Updating the Regulatory Settings for Distribution Networks

Improving competition and supporting a low emissions economy

Discussion paper

July 2021

Market Policy

Statement from the Chair

The Government's aspirations to reach net zero emissions by 2050 and 100 percent renewable electricity generation by 2030 are ambitious. The accelerated pace of change required to meet this target is unprecedented and difficult to navigate.

To support increased electrification of heat and transport we will see a rate of energy infrastructure investment not seen before in this country – including new renewable generation, and transmission and distribution network infrastructure. But we can't just build our way to 100 percent renewables. It's too expensive and will take too long.

The key to a successful and affordable transition is efficient investment in new generation and innovation to drive participation and creative local solutions. Distributors are at the centre of this.

Distribution networks have a critical role to play in supporting New Zealand's transition to a low emissions economy through their infrastructure that connects electricity users with electricity producers and maintaining the reliability of electricity supply. As the country transitions, electrification of transport and process heat will create a substantial increase in electricity demand going through distribution networks. Consumers will use more distributed energy resources (DER) such as solar panels, electric vehicles and batteries and there will be more connections to the grid.

Empowered consumers will take control of their energy and participate in the electricity system in new ways. It is critical that products and services provided to consumers by the competitive parts of the sector evolve to meet changing consumer needs. It is critical that system settings enable innovation to occur, and that existing participants are disciplined by strong competitive pressure to continue to deliver what customers want and need at an affordable price.

In addition to the competition issues around DER, we are also looking other issues related to distribution networks that have previously been raised by participants such as access to information, more efficient price signals, and reliability challenges arising from managing two-way power flows on distribution networks.

The Authority's aim is to have the right regulatory settings in place to promote competition and access to the distribution network to better support the transition to a low-emissions future at the pace required.

How is your business innovating right now to support New Zealand's transition to a low-emissions future?

Dr Nicki Crauford

Chair, Electricity Authority

Executive summary

The Electricity Authority's (Authority's) objective is to promote competition in, reliable supply by, and the efficient operation of the electricity industry for the long-term benefit of consumers. We want your views on changes to the regulation of the distribution networks that may be needed to:

- support an affordable transition to a low emissions economy
- ensure consumers benefit from the changes in technology and innovation happening now.

New technology is transforming distribution networks

The electricity industry is changing. Household, business, and industrial consumers have more options and control than ever before. Technologies such as solar panels, batteries and electric vehicles mean consumers can produce and store their own electricity. Smart controls for equipment and appliances, such as 'smart' hot water cylinders, allow consumers to more easily control when and how they use electricity.

The technologies used to generate, store, or manage energy are referred to as distributed energy resources (DER). As well as buying electricity, consumers can participate in the market as sellers of electricity and related services.

New technology is also providing some consumers with more choice. New and existing suppliers are competing to win customers by offering innovative products and services that reflect consumer preferences. The result will be a change to the decades-old electricity supply model dominated by large-scale and specialised electricity businesses.

Distribution networks have a critical role to play in supporting New Zealand's transition to a low emissions economy

The New Zealand Government has a goal of net zero emissions by 2050 and 100 percent renewable electricity generation by 2030. Electrification of transport and process heat will require a substantial increase in electricity demand.

Electricity distribution businesses (distributors) provide the network infrastructure that connects most electricity consumers with electricity producers. Distributors are also responsible for connecting and integrating DER to the network while maintaining supply reliability.

Where DER can be controlled, ie., output or consumption can be turned up or down on demand, it is referred to as flexibility services. An increase in flexibility services can help lower emissions by increasing the amount of renewable energy (RE) generation and load shifting (with batteries and demand response) to reduce peak demand.[1] Reducing peak demand lowers emissions because more fossil fuels are used for electricity generation at peak times when there is not enough RE generation to meet demand.

Flexibility services can create value in multiple ways by being sold to distributors, the system operator, or the grid owner to provide alternatives to:

- building infrastructure that provides new transmission and distribution network capacity

[1] Uncontrolled DER may create value for the owner but is unlikely to be able to provide the grid support options that controlled DER can provide. For example, electricity from a solar panel may be consumed by the owner during the day reducing their electricity bill but cannot be used to shift load at peak times.

- ancillary services, such as instantaneous reserve
- electricity traded in the wholesale spot market.

The economic value of flexibility services through controllable DER is substantially higher if it can be allocated to its highest value use across all markets. While many areas of the electricity sector are important for enabling the full value of DER to be realised, this paper is focused on electricity distribution.

This discussion paper identifies a range of potential issues on distribution networks

Regulation of distribution networks is increasingly complex due to changes in technology and business models. This paper captures the full regulatory environment so that the Authority and stakeholders can understand our regulatory settings within that broader context. To make material progress on matters for which we are responsible, we are required to approach regulation with the perspective of the full regulatory environment surrounding distribution networks. We believe that this will enable us to make most effective use of our tools in this area, while ensuring clarity about issues that are more appropriately addressed by another agency.

This discussion paper:

- identifies potential issues with distribution networks and seeks feedback on whether the right issues have been identified. The issues identified have been informed by previous projects.
- identifies a range of possible options to overcome the issues identified and invites stakeholder feedback on whether there are other interventions that could provide greater benefits for consumers in the long-term.

The issues and options draw from previous work undertaken by the Authority

The Authority has undertaken a substantial programme of work relating to distribution networks. Particularly relevant projects include:

- Enabling Mass Participation[2]
- Spotlight on emerging contestable service (a joint project between the Authority and the Commerce Commission in 2019) [3]
- Equal access (a project carried out by the Innovation and Participation Advisory Group (IPAG) between 2017 and 2019).[4]

Findings from these and other relevant Authority projects have been incorporated into the issues and options identified in this discussion paper. Revisiting areas where we have previously engaged with stakeholders will help extend our understanding as well as allow for widespread consultation and up to date feedback.

We recognise that some interested parties have made submissions on related topics to other government agencies, such as submissions to MBIE on the Electricity Price Review and to the

[2] Electricity Authority: Enabling Mass Participation, 2017
https://www.ea.govt.nz/development/work-programme/evolving-tech-business/enabling-mass-participation/

[3] Commerce Commission/Electricity Authority: Spotlight on emerging contestable services 2019
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/commerce-commissionelectricity-authority-joint-project-spotlight-on-emerging-contestable-services

[4] IPAG: Equal Access 2019
https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

Commerce Commission on its recent open letter.[5] We are cognisant of these submissions but encourage you to re-submit through this process where the issues are still relevant and with the latest evidence.

Many of the options identified in this paper have been considered and are being implemented in other countries

The United Kingdom and Australia, amongst other countries, have already experienced many similar issues facing distribution networks in New Zealand. There are important lessons for New Zealand in international experiences, noting these need to be adapted to New Zealand's unique position and local context.

Competition is likely to deliver long-term benefits for consumers and support the transition to a low emissions economy

DER and other services that connect to the network are contestable services, not a monopoly like distribution networks. Competition in this area can lead to more choice of supplier and type of service for consumers as well as help drive down costs. Additionally, competition is likely to give consumers more options to choose personalised levels of reliability and security of supply.

A cost benefit analysis (CBA) undertaken by Sapere (commissioned by the Authority) estimated that if DER were to realise its potential, the net benefit from 2021 to 2050 is expected to be $7.1 billion in net present value. Of this, $2.3 billion accrues to consumers while $4.8 billion will go to the owners and operators of the DER. A large proportion of this $4.8 billion will also go to consumers as they will be the hosts of DER. These benefits are additional to the benefits expected to occur from DER under the current market and regulatory environment.

That said, more participation is also likely to bring reliability challenges and costs, including those arising from managing two-way power flows on distribution networks.

This paper develops themes to assess the problems and identify and consider options to achieve the outcomes

The themes considered in this paper are:

- **information on power flows and hosting capacity –** distributors need greater visibility of their low-voltage networks to manage reliability and make efficient investment decisions. Third parties also need information on hosting capacity to make informed business decisions and compete on a level playing field.
- **electricity supply standards** – additional standards may be needed to address a range of power quality issues associated with increased competition and participation in the flexibility market.
- **market settings for equal access** – competition on the network can be improved by removing barriers to entry and levelling the playing field. Competitive flexibility markets can improve efficiency and decrease overall costs for consumers.
- **operating agreements** – the costs of developing and negotiating contracts for flexibility services is high for both flexibility traders and distributors. Distributors also

[5] New Zealand Government: Electricity Price Review, Final Report, 2019
https://www.mbie.govt.nz/assets/electricity-price-review-final-report.pdf#page=77
Commerce Commission: Open letter—ensuring our energy and airports regulation is fit for purpose, 2021
https://comcom.govt.nz/__data/assets/pdf_file/0022/253561/Open-letter-Ensuring-our-energy-and-airports-regulation-is-fit-for-purpose-29-April-2021.pdf

have a stronger negotiating position as a natural monopoly, which could deter flexibility traders from entering the market and reduce competition.

- **capability and capacity** – some distributors may not have the capability and/or capacity to coordinate and integrate DER which could lead to not all consumers benefiting from new technologies and innovation on distribution networks.
- **efficient price signals** – pricing can affect how consumers use electricity, how distributors and others manage load, when distributors invest in new (or replacement) network assets, and the timing, level, and location of investments in new technology by consumers and sector participants. This paper does not seek feedback on pricing as the Authority is undertaking a separate programme of work on faster reform to implement efficient distribution pricing.

Different options will be considered based on the size of the issue and the opportunity. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by the feedback received from stakeholders in submissions on this paper.

Feedback received will help refine and prioritise issues and options

The main body of this paper poses questions for stakeholders on each theme. Instructions for making a submission are set out in Appendix A. The Authority will consider all submissions made and publish all submissions along with a summary of the insights that we have gained.

The Authority will assess specific options that fall within our jurisdiction and a preferred option will be identified based on net benefits. The preferred option will then be released for further consultation.

Submissions on options that fall within the jurisdiction of another government agency (for example, those that come under the Commerce Commission's jurisdiction), will be shared with the relevant government agency. However, other government agencies have their own review processes, including consultation processes, so any submissions on options that fall within their jurisdiction should also be raised in those processes.

Contents

Tables

Figures

1 Introduction

1.1 The New Zealand Government has a goal of 100 percent renewable electricity generation by 2030. Electrification of transport and process heat will create a substantial increase in electricity demand.

Distribution networks have an important role to play in supporting New Zealand's transition to a low emissions economy

1.2 Distributors help provide the infrastructure that connects electricity users with electricity producers. An increase in distributed energy resources (DER) – including distributed generation, batteries, EV charging, and demand response – will help lower emissions. Distributors are responsible for connecting and integrating DER to the network while maintaining the reliability of the network.

1.3 Several agencies have expressed views on the importance of distribution networks in supporting the transition to net zero.

1.4 The Climate Change Commission recommends that the Government commits to delivering an energy strategy that includes:

"Supporting the evolution to a low-emissions electricity system fit for technology evolution. This should include work to increase the participation of distributed energy resources including demand response, and determining whether lines companies can integrate new technologies, platforms, and business models by:

a) Assessing whether they have the necessary capacity and capabilities to support climate resilience and the transition

b) Evaluating whether the current regulatory environment and ownership structures of lines companies are fit for future needs."[6]

1.5 Transpower's "Whakamana i Te Mauri Hiko" report states that New Zealand's 29 distributors:

"*must ensure they invest adequately in order to be ready to deliver a markedly different energy future – one in which electric vehicles must be able to shift energy consumption away from peaks*"[7]

1.6 The Infrastructure Commission (Infracom) have also just released their Aotearoa New Zealand Infrastructure Strategy Consultation Document. Infracom have stated that action is needed to:

"*Enable electricity distribution networks to minimise barriers to the connection and use of large numbers of local generation, storage and demand response facilities (distributed energy resources or DERs)*"[8]

1.7 In addition, the Commerce Commission recently released an open letter seeking views on the emerging issues for electricity networks as they relate to Part 4 of the Commerce

[6] Climate Change Commission:Ināia tonu nei: a low emissions future for Aotearoa, 2021

[7] Transpower: Whakamana I Te Mauri Hiko Empowering our Energy Future, 2020. https://www.transpower.co.nz/resources/whakamana-i-te-mauri-hiko-empowering-our-energy-future

[8] New Zealand Infrastructure Commission: He Tūāpapa ki te Ora Infrastructure for a Better Future: Aotearoa New Zealand Infrastructure Strategy Consultation Document, May 2021. https://infracom.govt.nz/assets/Uploads/Infrastructure-Strategy-Consultation-Document-May-2021.pdf

Act 1986 (Part 4). The open letter was particularly interested in emerging issues that relate to New Zealand's decarbonisation and use of new energy sector technologies and business models (the "energy transition") and the impacts of COVID-19.[9]

We want to ensure regulatory settings support the transition while promoting competition, reliability, and efficiency

1.8 Appropriate regulatory settings for distribution networks are needed to ensure the transition to a low-emissions economy is as efficient as possible while maintaining energy security, system adaptability and affordable electricity for consumers. Appropriate settings include improving competition for contestable services by removing barriers to entry and levelling the playing field.

1.9 Ultimately New Zealand needs to have the right amount of renewable electricity generation in the right place at the right time to support a successful transition to a low emissions economy. To support increased electrification of heat and transport, and further development of renewable generation, the Authority needs to promote competition through a stable investment environment with robust rules and clear price signals. Predictable, consistent, and evidence-based regulatory settings are critical to achieve this.

The benefits of updating the regulatory settings could be substantial across all consumer groups

1.10 Increased competition can lead to more choice of supplier and type of service for consumers as well as help drive down costs. That said, more participation is also likely to bring reliability challenges and costs, including those arising from managing two-way power flows on the distribution network.

1.11 Distribution pricing also plays a critical role in achieving benefits for consumers. Efficient pricing is the subject of a separate discussion paper on how to drive faster reform.

1.12 A cost benefit analysis undertaken by Sapere estimated that if DER were to realise its potential, the net benefit from 2021 to 2050 is expected to be $7.1 billion in net present value. Of this, $2.3 billion accrues to consumers while $4.8 billion will go to the owners and operators of the DER. A large proportion of this $4.8 billion will also go to consumers as they will be the hosts of DER. These benefits are additional to the benefits expected to occur from DER under the current market and regulatory environment.

This discussion paper is intended to draw out views and evidence on issues and options on distribution networks

1.13 This discussion paper:

- identifies potential issues with distribution networks and seeks feedback on whether the right issues have been identified. The issues identified have been informed by previous projects.
- identifies a range of possible options to overcome the issues identified and invites stakeholder feedback on whether there are other interventions and preferred direction.

[9] Commerce Commission: Open letter—ensuring our energy and airports regulation is fit for purpose, 2021 https://comcom.govt.nz/__data/assets/pdf_file/0022/253561/Open-letter-Ensuring-our-energy-and-airports-regulation-is-fit-for-purpose-29-April-2021.pdf

1.14 This paper captures the full regulatory environment, so that we can understand our regulatory settings within that broader context. Regulation of distribution networks is complex. To make material progress on matters that we are responsible for we are required to approach regulation with the perspective of the full regulatory environment surrounding distribution networks.

The issues and options draw from previous relevant work undertaken by the Authority

1.15 The Authority has undertaken a substantial programme of work relating to distribution networks. Particularly relevant projects include:

- Enabling Mass Participation (2017) – looked at promoting innovation and participation across the electricity supply chain. Enabling mass participation led to multiple subsequent projects including Equal Access, project Spotlight, Open Networks, and Multiple Trading Relationships.[10]
- Spotlight on emerging contestable service (2019) - the Authority and the Commerce Commission jointly consulted on the extent to which distributors participation in contestable electricity services is benefitting consumers. The findings are included in the perceived issues sections. Consulting on the issues again will provide us with an updated view on changes that may have occurred in the last two years.[11]
- Equal access (2017-2019) - carried out by the Innovation and Participation Advisory Group (IPAG), equal access highlighted problems and made recommendations on an equal access framework for transmission and distribution networks that would promote competition, efficiency, and reliability. However, IPAG's work was not widely consulted on. IPAG's findings are included as issues and options in this discussion paper to get stakeholder feedback.[12]

1.16 The Authority's work on multiple trading relationships, standards, access agreements, and information disclosure is also drawn from in the issues and options development of this discussion paper.

Many of the options identified in this paper have been considered and are being implemented in other countries

1.17 The United Kingdom and Australia, amongst other countries, have already experienced many of the issues facing distribution networks in New Zealand. There are important learnings that New Zealand can draw from, while also considering New Zealand's unique position and local context.

