Preparing Electricity Regulation for Disruptive Technologies, Business Models and Players – In the Long-Term Interests of Consumers

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Electricity Retailers' Association of New Zealand

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Findings in brief

New technologies, business models and players will disrupt traditional electricity sectors, ...

The changing economics of new technologies like photo-voltaic solar panels (PVs) and high-voltage batteries (including electric vehicles, EVs) – collectively, distributed energy resources (DERs) – will ultimately transform New Zealand's electricity sector. Other sources of transformation come from the rise of business models featuring data-based competition, and of the often disruptive players – data-based disruptors (DBDs) – who are redefining traditional sectors around the world. New Zealand's electricity sector will not be immune to these changes, and is potentially well-placed to facilitate these changes so that they best serve the long-term interests of consumers.

... transform electricity consumers who take up new offerings into "prosumers", ...

At the same time, these new technologies fundamentally alter what it is to be a "consumer". If households can sell surplus energy from PVs and/or from batteries or EVs, then they compete with existing "suppliers" such as generators and electricity distribution businesses (EDBs). If uptake occurs sufficiently, this could alleviate or resolve issues such as monopoly pricing of distribution services for those households, reducing the need for existing regulation. But it could give rise to new regulatory issues as well, such as heightened exposure to market power by those unable to take up new offerings, or when DERs are owned by parties with incentives to use them for purposes other than serving the long-term interests of consumers. Existing regulation needs changing, and new regulation may be needed.

Such "prosumers" – who either produce or consumer (or both), depending on circumstances and market signals – are not as easily characterised for regulatory purposes as traditional consumers, or consumers who do not adopt these new offerings. This

both complicates and changes assessments of who, or what purposes, electricity regulation is intended to serve. Just as businesses need to know their consumers better in a world of increasingly targeted offerings, so too regulators. DERs may be beneficial for those who adopt them, but possibly harmful to those who don't – including as an unintended consequence of existing regulation. Regulation needs to understand these differences to ensure it addresses the right issues, for the right parties, in the right way – balancing any emerging conflicts of interest between different consumer types.

... enable much more decentralised and algorithmic electricity trading, ...

New technologies, business models and players will relocate the centre of gravity of electricity production, distribution, consumption, and trade. New Zealand's existing centralised trading arrangements will need to accommodate increasingly decentralised, possibly algorithmic, peer-to-peer (P2P) trading. This raises issues about system reliability, as it does in financial markets, but raises the possibility of new ways to ensure lights stay on. How coordination is achieved, and by whom (or what algorithm or platform), are important issues to resolve, as is assigning responsibility for reliability (or for causes of unreliability). Former understandings of distribution networks face particular challenge, with DERs making network topologies much more dynamic, and electricity flows multi-directional.

... and bundling of electricity supply into high value-added consumer offerings

Consumers and networks are not the only features of electricity systems that are about to be redefined. DBDs in particular have the capacity to redefine how electricity is perceived, produced and sold. Just as data-based retailing disruptors bundle postage and packaging with online purchases, other sectors are awakening to the importance of providing consumers with value-added *bundles* of services. Electric-

ity is not immune – entertainment is increasingly being bundled with utility services such as broadband data: a wide variety of products (e.g. EVs) or services could likewise become increasingly bundled with electricity supply. Technologies such as ubiquitous smartphones and voice-activated digital assistants are just two examples of platforms for the Internet of Things (IoT) that pave the way for such bundling.

Data-based disruptors could redefine electricity retailing – resolving some regulatory concerns while creating others

This could radically redefine electricity retailing – as it has other forms of retailing – and fundamentally shift the location of market power in the electricity industry. The "retailer" of the future is likely to be a provider of a wide range of value-added services, for which electricity is just one of many bundled, supporting services. With almost insurmountable advantages in terms of knowing consumers – and both predicting and influencing their behaviours – DBDs create new regulatory issues relating to privacy, data security, and control of consumer data. The way they transform data into services redefines how we think about privacy, creating an important new form of currency (our "unprivacy"), and highlighting the importance of data for innovation. Also, their market power may help to relieve traditional market power issues, such as by creating competition, or through providing bargaining power over the costs of electricity supply and its transportation. But they might also create new market power concerns, through "winner takes all competition", and by impeding competition for the market through the creation of insurmountable "data moats". Existing regulation is affected by what they do, but also affects what they can do.

Priorities for preparing New Zealand's electricity sector regulation to meet these challenges and opportunities

It is timely to ensure that regulation operates as intended in light of these evolving challenges, and is updated, added to, or removed if not. It is also timely to check that the purpose and style of regulation best serve the long-term interests

of consumers. Specific steps identified as being particularly necessary in this report include:

1. Exploring how ownership of DERs by different parties (consumers, EDBs, generators, DBDs) affect the benefits of those technologies to consumers, and whether regulatory changes are warranted:

   (a) This requires particular consideration of how existing EDB regulation may distort DER uptake – relative to any distortions associated with DER ownership by other parties – if only because existing regulatory arrangements were designed before DERs were in realistic prospect.

2. Identifying any regulatory or other institutional reforms necessary to support – or simply not impede – the efficient and timely evolution of decentralised DER trading and coordination platforms.

3. Introducing "hard-wired" provisions in existing electricity regulation – a form of "regulatory pre-nup" – to ensure that it is revisited, revised or abandoned as appropriate, with clear criteria, rules, processes and accountabilities for doing so:

   (a) Both in *response* to new technologies, business models and players, but also to *pave the way* for innovations that best serve long-term consumer interests;

   (b) Similar to, but extending, the type of review provisions in New Zealand's telecommunications regulatory framework, which better-anticipates than electricity regulation the possibility of new technologies, business models or players changing the very rationale for regulation – and recognises the need for a clear understanding about when, how, and in whose interests, regulation will change in response to changing market circumstances.

4. Relatedly, developing arrangements to proactively:

(a) Demarcate where industry-specific regulation should end, and general competition regulation should begin – the "competition-regulation boundary"; and

(b) Identify where electricity sector issues – such as privacy, reliability and security – are shared with other sectors (i.e. transport, telecommunications, etc), or where regulation in one sector has significant impacts on the performance of others:

i. In order to determine where industry-specific ("vertical") regulation should be harmonised across sectors, or replaced by more pan-sectoral, activity-specific ("horizontal") regulation.

5. Rebalancing the use of industry-specific and general competition regulation in favour of the latter, while ensuring competition regulation is sufficiently reliable and effective to discharge its extra responsibilities:

(a) To reduce the risk of existing regulation constraining innovation; and

(b) Signalling greater "regulatory forbearance":

i. Assuming that new forms of competition will emerge as technologies, business models and players change – with likely significant long-term benefits for consumers;

ii. Rather than presuming that they won't emerge – and regulating on that basis, with the likely effect of impeding their emergence and associated consumer benefits.

In short, electricity sector regulation needs to become:

- *More tailored:*
  - To fundamentally changing, and increasingly differentiated, consumer interests and types of competition;
- *More performance-based, and less industry-specific*:

  - Recognising that new technologies, business models and players blur traditional regulatory boundaries, create issues shared across multiple sectors, and necessitate a change of regulatory focus to what really matters to consumers;

- *Forward-looking and dynamic, in a disciplined and rules-based way:*
  - Reflecting an increasingly uncertain environment, but providing clear guidance about how to navigate that environment if not charting a specific course through it;
  - Providing confidence to all that they know how the rules of the game will be changed, under what circumstances and by whom, and in whose interests, even if they don't know in advance what those rules will be.

Executive summary

Report purpose

This report asks whether New Zealand's current electricity sector regulatory arrangements remain "fit for purpose" – in the sense that they best serve the long-term interests of consumers – in the face of impending new technologies, business models and players. Where it identifies they are not, it outlines the pros and cons of possible solutions, and where possible, suggests a way forward to improve those arrangements. The intention is that the report's analysis and conclusions provide a basis for further discussion, debate and analysis, recognising that there are many uncertainties about the nature of new technologies, business models and players, as well as many strategic decisions – including by regulators – that will affect their future course.

This report was commissioned prior to New Zealand's 2017 general election, and before the resulting new government announced its electricity pricing review. While it does not respond directly to that review, this report addresses the review's interest in whether existing regulation is fit for purpose in light of changing technologies, business models and players, and also highlights distributional issues that might arise from such changes.

Report rationale

The report is required because New Zealand's current electricity sector regulatory arrangements have been developed based on certain presumed technologies, business models and players, which are possibly about to change in fundamental ways. For example, the current arrangements presume that electricity is produced by generators, transported via the national grid and then by local distribution networks, until it is finally consumed by consumers, under contract with a retailer. This unidirectional trade is coordinated with a high degree of centralisation. However, new technologies are emerging – and new business models and players – which mean

that future electricity production and related network services will be produced at a much more decentralised level, enabling more bi-directional trade, and decentralised control.

Disruptive technologies

These new technologies include PVs, "storage" in the form of high-voltage batteries, and EVs, which represent a mobile form of storage. In this report such technologies – and others besides – are collectively referred to as DERs. These resources not only offer the potential for small-scale distributed generation (DG) at even the household level. They also enable electricity to be stored in new ways at a highly decentralised level, and traded across time and space. These technological possibilities radically alter the nature of electricity production and consumption.

Among other things, they transform consumers into producers who either compete with, or complement, the services provided by incumbent generators and network services. At the same time, they enable generators and electricity distribution businesses (EDBs) to either lower the cost of producing their existing services, or extend the range of services they can offer. In all cases, this presents new regulatory challenges and opportunities to regulators.

