Future security and resilience: Phase 2 draft roadmap

Q&A session

13 April 2022

Introductions

ELECTRICITY AUTHORITY
TE MANA HIKO

Agenda	Who	Duration
Welcome & purpose of session	Joey Au/Alistair Dixon	10 mins
Introduction of FSR and recap of opportunities and challenges	Matt Copland	15 mins
Q&A	All	10 mins
Presentation of FSR roadmap - Key aspects - Outcome proposal highlights - Interdependencies (between items on the roadmap) - Indicators	Leith Macintosh/Murray Henderson	30 mins
Q&A	All	25 mins
Next steps and wrap up	Joey Au/Alistair Dixon	5 mins

ENERGY TRANSITION ROADMAP

Supporting an efficient transition to a low-emissions energy system

New Zealand has committed to achieving net zero emissions by 2050, with the Government aspiring to achieve 100% renewable electricity by 2030. Heating and transportation in New Zealand will need to be electrified. The significant increase in demand for electricity will require large quantities of new renewable electricity generation, increased use of distributed energy resources, new ways to participate and more participants – changing the dynamics of the electricity system and markets.

As the regulator of New Zealand's electricity system, our work provides an important platform for the country's aspirations. Low-emissions energy is one of our five key strategic ambitions, and we are working to ensure the transition is as efficient as possible while maintaining energy security, system adaptability, and affordable electricity for consumers.

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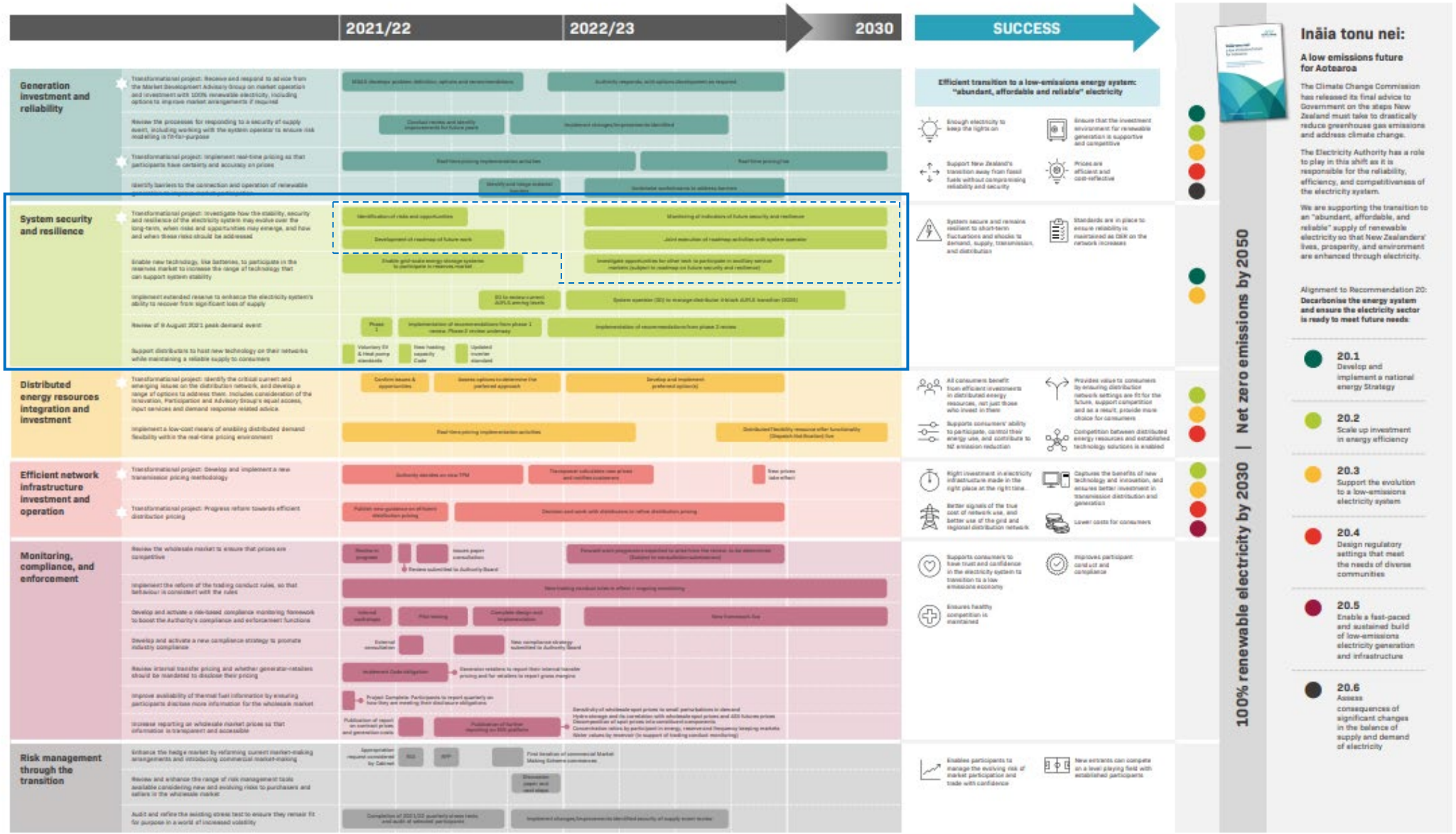


