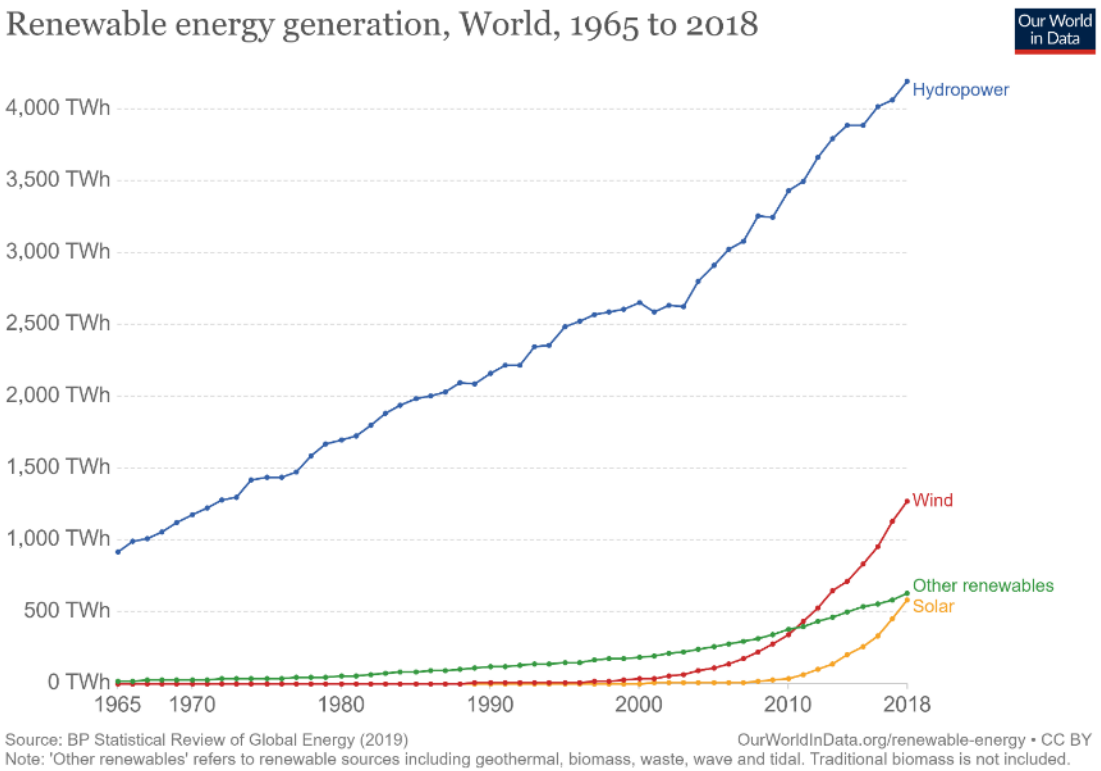
Figure 3.1 Announced foreign direct investments in renewables and oil and gas sector, first quarter 2005 to first quarter 2020 (USD million)



https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Post-COVID_Recovery_2020.pdf

We are beyond the tipping point…

Global View



https://ourworldindata.org/renewable-energy

UK Snapshot

- Wind the second biggest provider of electricity in Great Britain
- Nearly 1 million homes have adopted solar panels
- Solar electricity provides more electricity than coal in the UK
- Low carbon sources provide more than 50% of electricity