This report discusses these technology disruptions under the following major themes:

1. New technologies such as PVs and storage (including EVs) – i.e. DERs – potentially change the character of consumers who adopt them in ways that challenge how regulators should view those parties, both in isolation, but also relative to consumers who don't or can't adopt them;

2. Whether or not these new technologies improve long-term consumer welfare hinges on a range of factors, including how quickly and widely they are adopted, who owns and operates them, and under what (e.g. contractual) conditions;

3. In turn, the impact on consumer welfare of different parties owning and op-

erating new technologies turns on whether those technologies complement or substitute for those parties existing activities (or both), and the nature and extent of any market power they already possess;

4. Network topologies are likely to change significantly, becoming much more dynamic and bi-directional – causing distribution network operation to look more like that of transmission, and possibly materially changing the topology of the grid itself;

5. Trading in electricity and network support services is likely to become much more decentralised and algorithmic as customers increasingly take up DERs and related offerings;

6. The boundaries between the electricity and other sectors are likely to become increasingly blurred, and the regulatory issues they face increasingly shared;

7. The electricity sector is, more generally, likely to become much more like other, fast-moving and consumer-focused sectors are becoming; and

8. New business models and industry players could radically alter the location and type of market power in the industry, disrupting the competitive, ownership and regulatory landscapes of the sector as much as it does current industry players.

These themes are explored, in detail, in Section 4.

Disruptive business models and players

At the same time, new business models and players are likely to emerge in electricity sectors – in both large ones overseas, but also in relatively liberalised ones such as New Zealand's. Notably, these are likely to include the same sort of "disruptors" that have proven themselves highly able to accumulate, process and analyse vast amounts of consumer-level data, and to tailor new products and services to increasingly differentiated consumers. In many cases the "payment" they receive is more in

personal data than it is in money, changing how regulators need to think about competition issues, and forcing them to re-evaluate the costs and benefits of privacy. Such firms have redefined consumer engagement in a range of sectors, and are likely to do so in electricity.

In this report, these firms are called "data-based disruptors" (DBDs). Major themes addressed by this report in relation to these disruptors are:

1. Consumer-level competition across a wide range of sectors is becoming increasingly data-driven, and dominated by large international firms with comparative advantages in "big data" who can not just predict consumer-level demand, but influence it;

   (a) Associated with this change is the growing trend towards decentralised, P2P trading and the associated "sharing economy";

2. Data-based competition has inherent features driving it towards high levels of market concentration, at least in the consumer segments which take up their offerings;

3. It also uses consumers' personal information as both a form of currency, and a co-investment in innovation and hence product quality, challenging conventional notions of the value of privacy:

   (a) This will likely give rise to increasing "unprivacy differentiation" – with consumers favouring privacy either persisting with traditional service offerings or paying for them with money, while those more relaxed about sharing their data or having fewer financial resources pay for new offerings with their data;

4. Electricity sectors are ripe for entry by DBDs, who are likely to re-invent electricity retailing around highly consumer-focused offerings, and will leverage their market power from data into both retailing and DER aggregation;

5. This entry could cause a seismic shift in the balance of electricity sector market power, and likely result in a substantial realignment of industry ownership (or exit);

6. Existing firms might forestall such entry through:

   (a) Mergers with existing firms in other sectors that have superior access to consumer data and technologies for creating tailored consumer offerings, provided ownership constraints (e.g. state ownership) or competition regulators do not block such mergers – e.g. if such mergers' inherently defensive nature is not recognised; or

   (b) Tie-ups with DBDs – although experience from other sectors suggests this might simply assure eventual disruption through direct DBD entry; and

7. Electricity sector disruption by DBDs could have very uneven short- to medium-term consumer impacts, though it has the potential to bring very considerable consumer benefits (at least for those adopting their services, and prepared to part-pay for them with their data).

These themes are explored, in detail, in Section 5.

Key regulatory challenges and opportunities

This report identifies the key regulatory challenges likely to arise with new technologies, business models and players as being:

1. Consumers' interests will become increasingly differentiated and time-varying, and potentially production- rather than consumption-oriented (especially for those adopting DERs relative to those who don't) – complicating the identification of the "long-term interests of consumers";

2. The long-term welfare enjoyed by "consumers" from DERs will be affected by who owns and controls them, as well as regulation, and it is not assured that

their adoption will improve welfare in all cases – further complicating who it is that regulators are serving, and what interests are to be served;

3. DERs both substitute for, and complement, the activities of incumbent players such as generators and distributors, possibly in ways that vary over time and with circumstances – this complicates assessment of who should own and control DERs, and how they should (or need not) be regulated;

4. Distribution network topologies will become much more like that of the grid, with increasingly bi-directional energy flows – complicating distribution network management;

5. Trading in electricity and network support services is likely to become much more decentralised and algorithmic – raising the risk of more severe systemic events, but also possibly more effective tools for achieving reliability;

6. The boundaries between the electricity and other sectors are likely to become increasingly blurred, and the regulatory issues they face increasingly shared – accentuating the limitations of silo-ised, industry-specific regulation (e.g. due to regulators with narrow sectoral remits failing to account for how their decisions affect other, increasingly-interconnected sectors);

7. The electricity sector is likely to become much more like other, fast-moving and consumer-focused sectors – forcing regulators to likewise keep pace with understanding (changing) consumer preferences; and

8. New business models and industry players – in particular, DBDs – could become dominant in the industry – creating new issues such as:

   (a) Markets for DBD offerings tending toward high levels of harder-to-unsettle concentration – complicating the analysis of mergers between existing firms that might only pre-emptively and defensively create market power to balance against that of DBDs, especially if the market power impacts of DBDs remain to be seen (and raising questions about how to

balance the benefits of innovation against the costs of greater market concentration); and

(b) Charging customers in non-monetary terms, especially in terms of "unprivacy", i.e. accessing, using and trading their personal data – complicating the measurement of "price" in the provision of increasingly diverse and differentiated data-based services, and measuring the consumer costs and benefits of those services;

Some key regulatory opportunities presented by new technologies, business models and practices include:

1. Much more consumer-responsive and innovative service provision, providing quality benefits that compensate for higher consumer costs (in terms of pricing, or loss of privacy);

2. New business models and industry players – in particular, DBDs – could seize the balance of market power in the industry, potentially alleviating existing issues of market power in generation and networks that regulation would otherwise need to address (hence reducing the need for such regulation), though possibly at the expense of winner-takes-all competition in data-based offerings;

3. The possibility of adopting more decentralised network management approaches, given the impact of DERs on network topologies, and growth in technologies such as P2P platforms with "smart contracts" for (automated) decentralised trading – each of which could provide new or more efficient ways of achieving reliability; and

4. Providing regulators with new regulatory tools, such as contracting with DBDs who have unmatched consumer understanding to induce them to use that superior data to deliver desired regulatory outcomes (rather than fruitlessly trying to replicate that understanding).

These themes are explored, in detail, in Section 6.

Improving New Zealand's electricity regulation framework

Responding to these regulatory challenges and opportunities will require the following types of measures:

1. Electricity sector regulation needs to be much more tailored to increasingly differentiated consumer interests and offerings – new technologies and business models might provide the required tools;

2. Price regulation, in particular, needs to avoid creating or worsening any waterbed effects associated with consumers adopting new technologies and service providers to differing degrees;

3. Increasingly decentralised decision-making by both consumers and firms is not only likely to be inevitable, but also better enabled by new technologies, business models and players;

4. A corollary of such decentralisation is that the sort of transparency currently attaching to decision-making around the national grid is likely to be of increasing benefit at distribution level; and

5. Different regulatory issues arise with DER investments by different types of incumbent firms, or by DBDs, requiring different regulatory responses.

Other regulatory changes that are likely to maximise long-term consumer benefits from new technologies, business models and players are:

1. The use by regulators of a wider range of regulatory tools to better suit the issues confronting different consumers;

2. Greater regulatory focus on future changes affecting industry performance and regulatory issues:

   (a) Including greater "regulatory forbearance" – knowing that new technologies, business models and players have the potential to give rise to new

forms of competition, but also that existing regulation can impede their development; and

(b) With proactive management of issues straddling the boundary between competition and regulation;

3. More flexible and responsive regulation, including relatively greater reliance, than now, on competition law than industry-specific regulation – while ensuring that competition regulation is sufficiently reliable and effective to discharge its extra responsibilities;

4. A clearer focus on regulating for performance, which is technology-agnostic, rather than by (technology-specific) process;

5. Paying greater regard to regulatory issues shared across sectors or with impacts across sectors, notably to avoid unintended consequences, and to better assess privacy trade-offs, and reliability and cyber-security issues, associated with new technologies and business models; and

6. Recognising the increasing importance of international regulation of technologies, business models and players.

These themes are explored, in detail, in Section 7.

Regulating to transition towards a predictably unknowable future – "efficiently-dynamic regulation"

Measures such as those above are necessary but not sufficient to ensure the long-term interests of consumers are best served in an environment of highly probable but hard to define disruption. Additional measures are required to resolve the conundrum that regulation depends on the rate at which new technologies, business models and players arise, but in turn the advent of such innovations is itself influenced by regulation.

This leads to a regulatory "chicken and egg" problem. Should regulation be a:

1. *Strategic leader* – positioned to advance, or at least accommodate, the advent of new technologies, business models and players (even if this challenges the position of incumbents), anticipating that innovations will arise; or

2. *Strategic follower* – positioned to delay, or even impede, the advent of new technologies, business models and players, playing "wait and see" to respond to these innovations as they arise, but not before?

In either case, clear rules, criteria, processes and accountabilities are required to ensure that strategic regulatory choices are made for the long-term interests of consumers (and in what ways for different types of consumers).

Increasingly data- and platform-based competition means the electricity sector – like others – confronts the very real prospect of hard-to-unsettle, winner-takes-all disruption. There is therefore relatively greater rationale than previously – for high-level regulation at least (i.e. at the level of defining and demarcating industry-specific and competition regulation) – to act as strategic leader, with great care to do so in concert with firms (including entrants) and consumers. This is to ensure that regulation at all levels plays a constructive role in efficiently coordinating (e.g. through standards-setting) investments and other strategic choices by both firms and consumers.