1.18 This discussion paper sets out the vision for distribution networks (Section 2) and background information on distribution networks (Section 3). The paper then groups issues and option into six themes to assess issues and options:

- information on power flows and hosting capacity (Section 4)
- electricity supply standards (Section 5)

[10] Electricity Authority: Enabling Mass Participation, 2017
https://www.ea.govt.nz/development/work-programme/evolving-tech-business/enabling-mass-participation/

[11] Commerce Commission/Electricity Authority: Spotlight on emerging contestable services 2019
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/commerce-commissionelectricity-authority-joint-project-spotlight-on-emerging-contestable-services

[12] IPAG: Equal Access 2019
https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

- market settings for equal access (Section 6)
- operating agreements (Section 7)
- capability and capacity (Section 8)
- efficient price signals (Section 9).

Feedback received will help refine and prioritise issues and options

1.19 The main body of this paper poses questions for stakeholders on each theme. Instructions for making a submission are set out in Appendix A. The Authority will consider all submissions made and present them back to stakeholders along with a summary of the insights that we have gained.

1.20 The Authority will assess specific options that fall within our jurisdiction and a preferred option will be identified based on net benefits. The preferred option will then be released for further consultation.

1.21 Submissions on options that fall within the jurisdiction of another government agency (for example, those that come under the Commerce Commission's jurisdiction), will be shared with the relevant government agency. However, other government agencies have their own processes, including consultation processes, so any submissions on options that fall within their jurisdiction should also be raised in those processes.

2 Our vision for distribution networks

2.1 At the centre of our vision is the Authority's statutory objective to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers. Consumers include individuals, households, communities, small, medium, and large businesses, and industrial consumers.

2.2 The focus on competition, reliability and efficiency on distribution networks can lead to the following benefits to consumers:

- lower electricity prices
- improved reliability
- more control of bills and energy use
- greater choice and autonomy for electricity supply
- greater certainty about future electricity costs
- more information on consumption
- better understanding of how to optimise electricity use
- the ability to sell generation and discharge batteries into the grid
- the ability to support a low emissions economy.

An update to the regulatory settings on distribution networks may be needed to support the transition to a low emissions economy

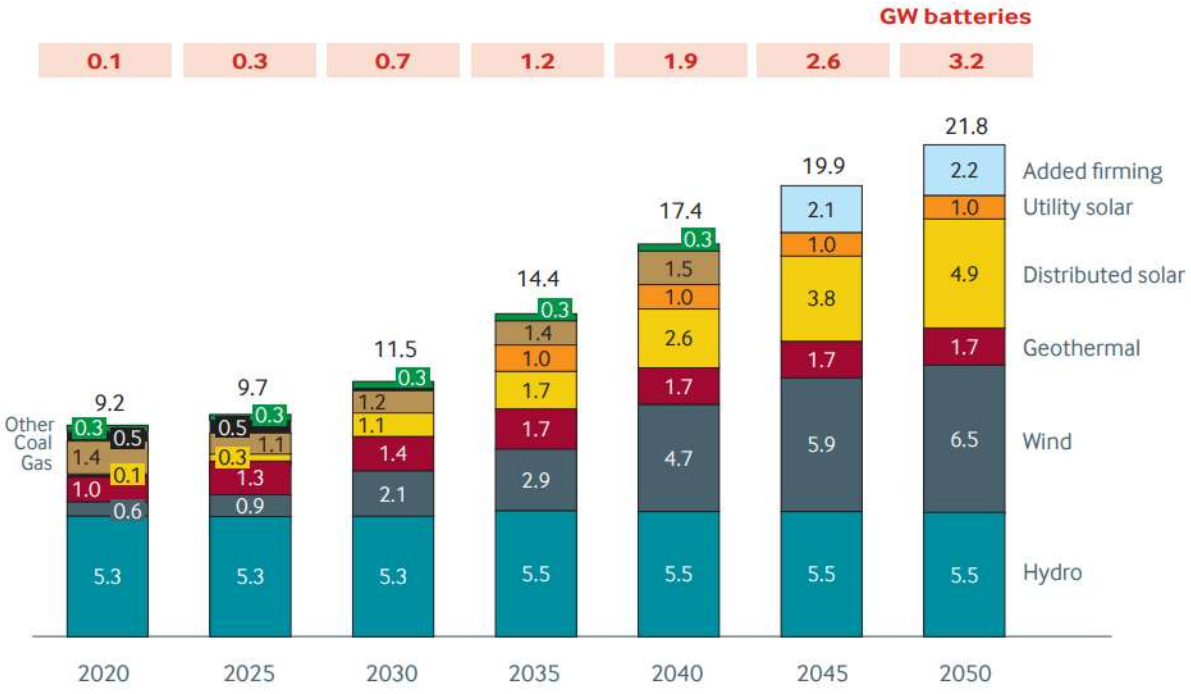
2.3 Electrification is a key enabler in the transition to a low emissions economy. We need to promote a stable investment environment with robust rules and clear price signals to unlock the potential for more renewable generation and ensure the transition is as efficient as possible.

2.4 Figure 1 presents Transpower's forecast of electricity generation capacity by type over time to 2050. Distributed solar PV generation is estimated to increase from 0.1GW in 2020 to 4.9GW in 2050.[13]

2.5 As New Zealand's demand peak is in the evening, distributed solar is less economically attractive to consumers unless deployed alongside battery storage. Transpower forecasts partial parallel deployment of distributed solar with battery capacity.

[13] Transpower: Whakamana I Te Mauri Hiko, Empowering our Energy Future, 2020. https://www.transpower.co.nz/resources/whakamana-i-te-mauri-hiko-empowering-our-energy-future

Figure 1: Generation capacity by type (Whakamana i Te Mauri Hiko)



2.6 As well as distributed solar and batteries, other types of distributed generation, EV charging and demand response all make up the DER that is forecast to increase.

2.7 Throughout this paper, we refer to *controllable* DER as flexibility services. Flexibility is the modifying of generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system.

2.8 DER can be owned by consumers but can also be owned and/or operated by third parties or distributors. An emerging model is for consumers to own DER but to then contract a flexibility trader to operate the DER in a way that optimises its use. The flexibility trader then sells flexibility services to the distributor. Alternatively, flexibility traders can own the DER installation and charge the consumer (householder) a monthly rental. This is the business model of solarZero.

Sector participants need the ability and the incentives to make efficient investment decisions

2.9 The outcome of the update relies on sector participants having the ability, information, and the incentives to make efficient investments in both network and non-network solutions. Non-network solutions include investing in DER, rather than upgrading the network.

2.10 Changes to the market settings are needed to facilitate efficiency and innovation, in particular:

- visibility and transparency between buyers and sellers of flexibility to inform long- and short-term investment and operational decision making
- flexible solutions need to be able to realise the true value of their flexibility
- market structures or signals are needed to make it simpler for providers to combine value streams

2.11 Avoiding or deferring network upgrades through DER can decrease the costs of distribution, lowering the end bill to consumers. DER can also improve security as it can decrease reliance on the centralised system.

Thriving competition delivers better outcomes for New Zealanders

2.12 Market competition is a key enabler to deliver a better energy future. We are committed to encouraging participation by putting in place the mechanisms needed to maintain a level playing field. A level playing field is where all parties using the network can be confident that they will be treated equally and receive efficient and non-discriminatory terms to use the network.

2.13 Although distribution networks are a natural monopoly, the market for DER and flexibility services is not. Adopting a market-based approach to getting network support (like flexibility) will deliver significant long-term benefits for consumers. For example:

- relying on third parties allows distributors to avoid the lock-in costs of infrastructure which gives them more flexibility to adapt to the changing environment
- competition between network support providers will encourage greater innovation. Over time this will mean that network business will be able to benefit from new and more efficient ways of providing network support from greater innovation in the market
- consumers will have more choice of supplier and type of service.

2.14 That said, more participation is also likely to bring reliability challenges and costs, such as those arising from managing two-way power flows on the distribution network.

Security and reliability of electricity supply is vital

2.15 As new smart technologies and solutions emerge, distributors and the energy market will have a more diverse range of options for delivering electricity. Systems will be more complex and more driven by data and communication technologies. Reliability and security of supply will need to be managed as distribution networks adapt to new power flow patterns.

2.16 Standards may be needed to decrease the risk that DER infrastructure, particularly inverter/chargers with conflicting settings, adversely affects supply reliability and power quality for other consumers.

Themes have been developed to assess potential issues and identify and consider options to achieve the outcomes

2.17 To improve competition and achieve outcomes for consumers, six themes have been developed to assess the potential issues and identify and consider options:

- **information on power flows and hosting capacity –** distributors need greater visibility of their low-voltage networks to manage reliability and make efficient investment decisions. Third parties also need information on hosting capacity to make informed business decisions and compete on a level playing field.
- **electricity supply standards** – additional standards may be needed to address a range of power quality issues associated with increased competition and participation in the flexibility market.

- **market settings for equal access** – competition on the network can be improved by removing barriers to entry and levelling the playing field. Competitive flexibility markets can improve efficiency and decrease the overall costs for consumers.
- **operating agreements** – the costs of developing and negotiating contracts for flexibility services is high for both flexibility traders and distributors. Distributors also have a stronger negotiating position as a natural monopoly, which could deter flexibility traders from entering the market and reduce competition.
- **capability and capacity** – some distributors may not have the capability and capacity to coordinate and integrate DER which could lead to not all consumers benefiting from new technologies and innovation on distribution networks.
- **efficient price signals** – pricing can affect how consumers use electricity, how distributors and others manage load, when distributors invest in new (or replacement) network assets, and the timing, level, and location of investments in new technology by consumers and sector participants. This paper does not seek feedback on pricing as the Authority is undertaking a separate programme of work on faster reform to implement efficient distribution pricing.

2.18 The themes are all interrelated and the options assessment will need to consider packages and staging of options across the themes to maximise the long-term benefits to consumers.

2.19 Many of the themes are focused on facilitating competition in flexibility markets. Distribution standards may need to be in place before the mass uptake of DER that is expected from more participation. Standards can help address a range of supply security, reliability and power quality issues associated with more DER connecting to low voltage distribution networks. Putting standards in place before mass uptake of DER will be easier and less costly than doing it retrospectively. Once power quality issues occur, they can be costly to fix.

2.20 Information on power flows and hosting capacity[14] can impact competition if only some entities have access to the information, or different entities have access on different terms. To avoid negative impacts on competition, options for improving information access will need to be considered alongside options to improve competition.

2.21 In addition, options for ensuring distributors are well placed for network transformation (considered under capability and capacity) should be considered alongside procurement templates and operational agreements.

2.22 Other dependencies and complementary options will be considered in more detail during the options assessment.

[14] The amount of new distributed generation or consumption (e.g., to charge electric vehicles) that can be connected to an electricity network, without diminishing the reliability or voltage quality for other network users, is referred to as the 'hosting capacity' of the network.

3 Background information

3.1 This chapter contains background information on distribution networks in New Zealand, including:

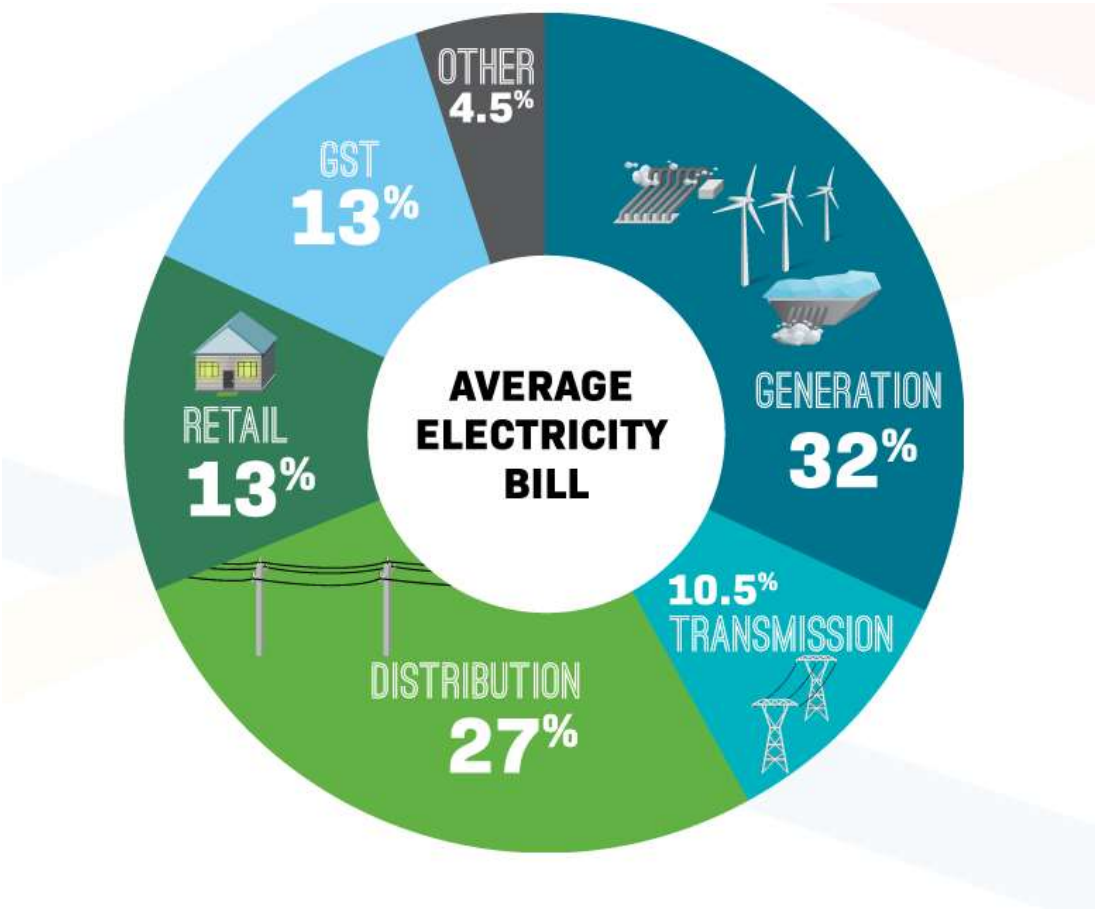
- key features of distribution networks
- regulatory framework
- terminology for flexibility markets.

New Zealand has 29 regional electricity distribution businesses

3.2 The distribution of electricity refers to the power poles and lines that feed electricity to and from consumers and distributed generators. There are 29 distribution companies in New Zealand. They provide and maintain the local power networks that carry electricity via power poles and lines from the national transmission grid to homes and businesses. Many distributors are owned and operated by community owned trusts or local authorities. Of the 29 networks, Vector is the largest with over 25 percent of all Installation Control Points (ICPs).

3.3 On average, distribution accounts for around 27 percent of your electricity bill, so it is important that the costs of distributors' networks are carefully managed.[15]

Figure 2: Average electricity bill



[15] Electricity Authority, My power bill
https://www.ea.govt.nz/consumers/my-electricity-bill/

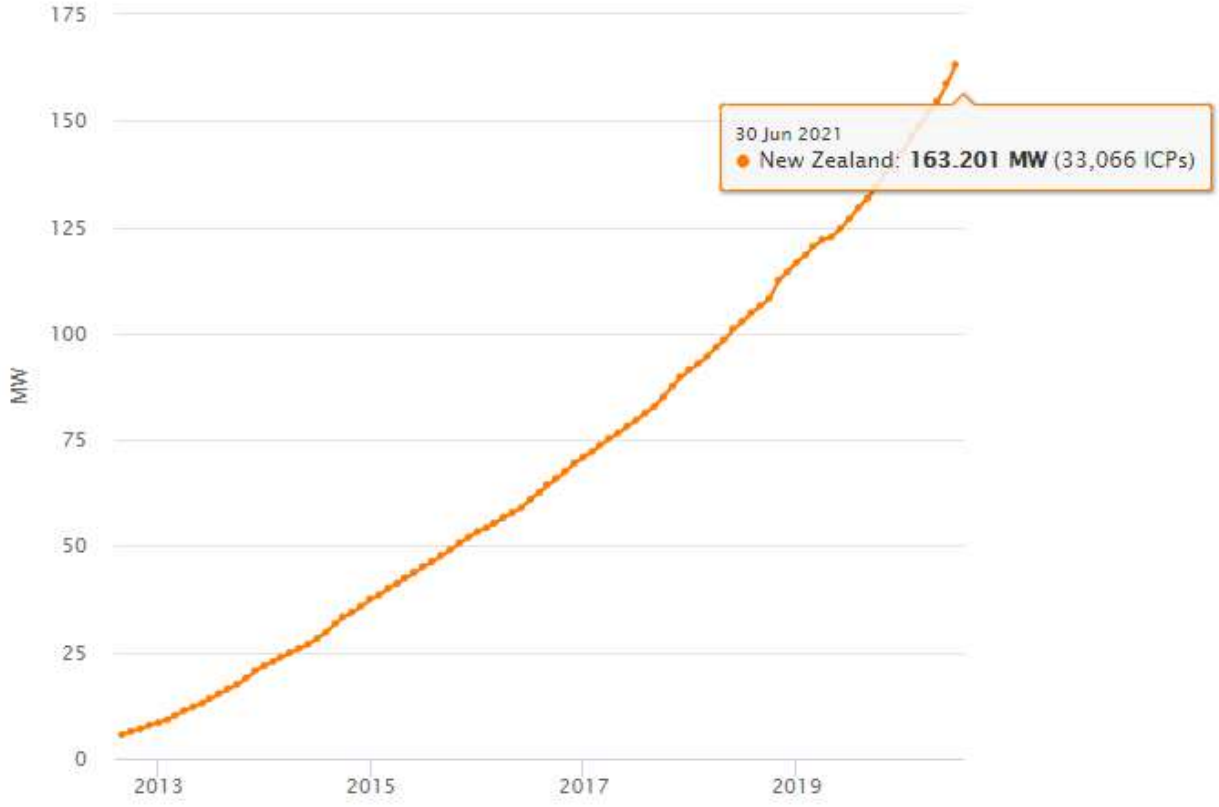
3.4 Electricity distributors in New Zealand are natural monopolies because it is more efficient to have one party provide the poles, lines, substations and other infrastructure associated with transporting electricity in a region.