Inäia tonu nei:

A low emissions future for Aotearoa

The Climate Change Commission has released its final advice to Government on the steps New Zealand must take to drastically reduce greenhouse gas emissions and address climate change.

The Electricity Authority has a role to play in this shift as it is responsible for the reliability, efficiency, and competitiveness of the electricity system.

We are supporting the transition to an "abundant, affordable, and reliable" supply of renewable electricity so that New Zealanders' lives, prosperity, and environment are enhanced through electricity.

Alignment to Recommendation 20:
Decarbonise the energy system and ensure the electricity sector is ready to meet future needs:

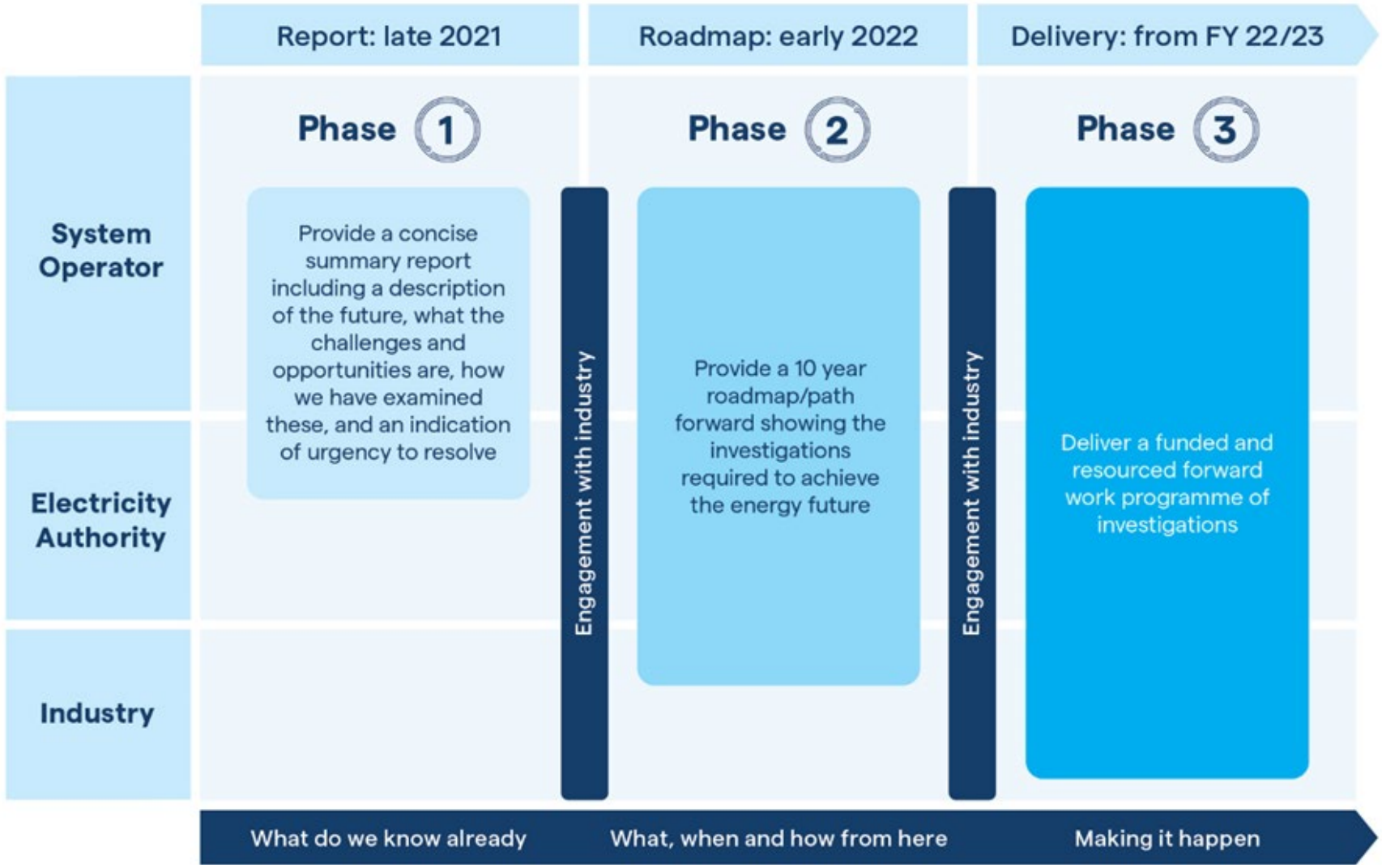
- **20.1** Develop and implement a national energy Strategy
- **20.2** Scale up investment in energy efficiency
- **20.3** Support the evolution to a low-emissions electricity system
- **20.4** Design regulatory settings that meet the needs of diverse communities
- **20.5** Enable a fast-paced and sustained build of low-emissions electricity generation and infrastructure
- **20.6** Assess consequences of significant changes in the balance of supply and demand of electricity

FSR background and approach

What is the Future Security and Resilience programme?

Key trends	Current	2030
Decarbonised: Transition to 100% renewables	• 85% renewable electricity • Mostly synchronous generation • Security of supply managed by market • Thermals to meet peaks and dry years • Small amount of DER	• 100% renewable electricity • More asynchronous and inverter-based generation • Will energy-only market manage security of supply? • New solutions needed for peaks and dry year • Increased reliance on DER
Decarbonised: More electrified economy	• High reliance on electricity in the economy • Electricity not relied on heavily for transport • Few, traditional demand growth sources – new industry, new housing	• Very high reliance on electricity in the economy • Electricity relied on heavily for transport and in industry • Many different demand growth sources – hydrogen, data centres, EVs, process heat
Distributed: More distributed electricity system	• Small amount of DER • Limited performance requirements in the Code but small penetration means this is not yet an issue • Limited use of demand-side and battery technology to manage peaks	• Millions of DER able to manage peaks in real-time (EVs, batteries, smart appliances) • Multi-directional power flows • More consumer participation and more market players • Potential issues caused by inverter-based DER
Digitised: Increasing digitisation and use of digital tech	• Increasing data and data management requirements • Gradual use of automation for control and switching • Increased use of data-driven decision making	• Increased complexity and volume of data • Expectation from operators and customers that controls, and communications will be automated and data-driven • Opportunities to improve consistency and efficiency

Future Security and Resilience programme activities



Opportunities & challenges to FSR (Phase 1)

How did we identify opportunities and challenges in the report?