That would at least reduce the risk of parties coordinating on inferior outcomes, but ideally helps to chart a course for future industry evolution in which long-term consumer interests are best served. Critically, status quo regulation represents a choice about how future technologies, business models and players will emerge (or not). The question is whether this is a conscious choice – to lead or to follow – that best-serves long-term consumer interests?

Key elements of more efficiently-dynamic regulation in the New Zealand electricity sector include clear and enforceable, ex ante regulatory commitments to:

1. Conditions under which deregulation would occur – or new regulation would be introduced:

(a) When, how, and by whom;

(b) To serve which consumer interests; and

(c) Balancing the interests of different consumer types in what ways?

2. Conditions under which older technologies might be discontinued and newer ones mandated; and

3. Not favour incumbent technologies, business models or players in the event that changing to new ones offers greater long-term consumer benefits.

Introducing such dynamically-efficient regulation in the New Zealand electricity sector is to draw on a specific feature of the country's telecommunications sector regulation (without endorsing that regulation more widely). Namely, the Commerce Commission must periodically consider whether specified criteria are met for regulated telecommunications services to be deregulated.

In the past, electricity sector technologies have been relatively slow-moving, and it is only more recently that DERs and new business models and players have emerged. This is in contrast to telecommunications sectors, where long-established infrastructures such as copper networks were long ago disrupted by newer technologies. Telecommunications regulation has therefore had to have been far more attuned to:

1. How new technologies, business models and providers could resolve historical market failures;

2. The harms to consumers of regulation impeding them from doing so; and

3. The need for regulation to facilitate innovation and investment.

The electricity sector is now facing a more dynamic and innovative environment of the sort long-facing telecommunications sectors. Hence, lessons can be learned from how telecommunications regulation has – or should have – evolved over time. This includes learning whether it has signalled clear "rules of the game", if not the precise direction of play, to firms and consumers in advance. With such clearly-signalled

rules, parties can make investments understanding how future regulation will evolve – rather than facing uncertainty about how, when, and to what ends that change will arise.

These themes are explored, in detail, in Section 8.

Some key outstanding questions

Many of the challenges and opportunities referred to above are still emerging, even in New Zealand which is a relatively late starter in the process of change, and which can therefore draw on the experiences of other jurisdictions in which change is more well-established. Consequently, much of the discussion, and hence many of the prescriptions, in this report should be treated as exploratory – a first attempt to chart a course in significantly novel territories. They hopefully provide clarity about the emerging issues, providing a framework for analysis, and offering insight as to how regulatory challenges and opportunities might best be responded to. Ultimately, however, they are merely offered as suggestions for further discussion, analysis and debate, recognising there are important uncertainties to be resolved, and important questions of strategy to be determined.

Some key outstanding questions that need to be addressed to ensure that New Zealand electricity regulation best serves the long-term interests of consumers include:

1. How can regulators better tailor their regulatory offerings to increasingly-differentiated consumers, and balance diverging consumer interests – especially when some of those consumers may also become producers, or are more prepared than others to "pay" for new offerings with their data (i.e. their "unprivacy")?

2. What steps should regulators take to ensure that adopters of new technologies and services do not create costs for others – especially those who do not wish to, or cannot, adopt those technologies and services – including as a consequence of regulation itself?

3. How should electricity sector regulation evolve to simultaneously reflect increasingly-divergent consumer interests, and increasingly-shared issues – such as the changing private/social costs and benefits of privacy, or security of supply – across different sectors (e.g. transport and telecommunications)?

4. Are new technologies, business models and players inherently beneficial for long-term consumer welfare – are there particular types of innovation (or particular owners of new technologies) that maximise consumer benefits while others do not, and how can/should regulation influence this?

5. Should new technologies, business models and players play by existing industry rules (e.g. centralised control), or should those rules be changed to accommodate those innovations?

6. Should regulation lead or follow – do the benefits of cautiously waiting and seeing how new technologies, business models and players evolve outweigh the costs of foregone opportunities (e.g. by failing to more pro-actively facilitate those innovations)?

This report attempts to shed some light on these questions, even if the solutions it offers need further discussion, debate and analysis.

Recommendations

Despite these outstanding questions, this report makes the following, "low-regret" recommendations that should contribute to ensuring that electricity regulation adapts to best serve consumers' long-term interests.

Specific steps identified as being particularly necessary in this report include:

1. Exploring how ownership of DERs by different parties (consumers, EDBs, generators, DBDs) affect the benefits of those technologies to consumers, and whether regulatory changes are warranted:

(a) This requires particular consideration of how existing EDB regulation may distort DER uptake – relative to any distortions associated with DER ownership by other parties – if only because existing regulatory arrangements were designed before DERs were in realistic prospect.

2. Identifying any regulatory or other institutional reforms necessary to support – or simply not impede – the efficient and timely evolution of decentralised DER trading and coordination platforms.

3. Introducing "hard-wired" provisions in existing electricity regulation – a form of "regulatory pre-nup" – to ensure that it is revisited, revised or abandoned as appropriate, with clear criteria, rules, processes and accountabilities for doing so:

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   (b) Similar to, but extending, the type of review provisions in New Zealand's telecommunications regulatory framework, which better-anticipates than electricity regulation the possibility of new technologies, business models or players changing the very rationale for regulation – and recognises the need for a clear understanding about when, how, and in whose interests, regulation will change in response to changing market circumstances.

4. Relatedly, developing arrangements to proactively:

   (a) Demarcate where industry-specific regulation should end, and general competition regulation should begin – the "competition-regulation boundary"; and

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i. In order to determine where industry-specific ("vertical") regulation should be harmonised across sectors, or replaced by more pan-sectoral, activity-specific ("horizontal") regulation.

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   (a) To reduce the risk of existing regulation constraining innovation; and

   (b) Signalling greater "regulatory forbearance":

      i. Assuming that new forms of competition will emerge as technologies, business models and players change – with likely significant long-term benefits for consumers;

      ii. Rather than presuming that they won't emerge – and regulating on that basis, with the likely effect of impeding their emergence and associated consumer benefits.

In short, electricity sector regulation needs to become:

- *More tailored:*
  - To fundamentally changing, and increasingly differentiated, consumer interests and types of competition;
- *More performance-based, and less industry-specific*:
  - Recognising that new technologies, business models and players blur traditional regulatory boundaries, create issues shared across multiple sectors, and necessitate a change of regulatory focus to what really matters to consumers;
- *Forward-looking and dynamic, in a disciplined and rules-based way:*

- Reflecting an increasingly uncertain environment, but providing clear guidance about how to navigate that environment if not charting a specific course through it;
- Providing confidence to all that they know how the rules of the game will be changed, under what circumstances and by whom, and in whose interests, even if they don't know in advance what those rules will be.

These, and other recommendations, are set out more fully in Section 9, which also discusses the likely best phasing of steps towards more "future-proof" electricity regulation.

Contents

List of Figures

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Richard has a particular interest in the economics of vertical industries, such as in electricity, telecommunications, gas, and liquid fuels. He also conducts research on the effects of different ownership types, including the differences in incentives and performance arising under customer and investor ownership (with such ownership differences featuring in New Zealand electricity distribution businesses).

Richard was previously Research Principal at the New Zealand Institute for the Study of Competition and Regulation. There he researched a wide range of issues relating to electricity sector organisation, regulation and performance. This included co-authoring, with Professor Lewis Evans, *Alternating Currents or Counter-Revolution? Contemporary Electricity Reform in New Zealand*, tracing the course of New Zealand's electricity reforms, assessing their performance, and comparing them with overseas electricity reforms. Prior to this he was involved in various electricity sector mergers, acquisitions and privatisations, in New Zealand and Australia, as an Associate Director of investment banking with Credit Suisse First Boston.

In 2014, Richard was awarded a PhD (with Distinction) in Industrial Organisation and Regulation by Toulouse School of Economics. There he also earned MSc and MPhil degrees in Economic Theory and Econometrics. He acts as peer reviewer for a range of academic economics journals, and conference scientific committees. His research has received a number of awards, and includes journal articles in peer-reviewed academic journals, books, chapters in edited volumes, research monographs, commissioned studies, and academic working papers.

Abbreviations

5G	Fifth generation wireless communications technology
AC	Alternating current
ACCC	Australian Competition and Consumer Commission
AI	Artificial intelligence
AVs	Autonomous vehicles
DBDs	Data-based disruptors
DC	Direct current
DERs	Distributed energy resources
DG	Distributed generation
EA	Electricity Authority
EDB	Electricity distribution business
EECA	Energy Efficiency and Conservation Authority
ERANZ	Electricity Retailers' Association of New Zealand
EU	European Union
EVs	Electric vehicles
FCC	Federal Communications Commission
FSRs	Financial storage rights
FTRs	Financial transmission rights
GDPR	EU's general data protection regulation, operative since May 2018
GHG	Greenhouse gas
GWh	Gigawatt hour

HSWA	Health and Safety in the Workplace Act 2015
HVDC	High-voltage direct current
ICP	Installation control point
IoT	Internet of things
KWh	Kilowatt hour
LFCT	Low fixed charge tariff
MaaS	Mobility as a service
MBIE	Ministry for Business, Innovation and Employment
MfE	Ministry for the Environment
MW	Megawatt
P2P	Peer-to-peer
PCBU	Person conducting a business or undertaking
PVs	Photo-voltaic (solar) panels
RES	Renewable electricity supply
V2I	Vehicle-to-infrastructure connectivity
V2V	Vehicle-to-vehicle connectivity
WTP	Willingness-to-pay

1 Introduction

This section sets the scene for the rest of the report:

- Providing context for this report, and explaining why it is needed;
- Describing the report's purpose and scope;
- Emphasising the report's focus on ensuring that regulation best serves the long-term interests of electricity consumers (and not other objectives); and
- Foreshadowing the discussions in subsequent sections, and outlining the report's structure.