Renewables in the Pacific

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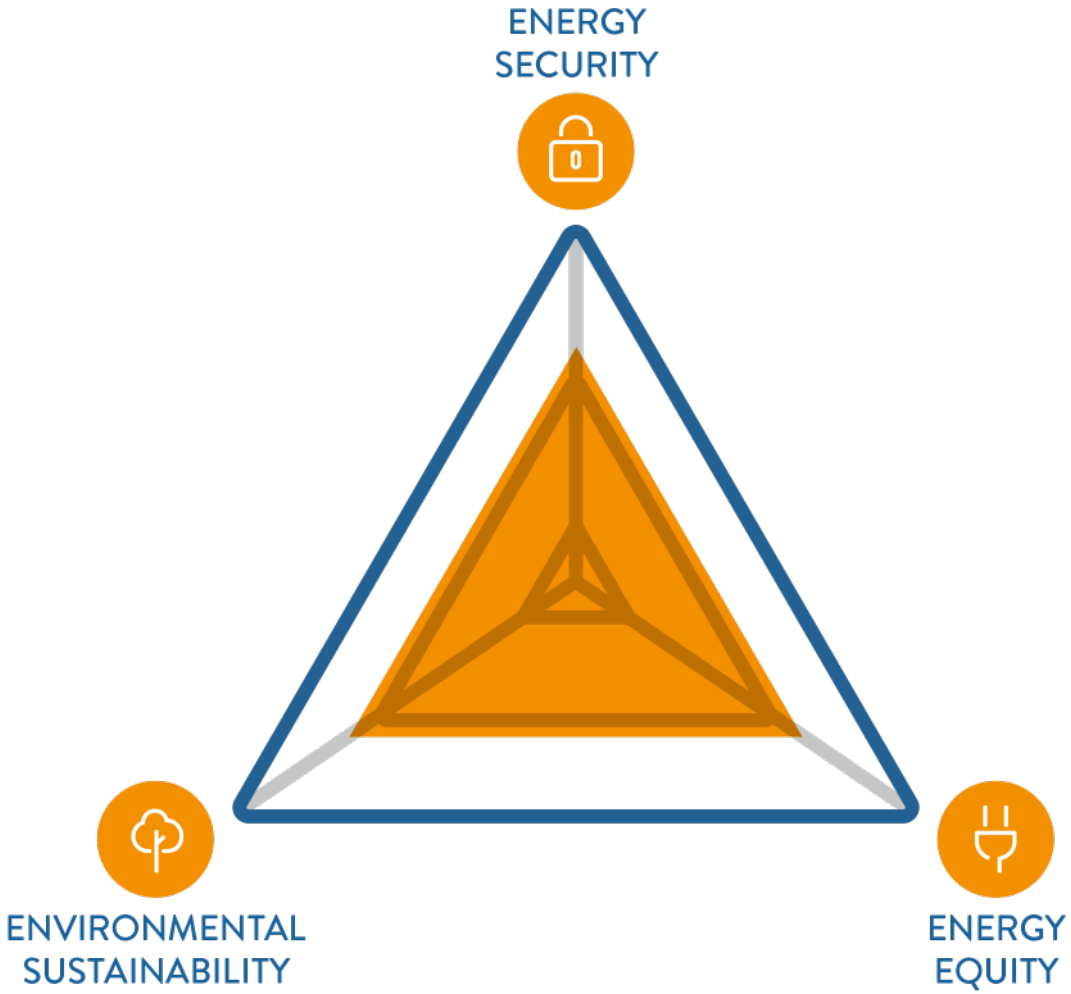
Why solar/battery in the Pacific



Energy Cost and Equity

- High costs for imported diesel fuel for generators
- Energy needed for economic growth and support
- Cost of electricity in The Solomon's is USD 1.2/kWh!

Environmental and Sustainability

- Acutely impacted by climate change
- Desire to show and deliver thought leadership on environmental issues

Energy Security and Resiliency

- Energy independence from imports
- Reduced exposure to changing prices of fossil fuels

Active across the Pacific and beyond…

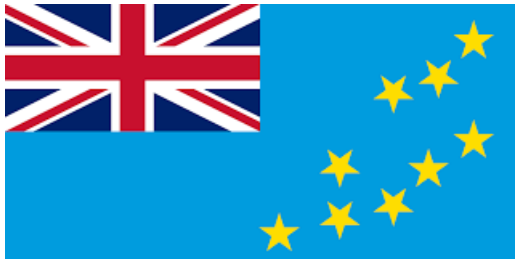
Solar Delivered/Constructed: Tuvalu, Nauru, Kiribati, Palau, Micronesia, Marshall Islands and… Timaru
Solar + Battery Delivered/Constructed: 4x Cook Islands, Palau, Tuvalu, Indonesia, Afghanistan and … Auckland