3.5 In 2020 New Zealand's distribution sector operated over 155,000 circuit kilometres of distribution lines with a regulated asset value of $13 billion. On average the sector delivered around 33 terawatt hours (TWh) of electricity to a little over 2.2 million connections, with an annual regulated profit of around $774 million. Total sector capital and operating expenditure is $1.9 billion.

Distributed generation

3.6 Distributed generation is any form of generation connected to a distribution network, whether directly or indirectly via a consumer's electrical installation. Of the distributed generation types, solar photovoltaic (solar PV or just "solar") has demonstrated the most rapid growth, and now represents 163 MW across 33 thousand ICPs. Figure 3 shows the increase in distributed solar generation since 2013.[16]

Figure 3: Installed distributed generation – Solar total capacity installed



3.7 Other installed distributed generation consists of 330MW of wind, 300MW of hydro, and 135MW of various other fuel types. There is an unknown amount of distributed battery resource installed. Distributed generation is forecast to significantly increase in the coming decades as set out in Figure 1.

Recent performance trends

[16] Electricity Authority: Electricity Market Information https://www.emi.ea.govt.nz/Retail/Dashboards/5YPBXT?_si=v|2,db|5YPBXT

3.8 The Commerce Commission sets information disclosure requirements for distributors and conducts performance summaries and analysis of the information distributors disclose. A summary of key statistics for all distributors in 2020 is shown in Figure 4. The key findings on the performance of distributors include:

- Profitability has been reasonable – The return on investment across the industry has generally been around five to six percent between 2013 and 2020.
- Lines charges have increased to support investment in infrastructure – Adjusted for inflation, line changes have increased by 1.2 percent per customer per year. An increase in investment in the national transmission network is a key driver of this increase.
- There has been little change to reliability – The average number of outages that each customer experiences has remained similar over time.[17]

3.9 Both Capital and Operating expenditure have increased over the last several years. This likely reflects the periodic nature of lines upgrades, and increased maintenance costs of health and safety compliance.

Figure 4: Performance summaries electricity distributors[18]

	2020 value	5 year trend	3 year CAGR
Regulatory asset base	$13,030m		+3.9%
Regulatory profit	$773.8m		-1.3%
Return on investment	6.83%		-2.8%
Line charge revenue	$2,615.9m		-0.4%
Other income	$21.0m		-5.9%
Customer connections	2,162,333		+1.2%
Energy delivered	32,574 GWh		+1.3%
Peak demand	6,573 MW		+0.5%
Network capacity	22,301 MVA		+1.4%
Capital expenditure	$1,727.3m		+26.2%
Operating expenditure	$690.3m		+4.5%
Capital contributions	$180.6m		+4.8%
Related party transactions	$1,602.5m		+48.3%
Line length	155,169km		+0.5%
Outages - SAIDI	209 minutes		-11.3%
Outages - SAIFI	2.13 faults		-0.4%

3.10 Reliability and interruptions of the distribution network as measured by the System Average Interruption Frequency Index (SAIFI) and the System Average Interruption Duration Index (SAIDI) shows an overall trend since 2013 of slightly more interruptions per customer, and more time with an interrupted service per customer.

[17] Commerce Commission: Trends in local lines company performance, 2020
https://comcom.govt.nz/__data/assets/pdf_file/0018/230517/Trends-in-local-lines-company-performance-17-December-2020.pdf

[18] Commerce Commission: Performance summaries for electricity distributors, 2020.
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/performance-summaries-for-electricity-distributors

Figure 5: SAIDI trend 2013 – 2020[19]

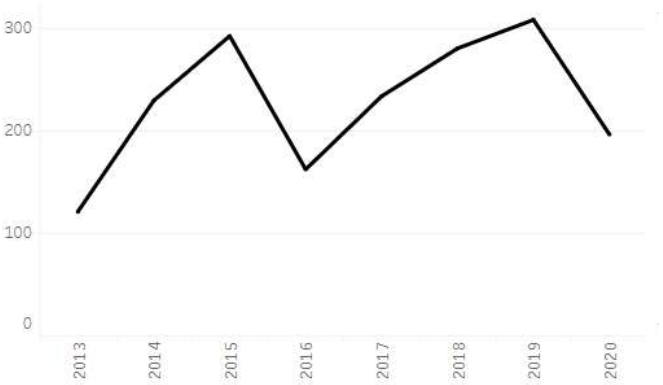
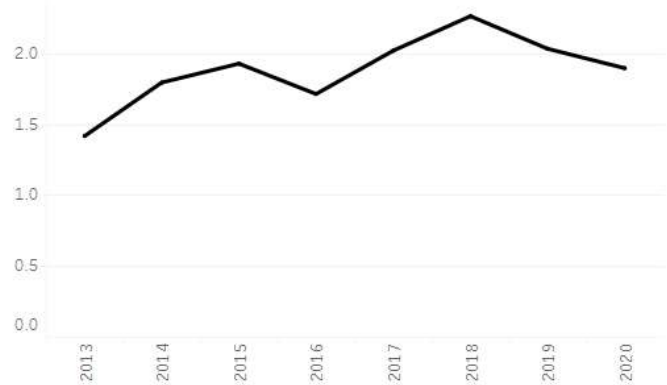


Figure 6: SAIFI trend 2013 - 2020[20]



Distribution networks are regulated by the Authority and the Commerce Commission

3.11 The electricity industry is regulated by multiple sector-specific and generic legislation. The primary legislation generally consist of statues, or Acts, that set out the broad outlines and principles the electricity industry must adhere to. Key legislation is detailed below in Table 1.

Table 1: Legislation affecting the electricity industry

Sector-Specific Legislation	Generic Legislation
Electricity Industry Act 2010	Commerce Act 1986
Electricity Act 1992	Fair Trading Act 1986
Part 4 of the Commerce Act 1986	Consumer Guarantees Act 1993
	Resource Management Act 1991
	Energy Efficiency and Conservation Act 2000
	Climate Change Response (Zero Carbon) Amendment Act 2019

3.12 *Hīkina Whakatutuki* Ministry of Business, Innovation and Employment (MBIE) is the steward of the energy system in its entirety and leads system strategy and policy advice.

3.13 Within the primary legislation, some authority has been delegated to agencies of Government to:

[19] Commerce Commission: Performance summaries for electricity distributors, 2020.
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/performance-summaries-for-electricity-distributors

[20] Commerce Commission: Performance summaries for electricity distributors, 2020.
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/performance-summaries-for-electricity-distributors

(a) fulfil the purposes of the Acts

(b) create more practical measures that enable the law to be enforced and operated in daily life.

3.14 The primary agencies of the electricity industry generally include:

(a) *Te Mana Hiko* the Authority, as the industry-specific regulator responsible for overseeing and regulating New Zealand electricity markets

(b) *Te Komihana Tauhokohoko* the Commerce Commission is responsible for enforcing laws relating to competition, fair trading, and consumer credit contracts and assessing mergers, and conducting market studies across the economy. Its regulatory responsibilities include the economic regulation of infrastructure such as electricity lines, gas pipelines, fibre, and airports, together with the dairy, fuel and wider telecommunications sector.

(c) *Te Tari Tiaki Pūngao* The Energy Efficiency and Conservation Authority (EECA), that focus on energy efficiency and the use of renewable energy sources.

3.15 There are other agencies that also have key roles in providing independent advice which could affect the electricity industry, including:

(a) *He Pou a Rangi* Climate Change Commission, that provide independent, evidence-based advice to Government to help Aotearoa transition to a climate-resilient and low emissions future

(b) *Te Waihanga* Infrastructure Commission, that seeks to lift infrastructure planning and delivery to a more strategic level and by doing so, improve New Zealanders' long-term economic performance and social, cultural and environmental wellbeing.

(c) *Te Kōmihana Whai Hua o Aotearoa* Productivity Commission, that provides advice to the Government on improving productivity in a way that is directed to supporting the overall well-being of New Zealanders, having regard to a wide range of communities of interest and population groups in New Zealand society.

The Authority administers the Electricity Industry Participation Code for the long-term benefit of consumers

3.16 The statutory objective of the Authority, given to us in the Electricity Industry Act 2010, is to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers. In performing its functions, the Authority must have regard to any statements of government policy concerning the electricity industry that are issued by the Minister.

3.17 To achieve the statutory objectives and perform its functions the Authority administers the Electricity Industry Participation Code 2010 (Code). It may also undertake market facilitation and market monitoring.

3.18 The Code sets out industry participant responsibilities, and the Authority's duties and responsibilities.

The Commerce Commission regulates revenue, quality and information disclosure of lines businesses for the long-term benefit of consumers

3.19 The Commerce Commission regulates the price and quality of particular goods and services in markets in which there is little or no competition, such as the transmission

and distribution sectors, for the benefit of consumers of those goods and services. This complements our responsibilities.

3.20 Part 4 of the Commerce Act sets out the particular goods and services that are subject to price-quality and/ or information disclosure regulation. It also sets out the process for the Commerce Commission to undertake inquiries into whether regulation of other goods and services may be needed. Electricity lines services (i.e. the "conveyance of electricity by line"), covering both transmission and distribution, are regulated under Part 4.

3.21 All distributors are subject to information disclosure under Part 4. The purpose of information disclosure is to ensure sufficient information is readily available to interested persons to assess whether the Part 4 purpose under section 52A of the Commerce Act is being met. The Commerce Commission carries out summary analysis of this information to inform all stakeholders, including the regulated businesses themselves. Amongst other things, information disclosure covers historical network and financial information as well as forecast asset management plans. Following its open letter, the Commerce Commission is considering what changes may be needed to information disclosure to reflect the changing nature of the energy sector.

3.22 Distributors that meet the consumer ownership criteria under section 54D of the Commerce Act are subject to information disclosure regulation only and are not subject to price-quality regulation.

3.23 Electricity distributors that are subject to price-quality regulation, are subject to either default or customised price-quality path regulation, along with information disclosure regulation under Part 4. A price path set under-price-quality regulation is intended to influence the behaviour of a regulated business by setting the maximum allowable revenue that the businesses can charge. The Commerce Commission also sets standards for the quality of services that each business must meet. This ensures that businesses do not have incentives to reduce quality to maximise profits under their price-quality path.

3.24 The Commerce Commission is also the economy-wide competition authority, responsible for enforcing laws relating to competition, fair trading, and consumer credit contracts.

Each agency has a different purpose and different set of regulatory levers

3.25 The Authority and the Commerce Commission have different purposes and different tools in relation to regulating the electricity transmission and distribution sectors. The tools are briefly outlined below in Table 2.

3.26 Each set of regulatory levers is used by each agency to achieve its regulatory objective/purpose. Although both agencies share information and consult with each other, they each have different tools and different purposes

Table 2: Regulatory levers by agency

Under the Electricity Industry Act 2010, the Authority can:	Under Part 4 (natural monopolies) of the Commerce Act 1986, the Commerce Commission can:
• Administer and amend the Electricity Industry Participation Code • Collect information via Section 46 of the Electricity Industry Act • Monitor compliance with the Act, the regulations, and the Code • Investigate and enforce compliance with the regulations, the Code, and Part 3 of the Act • Monitor and investigate market-facilitation measures • Exempt participants from one or more Code provisions • Make publicly available reviews, studies, and inquiries into any matter relating to the electricity industry	• Determine input methodologies (IM) for: • Cost of capital • Asset valuations • Allocation of common costs, including between regulated and unregulated services • The treatment of taxation • Apply the input methodologies to set price-quality regulation and information disclosure regulation for regulated goods or services • Collect information from distributors and require them to publicly disclose information • Carry out summary analysis of information from distributors • Hold an inquiry into whether a particular unregulated goods or services should be regulated

There is a memorandum of understanding between the Authority and Commerce Commission

3.27 The memorandum of understanding between the Commerce Commission and the Authority outlines our respective roles, responsibilities, areas of common interest, and agreed approach to working together.

3.28 The Authority and Commerce Commission work together in regulating the electricity industry. In doing so, the two regulators:

- ensure their respective roles are well-coordinated
- minimise any scope for uncertainties regarding jurisdictional issues
- keep each other informed
- clearly communicate their respective roles and responsibilities to stakeholders.

Connection of distributed generation

3.29 The connection of distributed generation was originally regulated in the Electricity Governance (Connection of Distributed Generation) Regulations 2007 and became effective on 30 July 2007 to enable the connection of distributed generation where connection is consistent with connection and operation standards.

3.30 These regulations have since been incorporated into Part 6 of the Electricity Industry Participation Code 2010 (the Code). Part 6 of the Code:

(a) provides regulated terms for the relationship between a distributor and a distributed generator

(b) mandates the application and approval process for connection and operation or distributed generation between the prospective distributed generator and the distributor

(c) provides regulated default terms of connection, a dispute resolution process and a set of pricing principles, though all these can be set aside by mutual agreement of the parties.

An EPR recommendation was to give the Authority more powers to regulate network access

3.31 The Government has made relevant policy decisions based on the Electricity Price Review (EPR) recommendations as set out in the December 2019 Cabinet Paper.[21] These include giving the Authority more flexible powers to regulate a distributor's involvement in contestable electricity services and clarifying what the Authority can regulate in network access agreements.

Terminology for flexibility markets

3.32 The Innovation and Participation Advisory Group (IPAG) has standardised a number of terms that are used throughout this paper.[22] The key terms to note are:

- **Distributed Energy Resources (DER)** – small-scale, distribution-connected assets that either reduce load or inject more power – whether generation (like solar panels), storage (like batteries), or automated load management devices.
- **Controllable DER** – DER whose output or consumption can be increased or decreased on demand – for example, diesel generation, batteries, and controllable EV chargers, but not intermittent renewable generation like wind or solar.[23] The impact of controllable DER is flexibility.
- **Flexibility markets** – mechanisms for matching and rewarding traders of controllable DER supply and/or demand on instruction or in response to prices.
- **Flexibility resources** – flexibility resources are deliverd through DER that is controllable. DER and larger resources like grid-connected generation or batteries that can provide flexibility services. Distributed solar without a battery is not a flexibility resource because it is not controllable.
- **Flexibility traders** – owners of DER portfolios who manage their DER portfolio to allocate it to its highest value uses. Flexibility traders interact with flexibility buyers (defined below) to provide the flexibility that they require. Importantly, flexibility traders maximise the value of DERs by allocating them to their highest value use ("value stacking") rather than dedicating individual DERs to one use.

[21] New Zealand Government: Electricity Price Review, Final Report, 2019 https://www.mbie.govt.nz/assets/electricity-price-review-final-report.pdf#page=77

[22] Innovation and Participation Advisory Group: Review of Transpower's Demand Response Programme, 2021.

[23] Although when combined with storage, intermittent renewable generation can provide controllable DER.

- **Flexibility management** – the business process of identifying need for, procuring, issuing operating instructions, and paying for flexibility services. For example, by an electricity distributor to shave peak demand in a particular location.

4 Information on power flows and hosting capacity

4.1 Investors need information on power flows and network hosting capacity to make informed business decisions and to compete on a level playing field. This chapter sets out the objectives, issues, and potential options for improving the regulatory settings for accessing information.

Distributors and flexibility traders need visibility over the network

4.2 Distributors need greater visibility of the performance of their low-voltage networks, both the current status and forward-looking information, so they are better able to:

- make efficient investment decisions
- manage reliability with greater penetration of DER
- specify needs that could be obtained from a third party to support network management.

4.3 Flexibility traders also need access on equal terms to information on congestion and hosting capacity so they can offer flexibility services to its highest value use. In addition to access to information, flexibility traders also need access to the network as discussed is Section 6.