1.1 Context

1.1.1 New Zealand electricity sector facing "disruption"

The New Zealand electricity sector is on the verge of a number of potentially disruptive changes in technologies, business models and players. These include technologies such as photo-voltaic solar panels (PVs), residential-scale home batteries for high-voltage electricity storage ("storage"), and electric vehicles (EVs, which can also be thought of as mobile storage) – together, distributed energy resources (DERs).

They also include the Internet of things (IoT), meaning more and more devices consume power, and power-consuming devices are increasingly becoming connected to the internet. These generate new data about consumers and their behaviours, and enable new ways to control and use those devices, or create services which use them.

Peer-to-peer energy trading platforms are beginning to emerge, enabling non-traditional electricity producers to buy and sell surplus electricity "off-market" from established electricity metering arrangements. Electric car manufacturers and others are offering buyers of electric cars a certain amount of free recharging, effectively "bundling"

electricity supply with the car purchase.

1.1.2 Data-driven disruptions in other sectors

The electricity sector is not the only sector in New Zealand facing these changes. A number of other sectors have already been "disrupted" by innovations such as the "sharing economy". Notable examples include Uber in passenger transport services, Airbnb in accommodation, and Netflix in entertainment. Other sectors, such as financial services, are similarly facing significant changes, including the possible entry by non-traditional, data-based competitors into areas like financial services retailing, traditionally the preserve of banks and insurance companies.

A defining feature of these disruptions is that new communications technologies mean that the things consumers do, or use, in their day-to-day lives are becoming tracked and connected at ever-increasing rates. Vast amounts of data are being generated, enabling firms – often "Tech Giants" – with the skills and resources for understanding consumer preferences and behaviours, to make highly innovative and competitive product offerings (sometimes at no monetary cost to users, who instead pay in kind through "unprivacy" – i.e. with their personal information). At the same time, the costs of creating new digital marketplaces has fallen. Together, this trend of "digitalisation", and "data-based competition", is making consumers of both new and traditional products evermore "contestable" – i.e. "up for grabs" by firms with strengths in these new technologies. It is also redefining what consumers are buying – e.g. mobility as a service (MaaS), rather than just a car, or bicycle.

Traditional suppliers are adapting their business models, either to pre-empt or respond to entry by such non-traditional players. Where they fail to do so, they face the risk of being displaced altogether by those entrants. Never before have so many consumers been "up for grabs", for so many products or services, by so many – often non-traditional and international – providers.

1.1.3 A particular feature of electricity sector disruption

Another important feature of these disruptions – not least in electricity – is that they have the potential to transform consumers into producers, at least at different times of the day or year, or as circumstances (e.g. market prices, or sunshine levels) vary.[1] This means electricity consumers who take up new technologies and business models can compete with their traditional suppliers, for example by supplying some or all of their their own energy (or energy transportation) needs.

However, they might also provide services that assist their traditional suppliers – e.g. providing back-up power or network support services to electricity distribution businesses (EDBs) in the event of network failures. The traditional, uni-directional model of electricity supply, running from generators to clearly-defined and distinct consumers, via a high-voltage transmission grid and then a low-voltage local distribution network, is likely to persist for the foreseeable future. But more and more, traditional electricity sector roles will become blurred, and power flows increasingly bi-directional, allowing parties to simultaneously play multiple roles in the supply chain (e.g. a consumer owning a battery or EV can at the same time be a generator and a provider of distribution services). Moreover, these changes are likely to be accompanied by substantial shifts in how consumers perceive electricity, and why, how and from whom they buy it.

1.1.4 Imperatives for change in New Zealand electricity

New Zealand's is not the only electricity sector facing these challenges.[2] It is a relatively late starter in the uptake of new technologies such as PVs, storage and EVs. Other jurisdictions, such as the United States (US) and European Union (EU), have actively promoted the uptake of such technologies as important steps

[1] The same can be said of Uber and Airbnb. Owners of existing car or accommodation capacity can consume the services that capacity provides for their own benefit. Alternatively, they can combine their labour with that capacity to produce those services for paying customers. Uber and Airbnb provide digital technologies that improve the matching of buyers to sellers, facilitate trust, and expedite payment.

[2] See International Energy Agency (2017) for a wide-ranging discussion of how digitalisation is likely to affect – or is already affecting – electricity systems globally.

towards decarbonising their electricity sectors, which have been heavily reliant on fossil fuels. They also offer the potential to reduce transport-related greenhouse gas (GHG) emissions. In part this has been because New Zealand's electricity sector has less need than most developed countries' to decarbonise electricity supply, since it is already mostly renewables-based (i.e. hydro, geothermal and wind). New Zealand does, however, face the challenge of decarbonising its transport sector, an important source of the country's GHG emissions. That might be achievable if vehicles using fossil fuels can be replaced with fully- or partially-electric vehicles, provided any required expansions in electricity supply can be achieved using renewable electricity supplies (RES).

In any event, as the costs of these new technologies fall, consumers will increasingly adopt them. This is particularly so if they represent cheaper alternatives to existing offerings, but also if they offer new benefits not achievable from existing technologies and providers. The question this report addresses is whether and how the uptake of these new technologies is desirable from a policy perspective, and what regulatory frameworks are required to ensure any new uptake occurs in the best possible way, and at the best possible rate, defining best in terms of the long-term interests of consumers (discussed further in Section 1.3.2).

1.2 Purpose and scope of the report

1.2.1 Purpose and intended use

The Electricity Retailers' Association of New Zealand (ERANZ) has commissioned this report from Cognitus Economic Insight (Cognitus). The purpose of the report is twofold:

1. To identify where New Zealand's current electricity sector regulatory framework is likely to no longer be "fit for purpose", in the face of emerging changes to technologies, business models and players; and

2. To discuss desirable changes to that framework, and how they might best be

achieved.

In commissioning this report, ERANZ's intention is that it informs discussion and debate about the development of future regulatory options for the New Zealand electricity sector. Many of the changes confronting the sector are not only novel, but also highly uncertain as to both their nature and timing (or, at least, as to how their nature and timing might be influenced in desirable ways – more below). Furthermore, international understanding about the implications of these changes – in both policy and academic circles – is still in early stages of development, with many policy options being proposed absent much guidance from past experience, experience from other jurisdictions, or substantive analysis. Hence, while this report makes firm recommendations where possible, in many places it simply identifies key questions that need further consideration. It offers insights as to how those questions might be addressed, and where possible, indicates a possible "pathway" to doing so.

1.2.2 Scope and limitations

An important feature of this report is that it highlights how these decisions cannot be considered in isolation. Firstly, the electricity sector is affected not just by industry-specific regulation such as price-quality regulation of electricity distribution services, but also by generic regulations that affect multiple sectors (e.g. workplace health and safety regulation). Secondly, it is affected by regulation in other sectors, even if those regulations are not intended to affect the electricity sector.

A relevant example, explored further in this report, is transport sector regulation – e.g. motor vehicle fuel efficiency standards, or public transport policy, each of which affect the purchase of new vehicles (including EVs). Also, the development and uptake of new technologies and business models is affected by the actions of international parties such as overseas businesses and regulators, with flow-on implications for their uptake in New Zealand. Despite these interactions, the scope of this report is confined to electricity sector regulation in New Zealand. This means

that, to some extent, these other influences must be taken as given.

A safe, reliable and efficient electricity supply is important in developed economies for a range of reasons. This makes electricity sector regulation important from a variety of perspectives – economic, legal, sociological, political, etc. Cognitus has expertise in the economics of competition and regulation, and as such these are the focus of this report. Its analysis is grounded in, and informed by, published policy-oriented applied theoretical and empirical economic analysis and research from around the world. Analysis of electricity sector regulation from other perspectives (e.g. political, or sociological) are beyond the scope of this report.

Finally, this report was commissioned in June 2017, before that year's general election and change of government, and before the new government's electricity pricing review was announced. This report does not directly respond to that review, although it discusses distributional issues – an important focus of the review – where they are expected to arise with new technologies, business models and players. This report does, however, address the readiness of New Zealand's electricity regulation for those new technologies, business models and players, hence sharing a focus of the review.

1.3 Report focus – the long-term interests of electricity consumers

1.3.1 Differing interests acknowledged

ERANZ is an industry body representing the interests of firms involved in the retailing of electricity in New Zealand. As such, the interests of ERANZ and its members cannot be assumed to be identical to those of electricity sector consumers. This is not to suggest that ERANZ's members do not care about their customers, as any competing firm must do so in order to stay in business and to thrive. Rather, it simply acknowledges that ERANZ's members are, by and large, firms that seek to provide their owners with competitive financial returns, not organisations that exist to maximise consumption-related benefits enjoyed by their consumers. It also

acknowledges that some consumers might adopt new technologies and business models that enable them to compete with ERANZ's members to some degree at some level (e.g. by self-supplying some part of their energy requirements), or to become their suppliers (e.g. providing ERANZ's members with storage services, and associated energy price arbitrage opportunities).

Likewise, the interests of ERANZ's members cannot be assumed to be identical to those of other industry participants (e.g. EDBs), non-traditional firms that might wish to enter into various parts of the sector, or New Zealand society as a whole. Furthermore, some of ERANZ's members – so-called "gentailers" – are "vertically integrated" into electricity generation as well as electricity retailing. Others are standalone, or "vertically separated", retailers, while some are "horizontally integrated" between electricity retailing and other activities (e.g. supplying gas, or internet services). Hence even the interests of ERANZ's individual members cannot be assumed to coincide.