5MWp Solar
14 MWh BESS



Solar/Battery project underway: Tuvalu, Tonga (x7), Solomon Islands (x4)

15MWp Solar
13 MWh BESS

Our vision for New Zealand

100% renewable, 100% possible

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NZ is a Leader in Renewable Electricity…

Highly renewable electricity system

- 60% of electricity from Hydro
- 10% of electricity from geothermal
- 8% of electricity from other renewables
- One of the most renewable electricity sectors in the OECD

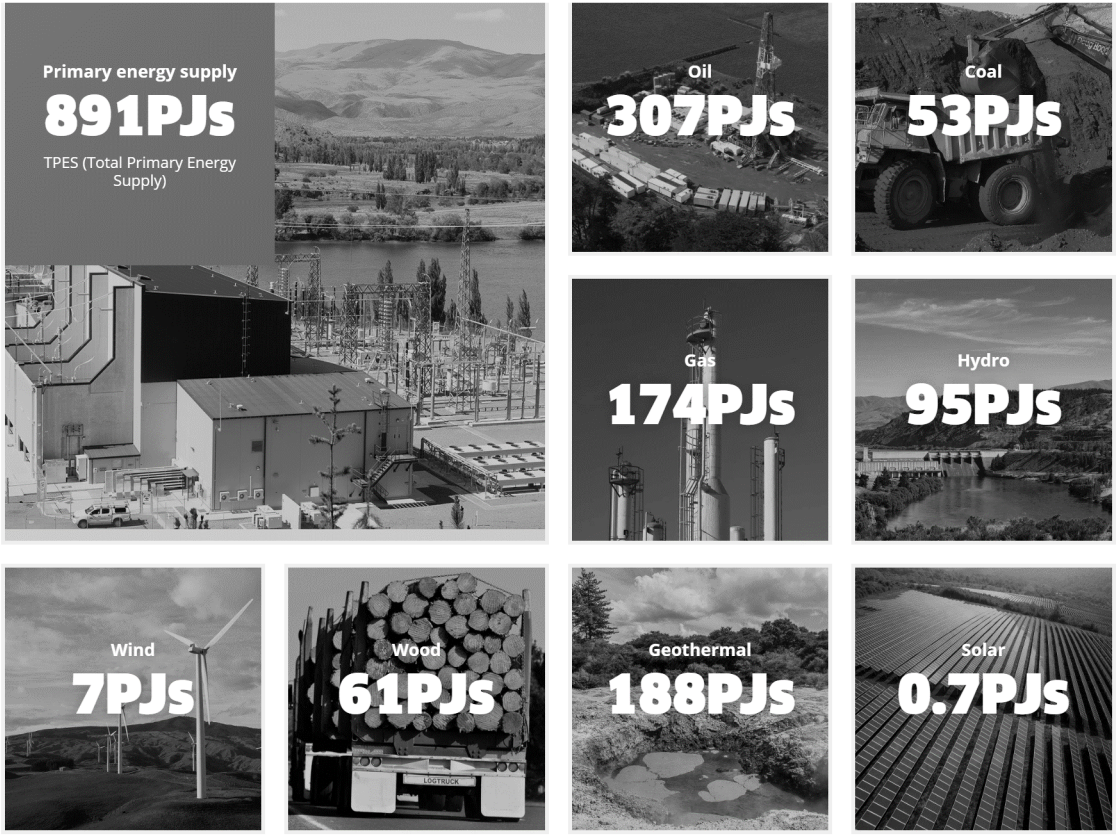
Companies working all over the world

- Solar power
- Battery energy storage
- Electricity networks and integration of renewables
- Control systems needed to make electricity systems manage renewable generation

https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/electricity-statistics/