Agreed scope and assumptions

- System Operator-centric
- Security of supply excluded

Confirmed our definitions of security & resilience

Considered what the future power system will look like

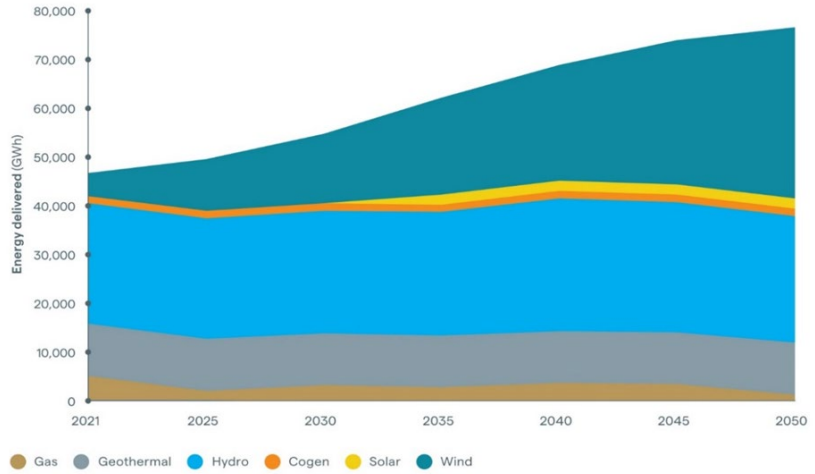
- Whakamana i Te Mauri Hiko Mobilise to Decarbonise scenario

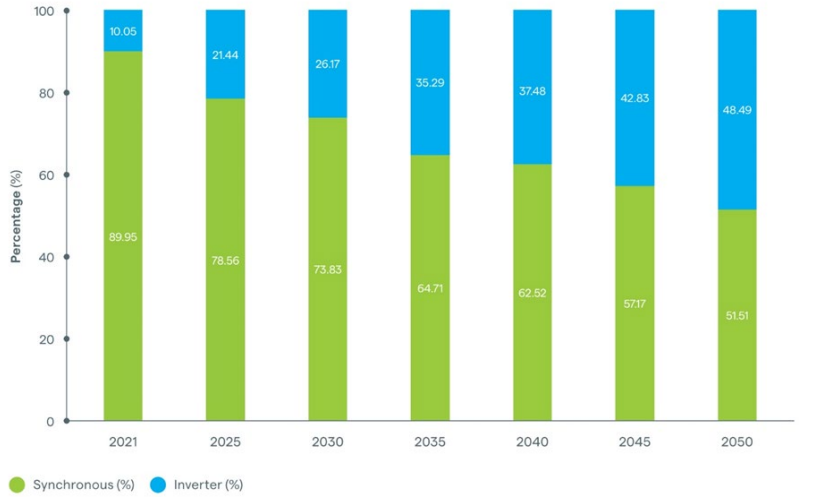
Reviewed existing studies

- Wind, Solar PV, BESS, EVs, Inertia & System Strength

Lessons learned from other jurisdictions

- Australia, Great Britain, Ireland, Hawaii, Singapore





Future Security and Resilience report findings

Opportunities and challenges	Timeframe	Priority
Enabling DER services for efficient power system operations	3-7 years	Medium
Visibility and observability of DER	3-7 years	Medium
Coordination of increased connections	0-3 years	High
Balancing renewable generation	3-7 years	Low
Managing reducing system inertia	7-10 years +	Low
Operating with low system strength	3-7 years	Medium
Accommodating future changes within technical requirements	0-3 years	High
Leveraging new technology to enhance ancillary services	Enduring	Medium
Maintaining cyber security	Enduring	High
Growing skills and capabilities of the workforce	Enduring	High

Rise of Distributed Energy Resources Changing generation portfolio Foundational opportunities and challenges

The rise of DER

The challenges of a changing generation portfolio

Foundational

High Priority = already negatively impacting on FSR and/or given level of understanding or effort to address means it needs immediate attention

Medium Priority = no immediate negative impact on FSR but investigation required

Low Priority = not likely to impact on FSR however will be monitored for changes in priority/urgency over time