1.3.2 Interests to be served in this report

Acknowledging these possible differences of interests, ERANZ's brief to Cognitus has been clear. In this report Cognitus has been required to consider what electricity regulatory arrangements would be "fit for purpose" in the sense that they best serve the long-term interests of electricity consumers (i.e. "long-term consumer welfare").[3] Cognitus is an independent economic consultancy, and its brief has been to provide its independent view on what regulatory arrangements best serve the interests of consumers, not those of ERANZ or its members. As such, ERANZ reserves the ability not to publish this report, but not to determine its contents – for which independence Cognitus records its thanks.

[3] As such, it can be considered a "dynamic efficiency" standard, as discussed further in Section 2.4.

1.3.3 Some potential complications

Section 4 discusses potential complications that arise when focusing on "consumer" benefits in a sector in which not all consumers adopt new technologies and business models in the same way, or at the same pace. Likewise, questions arise when defining the interests of consumers who might also – from time to time at least – be producers, and possibly trading electricity-related services with firms or other consumers. And with changes in technology and business models potentially becoming more rapid and disruptive over time, even further questions arise as to what constitutes the "long-term", at least in any sense of what might constitute an ultimate "steady state".

1.3.4 Assumed objective of regulation

Leaving these complications for later discussion, it is simply reiterated that the guiding principle for this report's discussion is how best to serve the long-term interests of consumers. This is to distinguish it from other possible analyses, such as the maximisation of benefits for "NZ Inc.", or of particular firms or groups of firms (in particular, of ERANZ, or any or all of its members). It is the working assumption of this report that acting in the long-term interests of electricity consumers is also the ultimate priority of electricity sector regulators.

1.4 Why this report is needed

The reasons why regulation is sometimes warranted are discussed in Section 2 (as are reasons why regulation is sometimes used even when it is not warranted). For present purposes it is sufficient to note that whatever were the historical rationales for electricity sector regulation in New Zealand, those rationales are likely to be changed by new technologies, business models, and industry players – if they haven't been already.

These new factors might reduce the need for existing regulation, for example where they relieve market power or consumer safety concerns. Alternatively, they might

strengthen the case for existing regulation, such as where they exacerbate existing market power or safety issues, or privacy concerns. This can arise, for example, when these factors affect the "institutions" governing exchange in the sector (i.e. markets, firms, contracts, etc) – e.g. with new markets and firms, and contracting and ownership arrangements, affecting the sector's competitive landscape. Finally, they might justify the introduction of new regulations to address new issues not previously of concern – e.g. cyber-security, or winner-takes-all competition becoming insurmountable due to the creation of critical "data moats". Alternatively, they might mean it is now possible to regulate existing issues that were previously too costly to address.

In all cases, new technologies, business models and industry players affect:

1. The issues that regulators must confront;
2. The tools at regulators' disposal to address those issues; and
3. The costs of retaining outmoded regulations (in terms of prolonging or exacerbating historical market power issues, or hindering desirable innovation and investment).

In other words, new technologies, business models and industry players not only affect the ways in which a sector operates – these affect the *benefits* of regulation. They also affect the technologies at the disposal of regulators for producing regulation itself, which changes the *costs* of regulation. By changing the benefits and costs of regulation, these new factors affect the optimal level and type of regulation, as well as the issues that require regulation in the first place.[4]

This report is needed because these new technologies, business models and industry players change the socially efficient level and type of regulation, and possibly in

[4]Strictly speaking, these factors affect not just the *levels* of the benefits and costs of regulation, but also their *rates of change*. From an economic perspective, these rates of change – or *marginal* benefits and *marginal* costs, being the extra benefits and costs of an additional "unit" of regulation – are what are important for identifying the ideal, or optimal level of regulation. Based on standard economic analysis, the optimal level of regulation occurs where its marginal benefits just equal its marginal costs: at any other level of regulation the net benefits of regulating can be improved upon by a change in the level of regulation.

very material ways. As a consequence, what might have been "fit for purpose" regulation in the past is likely to not be now. Confronting these new factors with existing regulation is likely to produce a variety of unintended consequences. Some of these will be *negative* unintended consequences, such as when existing regulation inhibits the uptake of desirable new technologies or business practices, or deters entry into the sector by consumer-welfare enhancing competitors. Ironically, some unintended consequences might be *positive*, such as when they induce greater uptake of consumer-welfare enhancing technologies or practices which consumers might otherwise be slow to adopt (e.g. due to lack of information about their benefits, or due to coordination issues between consumers and suppliers).[5]

Either way, in this report it is assumed that a relevant dimension on which regulation can be judged "fit for purpose" is that it both:

1. Sets out with a clear policy objective; and
2. Addresses that policy objective deliberately, rather than by "side wind".

Moreover, in addition to the need to identify both negative and positive unintended consequences of existing regulation – both of which can be regarded as "distortionary" – the need remains to identify what new types of regulation might be justified in the face of new technologies, business models and industry players. Hence this report is needed not just to identify those unintended consequences and how they might be remedied, but also to consider what other regulatory changes might best serve the long-term interests of consumers in a changing energy "futurescape".

1.5 A taste of things to come

From the discussion in later Sections it will become apparent that:

1. For the foreseeable future at least, not all consumers will adopt new technologies – from different types of providers and under different types of business

[5]For completeness, it should be noted that not all new technologies are welfare-enhancing, and hence there can be benefits if existing regulation impedes their adoption, unintentionally or otherwise. This is discussed further in Section 4.3.

models – in the same ways, or at the same rates;

2. In part this is because new technologies present novel risk-return profiles that are attractive (and affordable, understandable and feasible) for some consumers, but not to all – raising the question of how consumer-focused regulators balance, or influence, such diverging consumer interests;

3. While this means it will be difficult to define "one-size-fits-all" ideal regulation, it certainly does not mean that status quo regulation, by itself, is best-suited for the emerging environment;

4. Indeed, while New Zealand's overall regulatory framework has some significant positives in terms of its coverage, robustness and flexibility, there are aspects of current electricity sector regulation that have both negative and (possibly) positive unintended consequences meriting examination;

5. Moreover, there are important gaps in New Zealand's current regulatory framework in terms of transitioning efficiently to new regulatory arrangements in the face of rapidly evolving – but highly uncertain – regulatory challenges and opportunities;

6. This includes clear and enforceable rules, processes, criteria, responsibilities and time-frames for removing existing regulation where it proves to no longer be needed, but also for creating possible new regulations to ensure that existing market power in the sector is not used to inefficiently deter consumer-welfare enhancing changes;

7. Additionally, there are aspects of the current regulatory framework that are predicated on historical technologies and business models, and which either need revisiting, or leave significant gaps needing attention – including a need for greater attention to be paid to issues shared between electricity and other sector regulators (such as determining how much privacy – or sharing of personal information, "unprivacy" – is warranted in a world in which value-added services increasingly hinge on consumers revealing personal data);

8. This is not least because the competitive and contracting landscape of the New Zealand electricity sector is likely to undergo radical change as a consequence of new technologies, business models and players – including the entry of large, data-based firms, with insurmountable advantages in terms of not just understanding consumers and predicting their behaviour, but also influencing that behaviour;

9. It is important that regulation provides certainty where that is important, but also flexibility and responsiveness (in a rules-based way) to take advantage of consumer-welfare enhancing changes as they materialise;

10. Whatever the appropriate balance between regulatory certainty and flexibility has been in the past, the pace and nature of impending changes in the sector means that the balance has most likely shifted in favour of greater regulatory flexibility and responsiveness (with the inherent disruptiveness of sectoral changes likely to overshadow regulatory uncertainty);

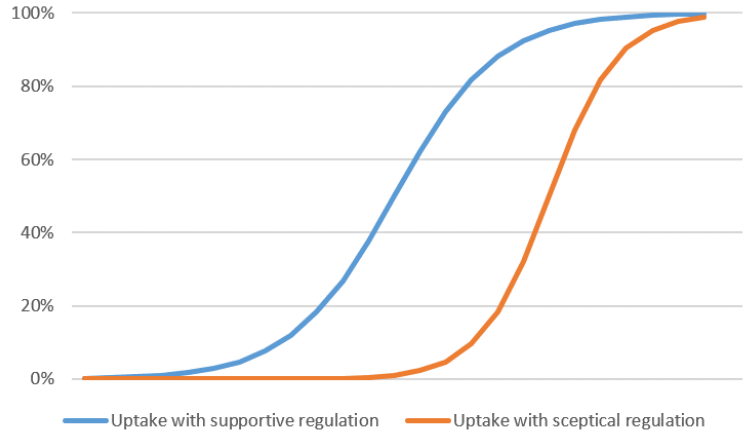
11. It is also important to recognise that the rate at which new technologies, business models and industry players emerge is not an external given – it reflects the choices of consumers, firms, and regulators, where the outcome of those choices for any one group depends on the choices of the other groups (Figure 1 provides an illustration of this);

12. This highlights the strategic role played by regulators – for better or for worse, intentionally or otherwise, regulatory choices (including choices to preserve the status quo) reflect a choice about the rate and type of uptake;

13. A consequence of this strategic role is that regulatory certainty – sometimes referred to as regulatory "commitment", or regulatory leadership – can complement, rather than conflict with, regulatory flexibility and responsiveness, by *inducing* sectoral changes rather than waiting to *respond* to them; and

14. New Zealand has a certain degree of flexibility in taking its own regulatory course. However, to a significant extent we will face constraints in terms

Figure 1: HOW REGULATORY CHOICES CAN INFLUENCE UPTAKE OF NEW TECHNOLOGIES



Note: Vertical axis is proportion of consumers adopting a new technology, while horizontal axis represents time.

of technologies, business models, new players, and associated regulatory arrangements, becoming increasingly internationalised, or at least driven out of larger jurisdictions such as the US and EU (and/or the subject of international trade agreements).

