

# Key achievements to date

## KPI review

**Hamish Avery**

*February 2026*



Future Architecture  
of the Network

**TE WHATUNGAHIKO**

# Going back in time – setting the scene

2019 – what we knew then

- New Zealand's **Zero Carbon Act** was implemented in **2019**  
New Zealand is legally committed to **net-zero long-lived greenhouse gas emissions by 2050** .
- Growth in electrification – more load
  - EVs
  - Industrial process heat
  - Domestic heat pumps

# Going back in time – setting the scene

2019 – what we knew then (2)

- Growth in generation
  - Not going to come from spinning turbines
  - More small-scale distributed generation – home solar
  - More wind and solar farms
  - More inverters

Concerns about future grid stability

# Going back in time – setting the scene

2019 – what we knew then (3)

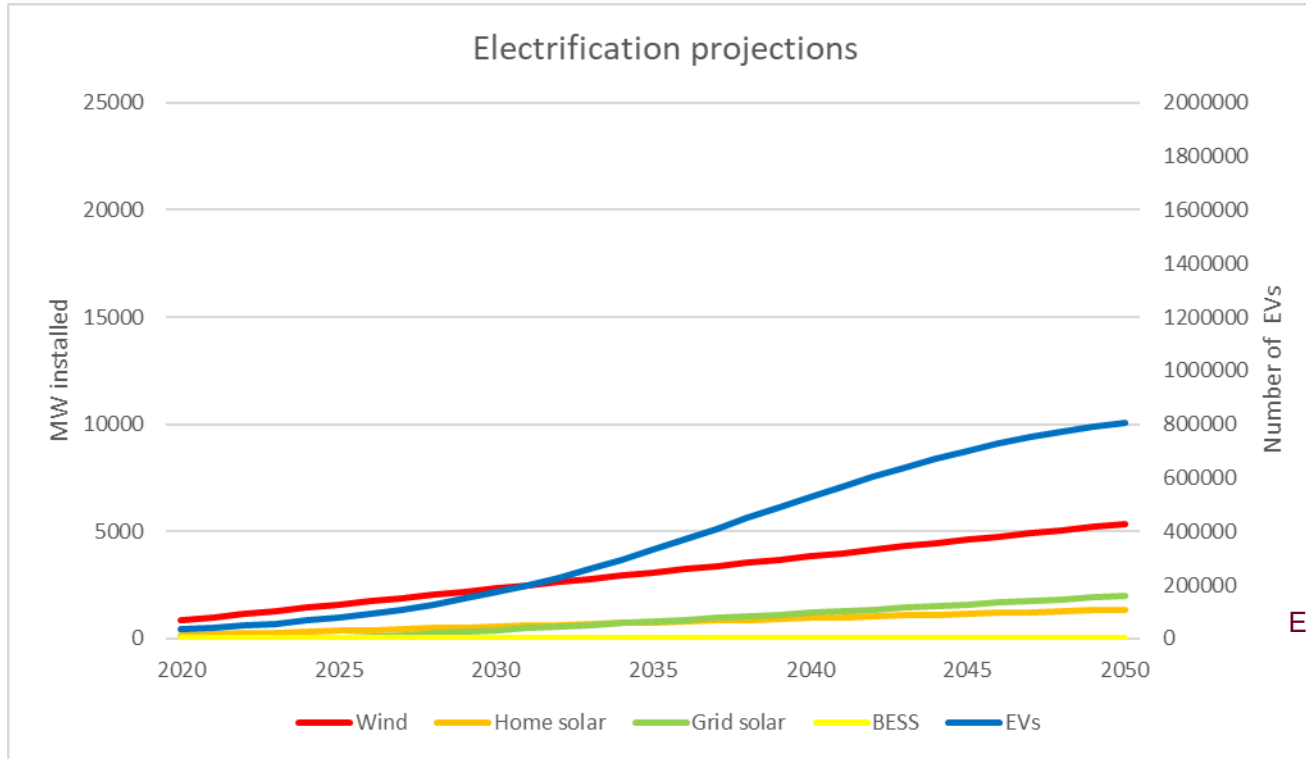
- Growth in distributed storage
  - Home batteries
  - Grid-scale batteries
  - Vehicle to grid on the radar
- A need for skilled people