Q&A

1. Any questions on approach to identifying opportunities and challenges?

2. Any other questions on the Phase 1 work?

Draft FSR roadmap (Phase 2)

Opportunity or challenge		Activity		Primary enabler	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027	Year 6 2028	Year 7 2029	Year 8 2030	Year 9 2031	Year 10 2032	Outcome
Accommodating future changes within technical requirements	7.1	Review and update Part 8 of the Code		System Operator, EA											Parts 8, 6, 7, 13, 14 of the Code will be updated to incorporate the capability and performance of new technologies and changes in the power system. Harmonics standards and other engineering standards, modelling and testing standards will take into account the introduction of new technologies. The Policy Statement and any other policies, procedures, guidelines and tools will also be updated accordingly.
	7.2	Review and update Parts 6, 7, 13 and 14 of the Code to ensure they align to Part 8													
	7.3	Identify standards to support technical requirements in the Code		Industry											
	7.4	Update the Policy Statement to manage emerging risks		System Operator, EA											
	7.5	Update the System Operator's policies, procedures, guidelines and tools		System Operator											
Coordination of increased connections	3.1	Update Grid Owner and System Operator commissioning processes and benchmark agreement		System Operator, Grid Owner											All System Operator and distributor processes will be updated to accommodate increased connections. The Grid Owner, EDBs and the System Operator will have the resources and capability to commission DER. Updated market tools, real-time operational tools and study tools will reflect the behaviour and capability of DER.
	3.2	Review the approach to planning connection studies													
	3.3	Review and update market and real-time operational tools		System Operator											
Operating with low system strength	6.1	Investigate system strength challenges and opportunities		System Operator											System strength performance criteria will be defined and established. The regulatory framework will be updated to include technical requirements for system strength. Relevant market products, operational procedures and tools will be in place.
	6.2	Amend the Code to require DER to support performance criteria		System Operator, EA											
	6.3	Develop suitable market products and tools		System Operator											
Enabling DER services for efficient power system operations	1.1	Enhance the Code and market system dispatch capability to accommodate DER offers		System Operator											The Code will define the technology agnostic role of DER. The market system will accept offers from DER owners, and operational tools and procedures will assess and dispatch DER. Electricity markets, the Grid Owner, EDBs and the System Operator will send efficient signals to DER. Grid exit point aggregation and participation of third-party flexibility traders will be enabled.
	1.2	Improve real-time security modelling and dispatch tools													
	1.3	Investigate DER functions to support the grid													
Visibility and observability of DER	2.1	Establish the impact of DER		System Operator											The impact of high levels of DER will be understood and managed. The regulatory framework will accommodate a high degree of DER uptake. Operational requirements will be established between the System Operator and distributors/DSOs.
	2.2	Determine the risk DER poses to the system													
	2.3	Update the Code to clarify DER obligations and operational requirements		System Operator, EA											
	2.4	Update procedures and tools to include DER asset information		System Operator											
Balancing renewable generation	4.1	Improve market system and generation/demand forecast		System Operator											The market system, operational procedures and tools will allow the scheduling and dispatching of renewable generation. Intermittent generation offers and the System Operator's demand forecast will be efficient and accurate. New or revised ancillary services will effectively manage active power imbalances.
	4.2	Consider new or revised ancillary services to maintain balancing													
Managing reducing system inertia	5.1	Create a frequency reserve strategy		System Operator											A frequency reserve strategy will be created. The updated Procurement Plan and testing methodologies will support assessment and procurement of new reserve types. Operational procedures and tools will be ready to dispatch new reserve types.
	5.2	Ensure that the Code and the market system can accommodate new reserve types													
	5.3	Incorporate new reserve types in the Procurement Plan and testing methodology													
	5.4	Update operational procedures and tools													
Leveraging new technology to enhance ancillary services	8.1	Investigate ancillary services		System Operator											The regulatory framework, engineering standards and procedures will be updated to reflect the capability and performance of new technologies and other changes within the power system. The Code will enable new technologies to offer ancillary services, and the System Operator's processes and tools will allow new technologies to accept offers and dispatch ancillary services. Studies will identify whether and when new ancillary services products are needed.
	8.2	Ensure tools monitor the performance of the power system													
	8.3	Update market system to enable DER to provide existing ancillary services													
Maintaining cyber security	9.0	Continually review and update cyber security measures		New Zealand energy sector											The energy sector's approach to the management of cyber security will be robust and well coordinated.
Growing skills and capabilities of the workforce	10.0	Encourage and train the workforce's next generation		Industry, educational institutions, professional associations											New Zealand will be able to produce its own workforce, with minimum reliance on overseas talent.