Energy is more than Electricity

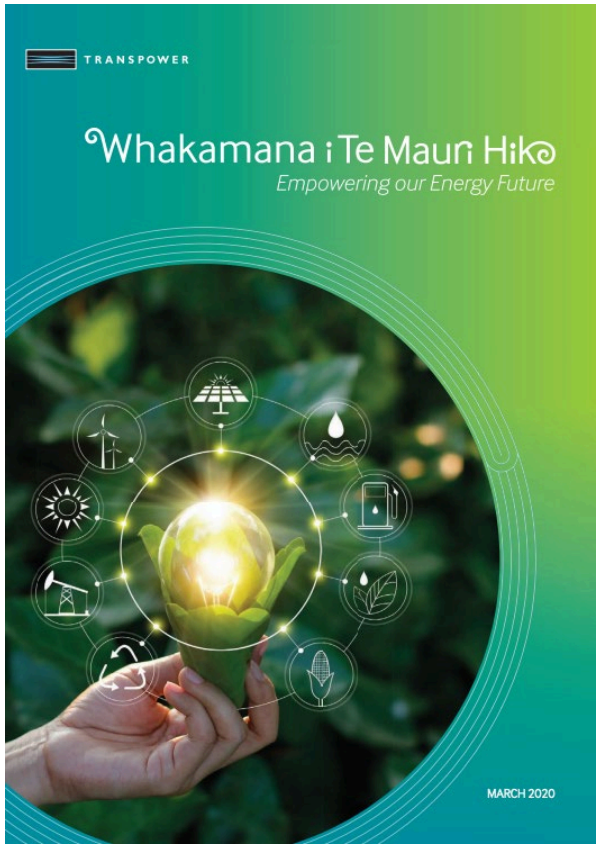
60% of New Zealand Energy is not renewable



http://www.energymix.co.nz/our-consumption/

100% Renewable Energy is an Opportunity

Billions of dollars of investment and job creation to provide 100% of energy from renewables



Whakamana i Te Mauri Hiko

- Empowering our Energy Future.

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Decarbonisation is the single biggest wealth creation opportunity of our lifetime

Creates Thousands of Jobs Across the Country

- Construction
- Operation
- Spread across New Zealand
- Serving Communities

An Energy System which Matches the Sustainable Image of New Zealand

- No air pollutants
- Low carbon economy
- Key drivers for the tourism and agricultural sectors

Economy

- Falling energy costs and Stabilising electricity markets
- Reduced dependence on imports
- Making New Zealand businesses more competitive