# Going back in time – setting the scene

2019 – what we knew we didn't know

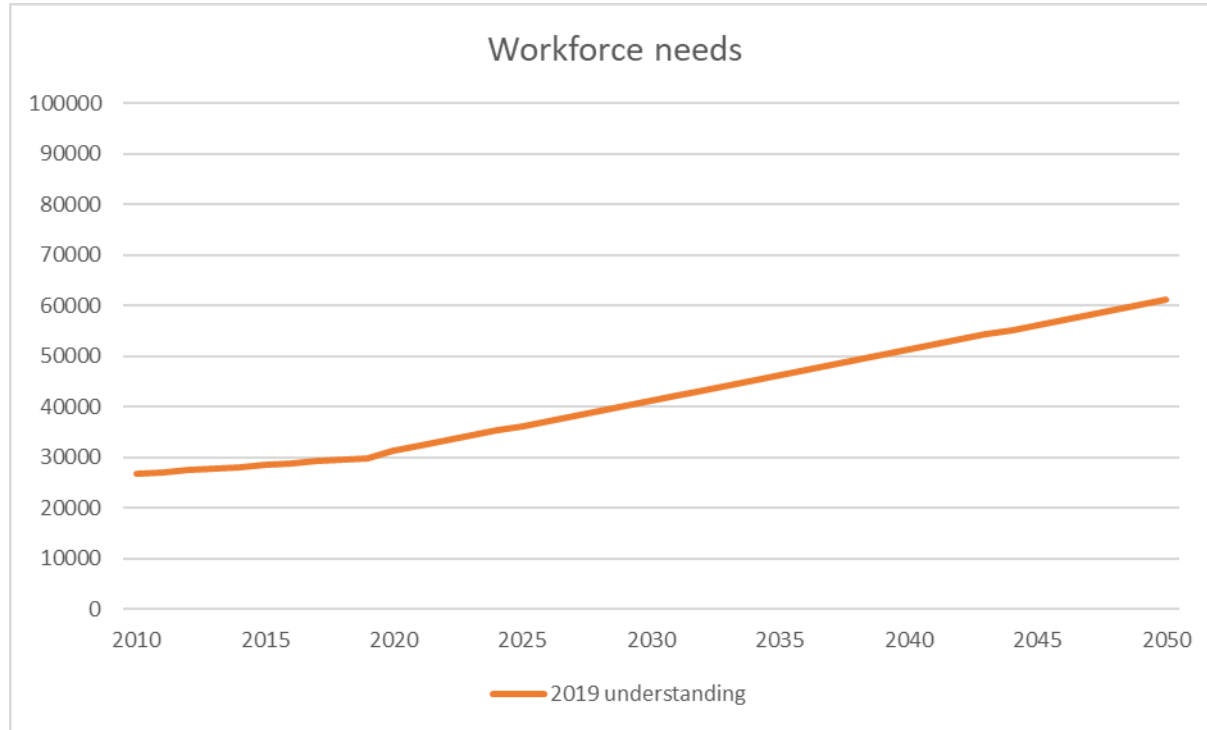
- Energy strategy for NZ
    - A pathway for electrification
    - Who would be doing what and when?
- } All scenarios must be considered

# Going back in time – setting the scene



EDGS projections etc

# Going back in time – setting the scene



EDGS projections etc

# Going back in time – setting the scene

It is this context that the FAN project was created.

While we didn't know how, and how fast, we would get to 2050 we *did* know that by the time we get there, our electrical grid will look very different to it does now, would need to be manage renewable generation, would have significantly more DC generation and load, would need to be resilience, and reliable, and we need new skills and technologies along the way.

Thus the full name: Architecture of the Future Low Carbon, Resilient, Electrical Power System

The KPIs were this set to drive us and hold us accountable to delivering what we saw as vital to the future wellbeing of our nation.

# Our KPIs

Our KPIs are set to measure our success against what we said we would do:

1. How we're keeping to our strategic intent
2. Our impact
3. How excellent we are
4. How we connect to industry
5. How we grow workforce capability
6. Our incorporation of Vision Mātauranga
7. How we connect to other researchers

# 1 Strategic intent KPIs

Research challenge is to determine the future electric grid architecture, topology and a transition pathway.

Our overarching goal is to answer the research question:

**Is a grid with high DC penetration possible, beneficial and how will it work and look like?**

Our main research question is divided into four technical workstreams:

- WS1: To what extent should DC permeate the AC infrastructure?
- WS2: How much of the LV and/or MV network should be DC?
- WS3: Which circuit topologies maximise the efficiency offered by DC systems?
- WS4: What is the transition pathway from AC to DC systems?