1.6 Structure of the report

The remainder of this report is structured as follows:

- Developing some background to frame later discussions – either or both of these two sections could be skipped by those familiar with the details:
  - Section 2 provides a brief background on why regulation is sometimes warranted – in short, where some sort of "market failure" arises, and where the costs of regulation are sufficiently outweighed by its benefits. It also discusses why regulation, in practice, might arise for other reasons, including those which may serve firms' or others' interests, not those of consumers;

  - Section 3 then provides a high-level survey of New Zealand's general regulatory institutions, as well as specific regulations of relevance in the New Zealand electricity sector. Regard will be had to how regulations in certain other sectors have implications for electricity sector performance (and vice versa);

- Identifying the coming challenges (and opportunities):
  - Section 4 explores how new technologies either resolve existing regulatory issues, create new ones, or provide new tools for existing but previously intractable ones;
  - Section 5 does likewise in relation to new business models and players;

- Providing a stock-take of how current regulatory arrangements are – or are not – up to the coming challenges:
  - Section 6 summarises the likely coming challenges and opportunities, and surveys strengths of the New Zealand regulatory environment, as well as issues it faces in confronting those challenges and opportunities;
  - Section 7 discusses possible improvements to New Zealand electricity sector regulation;
  - Section 8 discusses what steps might be taken now to transition towards an improved regulatory environment; and

- Drawing conclusions:
  - Section 9 concludes with some general regulatory prescriptions, statements of key outstanding questions and "low-regret" policy recommendations.

This section's main points are:

- New technologies, business models and players are likely to disrupt the New Zealand electricity sector, as they have many other sectors both locally and abroad;
- This changes the rationale, tools, and challenges for electricity sector regulation; and
- It is timely to take stock of New Zealand's existing electricity sector regulation, and to highlight how it needs to change to be more "future proof" in the face of change that is increasing, but highly uncertain.

2 Why we regulate, and when we should

This section backgrounds why we regulate, and compares different types of regulation. It:

- Defines regulation, and characterises it as a form of governance;
- Provides rationales for regulation, and for regulatory change; and
- Discusses pros and cons of a range of different regulatory approaches – including industry-specific regulation and competition regulation.

2.1 Introduction

Before focusing on how the New Zealand electricity sector is – or ought to be – regulated, it is useful to first summarise the rationales for regulation more generally. This reminds us why we have regulation, and why the rationale for regulation can change with changing circumstances. Those familiar with the economics of regulation could skip this section and proceed to later sections.

A full discussion is beyond the scope of this report, but the interested reader can find a more thorough treatment in Meade and Evans (2015), on which this summary extensively draws. The discussion begins by defining regulation and its various types. It then identifies regulation as a form of "governance" – highlighting that regulatory authority arises in multiple layers defined by the sources of that authority. The two main rationales for regulation are briefly summarised, namely:

1. *Normative rationales* – why we should regulate; and
2. *Positive rationales* – why we do regulate.

Sources of regulatory change are also briefly summarised. This is then followed by a discussion of the pros and cons of different regulatory approaches, which sets the scene for later sections.

Figure 2: COMMONLY-USED DICHOTOMY BETWEEN ECONOMIC AND SOCIAL REGULATION

Source: Meade and Evans (2015), Figure 1.

2.2 Regulation as a form of governance

As in Meade and Evans (2015), regulation is taken to mean:

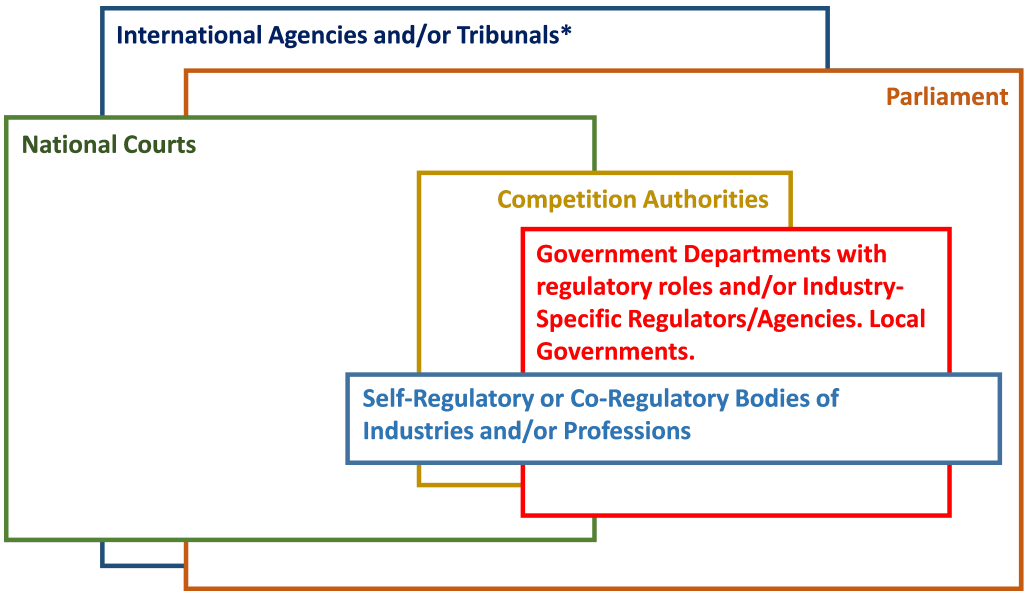
> "deliberate actions taken by government or government agencies to influence the behaviours of producers and/or consumers."

This means regulation can be thought of as a form of "governance", i.e. a way of coordinating action – in this case the choices of producers and consumers.

In practice, regulation is often classified as being either "economic" or "social" based on the types of issues it addresses, as shown in Figure 2. In reality these distinctions become blurred, as suggested by the overlap in the figure.

Regulation ranges from the extremes of "laissez-faire", in which government leaves private exchange (often referred to as market forces, or less accurately, competition), through to "command and control", in which it exerts significant coercive authority over that exchange. It can take the form of laws enacted by parliament, through to delegated forms of rule-making such as rules or regulations made by government ministers or officials. It also takes the form of enforcement choices by the courts, separate regulatory agencies, and other parties such as the police, or tax authorities. In some cases regulations originate in measures developed or imposed

Figure 3: OVERLAPPING, DISTINCT OR NESTED LAYERS OF REGULATORY AUTHORITY



* Where governments or other national agencies opt into international regulatory regimes.
Source: Meade and Evans (2015), Figure 2.

in international forums, such as trade agreements. The resulting multiple layers of regulatory authority are illustrated in Figure 3.

2.3 Rationales for regulation

2.3.1 Normative rationales

The "textbook" rationale for why regulation might be required is typically that some form of "market failure" has arisen. This means that private parties such as firms and consumers, if left to their own devices, make choices that are socially undesirable in one or more ways. To this is sometimes added the rider that regulation should only be introduced if the net benefits of regulatory intervention outweigh the net costs of tolerating the market failure. This recognises that we have imperfect technologies for regulating, and hence that regulation has costs as well as benefits. Hence the net

benefits of regulating may be no better than living with imperfect market outcomes.[6] Standard sources of "market failures" are:

1. *Market power* – one or more firms has the ability to shift prices faced by consumers or other firms, distort or limit product qualities, deter competitive entry by rival firms, etc;

2. *Externalities* – private parties base their choices only on their private (marginal) costs and benefits, so can fail to take into account the costs (negative externalities) or benefits (positive externalities) that their private choices impose or create for others – the classic example is pollution costs;

3. *Coordination failures* – private parties optimally respond to their individual incentives, but society benefits if they were able to coordinate on superior rather than inferior outcomes (e.g. agreeing on a socially-superior technology standard, rather than an inferior one);

4. *Public goods (and merit goods)* – goods which generate social benefits but which might be under-provided by private parties because they cannot exclude others from using them (or some parties may not be able to afford them), limiting the returns to private provision;

5. *Information asymmetries* – private provision or exchange can be affected by incentive issues arising when some parties are better informed than others about things like product quality, managerial effort, or consumer willingness-to-pay (WTP); and

6. *Cognitive biases* – private parties acting in apparently irrational ways.

[6] A useful analogy is the decision of a surgeon to operate. A person might in the normal course be healthy. Should they become unwell – analogous to a "market failure" arising – a surgeon may be able to relieve sickness, or restore health, by operating on that person. Surgery is not without its costs or risks, however, so the surgeon must weigh the risk-adjusted net benefits of operating against those of alternative forms of treatment, or simply leaving the patient to live with their condition. Boyle and Meade (2008) further extend this rider, showing that when regulation is at least partially irreversible, it should only be introduced when its net benefits are sufficiently large that they outweigh the option value of waiting for further information before regulating. This requires that the benefits of regulation do not just exceed its costs, but that they do so by a sufficient margin (reflecting foregone option value).

2.3.2 Positive rationales

The above "textbook" view of regulation is often complemented by less idealistic rationales. This recognises that regulation has a political economy dimension, meaning it arises in a context where interested parties might seek to use it for private rather than social benefits. For example, incumbent firms in an industry might seek the implementation of regulation as a means to deter competitive entry by rivals, rather than to benefit consumers. This presumes regulators can be induced to act in the interests of private parties rather than society as a whole, such as when they have inferior information than regulated firms about the issues or parties subject to regulation.

Hence, aside from whether or not regulation has positive net benefits and should be introduced to remedy some form of market failure, it might arise simply because it can be induced to change the competitive landscape in favour of interested parties.