New Zealand is Ideal for Wind and Solar

Uniquely structured electricity grid

Need for diversity in the generation mix

Hydro resource is great with wind and solar

100% renewable is only achievable with wind and solar

Strong community focus aligns to wind and solar

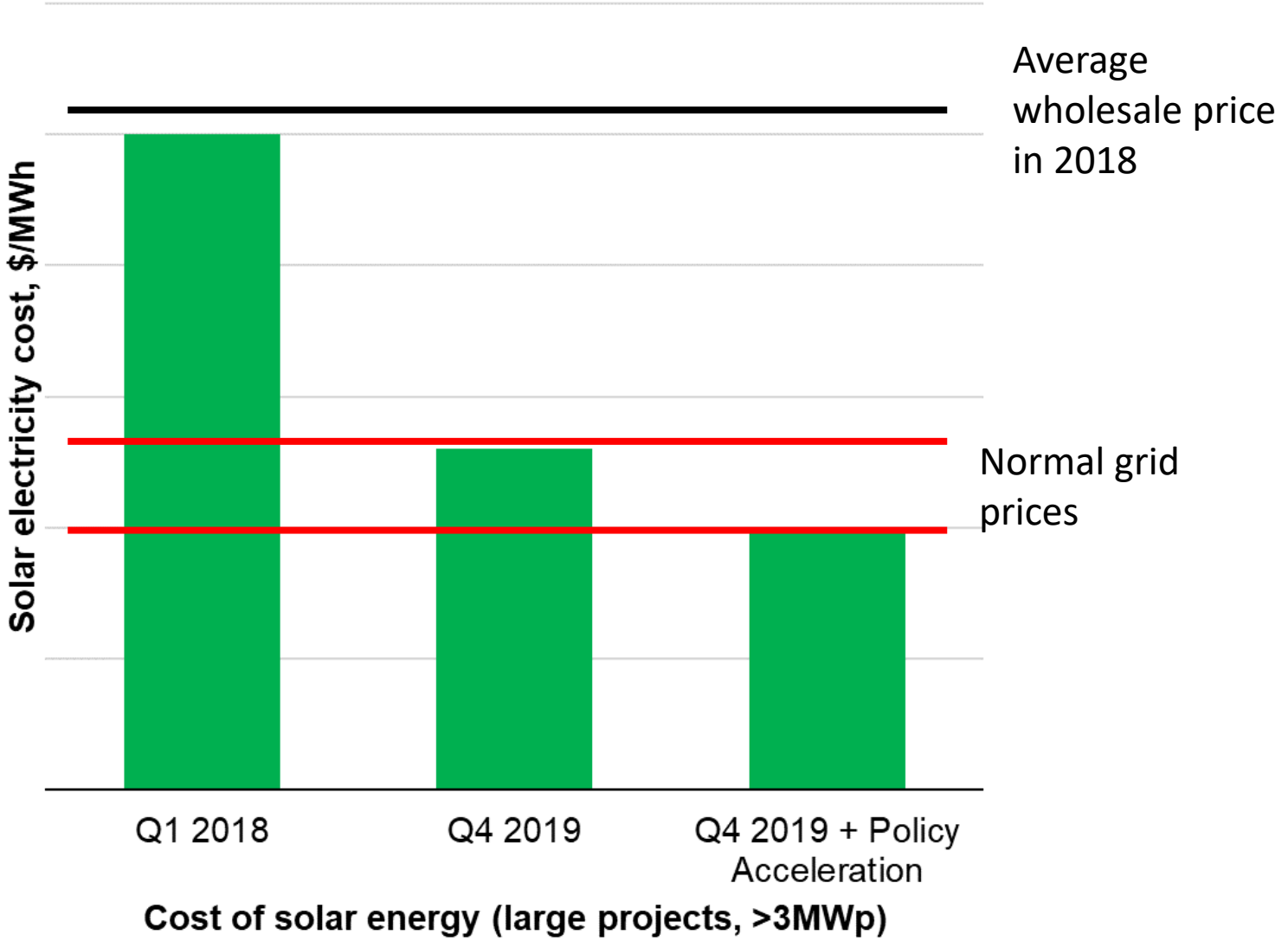
Provides investors with real long term assets to invest in

… and great weather!

A good investment opportunity?

Solar and Grid Parity in New Zealand

- Solar hit grid parity in New Zealand around Q4 2019.
- And offered prices fixed for 25-30 years
- Policy could accelerate renewable development in New Zealand such as
  - Low cost finance
  - Long term floor price contracts