## 2 Impact KPIs

- a. Programme outputs are valued by stakeholders;
- b. Programme is influencing/seeing alignment of domestic and/or international research programs; and
- c. Progress towards delivery of impact

Demonstrated by: 6 case studies in total

Skills transfer (from the research and/or from overseas trips): Number of tutorials/seminars/workshops about the future grid to build capability in the NZ workforce:

Demonstrated by: 7 tutorials, seminars or workshops held in total

## 2 Impact KPIs – case studies

Three case studies to date:

- 1&2. Multi-phase Hybrid AC-DC  
Unbalanced Power-flow Tool  
Features, Capabilities and Case studies
3. DC Demonstration house— a fully DC example of domestic living with DC appliances, including a heat pump, fridge, TV, water heating, lighting etc.



## 2 Impact KPIs – tutorials, seminars or workshops

Already achieved all 7 required

13 workshops, 4 tutorials, 9 seminars



# 3 Excellence

To what extent is the AETP supporting appropriate and world-leading science?

- a. The Research Programme delivers high-quality science of a strategic nature and incorporates new ideas, approaches, and mechanisms.
- b. The Research Programme has an excellent scientific program with international standing.
- c. Excellence is recognised by scientific peers and/or key stakeholders.
- d. The expertise needed to deliver excellent science is available to the research team (in-house or through collaboration).
- e. Effective processes are in place to ensure excellence.

# 3 Excellence

Demonstrated by:

At least 3 publications accepted annually by the top 25% of journals worldwide, as ranked by field-normalised impact factor

At least 2 publications in total with a citation score of 0.5, normalized by field, publication type, and publication year

At least 4 publications in total with a citation score of at least 1, normalized by field, publication type, and publication year.

2 awards for science achievement annually (not open or open internationally)

2 keynote addresses presented by core team members at International / domestic conferences in total

# 3 Excellence – publications

132 papers published or in review to date

Too early to have scores, but expected that KPI will be exceeded

# 3 Excellence – science awards

This KPI is slightly behind

# 3 Excellence – keynote addresses

20 keynote addresses given in total (14 needed) – fully achieved already

# 4 Research Horizons

To what extent is the research programme leveraging national and international energy research programmes or other relevant programmes? The research programme leads research of national and international significance, attracting buy in from partners, leverages co-funding and alignment of capability and infrastructure.

Demonstrated by:

Three research outcomes (ideas, methodology, products or expertise) used and implemented/developed commercially by industry by 30 June 2027.

\$80,000 in-kind co-funding annually

3 collaborations with complementary projects in total

# 4 Research Horizons – commercialisation

This KPI is on track with details kept confidential

# 4 Research Horizons – co-funding

We have already exceeded this KPI by a significant amount. To date industry has supported the programme with >\$950,000 of equipment, support, and time.

# 4 Research Horizons – collaborations

The project has formed extensive collaborations.

Key domestic collaborations include the connection with the 3 other SSIF AETP programmes as electric power is a cornerstone of all three projects – electrification of heat, creation of hydrogen, and electrification of transport

We have established an Affiliate Partner programme and have affiliations with:

Aalborg University (Denmark), IISC Bangalore (India), FEN- RWTH Aachen (Germany), TU Dresden (Germany), Purdue University (USA), TalTech (Estonia), TUMCREATE (Singapore), University of Cambridge, and UNSW (Australia)

# 5 Capability development

To what extent is the research programme increasing the capacity and capability for New Zealand to conduct high-quality Energy Technology research?

- a. Research team has the capability (multi-, inter- and trans-disciplinary) necessary to achieve the objective, and expertise gaps are filled.
- b. International science expertise is used where appropriate.
- c. A growing and diverse cohort of researchers and stakeholders are working in a culturally responsive, collaborative way.
- d. Emerging talent has opportunities (in research or leadership roles).
- e. The team involves, where appropriate, relevant stakeholder, end user and Māori experts.