2.3.3 Explaining regulatory changes

How regulation changes over time can be attributed to a range of factors. these include:

1. *Path dependency* – e.g. electric utility regulation in the US has taken a different course to that in other developed countries, mainly in reflection of differing degrees of historical state ownership in the sector;[7]

2. *Responses to shocks* – regulation (as well as deregulation/liberalisation) often arises in reaction to major adverse events, such as financial sector regulation following the global financial crisis, environmental regulation following oil spills, workplace health and safety regulations following workplace tragedies, etc;

3. *Changes in norms (i.e. values, beliefs, customs and traditions)* – social attitudes evolve either systematically or cyclically, resulting (e.g.) in changing

[7] See Evans and Meade (2005) for further discussion of the history of electricity sector reforms in the US and other jurisdictions.

attitudes towards the relative importance of decentralised and market-based economic activity, versus more centralised and/or government interventionist approaches in the economy;[8]

4. *Innovations in regulatory technology* – just as firms innovate to find better ways to produce goods and services that consumers want, regulators can innovate to find better ways to remedy market failures, reducing the costs of regulation, and hence enhancing its net benefits relative to tolerating market failures (this includes "learning-by-doing", which benefits regulators as much as it does firms);

5. *Innovations more generally* – as firms discover better ways to provide existing goods or services, or ways to provide new goods or services, this can:

   (a) Reduce the need for existing regulation – where historical market failures are resolved;

   (b) Strengthen the need for existing regulation – where historical market failures are aggravated; or

   (c) Raise the need for new regulation – where new market failures arise.

The latter set of possibilities is of particular importance for this report, given the potentially disruptive changes likely to arise in the New Zealand electricity sector as a consequence of new technologies, and the business models and entry by non-traditional players that these new technologies could enable.

2.4 Pros and cons of different regulatory approaches

It is beyond the scope of this report to provide a full survey of the different types of regulation and their relative merits.[9] Instead, a brief summary is presented of when certain kinds of regulation might be preferred over others. To motivate this

[8] Another relevant dimension in this regard is social attitudes towards the risks of new technologies, which depends on differences across different groups in terms of the perceived benefits of those technologies.

[9] The interested reader is referred to Section 4 of Meade and Evans (2015).

discussion, it is first useful to specify dimensions against which regulation might be assessed.

2.4.1 Regulatory dimensions

Dimensions against which different types of regulation can be assessed include:

1. *Static vs dynamic efficiency* – regulation might result in:

   (a) *Static* efficiency, meaning firms' short-term production costs are minimised and their prices are set close to (marginal) costs; or

   (b) *Dynamic* efficiency, meaning that long-term consumer welfare is maximised (taking into account the need for firms to have sufficient profits to induce and fund consumer-welfare enhancing innovations and investments);

2. *Market-based versus interventionist* – regulators can:

   (a) Intervene directly in markets to relieve the effects of market failures if not the market failures themselves – sometimes referred to as "command and control" regulation; or

   (b) Remedy the source of the market failures – such as by creating tradable property rights to pollute in emissions trading schemes with pollution caps, to remedy the lack of such rights in creating pollution externalities, or by creating clear liability rules;

3. *Vertical (i.e. sector-based) or horizontal (i.e. activity-based)* – regulation can apply:

   (a) To all major activities conducted within a given sector – e.g. market power, worker safety and consumer protection issues in electricity; or

   (b) To selected activities across all sectors – e.g. competition issues, workplace health and safety, cyber-security, or privacy;

4. *Certain (i.e. credible and time-consistent)* – regulations typically arise in sectors requiring significant long-lived and irreversible investments by private parties, meaning regulatory certainty and a clear understanding of how regulation might change is important to reassure those parties that they can expect their investment returns not to be undermined by unexpected future regulatory changes;[10]

5. *Flexible and responsive* – regulations must evolve in response to unexpected developments, if doing so enhances consumer welfare (and does not produce offsetting social harms), e.g. the benefits of motorised transport might never have eventuated if historical regulations favouring horses and cart could not have been changed; and

6. *Impartial* – regulation should not prefer any particular technology, business model or industry participant, unless doing so is in the long-term interests of consumers.[11]

It should be clear that there are tensions inherent in these dimensions. Regulation might achieve static efficiency for the short-term benefit of consumers. But if that denies private investors the profits they require to recover fixed investment costs, then consumers might be denied long-term benefits when those investments do not arise (in which case the regulation does not produce dynamic efficiency).[12]

Interventionist regulation can have the effect of precluding market-based solutions to market failures, and carries the potential for significant unintended consequences as private parties respond to the incentives it creates. Conversely, it is a relatively

[10] Note that this is not the same as meaning those parties can expect their investment returns to be assured. Every investor faces the risk that new technologies, business models or industry entrants might make their existing investments redundant. Regulation, in general, should not do otherwise, since that could serve to lock in inferior technologies that delay or deter innovations that enhance consumer welfare.

[11] Other ways this is sometimes described is that regulation should create a "level playing field", or be "technologically agnostic", although in each case it is not often acknowledged that this should not preclude regulation from favouring any given technology (etc) if doing so benefits consumers. An obvious example is regulation that mandates the discontinuance of an old technology to hasten the adoption of a superior new one – e.g. the discontinuance of analogue television, or prohibition of horses on motorways.

[12] Gugler et al. (2013) provide evidence on the scale of trade-offs between static and dynamic efficiency in electricity sectors, with higher electricity prices indeed associated with higher investment levels.

low-cost form of intervention that might produce benefits when market-based alternatives are too costly or challenging to implement.

Private investors should wish for regulation that does not change unexpectedly in ways that undermine long-lived and irreversible investments. But entrant investors should wish that regulators do not impede unexpected innovations that benefit consumers.

These tensions are important features of the discussions in Sections 6 and 7. Those sections discuss how new technologies, business models and industry players are likely to change the ideal balancing of these tensions. They also discuss how changes in the pace and nature of these factors affect rules for how regulation should change over time.

2.4.2 Comparing different regulatory approaches

Different types of regulation produce different trade-offs between the above dimensions. Some key examples are:

1. *Process-based regulation* – a form of command-and-control regulation, it dictates technologies that must be used to achieve desired outcomes (e.g. catalytic converters to reduce vehicle emissions).[13] This can be relatively low-cost to implement, is easy to enforce, and can provide certainty. However, it reduces incentives for innovation by stifling alternative approaches (regulations would need to change to allow the use of superior new technologies).

2. *Performance-based regulation* – specifies desired regulatory outcomes, while remaining open to different technological approaches to achieve them.[14] This can be harder to implement and enforce, since measuring performance can be difficult and often reliant on judgment, meaning it is not always cost-effective. However, it provides stronger innovation incentives, since firms are able to profit from introducing new technologies that achieve required

[13] Hence it is an example of regulation that is not technology agnostic.
[14] This is an example of technology-agnostic regulation.

performance standards at lower cost. These incentives are not perfect though, since specified performance standards might not accurately reflect consumer preferences (which can also be hard to measure), or they may fail to keep pace with changing preferences, or firm's production possibilities (e.g. radically improved quality). Regulatory certainty may also be relatively low, with firms possibly facing uncertainty regarding whether new technologies will satisfy performance standards.

3. *Rate of return regulation* – allows monopoly firms to earn a fair rate of return on necessary investments, recovering their investment costs through regulated prices. This can serve to over-incentivise investments, with risks of poor investments imposed on customers rather than shareholders. It can also serve to entrench existing providers and technologies, providing little incentive for innovation, and shielding customers from entrant suppliers.

4. *Incentive regulation* – allows monopoly firms to earn revenues, or charge prices, that decline by a pre-specified rate over a pre-specified time-frame.[15] This ensures regulated firms retain incentives to introduce efficiencies within their regulated period, since they enjoy extra returns from doing so. They also face stronger incentives to avoid inefficient investments, with the risks of such investments shared to a greater degree by shareholders than under rate of return regulation. However, the periodic reset of regulatory targets tends to introduce a ratchet effect by which good performance in one regulatory period results in tighter performance requirements in subsequent periods, ensuring customers share in some of the efficiency gains that have been introduced. This serves to dampen the investment incentives otherwise provided.

5. *Self-regulation* – arises in industries where members can be induced or relied upon to cooperate in the achievement of regulators' specified aims (often backed up with the threat of more direct regulation). It can be particularly

[15] This is commonly referred to as CPI-X regulation, where "X" represents the rate at which revenues or prices must decline in real terms over the relevant regulatory period (e.g. five years).

useful when regulators lack the information or highly specialised skills to effectively regulate for processes or performance that are hard to regulate, and can rely on industry members' professional ethics or other implicit incentive mechanisms to ensure they do not misuse their superior knowledge or skills.[16] Such arrangements can preserve investment, innovation and performance incentives for incumbent providers, but present a "closed shop" that impedes new technologies, business models or entrants. They can also give relatively greater weight to provider welfare than to consumer welfare, compared with other regulatory approaches.

6. *Customer ownership* – electricity sectors, including in New Zealand, provide specific examples of firms such as EDBs that might otherwise exert market power over their consumers being owned by those consumers as a means to mitigate that risk.[17] This can (partially) substitute for specific regulation, and motivates the exemption of EDBs with sufficient consumer control from price-quality regulation.[18] This leaves issues of performance specification, and the preservation of investment incentives, as matters dealt with by the parties (i.e. customers) who bear the costs of poor choices – subject to the efficiency or otherwise of internal governance arrangements in customer-owned firms, and capital constraints they can face.

7. *Countervailing buyer power* – as for customer ownership, this represents a possible (partial) alternative to regulation, relying on the bargaining power of large buyers to countervail against any market power wielded by their suppliers.[19] Where such buyers arise, they can be more adept than regulators

[16] Professional bodies are an important example, such as in the medicine or law, where regard for the patient, or serving the interests of justice, can be important incentive disciplines.

[17] Meade (2005) discusses the role of customer ownership as a substitute for regulation. Meade and Söderberg (2017) provide evidence on how customer ownership reduces EDB prices. Hansmann (1996) surveys the role of customer ownership in addressing market failures – described as costs of market contracting – in a range of US sectors.