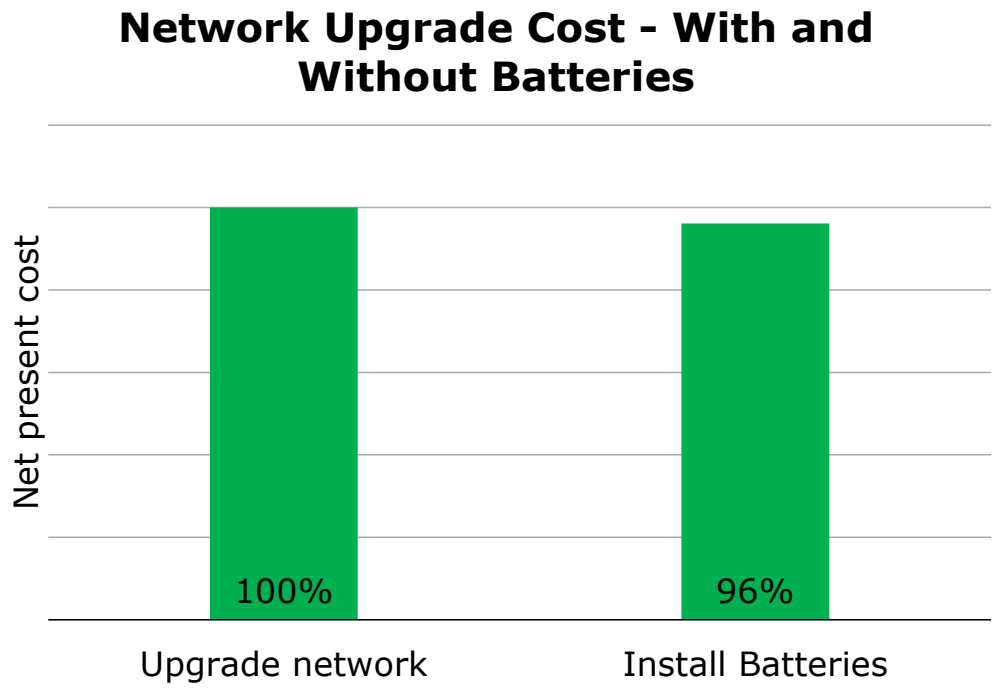
We think New Zealand is at a tipping point with respect to solar power

Batteries can reduce grid costs

- Infratec consulting piece for a major New Zealand Lines Company, 2019
- Grid Constraint:
  - Present electricity network unable to support economic growth and EVs
  - Multi-million dollar cost of upgrading network
  - Multi-year planning cycle with associated risk to build new power lines across and area of outstanding natural beauty

Benefits of battery solution

- ✓ 4% reduction in lines charges
- ✓ Limited environmental impact
- ✓ More resilient electricity grid
- ✓ Additional benefits across the power system yet to be valued



Don't worry, I'm a realist!

Wind and Solar In New Zealand

Wind Power per Country

27	Chile	–	–	–	20	168	172	205
28	South Africa	–	–	–	–	–	–	–
29	Uruguay	–	–	–	–	–	43	56
30	Argentina	–	–	–	–	–	113	167
31	Thailand	–	–	–	–	–	7	112
32	Egypt	230	310	390	430	550	550	550
33	South Korea	176	192	278	348	379	407	483
34	Pakistan[38]	–	–	–	–	–	–	–
35	Morocco	64	125	125	253	286	291	291
36	Ukraine	86	89	90	94	87	151	302
37	Taiwan	188	280	358	436	519	564	564
38	Bulgaria	36	70	120	177	500	612	674
39	New Zealand	171	322	325	497	530	623	623
40	Croatia	n/a	n/a	69.4	104	152	187.4	207.1
41	Nicaragua	–	–	–	–	–	62	102
42	Lithuania	56	50	54	91	163	203	263
43	Costa Rica	–	–	74	123	119	132	147

39th biggest wind sector in the world
Less wind power than Sweden, Denmark, Ireland, Taiwan

Solar Power per Country

At least 56 countries with more solar than New Zealand including Cyprus, Malta, Luxembourg and the UK!

So why is New Zealand so slow to adopt wind and solar electricity generation?

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THE BIGGEST COST IN RENEWABLE ENERGY IS RISK.