Current settings may limit the efficient flow of information

The nature of the problem

4.4 Information on power flows and hosting capacity is needed to determine where the network is congested and may need to be upgraded. This facilitates efficient investments in networks and DER as well as the efficient operation of DER. More efficient investment decisions lead to lower costs and more reliability for consumers.

4.5 Distributors have noted that in a new technology environment they require a higher resolution view of their network and a core part of this is access to non-anonymised and non-aggregated half hourly data. In a survey undertaken by the Authority in 2019, distributors noted that they were concerned with their current lack of visibility on technology uptake and its impact on their networks. The reasons given for this were primarily technical (for example, the potential implications for network asset management and operations).[24]

4.6 However, access to real-time (or even half hourly) data is expensive, and not widely available. This is partly due to the processes required to verify, validate, and estimate raw data, but also due to the way data is communicated from meters to back-office systems and end users.[25] As the level of DER increases, having near real-time data will be essential to optimise the network throughout the day.

4.7 Figure 7 sets out the current flows of information. Consumption data is currently collected by metering equipment providers (MEPs). Retailers then purchase the data from MEPs.

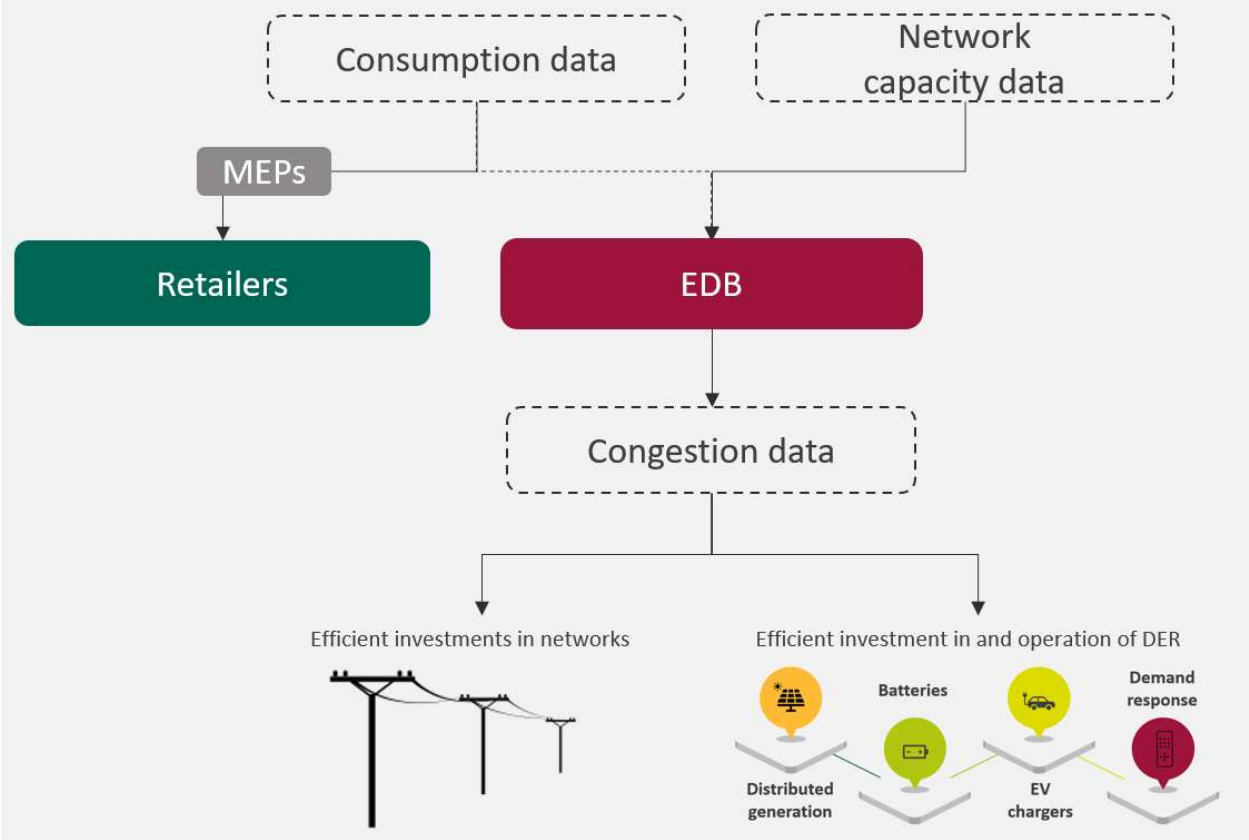
[24] Electricity Authority: Review of distributor's capacity to respond to changing technology, 2019
https://www.ea.govt.nz/assets/dms-assets/25/25822Review-of-distributors.pdf

[25] IPAG: Input Services Draft, 2019
https://www.ea.govt.nz/assets/dms-assets/26/26593IPAG-Draft-Access-to-input-services-04-December-2019.pdf

4.8 In some cases, distributors have access to consumption data from:

- arrangements with retailers who give them access to power flow data
- their own meters installed on the network – distributors are potentially investing a significant amount of money to install additional monitoring gear that could be delivered by reconfigured advanced metering infrastructure.

Figure 7: Congestion data flows



The Default Data Template has tried to address the concerns of sharing data

4.9 While some barriers have been removed in accessing information (notably for consumers) there are still some barriers which are limiting the ability of distributors to access information to then make better decisions around its network management.

4.10 One of the recommendations in the Electricity Price Review is to "ensure distributors have access to smart meter data on reasonable terms".[26]

4.11 To address industry concerns about the about the exchange of consumers' consumption data between distributors and retailers, a July 2020 Code amendment introduced a default Data Template. Distributors can opt into the Data Template with a retailer for facilitating the exchange of historical consumption data.

4.12 Distributors that do have consumption data are then able to compare the data with the capacity of their networks to make more efficient investments and pricing decisions. However, distributors have noted that in a new technology environment they require a

[26] MBIE: Electricity Price Review, 2019
https://www.mbie.govt.nz/assets/electricity-price-review-final-report.pdf#page=77

higher resolution view of their network and a core part of this is access to non-anonymised and non-aggregated half hourly data.

4.13 As the Data Template has been operational for less than one year, there is a need to understand from distributors how this process is working and whether it has helped them get the information they need to develop efficient network pricing and planning.

4.14 Although the Authority recently decided to decline a proposal to amend the Data Template, if evidence is submitted showing that there is an issue with distributors securing data on reasonable terms then this would be considered as part of this consultation.

Flexibility traders may have access to consumption data through a consumer

4.15 Consumers can request consumption data up to four times a year for free and retailers must respond within five days. Consumers may also authorise a third-party agent to access the data on their behalf. The Authority's *Streamlining consumers' access to electricity consumption data* project will be consulting on a range of interventions to improve consumers' access to consumption data.

4.16 While the existing Electricity Information Exchange Protocols provide standardisation of some data, they do not make available the full scope of data available, nor do they enable instantaneous integration with modern websites, trading systems or other technology.

4.17 Flexibility traders do not have access to the congestion data unless the distributor provides it to them. This means they are unable to make informed investments in DER. For flexibility markets to be competitive, congestion data would need to be available for everyone competing in that market on the same terms.

Parties impacted

4.18 Consumers are impacted when they are unable to make informed decisions about energy use and investments. Flexibility traders are also affected as they are unable to make informed investments into DER where it is most needed. Flexibility traders also face an uneven playing field where distributors do have congestion data and they do not. Inefficient investments ultimately affect the consumers in terms of higher bills than necessary and risks to electricity reliability.

4.19 Distributors are impacted where they do not have access to power flow data. Distributors must invest in networks to ensure reliability but may be unsure where investment is needed. Distributors may also not be able to effectively coordinate DER with the distribution network service. This issue will get worse as the level of DER on the network increases. This affects reliability and also increases costs for consumers.

4.20 Where obligations to provide energy data (both to reconciliation and to customers) sit with retailers, meeting obligations to provide data requires significant manual effort.

The size of the problem

4.21 The size of the problem is proportional to the savings that could be achieved, less the cost of the intervention. The savings come from the network investments that could be avoided if more information on power flows was available. The size of the problem is likely to increase as DER becomes a more viable alternative solution to network investment.

4.22 Streamlining consumers access to data will help unlock some of the potential benefits. The Authority's *Streamlining consumers' access to electricity consumption data* project will consult on a range of interventions to improve consumers' access to consumption data later this year. Improved access to consumption data will enable consumers to make more informed investment decisions about DER technology.

4.23 The uneven playing field from flexibility traders not having access to congestion data will impact competition in contestable markets. The size of this is discussed under market settings in Section 6.

- ***Q.1 Have you experienced issues relating to a lack of information or uneven access to information?***
- ***Q.2 What information do you need to make more informed investment and operation decisions?***

Potential options to address the issue

4.24 Different options will be considered based on the size of the issue and opportunity. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by evidence received from stakeholders in response to this paper.

4.25 The figure below summarises a range of options. When assessing the options in more detail, we will consider which option will be the most effective and whether a staged approach or a combination of options should be used to address the issue.

	Minor issue	Medium issue	Significant issue
Options	• Inform and educate consumers on how to request their consumption data • Encourage distributors to collaborate in finding the most efficient way of capturing and publishing utilisation data	• Assess options to implement shared data arrangements • Publish guidance for distributors to report on export congestion and network investment needs	• Shared data through API • Central meter data store

4.26 Consumers are already able to share their consumption data with flexibility traders if they wish, however they may not know this. **For a minor issue**, an appropriate option could be informing and educating consumers on how to request their consumption data. This could be in scope of the Authority's current consumer data access project. Another option is education to retailers and third parties to make sure they are aware of current obligations to consumers.

4.27 The Authority has consulted previously on improving shared data arrangements through multiple trading relationships (2017-2019), this is now known as Additional Consumer Choice of Electricity Services (ACCES). The Authority received feedback from stakeholders, including retailers and gentailers on proposed steps to make it easier for

consumers to share consumption data enabling greater consumer uptake of electricity services. Consensus feedback noted the importance of having access to efficient and reliable data, but work is needed to better facilitate this access, especially as technology improves. Feedback noted that regulatory intervention should allow for the development of technology when improving access to data.

4.28 **For a medium sized issue**, intervention may include options for shared data arrangements. This would include regulatory and technical solutions to enable information to be shared to different participants. Decisions would need to be made in relation to authentication, data rights, liability, and compliance. There may be a cultural tendency to not want to share data. Stakeholder feedback from retailers and gentailers on ACCES noted some reservations about sharing data and privacy obligations, specifically that proposals to increasing access to data is insufficient to let go of privacy obligations. Companies may be happy to receive data but unwilling to deliver it because of the value. This intervention would need to include key messages on reciprocity and the value that can be extracted from efficiency gains.

4.29 The Authority could also publish guidance for distributors to report on export congestion and support distributors in providing accessible information on current or expected network investment needs in Asset Management Plans.[27]

4.30 **For a significant issue**, intervention may include a central meter data store (CMDS). Implementing a CMDS is a significant and complex project that fundamentally changes the way in which New Zealand's electricity meter data is gathered and managed. A CMDS could enable better access to data using a centralised access mechanism which provides access to all data via a single request channel. This would address issues around timeliness, standardisation, and process. Having common standards will allow innovators to compete on the substance of their core offerings rather than the format of their data exchange processes.

4.31 However, a more efficient solution could be sharing data through an application programming interface (API). Shared data would require a pre-emptive licence to access the data, rather than open access to the data. According to IPAG, this repository need not be physically centralised. A physical central meter data store would require duplication of data, communications links, complex implementation, and would not address non-kWh data. Data could instead be shared by retaining the existing distributed data model but using modern APIs to connect data requestors directly with data holders. Retailers could be responsible for ensuring that half hourly consumption data is accurate, up to date, and in the correct format for the API to retrieve.

4.32 For either solution, we would need to further consider:

- **The collection of half hourly data** – around 83 percent of the nearly 2.2 million ICPs in New Zealand have smart meters certified to provide half hour data. For 1.4 million ICPs, 65 percent of the total, half hour usage data is ignored in central reconciliation and settlement processes.[28] Instead, they are reconciled by applying a fixed profile to monthly totals, just as their accumulation meter predecessors were. IPAG have recommended a profiling sunset date at which half hour reconciliation

[27] IPAG: Equal Access 2019
https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

[28] IPAG: Input Services Draft, 2019
https://www.ea.govt.nz/assets/dms-assets/26/26593IPAG-Draft-Access-to-input-services-04-December-2019.pdf

becomes mandatory for all capable sites. If retailers are required to have this information in a certain format for data sharing, this may also encourage retailers to also use half hourly data for reconciliation which could provide additional benefits to consumers.

- **Authorisation and access** – ensuring data is available to those who have the right to it, and not to those who do not. These issues must be dealt with separately, regardless of whether the central data store is physical or virtual through APIs.[29]

4.33 In Great Britain, the Energy Data Taskforce has recommended all energy system data should be presumed open, and combined with data catalogue to increase visibility of data sources.[30] They also have a project called *midata* focussed on consumption data access and have implemented real time congestion heat maps in some parts of the country.[31]

4.34 Australia's Consumer Data Right will also inform thinking about a CMDS. The Australian Government has implemented a programme of reform to give Australians more control over their own data. The Consumer Data Right (CDR) aims to improve consumers' ability to compare and switch between products, encouraging competition between providers. Progressive roll-out of the CDR across the banking sector began in July 2019 and a position paper on energy sector data access was released in August 2019.[32]

4.35 New Zealand has also been exploring CDR, with the Ministry of Business, Innovation and Employment (MBIE) releasing a discussion document in August 2020 on options for a CDR. MBIE's paper sought feedback on whether New Zealand needs a CDR, what form could this take and how it could be designed. On 5 July 2021, the Government decided to implement a new legislative framework for a consumer data right. This will allow consumers to securely share data that is held about them with trusted third parties, using standardised data formats and interfaces.[33]

4.36 Table 3 sets out a high level, initial observation of the potential pros and cons for each package of options. The next stage of the work will include a preliminary assessment of options, followed by a cost benefit analysis for selected options.

[29] IPAG: Input Services Draft, 2019
https://www.ea.govt.nz/assets/dms-assets/26/26593IPAG-Draft-Access-to-input-services-04-December-2019.pdf

[30] Catapult Energy Systems: Energy Data Taskforce makes 5 key recommendations, June 2019. https://es.catapult.org.uk/news/energy-data-taskforce-makes-five-key-recommendations/

[31] Ofgem: Midata in Energy Project. https://www.ofgem.gov.uk/gas/retail-market/market-review-and-reform/midata-energy-project

[32] Consumer Data Right in Energy. Position paper: data access model for energy data. Australian Competition & Consumer Commission. August 2019.

[33] MBIE: Consumer data right, 2021 https://www.mbie.govt.nz/business-and-employment/business/competition-regulation-and-policy/consumer-data-right/

Table 3: Pros and cons of intervention to improve access to information

	Pros	Cons
Minor issue	• Low cost to implement.	• May not improve data.
Medium issue	• Improved investments, leading to lower costs and more reliability for consumers.	• Privacy issues associated with data exchange • Risk of decreasing competition for flexibility services if data is not published / if access to data is on different terms.
Significant issue	• Participants can access information enabling increased competition • Faster and easier access improves efficiency • Investments more efficient, leading to lower costs and more reliability for consumers.	• Risk that reliability is affected if the centralised system goes down • Privacy issues associated with data exchange • Significant cost to set up and also resource intensive to maintain • Only as good as the data that goes into it. Benefits may be the same as medium intervention.

- ***Q.3 What options do you think should be considered to help improve access to information?***

5 Electricity supply standards

5.1 Standards for electricity supply exist, covering a range of matters that require standardisation for safety, and supply reliability and quality purposes.

5.2 In this section, we set out the purpose and role of electricity supply standards, along with potential issues driven by increasing levels of DER and discuss some possible options to address the issue. The options involve changes to existing standards and the introduction of new standards. We also consider options that involve price incentives and contestable markets, reflecting that over-standardisation can suppress competition and lead to inefficiency,

Standards should provide confidence to consumers, DER investors, and distributors

5.3 The purpose of appropriate electricity supply standards is to give:

(a) consumers confidence that they can consume higher quantities of renewable electricity without affecting supply reliability and quality

(b) investors confidence that they can purchase DER equipment that connects safety and reliably to the distribution network and interoperates with electricity market services

(c) distributors confidence that they can meet their statutory obligations for maintaining supply reliability and quality.

5.4 While standards have an important role in providing stakeholder confidence over the safety and performance of DER, they may not provide the most efficient outcomes in times of rapidly developing technology in all cases. Standards may also narrow the choice of appliances that consumers have, or the choice of equipment that participants can purchase. Locking in standards may be tantamount to picking a winner and they may become out of date which would not benefit consumers in the long term when better options become available. Options to resolve problems also need to consider whether incentive-based approaches provided by competitive markets can lead to superior outcomes.