# 5 Capability development

Demonstrated by:

6 postdoctoral fellows joining the programme

10 PhD or Masters completions

70 summer students involved in the programme

2 industry secondments of PhD or postdocs

20 female staff or students in the programme

3 student projects performed with industry

# 5 Capability development – postdocs

This KPI is fully expected to be exceeded: 7 c.f. 6 required

# 5 Capability development – PhD/masters completions

This KPI is fully expected to be exceeded: 24 c.f. 10 required

The programme has 19 PhD students and 5 masters students either enrolled or completed

# 5 Capability development – summer students

This KPI is tracking above requirements

Each partner University hosts summer students to perform research

# 5 Capability development – industry secondments

This KPI has been fully achieved

1x secondment to Orion (UC)

1x secondment to Siemens Energy (Erlangen, Germany) (UC)

# 5 Capability development – gender balance

This KPI has already been exceeded for the programme.

37 female staff and students have been involved in the programme to date

# 5 Capability development – industry student projects

This KPI has already been exceeded for the programme.

1x Meridian project (UC)

2x Powerco project (UoA + AUT)

2x Transpower projects (UC)

# Vision Mātauranga

To what extent are effective partnerships with Māori being formed, Māori capability being built and Mātauranga Māori being integrated in Platform research to address the needs and aspirations of Māori and all New Zealanders?

- a. Mātauranga Māori is integrated into research, where appropriate.
- b. Māori capability is built through opportunities to engage in AETP research. AETP research gives effect to the Vision Mātauranga policy.

# Vision Mātauranga

Demonstrated by:

VM strategy and plan defined (across all workstreams) and communicated annually

4 core team members involved in VM-related activities

More than 7 Māori students involved in the programme in total

4 Māori partners engaged in programme projects

2 case studies/technology demonstrations involving Māori communities

# Vision Mātauranga – VM strategy

To what extent are effective partnerships with Māori being formed, Māori capability being built and Mātauranga Māori being integrated in Platform research to address the needs and aspirations of Māori and all New Zealanders?

- a. Mātauranga Māori is integrated into research, where appropriate.
- b. Māori capability is built through opportunities to engage in AETP research. AETP research gives effect to the Vision Mātauranga policy.

# Vision Mātauranga – team participation

This KPI has been fully achieved for the programme

- Ramesh Rayudu (leader) and Hamish Avery
- Tipene Merrit (leader) and Nirmal Nair

# Vision Mātauranga – student participation

This KPI is on track

While participation of Māori students will meet the KPI, it is noted that the numbers of Māori postgraduate students in this area is extremely low and efforts have been made through the Vision Mātauranga programme (outreach etc.) to encourage younger Māori to consider energy as a broader topic as a career choice.



# Vision Mātauranga – partnerships

Halcombe Iwi: working with Kia Whitingia on their community energy programme

Te Ahuru Mowai: Data and wellbeing analysis in collaboration with MBIE-MREF and MOTU, relating to their solar installation

Ōnuku Marae: Study on energy use, energy efficiency, and optioneering for resilience and economy

Aorangi Marae: Incorporating Māori aspirations for communal living, energy production and usage into research.

# Vision Mātauranga – case studies / tech demos

This KPI has been fully achieved

- A case study was performed for Ngāti Toa for Te Ahuru Mowai, to support the urban Māori housing energy.
- Ōnuku Marae case study on energy use, energy efficiency, and optioneering for resilience and economy
- A case study project with Aorangi Marae is underway



# Collaboration and partnerships

To what extent is the Research Programme developing and maintaining effective domestic and international collaborations?

- a. The Research Programme is nurturing, leveraging and growing national and international partnerships.
- b. The Research Programme is collaborating with researchers new to the New Zealand energy research space.

# Collaboration and partnerships

Demonstrated by:

20% of all publications produced as a result of international collaboration.

2 international industry representatives or academics to participate and present at NZ based workshops/conferences, annually

1 PhD student from international research entities hosted for a few months in New Zealand, annually

5 PhD students hosted by an international University, bringing back expertise and transferring this back to the Research and the Industry teams

4 researchers (postdoc and core team members) hosted by an international University, bringing back expertise and transferring this back to the Research and the Industry teams)

# Collaboration and partnerships

– international publications

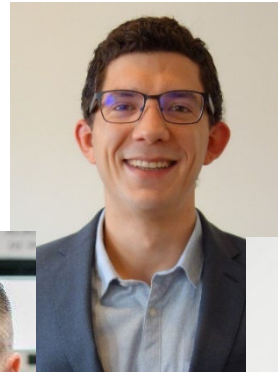
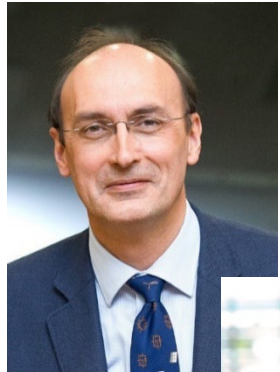
This KPI is on track