Rise of Distributed Energy Resources Changing generation portfolio Foundational opportunities and challenges

Future Security and Resilience 7: Accommodating future changes within technical requirements

Problem description

Timeframe	Current capability	Rationale
In 0–3 years	The Code, technical standards and operational procedures are based on a centralised generation model and a high proportion of synchronous generation.	**Won't be adequate because:** Increasing uptake of DER and IBR will change the direction of power flow and the behaviour of the system, rendering the Code, standards and procedures not fit-for-purpose.

Opportunity statement

What is the change required?	Why is it required?	Which Electricity Authority strategic priority does this outcome enable?	Who will be impacted?
Review and update the Code and ensure alignment of all other standards, operating procedures, processes and practices	To ensure assets are dispatched and the power system is operating in a secure and efficient manner	Trust and confidence Low-emissions energy Thriving competition	Ancillary service agents Ancillary service providers Asset owners Distributors Electricity Authority Grid Owner System Operator

Outcome

Measurable objective	Timeframe
To complete our goal, the future state needs to look like: Parts 8, 6, 7, 13 and 14 of the Code will be updated to incorporate the capability and performance of new technologies and changes in the power system. Harmonics standards and other engineering standards, modelling and testing standards will take into account the introduction of new technologies. The Policy Statement and any other policies, procedures, guidelines and tools will be updated accordingly.	**By** 2025

Benefits

What will this improve and what benefits will be introduced?	Risks?		Interdependencies
Use of new-generation technologies will be optimal and efficient, ensuring the system remains secure and maintaining the quality of the supply.	**Risk of action:** Code and technical standard updates that are not inclusive and flexible enough to support evolving technology; a resulting need for ongoing amendments	**Risk of inaction:** Insecure system operation and inefficient market operation, affecting the security, quality and cost of electricity supply Operation being constrained by outdated regulation	FSRs 1, 3 and 8

Governance

Business owner	Delivered by	Priority indicator
Electricity Authority, Grid Owner, System Operator, distributors and Electricity Engineers' Association (EEA)	TAS, project team and BAU	Emerging technologies Connections requests System behaviours

FSR 7.1: Accommodating future changes within technical requirements – Review and update Part 8 of the Code

Problem description

Timeframe	Current capability	Rationale
In 0–2 years	The technical requirements and asset owner performance obligations in set out in Part 8 of the Code only support the operation of the present system, which features high levels of synchronous generation technology.	**Won't be adequate because:** Increasing uptake of new generation technology will require new technical requirements and asset owner performance obligations.

FSR 7.2: Accommodating future changes within technical requirements – Review and update Parts 6, 7, 13 and 14 of the Code to ensure they align to Part 8