Existing standards for electricity supply

Electricity supply must comply with the Electrical Safety Regulations

5.5 Supply of electricity via a common network requires, at a minimum, “wire-level” standardisation. In New Zealand, these standards exist as statutory requirements that address the supply quality and safety-related matters included in the Electrical (Safety) Regulations 2010 (the ESRs). These cover, in the order presented in the ESRs:[34]

(a) supply frequency[35] – for New Zealand this is 50 Hertz +/- 1.5%, except for momentary fluctuations

(b) supply voltage[36] – for New Zealand this is:

[34] See Electrical (Safety) Regulations 2010, Part 3 Systems of supply.

[35] Ibid. section 28

[36] Ibid. section 29

(i) at standard low voltage of 230 volts +/- 6%, except for momentary fluctuations or

(ii) another (usually higher) voltage as agreed between the electricity retailer[37] and the customer

(c) electrical safety[38] – for example, as related to electrical fault levels

(d) power quality[39] – related to interference from:

(i) the operation of the customer's electrical appliances and fittings

(ii) harmonics generated by appliances and fittings

(iii) flicker caused by appliances and fittings.

5.6 These standards are mandatory legal requirements that have been in place for many years. Taken together, they drive a range of associated standards that deal with things like:

(a) the design, installation, and operation of networks, particularly the low voltage networks closest to consumer points of connection to the network

(b) consumer electrical installations (i.e., wiring within buildings and premises)

(c) electrical appliances that consume electricity (for example, heat pumps, toasters)

(d) distributed generation if present (for example, rooftop solar PV).

5.7 As currently defined, these associated standards do not explicitly cover a battery ESS, which is a relatively new (and increasingly popular) technology that functions as both a power demand while charging, and as distributed generation while discharging. A battery ESS installation always includes a charge/discharge controller, which manages the battery ESS's rate of charge or discharge (stated in kW) across its rated energy storage range (stated in kWh).

Part 6 regulates connection of distributed generation

5.8 Part 6 of the Code regulates connection of distributed generation to a local network if connection is consistent with the local distributor's connection and operation standards. As defined in the Code, distributed generation includes all DER equipment that has the ability to inject power (generate) into a consumer electrical installation or directly into the local network.

5.9 Part 6 includes:

(a) mandated information relevant to connection of distributed generation that the distributor must publish

(b) application and approvals processes for applications (i) up to 10 kW capacity (2 options, called Part 1 (comprehensive) and Part 1A (streamlined)) and (ii) over 10 kW, including eligibility criteria for application under the Part 1A process

[37] Electricity retailers, as a practical matter, would need to arrange and agree to such other supply voltage with the local distributor. In practice, consumers, or their agents (developers, builders etc.) deal directly with distributors for supply at higher voltages.

[38] Ibid. section 30

[39] Ibid. section 31

(c) a default agreement if the parties fail to negotiate a connection agreement or choose not to

(d) pricing principles

(e) maximum rates for applications fees.

5.10 Clause 8.25 of Part 8 of the Code requires distributed generation above 1MW to comply with certain requirements additional to Part 6.

5.11 Local distributors must include their connection and operation standards in their published information. Distributor connection and operation standards are largely for individual distributors to develop and specify, although they must reflect, or be consistent with, reasonable and prudent operating practice. They must include the distributor's congestion management policy, emergency response policies and safety standards.

5.12 The Electricity Engineers' Association (EEA) has developed a good practice guideline for connection of distributed generation, but this is not publicly accessible.[40]

Voluntary standards exist for domestic and commercial EV chargers and medium temperature hot water heat pumps

5.13 The EV voluntary standards[41] have been prepared as a collation of best-practice advice for New Zealand consumers and commercial EV charger providers on the charging and installation of EV chargers at residential and commercial premises.

5.14 The EV voluntary standards are designed to provide consumers with clear and simple guidance on how to safely and cost effectively charge an EV in the home. Both PAS's also covers key aspects that equipment installers need to consider, prior to the installation of an EV charger in a residential environment.

5.15 The standards advise that customers should contact their local distributor to determine communication and participation requirements so that the equipment will be compatible with the distributor's load control programme, both now and into the future. It thereby assumes that distributors will be the only parties with "load control programmes".

5.16 The standard also notes that vehicle-to-grid (V2G) bidirectional power flow is available on some models of EV and that V2G is expected to increase in future. The use of V2G to provide EV battery discharge – so as to participate in relevant markets – would bring a V2G installation into the definition of "distributed generation" under Part 6 of the Code.

5.17 The heat pump standard[42] is targeted exclusively at medium temperature hot water (MTHW) heat pumps that may be used as coal or gas boiler replacements or used in process heat installations.

[40] *Connection of small-scale inverter-based distributed generation (interim guide)*, EEA, 2018

[41] *SNZ PAS 6010:2021 Electric vehicle (EV) chargers for commercial applications, EECA, 31 March (PAS 6010) and SNZ PAS 6011:2021 Electric vehicle (EV) chargers for residential applications, EECA, 31 March (PAS 6011)*

[42] *SNZ PAS 5210:2021 High-temperature heat pumps*

Additional standards may be needed to address quality issues associated with increased DER

High levels of DER may cause a supply voltage problem or overload network assets

5.18 DER, such as a rooftop solar PV installation on its own, with no battery ESS included, is simply distributed generation. If the level of solar generation exceeds the consumer's demand at any instant, the excess flows back to the local network.

5.19 Hosting capacity measures the capacity of the local network to accept the reverse power flow from distributed generation while not overloading network equipment ratings and maintaining voltage within statutory limits for supply to all consumers. A high level of reverse power flow combined with low demands along a section of the network will tend to drive the local voltage higher, in extreme cases to excessively high levels.

5.20 The distributor is required under the ESRs to maintain standard low voltage at 230 volts plus or minus 6 percent (i.e., 216–244 volts), which represents a reasonably tight range in practice – especially on low voltage networks that have little or no monitoring in place.

5.21 If the aggregate installed capacities of DER grow to very high levels relative to the hosting capacity of the local network, network assets, such as cables, lines and transformers could reach their maximum ratings. Maintaining phase balance between the three phases that make up most low voltage networks can also lead to problems.

5.22 Accordingly, increasing levels of DER can give rise to both *supply voltage* and *network asset overload* problems.

High levels of DER may exacerbate a system frequency problem

5.23 All generation, whether distributed or grid-connected, contributes to maintaining the system frequency, which measures the same everywhere across all networks.[43] At 50 Hz exactly, national supply and demand are in perfect balance.

5.24 Standards exist relevant to system frequency:

(a) the ESRs, which require that local distributors maintain supply at 50 Hz plus or minus 1.5 percent (i.e., 49.25–50.75 Hz), except for momentary fluctuations

(b) Part 7 of the Code (System operator), which requires the system operator to comply with its principal performance obligations (PPOs).

5.25 Solar and battery DER generally connects to a customer installation through an inverter. An inverter is a sophisticated electronic device that interconnects a direct current (DC) system (for solar panels and/or a battery ESS) with an alternating current (AC) system (i.e. a customer's electrical installation that in turn connects to the local or embedded network). Some inverters (more correctly called converters or inverter/rectifiers) can operate bidirectionally, which would allow a battery ESS to charge from and discharge into an AC system.

5.26 A system contingent event occurs when the sudden and unexpected loss (tripping offline) of a large generation unit or the HVDC link. If a contingent event occurs on the power system, the system frequency will start to fall quickly on the side that has a deficit of generation and rise on the side that has a surplus of generation. An inverter that

[43] This is accurate enough for this discussion, without going into power system dynamics and HVDC inter-island link control modes.

connects DER to a consumer's electrical installation always includes self-protective functions that act to ensure the device is not damaged.

5.27 Effective management and recovery of an under-frequency event, in a way that mitigates the risk of collapsing the power system (which, while it has not happened in New Zealand, is a real continuous risk), requires that all operational generation units, regardless of capacity or location in the network, remain connected and operational. This desirable attribute of any generation unit is referred to as fault ride-through.

5.28 Grid level frequency management is also a critical need driving nationally consistent standards. Accordingly, increased levels of DER, connected through inadequate or incorrectly setup inverters, can give rise to a *system frequency* problem unless the inverters have appropriate frequency response.

High levels of DER may affect the power quality experienced by network neighbours

5.29 DER inverters are basically appliances usually rated at several kilowatts, which is quite a high capacity relative to other household appliances. They contain power electronic components that, if inadequately designed, can lead to excessive levels of voltage and current harmonics. Harmonics can affect power quality both within the installation that they are generated in, and also within installations that share the same section of network.

5.30 The ESRs specify relevant equipment standards that inverters must be tested against. Increased levels of DER, connected through inadequately designed or incorrectly setup inverters, can give rise to *power quality* problems.

Connection and operation standards are inconsistent across network areas

5.31 Distributors are required to publish connection and operation standards on their website. While good industry practices for connection of DER exist, Part 6 provides each local distributor with a fairly wide latitude to write, publish and update connection and operation standards.

5.32 This has both pros and cons:

(a) On the one hand flexibility can allow a distributor to efficiently reflect local conditions or differences in their connection and operation standards or to quickly update their standards to reflect an improved technology or processes.

(b) On the other hand, local differences between network areas work against national consistency, which is an important factor when DER designer/installers strive to operate efficiently across multiple networks. DER suppliers and installers may find that navigating at least 29 different connection and operation standards time consuming, difficult, and potentially contributing to interpretation errors. A template document to standardise format and location on information within distributors connection and operations standards may lead to a more efficient outcome for consumers.

5.33 This may present a problem if, as expected, DER penetration increases significantly from current levels. At least some aspects of current connection and operation standards may benefit consumers in terms of competition (access to a wider range of businesses offering DER and DER services), supply reliability (nationally consistent inverter frequency standards) and efficiency (less effort required to comply with local differences).

Inconsistent use of the standards suite

5.34 The standards suite AS/NZS 4777 provides a standard covering grid connection of energy system via inverters.[44] Part 1 relates to installation requirements while Part 2 covers inverter standards. Parts 1 and 2 were published in 2016 and 2015 respectively but Part 2 has recently been further revised and published as a 2020 standard.

5.35 AS/NZS 4777.2:2020 is very important in the New Zealand context as it reflects standards that inverter manufacturers will seek to conform their inverter products against. Design and conformance testing are non-trivial exercises for inverter manufacturers. New Zealand DER installers are strongly tied to an inverter supply chain that is led by significantly higher demand in the Australian market.

5.36 Part 6 of the Code only requires the use of an AS/NZS 4777.2 compliant inverter as an *eligibility criterion* for access to the streamlined Part 1A connection application and approval process. Applicants seeking to use inverters that comply with other standards, perhaps older standards, can still apply for connection through the Part 1 process.

5.37 As a further issue relating to clear and consistent use of standards, the original AS 4777.1:2005 standard is still referenced in the ESRs as the primary standard covering inverter installation safety.[45] The Authority has previously referred the issue to MBIE and understands MBIE intends to update the reference to the latest standard in due course.

5.38 Unclear or conflicting references to standards may give rise to a problem in terms of efficiency (confusion of connection processes).

Part 6 may not remain fit for purpose in future

5.39 Part 6 originated as the Electricity Governance (Connection of Distributed Generation) Regulations 2007, which were moved into the Code in November 2010. One of the original drivers was to provide regulated processes aimed at making distributed generation connection applications more consistent across distribution networks.

5.40 The Authority's operational review of Part 6 in 2013-14 sought to further streamline the relatively complex connection application process for capacities up to 10 kW.

5.41 However, as currently defined, Part 6 allocates one application process for DG with a nameplate capacity above 10kW. With the increasing number of higher capacity DG considering connection to local networks, the amount of investigation and work a distributor may be required to carry out to approve a connection is increasing. Distributors may consider that the Part 2 application process should be capped at 1MW and a third application process introduced for proposed DG installations that have a nameplate capacity above 1MW.

Summary of standards for DER and possible changes needed

5.42 The table below summarises the current standards for DER and possible changes that may be needed if power quality issues arise.

[44] The standard originated as the AS 4777:2005 suite of 3 separate parts.

[45] See section 60(2)(f) of the ESRs.

Table 4 Summary of DER standards and possible changes needed

Category	Current guidelines/standards	Possible changes needed
EV charging	**Safety** *Electric Vehicle Charging Safety Guidelines,* WorkSafe, May 2019 (and 2 addenda dated October 2019 and December 2020).	Appliance safety guidelines are integrated in the ESRs where necessary. The ESRs themselves will need to evolve as necessary to address future safety problems
	Usage *SNZ PAS 6011:2021 Electric vehicle (EV) chargers for residential use*, EECA, 31 March 2021 PAS 6011 is a voluntary standard covering domestic EV chargers.	The guidelines are currently voluntary. If they do not prove effective and uptake increases significantly then mandatory standards may be needed. There are both mandated centrally controlled approaches and market incentive approaches to integrating EV chargers with markets for demand response and instantaneous reserve. As written, PAS 6011 assumes that all such market interaction will be controlled via the local distributor, similar to the way that ripple and pilot wire control of domestic water heating cylinders was implemented historically. This is not the only approach so PAS 6011 may need to reflect that in a future revision.
Batteries	Installation and connection of batteries are regulated under Part 6 of the Code and must comply with distributor connection and operation standards. Aggregation of many small batteries to provide services in the energy and reserve markets is not currently regulated.	Batteries, solar PV and other small forms of generation can potentially be aggregated and operate as a large virtual power station. There is currently no regulation governing operation of a large number of small generation stations and this needs to be addressed between the Authority and the system operator. This will involve amendments to Part 8 (Common quality)
Distributed generation	Part 6 of the Code regulates the connection of distributed generation. Through EEA, the distribution industry has developed a good practice guideline for connecting small scale distributed generation.	Further refinements to the Code and EEA guideline will be necessary as DER develops. Part 6 may benefit from a fit-for-purpose review when DER significantly increases penetration into consumer installations. Distributor connection and operation standards may need to contain a mix of both mandatory and operational/flexible provisions. DER at significant scale will likely require mandating key aspects of inverter standards, particularly those aspects that directly impact system frequency, network voltage, network loading vs capacity and power quality.
Standards for controlling network-interactive appliances	MBIE is currently consulting on proposals to amend the EECA Act, particularly the proposals to enable regulation of appliance standards for 'demand response enabled devices' (like EVs, hot water systems and heat pumps).	Guidelines may assist with purchase decisions that seek to future-proof appliances to participate in demand response programmes. Mandating demand response capabilities in appliances is likely unnecessary.

Parties impacted

5.43 Distributors would be impacted if increased DER penetration interferes with them meeting their statutory obligations to maintain voltage, safety, and reliability. Consumers would then face lower levels of reliability.

5.44 If security of supply was likely to be affected, two scenarios may occur:

- scenario 1: Distributors seek to minimise capital expenditure by imposing constraints on the adoption of DER. This may effectively restrict connection of technologies including renewable generation and electric vehicle chargers, and impose significant cost on efforts to decarbonise industry.
- scenario 2: Distributors increase the capacity of networks to increase hosting capacity. This imposes significant costs on their customers.

5.45 Scenario 1 would impact consumers by preventing the benefits that can occur from increased DER. It would also affect consumers who want to own DER and feed energy back to the grid.

5.46 Scenario 2 would impose additional costs on consumers from intensive investment in network capacity.

The size of the problem

5.47 The size of the problem for Scenario 1 occurring is the forgone benefits that would occur from increased DER (discussed in Section 6).

5.48 The size of the problem for Scenario 2 is the additional costs from intensive investment in network capacity.

- ***Q.4 Have networks experienced issues from the connection or operation of DER?***
- ***Q.5 Do the Electrical (Safety) Regulations require review? If so, what changes do you think are needed (a) in the near term and (b) in the longer term?***
- ***Q.6 Does Part 6 remain fit for purpose? If not, what changes do you think are needed (a) in the near term and (b) in the longer term?***
- ***Q.7 Is there a case to be made for minimum mandatory equipment standards for DER equipment, specifically inverter connected DER?***

Potential options to address the issue

5.49 Different options will be considered based on the size of the issue and opportunity. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by evidence received from stakeholders in response to this paper.

5.50 The figure below summarises a range of options. When assessing the options in more detail, we will consider which option will be the most effective and whether a staged approach or a combination of options should be used to address the issue. There may however be occasions where an issue is critical, compliance is essential or there is a constriction to competition, and it is therefore necessary to adopt a substantial approach from the outset.