Low risk = low costs of finance and long term returns

Making Renewable Energy Work

Renewable Energy…

- High capital investment with low operating costs
- Long asset life (25-30 years)
- Variable output

… needs the right environment …

- ✓ Strong policy environment
- ✓ Stable commercial environment
- ✓ Investors with a long term view

… to drive down the costs of finance

A strong policy and commercial environment accelerates the renewable energy industry

Conclusions

Conclusions and Summary

New Zealand companies are ready to deliver

60% of New Zealand energy to be decarbonised

Investment ready

The fundamentals of the New Zealand market are good for renewables

And if we can manage risk then we get…

One of the greatest investment opportunities of our lifetime

Thank you and Keep in Touch

Option 1: Send an email

Dr Andrew Crossland

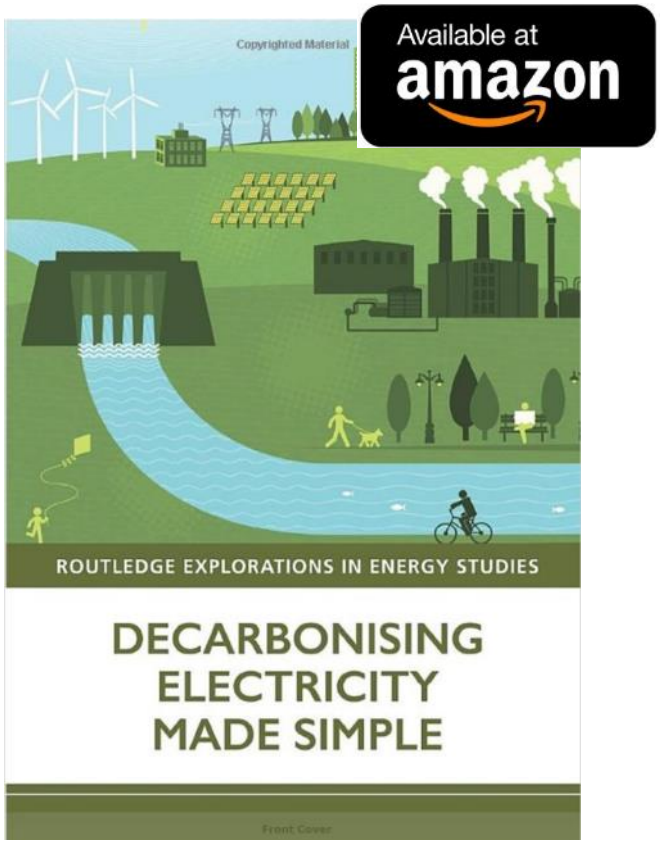
andrew.crossland@infratec.co.nz

Option 2: Follow us

Connect with us on LinkedIn

Visit:
www.infratec.co.nz

Option 3: Buy my book :)



Vector Powersmart
Pacific solar and battery systems and learnings to increase renewables in New Zealand

Presented: Shazad Ibnul

Vector case studies for BEC webinar “New Zealand a world leader in renewable energy”

vector powersmart

Tokelau; world’s first solar powered principality

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Tokelau; world's first solar powered principality

Vector Powersmart, MFAT and the Government of Tokelau, 2013 and 2020

- Challenge: pre 2012, 100% of Tokelau's energy from diesel generators
- Solution: one of the largest solar / battery systems in the world
- **Outcome:** nearly 100% of Tokelau's energy from renewable as a result electricity prices decreased and demand increased

Vector Powersmart is returning this year in partnership with MFAT and Government of Tokelau to expand the system

vector powersmart

Niue; integrating new with existing infrastructure

vector powersmart

Niue; integrating new with existing infrastructure

- Challenge: Niue Government target is 80% renewables by 2025. Solar generation curtailment to maintain stable grid