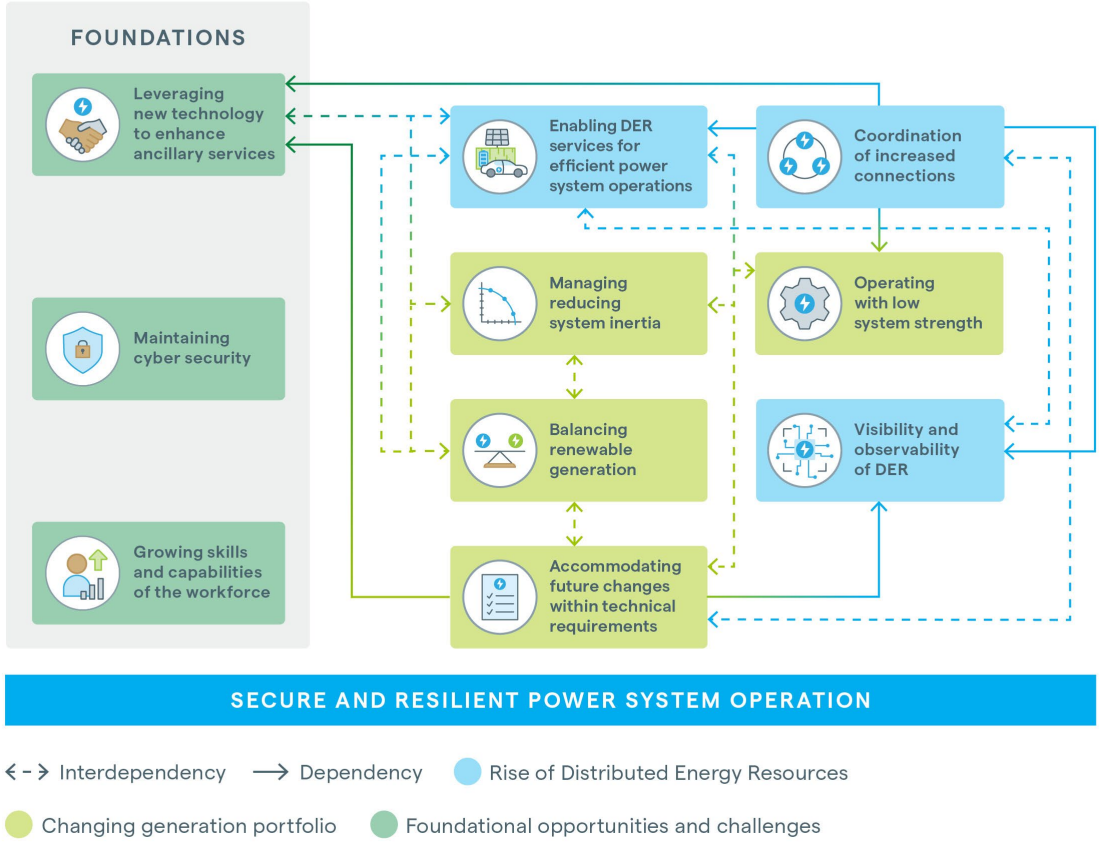
Problem description

Timeframe	Current capability	Rationale
In 1–3 years	The Code is tailored to a power system characterised by a high degree of centralised generation and passive loads.	**Won't be adequate because:** Increasing uptake of DER will change the generation profile of the system. The Code needs to reflect this, to allow maximum use of DER (for example, through participation in the system operation and provision of ancillary services).