	Minor issue	Medium issue	Significant issue
Options	• Voluntary guidelines • Develop templates • Education and awareness	• Recommend standards templates • Threat of regulation • DER registry • Lay foundations for standards	• Mandatory uniform standards

5.51 **For a minor issue,** an option could include developing a range of measures including policy, guidelines, education, or information papers seeking to persuade the adoption of certain practices. This option could be considered for low levels of distributed generation if it starts to impact power quality. This option could also be considered for batteries injecting power back into the grid.

5.52 Guidelines could be developed by industry or facilitated by the Authority and then published by the Authority. A similar intervention is currently included in the Authority's recommendations for consumer care by retailers who manage credit for consumers who have payment difficulties. A voluntary guideline has been produced to set out a fair process for all consumers, including consumers who have difficulty paying their invoices.

5.53 Approaches may also be used where the Authority does not have the power to regulate, but there is clearly a consumer and industry benefit that alignment can provide. An example of this is included within the consumer care guidelines where the recommendation is made that medically dependent consumers are not disconnected for debt purposes.

5.54 Cost reflective pricing is a different way to encourage certain behaviour around operating DER. Distributors can charge DER owners who impact network congestion and reward owners who help relieve congestion. However, the level of response that will occur from price signals is unknown therefore relying on this alone may have significant risks.

5.55 **For a medium sized issue**, intervention may include strongly recommending the use of policy, guidelines, education, or information papers. It could include the threat of regulation if the recommendation is not adopted and the orderly operation of the electricity market is affected, or the lack of action is not to the long-term benefit of consumers.

5.56 Intervention could also include starting to lay foundations for standards to be mandated in the future if they needed. For example, signalling to EV owners that they may be required to have smart chargers if the network becomes congested in the future. Smart chargers have an automated function where the distributor or flexibility trader would be able to control charging if needed to ensure security of supply.

5.57 A DER registry could also be mandated. This would mean that distributors would have full visibility over where DER is located on their network helping them forecast where congestion may or may not be an issue in the future allowing either non-network or network alternatives to be considered. Currently the connection of inverters and the location of distributed generation (which includes batteries) requires the consent of the network that the connection is being made to so location and capability is known, and

recorded centrally in the registry.[46] However, the connection of in-home or in-business EV chargers does not require network consent and the first that a network owner may know that a section of its low voltage network is overloaded is when the street fuses fail.

5.58 **For a significant issue**, intervention could include introducing mandatory requirements for any connection to the network. In the case of EV chargers, this option could be considered if the voluntary guidelines do not prove effective and they pose a threat to power quality. The standards could involve automated control, or control by the distributor, which can stop charging in peak times to decrease network congestion.

5.59 Small forms of distributed generation may also need mandatory standards as they can operate as a very large virtual power station. The is no current regulation governing the operation of a large number of small generation stations which could be a risk in the future.

5.60 For appliances, MBIE are currently consulting on whether to allow Minimum Energy Performance Standards (MEPS) and energy rating labels to include requirements related to demand response capability.

5.61 Table 5 sets out a high level, initial observation of the pros and cons that might occur for each package of options. The next stage of this work will include a preliminary assessment of options, followed by a cost benefit analysis for selected options.

[46] The registry is the central MOSP system that records information on connections to networks and is available to all participants to assist decision making.

Table 5: Pros and cons of intervention for standards

	Pros	Cons
Minor issue	• Low cost to implement • Helps promote behaviour that has minimal impact on reliability • Easily amended where technology is evolving.	• May not be effective to change behaviour • Not enforceable • Risk that reliability is affected when sufficient non-alignment occurs.
Medium issue	• Settings in place to ensure reliable electricity supply as the level of DER increases • Future proofing consumer costs • More easily amended than Code or regulation where technology is evolving.	• Some additional costs for DER owners • Not enforceable • Lack of control could discourage DER • Uncertainty when buying products (e.g. non-smart EV chargers).
Significant issue	• Enforceable • Maximum efficiency as everyone is guaranteed to be aligned • Reliability ensured • Time savings from uniform standards • Confidence in owning and operating DER.	• Difficult to amend requirements • Regulation may inhibit the adoption new technology and processes • Additional costs for DER owners • A lack of control could discourage DER • Potential regulatory constraints around changing the Act.

- ***Q.8 What standards should be considered to help address reliability and connectivity issues?***
- ***Q.9 Is there a case to look at connection and operation standards under Part 6 with a view to mandating aspects of these standards?***

6 Market settings for equal access

6.1 Competition can be improved by removing barriers to entry and levelling the playing field. Competitive flexibility markets can improve efficiency decreasing the overall costs for consumers. This chapter focuses on market settings for equal access, including incentives of distributors to invest in flexibility services and competition in the market for flexibility services. The objectives for this theme are set out along with perceived issues and potential options to address the issue.

The objective is to have a competitive market for non-network solutions

6.2 The objective is for distribution services to be delivered using an efficient mix of network and non-network alternatives. Traditionally, network congestion has been dealt predominantly by upgrading the network in addition to some ripple control (controlling hot water systems). However, as technology has evolved, using flexibility services can now be a more efficient solution in some cases. More efficient means delivering the same results for a lower cost or delivering better results for the same cost. Consumers then benefit from lower prices.

6.3 Third parties should also be also to connect to the network and be confident that they will be treated equally and receive efficient and non-discriminatory terms to use the network. Non-network alternatives should be procured competitively with all providers competing on a level playing field.

Distributors may favour in-house solutions

The nature of the problem

6.4 The nature of the problem is two-fold:

- distributors may favour network solutions when non network solutions could be a more efficient option. This means opportunities might be missed to support climate targets and decrease distribution costs.
- if distributors do decide to invest in DER, they may be more likely to favour in house investment, or use subsidiary firms, rather than follow a competitive procurement process. Flexibility traders are not able to compete on an even playing field, discouraging market entry and competition. DER controlled by a distributor is also likely to get locked in as a distribution alternative, rather than being allocated to its highest value use.

6.5 This problem may come from distributors not yet having the evidence that coordinated DER delivered through a contestable framework can provide network reliability or serve as an alternative to network investment.

IPAG considers that further incentives are needed to encourage (or even require) distributors to use flexibility services

6.6 The regulatory regime put in place by the Commerce Commission under Part 4 of the Commerce Act includes incentives to encourage distributors to buy flexibility services when this is the most efficient option because distributors subject to price-quality paths are financially rewarded for reducing costs.

6.7 However, IPAG's Equal Access report notes (problem statement 7) that Part 4 incentives for using DER for regulated services and network alternatives may not be well understood. This may lead distributors to focus on in-house solutions, without using a contestable framework or not use DER as a network alternative at all.

6.8 IPAG also notes that not all distributors regulated by the default price-quality path are profit maximisers and managers in many distributors are cautious about the use of new technologies and techniques.[47]

[47] Innovation and Participation Advisory Group: Equal Access, 2020 https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

6.9 Many distributors seem to consider the use of flexibility services as difficult and that traditional resources are adequate for network management.

6.10 Although some distributors have made progress in this area (see Box 1) the slow progress to-date may be evidence that further action is needed.

Project spotlight found that there is widespread perception that distributors prefer to invest in networks rather than buying flexibility services

6.11 Submissions included suggestions that distributors may prefer capital expenditure (capex) to operating expenditure (opex) and highlighted a need for distributors to better understand the impact of emerging technologies. Most commentary suggests distributors have a bias in favour of capex because the regulated weighted average cost of capital (WACC) is typically higher than their true cost of capital (because regulators know the risk of underinvestment and overinvestment are not symmetrical). Also, under price cap regulation, capex savings are not fully retained in future regulatory periods (they are passed on to consumers), whereas traditional network capex stays in the asset base for decades. Following project Spotlight, the Commerce Commission equalised incentives in the electricity default price path to help address this issue.

6.12 Project spotlight also had several submissions on the competitiveness of DER procurement and possible cross subsidisation by distributors.

> *"There is also the potential for consumer harm to occur where there is a lack of incentives on distributors' procurement decisions"*
>
> *"Short-run cross-subsidisation can also reduce long-run competitiveness in a market."*
>
> *"The provision of a free service by a monopoly will make those areas substantively less attractive to commercial providers of car charging services, essentially - because they cannot compete with a free product"*

6.13 Free DER services (like EV charging) may seem like a benefit to consumers and a way to support climate targets. However, if the costs are passed on to another part of the business, then all consumers are paying for the service, not just the recipients of the services. Providing 'free' charging also deters competition that cannot compete with a 'free' product and so the rapid deployment of EV charging can suffer as a result.

6.14 Vector's submission disagreed with the issues mentioned above. The submission states that the Commerce Commission cost allocation rules ensure that only costs that are genuinely attributable to the regulated service can be allocated to the Regulated Asset Base (RAB) and that related party transaction rules ensure related businesses are not unfairly favoured. Vector also states that:

> "Ownership of assets by EDBs can help to overcome contracting challenges, strengthen accountability, and provide additional flexibility".

DER controlled by a distributor gets locked in as a distribution alternative

6.15 DER can create value by being used as a distribution alternative, transmission alternative, ancillary service alternative, reserve energy alternative, and a spot market energy alternative. The economic value of DER is substantially higher if it can be allocated to its highest value use across all flexibility markets. This is unlikely to occur to the fullest extent possible if DER is controlled by a distributor rather than a flexibility trader.

Box 1: Case studies of flexibility services

Progress has been made by some distributors including Aurora, Orion, Vector, and Wellington Electricity.

- Aurora recently concluded a request for proposal (RFP) for non-network support in the Upper Clutha where a time and location-specific call for flexibility has resulted in a contract with solarZero as a flexibility trader to build a portfolio over which Aurora has priority call at network peak.
- Vector has engaged directly with DER resource owners through its mPrest platform which is described as a Distributed Energy Resource Management Software.
- Wellington Electricity has been establishing and developing processes and policies to support the development of dynamic connection agreements (DCA) for EV charging. DCA change the style of traditionally passive connection to the distribution network to allow variability required for DER.

Parties impacted

6.16 This perceived issue impacts flexibility traders, who may feel they cannot compete in a market with an uneven playing field. Flexibility traders may be discouraged from entering the market.

6.17 Flexibility traders have contracts with consumers to operate the consumers DER. As mentioned in the vision section, a competitive market for flexibility traders helps drive down costs and improve the quality of the service. Consumers benefit from this in two ways:

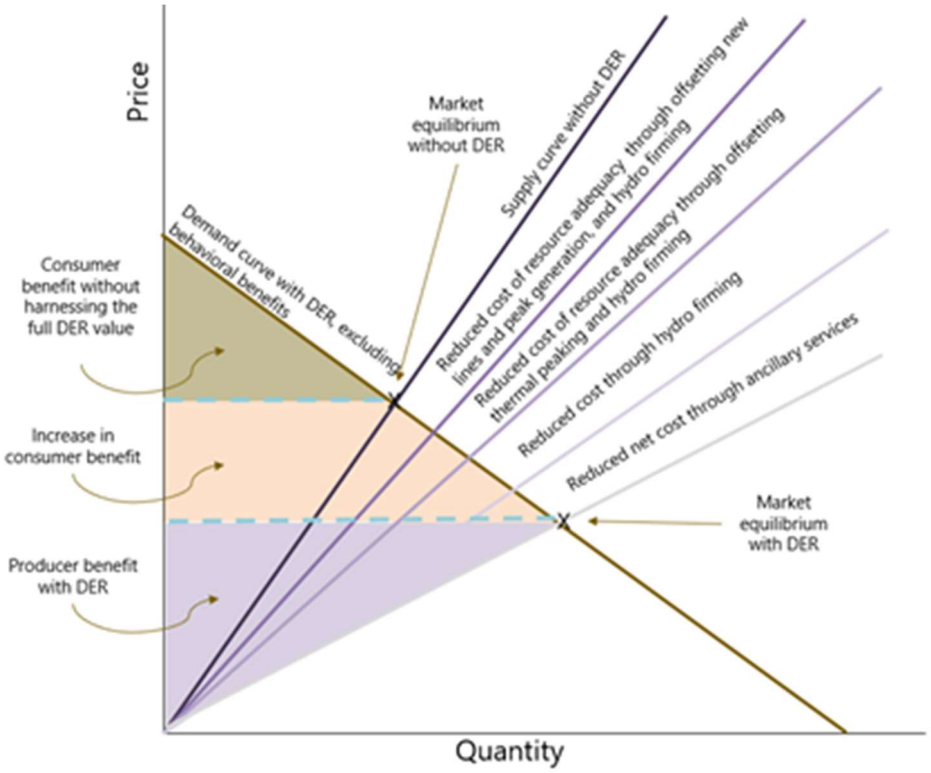
- consumers contracting flexibility traders are likely to get a better deal
- flexibility traders are likely to provide better services to distributors, which improves the efficiency of the system and decreases costs. The decrease in costs is then passed through to all consumers.

6.18 Consumers would also benefit from cheaper electricity prices if DER was allocated to its highest value use.

The size of the problem

6.19 The Authority engaged Sapere to develop a cost-benefit analysis of DER if it were to realise its unfettered potential. If DER can be harnessed, it would create value through multiple ‘value streams’ including contributing to resource adequacy, offset thermal peaking and offset new lines investments and generation. It can contribute to ancillary services including instantaneous reserves, frequency keeping, voltage support, harmonics, and inertia. Sapere’s illustration of economic surplus from DER is shown in Figure 8.

Figure 8: Illustration of total economic surplus in the context of DER



6.20 Sapere forecast what DER could be deployed in place of traditional ways of providing services, such as through building peaking plant, transmission, and distribution lines. Where DER could provide these services, there is an increase in value (economic surplus) through achieving at least the same level of service at cheaper cost. For DER to provide these services, all problems with access, pricing, and coordination would need to be addressed.

6.21 The total economic surplus is the sum of consumer surplus and producer surplus. The clearing price sets the boundary between the producer surplus (whose profits are the price minus the cost) and the consumer surplus (whose net benefit is the private benefit minus price to purchase). Conceptually, this is illustrated in Figure 8.

6.22 Sapere estimated that if DER were to realise its potential, the net benefit from 2021 to 2050 is expected to be $7.1 billion in net present value. Of this, $2.3 billion accrues to consumers while $4.8 billion will go to the owners and operators of the DER. A large proportion of this $4.8 billion will also go to consumers as they will be the hosts of DER. These benefits are additional to the benefits expected to occur from DER under the current market and regulatory environment.

6.23 These net benefits are not just from the distribution sector, they come from DER being allocated to its highest value use. However, distributors play the important role of facilitating DER connection, as well as using the flexibility services. When DER can be allocated to its highest value use, the benefits are more likely to outweigh the costs of the investment, encouraging more uptake.

Table 6: Summary estimates of economic surplus from DER uptake, net present value over 2021-2050

	$ billion, net present value
Consumer surplus	$2.3
Producer (prosumer) surplus	$4.8
Total economic surplus	**$7.1**

- ***Q.10 What flexibility services are you pursuing?***
- ***Q.11 Are flexibility services being pursued through a competitive process?***

Potential options to address the issue

6.24 Different options will be considered to address issues relating to:

- incentivising non-network solutions when they are more efficient than network solutions
- competition for flexibility services.

Options for incentivising non-network solutions when they are more efficient than network solutions

6.25 Different options will be considered based on the size of the issue and the opportunity from incentivising non-network solutions. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by evidence received from stakeholders in response to this paper.

6.26 The figure below summarises a range of options. When assessing the options in more detail, we will consider which option will be the most effective and whether a staged approach or a combination of options should be used to address the issue.

	Minor issue	Medium issue	Significant issue
Options	• Education on flexibility services • Require distributors to disclose progress • Publish a comparative report	• Fund trials • Distributors required to prove that they have fully explored flexibility	• Link distributors' regulated revenue to their progress in developing the use of flexibility services

6.27 **For a minor issue**, intervention could include education to distributors of the benefits of using flexibility services and publishing a comparative report. The comparative report

could be in the form of scorecards, similar to the distribution pricing scorecards undertaken by the Authority.[48]

6.28 **For a medium sized issue**, intervention may include funding for trials so that distributors have room to experiment before adopting technology on a wider scale. The key here would be to avoid multiple distributors doing isolated trials and not sharing results.

6.29 Options may also include distributors having to prove they have explored flexibility options for network investments over a certain size. IPAG recommends that the Commerce Commission requires directors of distributors to sign an annual declaration to certify that the business investigated the use of DER for non-network alternatives.[49] Other ways to implement this option could be more strenuous and would only be considered for a significant issue. For example, having to submit analysis to the Commerce Commission for each investment. For either implementation approach, a template and guidelines that help assess different network and flexibility options could help facilitate this option.