# Collaboration and partnerships

– international visitors

This KPI is on track

We note and welcome the international industry and academic visitors today



# Collaboration and partnerships

– hosting international PhDs

This KPI is on track

We are making extensive use of our FAN Affiliate Programme

# Collaboration and partnerships

– international PhD placements

This KPI is slightly behind schedule

We are making extensive use of our FAN Affiliate Programme and have plans in place to meet this KPI by programme completion

# Collaboration and partnerships

– international research team placements

This KPI is slightly behind schedule – we are making extensive use of our FAN Affiliate Programme and expect to meet this KPI by programme completion

# End of the KPI review

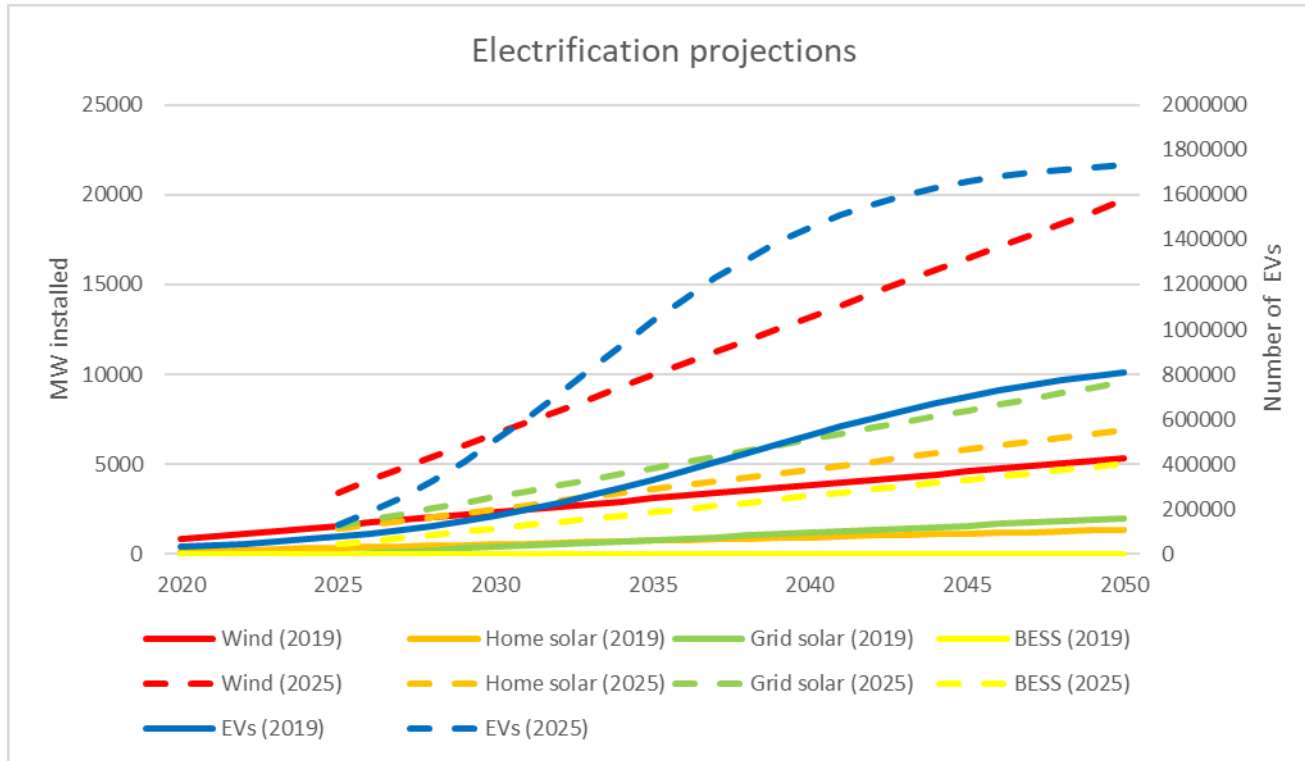
But wait – there's more

# So coming back to the present

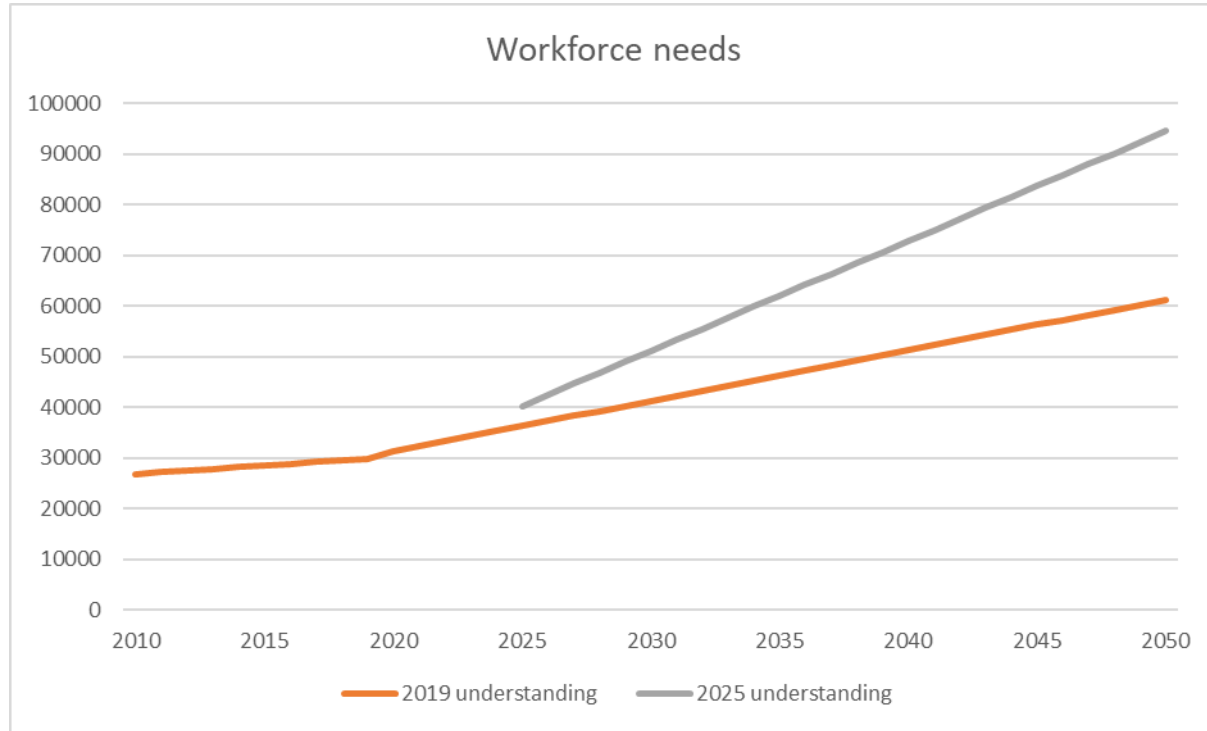
2025 – what's changed

- *We still* don't have an energy strategy for NZ
- We are running out of gas faster than expected
- The EV uptake has stalled
- Grid-scale solar has taken off
- As much, or even more, fear of the 'dry year'

# Coming back to the present



# Coming back to the present



# Coming back to the present

What have we learned?

- The strategic importance of this programme has been validated
  - Industry has been highly supportive
  - Starting alone in this field, many international programmes in the same area have started – we have been at the forefront of this emerging international study area
  - More work needs to be done
- Our 2050 target remains, but immediate research questions exist, and in the absence of a national energy strategy, all scenarios must be examined

# Coming back to the present

What would have changed?

- The gender diversity KPI did not stretch us
  - We are a long way from equality, and should set KPIs higher
- The PhD completions KPIs did not account for recruitment times
- There is a scarcity of Māori researchers, and some KPIs should have been explicitly allocated to outreach

This work was supported by the Ministry of Business Innovation and Employment, New Zealand under the Strategic Science Investment Fund – Advanced Energy Technology Platform programme “Architecture of the Future Low Carbon, Resilient, Electrical Power System” contract number UOCX2007

# Thank you

[www.fan.ac.nz](http://www.fan.ac.nz)

[futurearchitecturenetwork@canterbury.ac.nz](mailto:futurearchitecturenetwork@canterbury.ac.nz)



Future Architecture  
of the Network

TE WHATUNGAHIKO

# Questions?

[www.fan.ac.nz](http://www.fan.ac.nz)

futurearchitecturenetwork@canterbury.ac.nz



Future Architecture  
of the Network

TE WHATUNGAHIKO