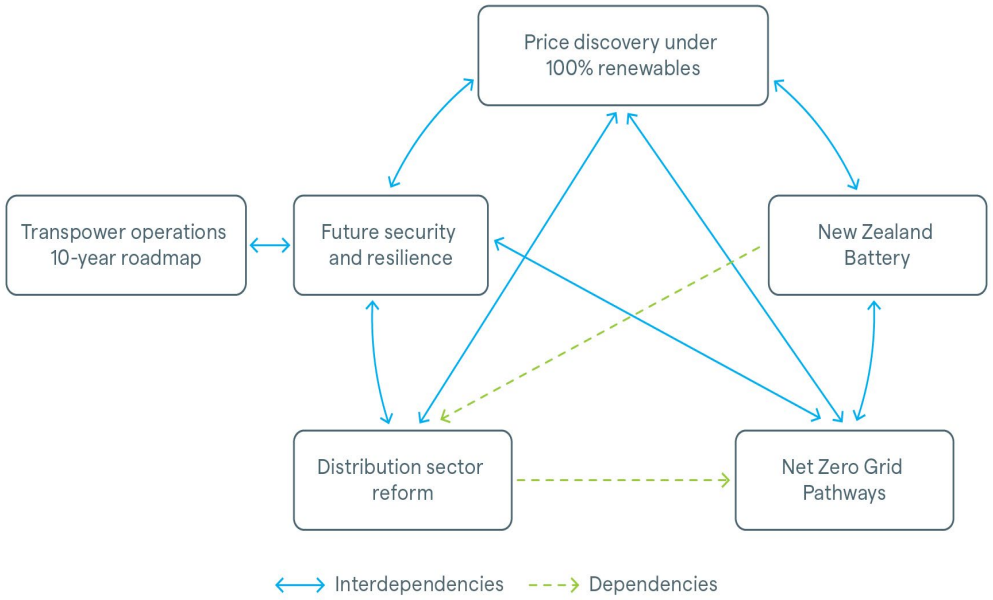
Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
FSR 7 – Overall outcome	✓	✓	✓							
FSR 7.1 – Review and update Part 8 of the Code	✓	✓								
FSR 7.2 – Review and update Parts 6, 7, 13 and 14 of the Code to ensure they align to Part 8		✓	✓							
FSR 7.3 – Identify standards to support technical requirements in the Code	✓	✓	✓							
FSR 7.4 – Update the Policy Statement to manage emerging risks	✓									
FSR 7.5 – Update the System Operator's policies, procedures, guidelines and tools		✓	✓							

Interdependencies

Interdependencies between each opportunity and challenge



Pan-industry interdependencies



Indicators

	Rise of Distributed Energy Resources			Changing generation portfolio				Foundational opportunities and challenges		
	Leveraging DER to build and operate the future grid	Visibility and observability of DER	Coordination of increased connections	Balancing renewable generation	Managing reducing system inertia	Operating with low system strength	Accommodating future changes within technical requirements	Leveraging new technology to enhance ancillary services	Maintaining cyber security	Growing skills and capabilities of the workforce
Why	Monitoring the amount and type of DER available will assist in identifying opportunities to leverage it for system operations	Establishing a measure for DER impact on system performance will enable the risk to be monitored	Monitoring connection requests will identify emerging risks	Monitoring existing system performance as intermittent generation increases will enable the risk to be monitored	Monitoring existing system performance as the proportion of synchronous generation reduces will enable the risk to be monitored	Establishing a measure for impact of system strength on system performance will enable the risk to be monitored	Ongoing monitoring of system performance and types of connection requests will enable gaps in technical requirements to be identified	Monitoring the number and type of connections, and amount and type of DER will assist in identifying technologies which could be used to enhance ancillary services	Monitoring cyber security events will assist in identifying if this risk is increasing or evolving over time	Monitoring the number and type of skilled resource vacancies to assess if this challenge is increasing or evolving over time
What (Measures)	Number and type of DER installations	TBC pending investigation	Number, location and type of connection requests	Number of frequency and voltage excursions outside acceptable limits	Number of instances where Rate of change of frequency exceeds 0.8 Hz per second for a CE contingency	TBC pending investigation	System performance Number and type of connections requests	Number and type of connection requests Number and type of DER installations	Number and type of cyber security incidents	Number of vacancies for given technical roles
Key	Grid level					Industry wide				

Q&A

1. Any questions on how the roadmap has been developed?
2. Any questions on the timeline / priorities in the roadmap?
3. Any questions on the outcome proposal format?
4. Any questions on interdependencies?
5. Any questions on indicators?

Next steps

- Any written feedback to be provided by 5pm on 10 May (feedback will published unless otherwise requested)
- Stakeholder feedback received will inform updates and revisions to the Phase 2 draft roadmap
- Joint development programme to commence from mid 2022
  - Activities will be subject to prioritisation across other Authority initiatives promoting competition, reliability and efficiency
- All updates on the programme are published in the Electricity Authority Market Brief

Thank you

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