6.30 Examples of this intervention from overseas include:

- starting in the United Kingdom in 2023, all capital grid upgrades that will cost more than £1 million will need to prove that a flexibility-based alternative solution is not a reasonable option.[50]
- in Australia, a cost-benefit test must be applied when assessing options for solutions for network projects above $6 million. This is required under Chapter 5 of the National Electricity Rules.[51]

6.31 **For a significant issue**, an option is to link each distributor's regulated revenue to their progress in developing the use of flexibility services. This could only be applied to distributors whose revenue is regulated, and may result in perverse outcomes (for example, over-investment in flexibility). This change would need to be as straightforward as possible and education to distributors would be needed to ensure that incentives are understood.

6.32 Table 7 sets out a high level, initial observation of the pros and cons that might occur for each package of options. The next stage of this work will include a preliminary assessment of options, followed by a cost benefit analysis for selected options.

[48] Electricity Authority: Distribution Pricing Scorecards, 2020. https://www.ea.govt.nz/operations/distribution/pricing/distribution-scorecards-2020/

[49] Innovation and Participation Advisory Group: Equal Access, 2020 https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

[50] Greentech Media: How the UK Is Building Grid Markets to Reward Flexible Distributed Energy, 2020 https://www.greentechmedia.com/articles/read/how-the-uk-is-building-grid-markets-to-reward-flexible-distributed-energy

[51] Australian Energy Regulator (2017) "Regulatory investment test for distribution application guidelines" https://www.aer.gov.au/system/files/AER%20-%20Final%20RIT-D%20application%20guidelines%20-%20September%202017.pdf

Table 7: Pros and cons of intervention for incentivising non-network solutions

	Pros	Cons
Minor issue	• Low cost to implement.	• May not be effective in incentivising non-network solutions.
Medium issue	• Improved efficiency, leading to lower costs for consumers.	• Could incentivise distributors to do multiple small investments to avoid exploring flexibility • Trials may not be learnt from and may not evolve to be core business • Distributors will need additional resources to assess efficiency.
Significant issue	• Efficiency benefits, leading to lower costs for consumers.	• Risk that reliability is affected • Could be burdensome to regulate • Could lead to over investment in flexibility.

Options for increasing competition for flexibility services

6.33 Different options will also be considered based on the size of the issue and the opportunity from increasing competition for flexibility services. The figure below summarises a range of possible options.

	Minor issue	Medium issue	Significant issue
Options	• Education on competitive procurement and coordination • Procurement guidelines	• Enable multiple trading relationships • Assess cost allocation rules • Assess related party transaction rules • Encourage distributors to make available 'standing offer' price information for DER	• Competitive tenders for flexibility services • Restrictions on distributors owning or operating DER

6.34 **For a minor issue**, an option could be education and awareness on how to run competitive tenders and how to coordinate flexibility. Procurement guidelines could also be developed to assist distributors if they chose to use them.

6.35 **For a medium sized issue,** intervention may include enabling multiple trading relationships. Current market settings mean that consumers receive an electricity bill from only one supplier, typically their retail electricity company. This may unnecessarily limit consumer choice and control and hinder competition. For example, some

consumers may want to buy electricity from one supplier and sell their excess electricity to a different party. In 2017, The Authority consulted on whether consumers can easily establish relationships with more than one electricity provider if they wish to.[52] We received views on the size of the potential barriers and whether removing these barriers might create a net long-term benefit to consumers by improving competition. This work led to Additional Consumer Choice of Electricity Services (ACCES). The results of ACCES were the streamlining of the data request process and changes to the registry transfer hub. However, more changes are needed to support multiple trading relationships.

6.36 Ara Ake are considering doing an off-market trial which relates to multiple trading relationships. The Authority is assisting Ara Ake on how the trial can be done under the existing Code. The trial will help identify areas in the Code that may need to be amended to allow multiple trading relationships to work more efficiently. Kāinga Ora are also looking into peer-to-peer trading. This would require multiple trading relationships if the two parties had different retailers. Both pieces of work will provide useful insight into the benefits to consumers from multiple trading relationships and peer-to-peer trading.

6.37 Another option is to consider whether the current cost allocation rules and related party transaction rules are sufficient to prevent cross-subsidisation and enforce competitive procurement process.[53] Taking into account an assessment of current rules, a process to consider changes could be instigated by the Commerce Commission to improve the desired outcomes. IPAG have recommended that the Commerce Commission undertakes an information campaign on Part 4 incentives including publicising relevant case studies as part of the DPP reset and reinforce its expectations of the treatment of costs and revenues for regulated service under the Commerce Commission Part 4 regime via an annual review of practices and penalties for rule-breakers.[54]

6.38 In 2016, the Commerce Commission, through their input methodologies review, consulted on the treatment of revenues and costs from emerging technology[55]

6.39 The Commerce Commission responded to a number of issues raised by stakeholders, in particular concerns raised by retailers about whether regulated suppliers should be allowed to deliver unregulated services using assets shared with the regulated services.

6.40 A number of parties submitted that distributors should be restricted in their ability to participate in emerging technologies markets. For example, some parties submitted that Commerce Commission should require regulated companies to procure services from some emerging technologies on an arm's length basis, while some suggested that ringfencing requirements be imposed.

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[52] Electricity Authority, Market Commentary: Multiple trading relationships, 2017
https://www.ea.govt.nz/about-us/media-and-publications/market-commentary/projects/multiple-trading-relationships/

[53] Electricity Authority: Commerce Commission note on extending rules to Transpower. https://www.ea.govt.nz/assets/dms-assets/27/03-Commerce-Commission-note-on-extending-rules-to-Transpower.pdf

[54] IPAG: Equal Access 2019
https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

[55] Commerce Commission: Input methodologies review draft decisions, Topic paper 3: The future impact of emerging technologies in the energy sector, 2016
https://comcom.govt.nz/__data/assets/pdf_file/0021/63066/Input-methodologies-review-draft-decisions-Topic-paper-3-The-future-impact-of-emerging-technologies-in-the-energy-sector-16-June-2016.pdf

6.41 The Commerce Commission's view at that time was that this kind of "structural changes, if deemed necessary (which we consider they are not at this stage), are best delivered directly by policy makers through legislation, rather than indirectly by the Commerce Commission through changes to Part 4."

6.42 In any case, the Commerce Commission considered that imposing regulatory restrictions on distributors' ability to efficiently respond to the changing environment was not appropriate at that stage. The reasons were as follows:

- the requirement of arms-length transactions risks undermining the incentive on EDBs to improve efficiency through diversification
- the likely higher transaction costs associated with arms-length transactions was one important (and growing) factor
- section 52T(3) of the Commerce Act required that the Commerce Commission's cost allocation IM must not unduly deter investment by a regulated supplier in the provision of other regulated or unregulated services
- the benefits were conditional on the creation of a workably competitive market that does not fully exist today.

6.43 In addition, the Commerce Commission did not consider that the cost allocation IM gave distributors an undue advantage. The Commerce Commission will launch a review of the input methodologies early in 2022.

6.44 **For a significant issue,** an option could be to place limitations on distributors owning or operating DER on their own network. Distributors would have to have to run a competitive procurement for flexibility services and can only invest in DER directly if there is insufficient interest from the market. Distributors could still own and operate DER on other networks except their own. The Council of European Energy Regulators (CEER) recommends that distributers acts as a neutral facilitator providing the information, system operation, network infrastructure and management functions.

6.45 While considering this option, care will be taken not to outright exclude monopoly distributors from providing flexibility services solely because of their market power in adjacent markets. There may be cases where distributors are better placed to operate or deliver flexibility services in a way that delivers net public benefits. We will work with the Commerce Commission to explore approaches including the ability to put in place any reasonable protections that are required should the best option be for the services to be operation by a distributor.

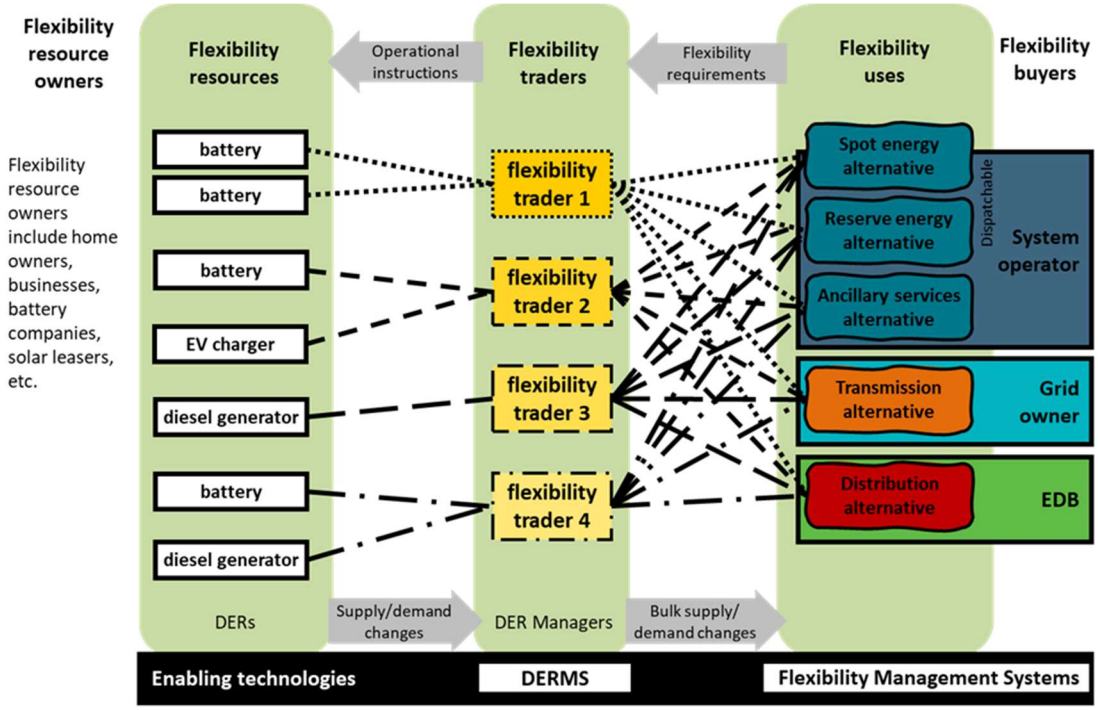
6.46 The Clean Energy Package in the European Union prohibits distributors from owning storage or EV charging infrastructure unless they can demonstrate to the regulator that the market cannot provide.[56]

6.47 Another option would be restricting distributors from owning and operating any DER, making them purely "neutral facilitators". This option would include restrictions on owning or operating DER through subsidiary companies. Distributors would also have to sell any existing DER that they own.

[56] European Commission: Clean energy for all Europeans package, 2019 https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en#governance-regulation

6.48 IPAG consider that DER management must be carried out by flexibility traders (owners of DER portfolios) and not network owners.[57] The economic value of DER is substantially higher if it can be allocated to its highest value use across all flexibility markets rather than being dedicated to the sole purpose of deferring or de-risking investment in one network. Figure 9 sets out IPAG's vision for flexibility markets. Flexibility buyers, including distributors, cannot directly contract flexibility resources and must go through a flexibility trader.

Figure 9: Flexibility Markets (IPAG)



6.49 Table 8 sets out a high level, initial observation of the pros and cons that might occur for each package of options. The next stage of the distribution work will include a preliminary assessment of each option, followed by a cost benefit analysis for selected options.

[57] Innovation and Participation Advisory Group: Review of Transpower's Demand Response Programme, 2021.

Table 8: Pros and cons of intervention for increasing competition

	Pros	Cons
Minor issue	• Low cost to implement.	• May not be effective in increasing competition.
Medium issue	• Improvement in the level of competition, leading to lower costs for consumers.	• Risks that the market is too small for a competitive tender, and the costs are not justified • Risks to power quality from DER integration.
Significant issue	• A competitive market, leading to lower costs for consumers. • DER is not locked in, and can be allocated to its highest value use.	• Risks that the market is too small to be competitive, and flexibility services decline • Risk of distributors being biased towards other distributors in 'competitive' tenders • Risks to power quality from DER integration • Consumers lose the benefit of competitive pressure from distributors investing.

- ***Q.12 What options should be considered to incentivise non-network solutions?***
- ***Q.13 What options would encourage competitive procurement processes for flexibility services?***

7 Operating agreements

7.1 The costs of developing and negotiating contracts for flexibility services is high for both flexibility traders and distributors. Distributors also have a stronger negotiating position as a natural monopoly, which could deter flexibility traders from entering the market and reduce competition. This chapter focuses on operating agreements between distributors and flexibility traders. The objectives for this theme are set out along with perceived issues and potential options to address the issue.

Agreements should represent a fair balance of interests between parties

7.2 The objective is for distributors and flexibility traders to negotiate suitable operating agreements that represent a fair balance of interests between parties.

7.3 In addition, transaction costs of bargaining and developing contracts between distributors and flexibility traders should be reduced and the perceived barrier to entry minimised.

The costs of developing and negotiating contracts for flexibility services is high

The nature of the problem

7.4 The costs of developing and negotiating contracts for flexibility services is high for both flexibility traders and distributors. This is due to the complexity of the services and the fact that this type of contract is not commonplace in New Zealand.

7.5 In addition, distributors have a stronger negotiating position as a natural monopoly. This could deter flexibility traders from entering the market.

7.6 IPAG's equal access work states that the transaction costs for facilitating DER are high and can impede trading between procurers and providers of flexibility services.

7.7 Submissions from Project spotlight suggested that distributors might favour ownership instead of contracting services due to challenges of managing performance, accountability, and flexibility with flexibility traders.

7.8 There are also challenges for flexibility traders in terms of negotiating contracts that ensure a sufficiently long-term and predictable revenue stream that supports investment in long-lived assets.

7.9 These challenges can create high transaction costs for legal and operational resources needed for negotiating, which can impede trading between distributors and flexibility traders taking place.

Parties impacted

7.10 This perceived issue impacts distributors who have to enter into bespoke agreements with each flexibility trader, increasing their negotiation and contract management costs.

7.11 Flexibility traders are also impeded by the resource requirements to complete successful negotiations. They are also impacted by uneven bargaining position they have, leading to accepting risks that they may not be best placed to manage.

7.12 The issues ultimately result in a higher transaction cost behind a successful negotiation, and possibly less competition, which means higher costs passed on to consumers.

The size of the problem

7.13 The costs of this issue are likely to increase as the uptake of DER on networks increases. One of the key costs might come from risks being allocated to flexibility traders that are outside of their control and they are unable to manage. This increases the cost of providing the service and may discourage participation in the market.

7.14 Another cost is the cost to both distributors and flexibility traders of negotiating agreements. As a proxy, 2018 research into the costs incurred by retailers and distributors when negotiating a new Use of System Agreement (UoSA) found almost half of retailers surveyed would spend more than $5000 negotiating; some retailers said the cost could be up to $150,000.[58]

7.15 These challenges can be most acute where performance requirements are high and the market or the technology is immature. For example, the more critical the additional generation is to the network, the higher the performance requirements and challenges for negotiating that performance risk.

- ***Q.14 Have you experienced difficulties with negotiating operating agreements for flexibility services?***
- ***Q.15 Are the transaction costs of developing contracts a barrier to entering the market for flexibility services***?

Potential options to address the issue

7.16 Different options will be considered based on the size of the issue and opportunity. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by evidence received from stakeholders in response to this paper.

7.17 The figure below summarises a range of options. When assessing the options in more detail, we will consider which option will be the most effective and whether a staged approach or a combination of options should be used to address the issue.

	Minor issue	Medium issue	Significant issue
Options	• Develop guidance for operating agreements	• Establish a 'DDA style' agreement which parties can opt in to	• Establish a mandatory set of terms that parties must use

7.18 **For a minor issue**, and option is to develop a set of best practice terms, as guidance to flexibility traders and distributors to base operating agreements on.

7.19 **For a medium sized issue**, an option is to develop a ‘DDA style’ standardised agreement. The Default Distributor Agreement (DDA) was introduced in July 2020 to provide retailers access to networks on more reasonable terms. The terms in the existing DDA are tailor-made for the distributor-retailer relationship and can be opted in to if negotiations are unsuccessful.

[58] Electricity Authority, Default Distributor Agreement (DDA) Research, 2018
https://www.ea.govt.nz/assets/dms-assets/25/25536DDA-Research-Report-2018.pdf

7.20 The Authority could consider what terms may be suitable for a DDA-style agreement between distributors and flexibility traders. The terms may include a transfer of the quality standard risk to the flexibility trader where they are best able to manage that risk.

7.21 The agreement would need to address the incentives and accountability mechanisms on distributors if they contract for flexibility services that subsequently fail to perform. The agreement should reflect that risks should be borne by the party best able to manage or mitigate that risk.

7.22 **For a significant issue**, an option is to develop a mandatory agreement which cannot be contracted out of by either party. This would ensure standardisation of agreements but trade off a degree of flexibility.