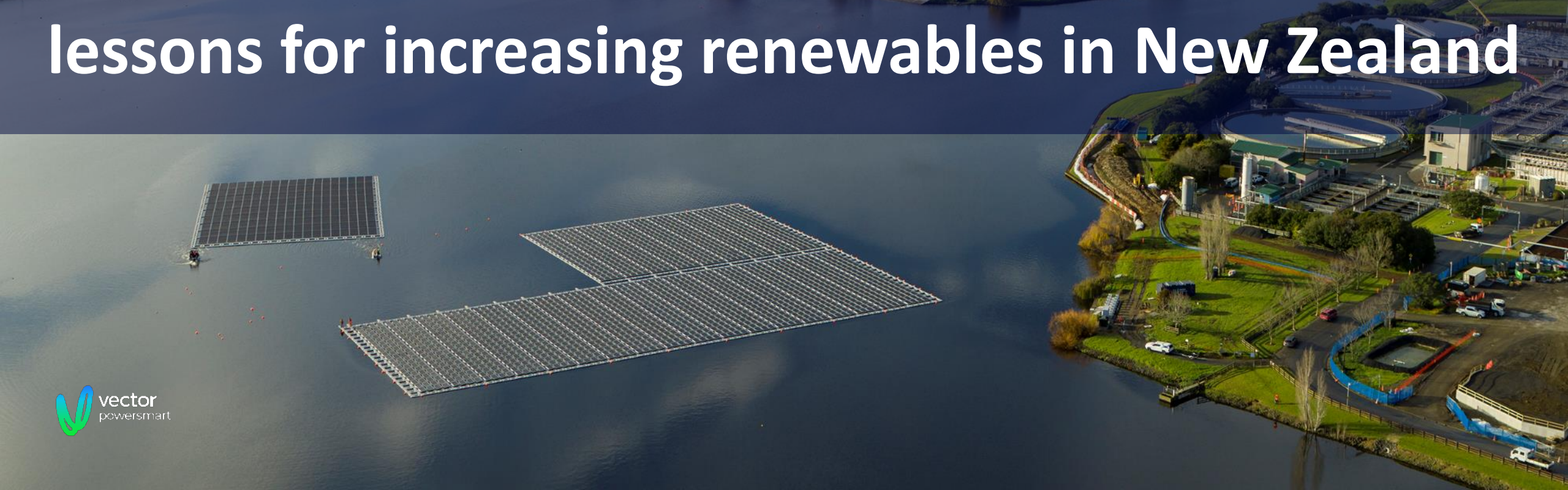
- Solution: **Vector Powersmart energy management system to coordinate the** integration of existing solar (500 kWp), new solar (600 kWp) and batteries (3 MWhp)

- **Outcome:** increased system stability, reliability and reduced emissions with increased use of renewables

Increasing renewables is about more than installing more renewable generation – it is about creating a smart and coordinated system that pairs renewable generation with energy storage

vector powersmart

lessons for increasing renewables in New Zealand



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lessons for increasing renewables in NZ

- Getting the most value from distributed solar requires coordination and visibility of the whole system
- The community needs to be at the centre - it is about understanding customer needs and network requirements
- Decentralisation increases resilience and efficiency – new renewable generation should be close to demand
- Distributed solar has a significant role in our energy future – particularly with innovative solutions

There is transformative potential for New Zealand's energy systems now

vector powersmart

Thank you

For further questions please email:

Rogier Simons – GM of Vector Powersmart

Rogier@powersmartsolar.com

vector powersmart

Question and Answers

- Type questions in the chat box
- Tina will moderate the questions and select Andrew or Shazad to answer… and may answer a few herself!
- Question session will finish on the hour

Dr Andrew Crossland FEI

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Shazad Ibnul

shazad@powersmartsolar.com

Use Policy to Accelerate Renewable Energy

- Contracts for Difference
- Long term power purchase contracts
  - Floor price paid to wind developer i.e. guaranteed minimum price
- Element of risk to developer on spot market prices
- But long term security
- Has provided correct environment to reduce costs of wind in the UK
  - Allowed investment in R&D
  - Brought in low costs of finance
  - Brough jobs to UK across the project cycle – manufacture, construction, operation