7.23 Table 9 sets out a high level, initial observation of the pros and cons that might occur for each package of options. The next stage of this work will include a preliminary assessment of each option, followed by a cost benefit analysis for selected options.

Table 9: Pros and cons of intervention for operating agreement

	Pros	Cons
Minor issue	• Low cost to implement • Maximises flexibility.	• May not be sufficient to overcome the barriers in negotiating efficient operating agreements.
Medium issue	• Allows for some level of flexibility in negotiations • Helps level bargaining positions • Somewhat decreases resources needed to develop and negotiate agreements.	• Implementation costs.
Significant issue	• Ensures even bargaining positions • Decreases resources needed to develop and negotiate agreements.	• Could inhibit potential benefits of having flexibility in negotiations • High implementation costs.

- ***Q.16 Would an operating agreement help lower transaction costs and level negotiating positions?***
- ***Q.17 What kind of operating agreement would address the issues described in this chapter?***

8 Capability and capacity

8.1 Having 29 distributors is not necessarily the most efficient way to structure the distribution sector in New Zealand. This potential inefficiency may become pronounced as distributors have to adjust to network transformation due to the complexities of integrating DER and the electrification of the economy. An inability for some distributors to adjust may lead to not all consumers benefiting from the changes in technology and innovation happening on distribution networks. The objectives for this theme are set out along with perceived issues and potential options to address the issue.

The objective is for distributors to have the capacity and capability to adjust to changes on distribution networks

8.2 The objective is to ensure that distributors are ready to scale up and adjust to network transformation. Distributors need to recognise and plan for the less firm nature of DER to improve efficiency while ensuring reliability standards.

Additional skills may be needed for distributors to manage the transition

The nature of the problem

8.3 Distributors range in size as well as skills and capability. It is possible that some distributors do not have the capability and infrastructure to integrate increased volumes of DER as well as manage the increased load from the electrification of transport and process heat.

8.4 The Authority, the International Energy Agency (IEA), the EPR, and academics have all looked into different aspects of the efficiency of distributors and their ability to adapt.

8.5 In 2019, the Authority did a study on how distributors were adapting to technology-driven change in their operating environment.[59] The Authority found that in general, distributors did not sense imminent issues and intend to adapt in measured ways.

8.6 Distributors had the view that technology-driven transformation of electricity supply was in its very early stages. Whilst distributors saw some issues arising in the next ten years, their responses generally indicated they could cope with these if necessary. However, distributors indicated that a rapid change in technology uptake, either over the entire network or in clusters, would lead to quite a different response.

8.7 Whilst most stakeholders agreed with distributors on the current speed of uptake of new technologies, some considered technology-driven changes could happen swiftly, leaving distributors struggling to catch up.

8.8 The study also found that for most distributors, strategic organisational reform (for example, organisational structure, cultural change) was not yet emerging as an area of key adaptation focus.

8.9 In a study by the IEA in 2017, concerns were raised about the sector's capacity to effectively harness efficiencies associated with economies of scale, to quickly and

[59] Electricity Authority: Review of distributor's capacity to respond to changing technology, 2019 https://www.ea.govt.nz/assets/dms-assets/25/25822Review-of-distributors.pdf

effectively respond to the fundamental sector transformation, and organizational governance.[60]

8.10 The IEA noted that these concerns were magnified by recent investments in non-core assets by some community-owned trusts and local authority-owned distributors. These activities potentially expose distributors to substantial business risks which many may be ill-equipped to manage.

8.11 Examples of investments in non-core assets include:

- In July 2015, Marlborough Lines announced its purchase of an USD 62 million (80%) stake in the Yealands Wine Group.
- Delta Utility Services Limited (a business unit of Aurora Energy) invested in commercial property which resulted in losses estimated at around USD 6.1 million.[61]

8.12 An opposing argument is that they investments were assessed by the distributor to provide the most benefits to the region.

8.13 In response to the review by the IEA, Energy Trusts of New Zealand commissioned George Yarrow, founding Chair of the Regulatory Policy Institute, to review the findings. Yarrow argues that more conclusive evidence is needed to arrive at useful conclusions or recommendations. He also argues there is no conclusive evidence of significant economies of scale in electricity distribution.[62]

8.14 The EPR also considered the operating costs of distributors in 2017 and found that most small distributors have higher operating costs per consumer than big distributors, although the pattern is far from uniform. The EPR notes that some of the difference may be due to how dispersed consumers are and the terrain.[63]

Parties impacted

8.15 This problem is most likely to impact consumers in regions where the distributor does not have the capacity or capability to realise benefits from flexibility services or adapt to the connection of DER and two-way flows.

8.16 These consumers would potentially have higher distribution costs to consumers in other regions due to inefficient investments. For example, investing in upgrading networks where flexibility services is more efficient, or investing in unrelated industries. Consumers are also likely to have less options to own DER and feed back to the grid.

The size of the problem

8.17 There are 12 distributors serving a total of 370,000 consumers, that are customer owned and are exempt from price-quality regulation.[64] These distributors are only subject to

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[60] Energy Policy of IEA Countries: New Zealand Review, 2017.
https://www.iea.org/reports/energy-policies-of-iea-countries-new-zealand-2017-review

[61] Energy Policy of IEA Countries: New Zealand Review, 2017.
https://www.iea.org/reports/energy-policies-of-iea-countries-new-zealand-2017-review

[62] G. Yarrow: The International Energy Agency's 2017 Review of New Zealand, 2018.

[63] Ministry of Business, Innovation & Employment: Electricity price review, 2018.
https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-consultations-and-reviews/electricity-price/

[64] Commerce Commission: Performance Accessibility Tool for Electricity Distributors.
https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data/performance-accessibility-tool-for-electricity-distributors

information disclosure requirements. Although these distributors have incentives to keep local consumers happy, they may be reluctant to innovate.

8.18 The evidence is not conclusive about whether economies of scale is an issue and, if it is, what the size of the issue is. However, as the level of flexibility services increases, there will be benefits of standardising processes and building capability.

- ***Q.18 What are distributors doing to ensure their network can efficiently and effectively manage the transformation of networks?***

Potential options to address the issue

8.19 Different options will be considered based on the size of the issue and opportunity. The opportunity is the potential benefits to consumers if the issue is addressed. This will be informed by evidence received from stakeholders in response to this paper.

8.20 The figure below summarises a range of options. When assessing the options in more detail, we will consider which option will be the most effective and whether a staged approach or a combination of options should be used to address the issue.

	Minor issue	Medium issue	Significant issue
Options	• Encourage collaboration • Improve transparency of investment decisions • Develop a reporting framework for distributors and DER suppliers to report results of trials	• Impose price quality regulation on all distributors • Clarifying the roles of a distribution network operator (DNO) and a distribution system operator (DSO) • Create industry body to body would promote coordination of DSOs • Encourage joint-venture arrangements	• Adopt a single DSO model

8.21 **For a minor issue**, an option could be improving transparency of investment decisions by community owned distributors. This option was recommended for New Zealand by the International Energy Agency. This could help signal if trust owned distributors are preparing infrastructure for the transition. Another option is to encourage cooperation between distributors so that best practices can be shared and learnt from collectively. The Authority could also develop a reporting framework for distributors and DER suppliers to report results of trials.[65]

[65] IPAG: Equal Access 2019
https://www.ea.govt.nz/assets/dms-assets/26/26594Equal-Access-IPAG.pdf

8.22 **For a medium sized issue,** an option may be to extend price quality regulation to all distributors.

8.23 The IEA recommends that the New Zealand Government "Extend price-quality path regulation to all distributors where it is cost-effective to do so, which would be facilitated through regional integration, starting with enforcement of reliability standards".[66] More recently, the EPR considered this question and suggested that quality-only regulation under Part 4 was worth considering.[67]

8.24 This option could help ensure distributors are investing efficiently and in a way that supports the transition. However, there are significant costs of extending price-quality to all distributors and the benefits may not be material.

8.25 Another option is to encourage joint venture or contractual arrangements. This may involve a distributor transferring the operation of some functions to another distributor. Making a clear distinction between distribution network operators (DNOs) and distribution system operators (DSOs) would help separate functions and encourage competition.

8.26 An industry body could also be created to promote coordination amongst DSOs and pave the way for them to take on more tasks to ensure their grids are smarter, flexible and capable of integrating more renewable energy resources.

8.27 **For a significant issue,** intervention may include adopting a model with one DSO. This would involve network owners remaining the same but there being one (or possibly more) network operators. This would involve a regulatory change to define operators and owners as separate entities. Different actors of the DSO model would need to be considered including the number of DSOs, and the control of assets and pricing signals.

8.28 The DSO model could lead to a smaller number of network operators (possibly only one operator) across multiple networks creating economies of scale which could improve efficiency.

8.29 It is possible that the DSO model could happen without regulatory intervention if the right incentives were in place. If distributors had stronger incentives to operate more efficiently, then they would find their own solutions which may involve outsourcing network operation.

8.30 Table 10 sets out a high level, initial observation of the pros and cons that might occur for each package of options. The next stage of this work will include a preliminary assessment of each option, followed by a cost benefit analysis for selected options.

[66] Energy Policy of IEA Countries: New Zealand Review, 2017. https://www.iea.org/reports/energy-policies-of-iea-countries-new-zealand-2017-review

[67] New Zealand Government: Electricity Price Review final report, 2019 https://www.mbie.govt.nz/assets/electricity-price-review-final-report.pdf

Table 10: Pros and cons of intervention for building capability and capacity

	Pros	Cons
Minor issue	• Low cost to implement.	• May not improve efficiency.
Medium issue	• Improved efficiency, leading to lower costs and more reliability for consumers.	• Risk that costs for trust owned distributors outweigh the benefits for consumers.
Significant issue	• Improved efficient, leading to lower costs and more reliability for consumers.	• Potentially resource intensive to implement.

- ***Q.19 How are distributors currently working together to achieve better outcomes for consumers?***
- ***Q.20 Could more coordination between distributors improve the efficiency of distribution?***

9 Efficient pricing

9.1 To ensure the long-term benefit of consumers, growing demand needs to be met by the optimal combination of new technologies and network investment in the right places. Efficient distribution prices help support this ambition.

9.2 Pricing affects how consumers use electricity, how distributors and others manage load, when distributors invest in new (or replacement) poles and wires, and the timing, level and location of investments in new technology by consumers and sector participants. Reform towards efficient pricing will drive the efficient flexibility management and the electrification of process heat – in the right place at the right time. Pricing reforms would help the distribution sector contribute to New Zealand being on a least cost pathway to a low emissions economy.

Since 2017, distributors have been asked to provide pricing methodologies and plans for pricing reform to the Authority

9.3 In 2019 new distribution pricing principles were published and the Authority introduced the scorecards review: these seek to motivate distributors to reform pricing and put more emphasis on efficiency of pricing. The third scorecards review is nearing completion. Overall the scorecard process has provided a useful vehicle for engagement between distributors and the Authority.

9.4 Across distributors, progress and appetite for change is variable. While some distributors are reforming their prices, others who experience network congestion are not, and some are reforming prices away from efficient pricing or appear to misunderstand the pricing principles. The Authority considers the current approach has been useful to some extent but is not sufficient to motivate progress in pricing reform across all distributors: overall, reforms are slow.

9.5 The Authority recognises that not all distributors need to urgently reform their pricing. However, all distributors need to more closely examine their cost drivers and pricing to properly understand whether they need to act in the near term. The reviews indicate that distributor pricing to commercial customers, particularly larger ones, is generally more efficient, reflecting the bargaining power and options available to those customers. But that still leaves a significant portion, mass market/residential consumers, for whom prices may not yet be efficient.

The Authority has initiated work to drive faster reform to efficient distribution pricing

9.6 The Authority continues to progress work that aims to drive faster progress towards efficient pricing. We are revising the current practice note on distribution pricing to provide greater clarity for stakeholders on what efficient pricing looks like for different networks. We anticipate publishing a draft of the proposed enhanced guidance on efficient distribution pricing in spring 2021, for feedback from interested parties.

Glossary of acronyms and abbreviations

Acronym	Definition
The Act	The Electricity Industry Act 2010
Authority	Electricity Authority
Capex	Capital expenditure
CDR	Consumption Data Rights
CEER	Council of European Energy Regulators
CMDS	Central meter data store
The Code	Electricity Industry Participation Code
DCA	Dynamic Connection Agreement
DDA	Default Distributor Agreement
DER	Distributed Energy Resource
DG	Distributed generator
DNO	Distribution network operator
DPP	Default price-quality path
DSO	Distribution System Operator
EDB	Electricity Distribution Business
EECA	Energy Efficiency & Conservation Authority
EPR	Electricity Price Review
EV	Electric vehicle
ICP	Installation Control Point
IEA	International Energy Agency
IM	Input methodologies
Infracom	The Infrastructure Commission
IPAG	Innovation and Participation Advisory Group
MBIE	Ministry of business, innovation & employment
MW	Megawatt
MEP	Metering Equipment Provider
NZ	New Zealand
Opex	Operating expenditure
PV	Photovoltaics
RAB	Regulated Asset Base

Acronym	Definition
RFP	Request for Proposal
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
TWh	Terawatt hour
UoSA	Use of System Agreement
USD	United States Dollar
WACC	Weighted average cost of capital

Appendix A What you need to know to make a submission

The purpose of this paper is to consult with interested parties on the Authority's proposal to update the regulatory settings for distribution networks.

The updates are to ensure regulatory settings support the transition to a low emissions economy while promoting competition, reliability, and efficiency

How to make a submission

Our preference is to receive submissions in electronic format (Microsoft Word) in the format shown in Appendix B. Submissions in electronic form should be emailed to distribution.feedback@ea.govt.nz with "Consultation Paper—Updating the Regulatory Settings for Distribution Networks" in the subject line.

If you cannot send your submission electronically, post one hard copy to either of the addresses below, or fax it to 04 460 8879.

Postal address	Physical address
Submissions Electricity Authority PO Box 10041 Wellington 6143	Submissions Electricity Authority Level 7, Harbour Tower 2 Hunter Street Wellington

Please note the Authority wants to publish all submissions it receives. If you consider that we should not publish any part of your submission, please

Indicate which part should not be published

Explain why you consider we should not publish that part

Provide a version of your submission that we can publish (if we agree not to publish your full submission).

If you indicate there is part of your submission that should not be published, we will discuss with you before deciding whether to not publish that part of your submission.

However, please note that all submissions we receive, including any parts that we do not publish, can be requested under the Official Information Act 1982. This means we would be required to release material that we did not publish unless good reason existed under the Official Information Act to withhold it. We would normally consult with you before releasing any material that you said should not be published.

When to make a submission

Please deliver your submissions by **5pm** on Tuesday **14 September 2021**.

We will acknowledge receipt of all submissions electronically. Please contact the Authority info@ea.govt.nz or 04 460 8860 if you don't receive electronic acknowledgement of your submission within two business days.

Appendix B Format for submissions

Submitter	

[Remove rows with questions not answered]

Q.1 Have you experienced issues relating to a lack of information or uneven access to information?
[comment]
Q.2 What information do you need to make more informed investment and operation decisions?
[comment]
Q.3 What options do you think should be considered to help improve access to information?
[comment]
Q.4 Have networks experienced issues from the connection or operation of DER?
[comment]
Q.5 Do the Electrical (Safety) Regulations require review? If so, what changes do you think are needed (a) in the near term and (b) in the longer term?
[comment]
Q.6 Does Part 6 remain fit for purpose? If not, what changes do you think are needed (a) in the near term and (b) in the longer term?
[comment]
Q.7 Is there a case to be made for minimum mandatory equipment standards for DER equipment, specifically inverter connected DER?
[comment]
Q.8 What standards should be considered to help address reliability and connectivity issues?
[comment]
Q.9 Is there a case to look at connection and operation standards under Part 6 with a view to mandating aspects of these standards?
[comment]
Q.10 What flexibility services are you pursuing?
[comment]
Q.11 Are flexibility services being pursued through a competitive process?

[comment]
Q.12 What options should be considered to incentivise non-network solutions?
[comment]
Q.13 What options would encourage competitive procurement processes for flexibility services?
[comment]
Q.14 Have you experienced difficulties with negotiating operating agreements for flexibility services?
[comment]
Q.15 Are the transaction costs of developing contracts a barrier to entering the market for flexibility services?
[comment]
Q.16 Would an operating agreement help lower transaction costs and level negotiating positions?
[comment]
Q.17 What kind of operating agreement would address the issues described in this chapter?
[comment]
Q.18 What are distributors doing to ensure their network can efficiently and effectively manage the transformation of networks?
[comment]
Q.19 How are distributors currently working together to achieve better outcomes for consumers?
[comment]
Q.20 Could more coordination between distributors improve the efficiency of distribution?
[comment]