[18] Though Meade (2014a) finds conditions under which regulation of customer-owned firms might be more strict than that for investor-owned ones when regulators are concerned with both quality and prices.

[19] Littlechild (2008) discusses the approach in a range of sectors, and Bottasso et al. (2017) present evidence form the UK airport industry. Meade (2014b) shows that countervailing buyer power can be created through forward trading, and can enhance consumer welfare in vertical

at ensuring their performance preferences are satisfied, and adapting to new circumstances. However, they do not necessarily sustain efficient investment, since bargaining power can give rise to the risk of opportunistic behaviour that undermines investment incentives, which creates incentives for one of the parties to the relationship to own the other (i.e. "vertical integration").[20]

2.4.3 General competition regulation versus industry-specific regulation

Of particular note in this report is the boundary between antitrust regulation by competition authorities, and industry-specific regulation. In New Zealand's case, both types of regulation are conducted by the Commerce Commission, with additional industry-specific regulation by the Electricity Authority in the case of electricity).[21] Competition authorities intervene to ensure that competitive processes are protected, but typically only after a breach of relevant competition laws has occurred.[22] They rely on generalist staff to respond to competition issues as they arise, and in whichever sector they arise.

Industry-specific regulators, by contrast, intervene in industries in which there is little pre-existing competition and little prospect of such competition arising, or where other industry-specific "market failures" arise (e.g. re pubic safety). They rely on staff with industry-specific skills to design mechanisms to remedy market failures. Because they are closer to a specific industry, industry-specific regulators are regarded as potentially more prone to "capture" by industry interests, for example by relying on them for information, or potentially providing career pathways. They can also be more subject to political direction, increasing short-term responsiveness to changing circumstances, but raising possible costs in terms of reduced long-term investment incentives.

industries such as electricity sectors in which vertically-integrated generator-retailers wield market power over stand-alone retailers. Chen (2007) argues that the competition effects of buyer power rests a great deal on the extent of existing seller power.

[20] For a discussion comparing vertical integration with alternative ways of resolving such issues in both telecommunications and electricity sectors, see Howell et al. (2010).

[21] Overlapping regulation includes matters such as fair trading (also administered by the Commerce Commission) and privacy regulation (by the Privacy Commissioner), to name just two.

[22] The main exception is merger clearances, which are required before mergers with the potential to undermine competition have occurred.

Industry-specific regulation is preferable when industry-specific knowledge is important and the risk of industry capture is low. Conversely, competition regulation can be preferred when the greater independence of competition authorities reduces their exposure to either industry capture or political direction, provided having specialist knowledge is not sufficiently important to offset these benefits. It can also be useful as a check on industry-specific regulation, such as when that regulation gives rise to competition issues.

2.4.4 Discussion – limits of competition, and supporting roles for regulation

The above highlights that a discussion of optimal regulation requires consideration of a range of boundaries. One set of boundaries is between different types of regulatory agency – such as between competition authorities and industry-specific regulators. Another is between different regulatory bodies with overlapping interests in a particular sector (e.g. privacy regulators, and workplace safety and health regulators). Yet another is the boundary between different regulatory approaches, such as the balance between process- and performance-based regulation. Finally, there are boundaries between regulation itself, and mechanisms such as ownership, or countervailing buyer power, which can either complement, or substitute, for regulation.

In practice, most industries are subject to a range of overlapping regulatory agencies, objectives and tools, and regulatory alternatives. Sometimes changes in any of these give rise to new technologies, business models or industry players.[23] Other times it is the advent of such factors that gives rise to regulatory change. As is often the case in economics, observed arrangements represent an equilibrium of the strategic interactions of regulators (and politicians), firms and customers, with a "shock" to any one of these players resulting in a realignment of the self-interestedly optimal responses of the other players. The key question for this report is how to induce a desirable regulatory realignment in response to new technologies, business models

[23] For an interesting case study of how marijuana legalisation in parts of the US has interacted with conflicting (e.g. anti-drug trafficking tax) legislation to affect entry, innovation and business organisation, see "Disjointed" in *The Economist*, 18 November 2017.

and players.

Importantly, it is optimistic to assume that competition alone will ensure consumers enjoy the full benefits of these innovations. For a start, how competition evolves in part clearly rests on responses by regulators.[24] Regulators therefore play a key role in removing regulatory obstacles to desirable innovations, and ensuring innovators do not enjoy undue regulatory freedom, relative to incumbent firms, where they give rise to new or existing regulatory issues without offsetting benefits.

Furthermore, competitive entry – including by non-traditional providers, using non-traditional business models and/or new technologies – need not necessarily benefit consumers, at least not immediately. While such entry may provide significant welfare gains for certain consumers, in the form of new services and/or lower prices for existing ones, this may produce no benefit, and possible costs, for others.[25] Moreover, new entrants often incur fixed costs which must be weighed against the benefits of their new or lower-priced services,[26] creating a possible case for industry entry not being unfettered.

Finally, new technologies, business models and players often rely on the development of new standards, or developing shared infrastructures, creating coordination issues that competition alone cannot be assumed to resolve. These are just some examples of how competition alone is not guaranteed to deliver maximum consumer benefits, and hence why a supporting role for regulation is likely to be unavoidable, and can be warranted, in affecting the pace, nature and scale of new innovations.[27]

[24] Witness how the evolution of passenger transport and accommodation services is taking different paths around the world in response to entrants like Uber and Airbnb, and also reflecting the bargaining position of incumbent providers as a consequence of past regulatory choices (such as restrictions on entry into the taxi or hotel industries).

[25] For example, competition by Uber might result in a reduction in the availability of traditional taxi services, potentially raising prices and lowering service quality for customers who cannot afford or choose not to use new technologies (e.g. older customers, or those who place a premium on privacy). This is sometimes referred to as a "waterbed effect".

[26] Mankiw and Whinston (1986).

[27] To further illustrate the point, markets themselves are made, not born. Details about market microstructure – like the design of auction mechanisms – are key for how markets perform. Regulators often play a role in developing such details and mechanisms, or assisting firms to do so where they face coordination problems or public good/externality issues.

This section's main points are:

- Regulation can be thought of as a form of governance, coordinating the choices of producers and consumers;
- Regulation is warranted if it is the least-cost way of remedying market failures, and its costs outweigh its benefits (but not otherwise) – new technologies, business models and players change this regulatory calculus, possibly removing the need for existing regulation while creating need (or justification) for new regulation; and
- New technologies, business models and players are likely to change the optimal balance between regulatory dimensions such as commitment and flexibility/responsiveness, and sector or activity focus, as well as between industry-specific and general competition regulation (i.e. the competition-regulation boundary).

3 How the electricity sector is regulated in New Zealand

This section provides further background, on both the New Zealand electricity sector and its regulation. It:

- Provides a high-level overview of the sector;
- Profiles the sector's main regulatory actors;
- Summarises the principal elements of New Zealand's electricity sector regulation; and
- Discusses key regulatory objectives, as well as their origins and trade-offs.

3.1 Introduction

This section provides further context, for discussion in later sections, of how New Zealand's electricity sector arrangements can be improved. It can be skipped by those already conversant with electricity sector organisation and regulation in New Zealand.

The section begins by providing an overview of how the sector is currently organised, and introduces the current main industry players. It then summarises the regulatory actors with either direct or indirect interests in the sector. The principal elements of regulation in the New Zealand electricity sector are introduced, and certain key elements explored in further detail. Finally, the section discusses the origins of, and trade-offs involved with, the design of current regulatory arrangements.

By understanding the context of New Zealand's electricity sector regulatory and other arrangements, it is easier to understand how those arrangements remain appropriate in the face of likely sectoral disruptions, and where they might require changing. These are the subjects of the following sections.

3.2 Overview of the New Zealand electricity sector

Figure 4 illustrates the current organisation of the New Zealand electricity sector, providing a framework for discussing its key elements and their regulation.

Key players in the current New Zealand sector are:

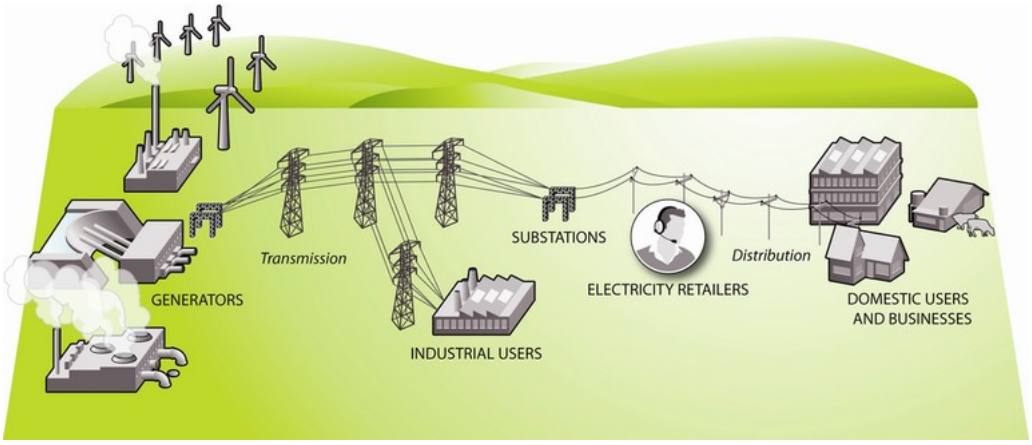
1. *Generators* – privately-owned or private- and state-owned Meridian, Contact, Genesis, Mercury, Trustpower, Nova and others – historically a small number of competing firms, typically with large, long-lived power station investments used for generating electricity in real-time using a variety of fuel types (hydro, geothermal, wind, gas, etc), and commonly vertically-integrated into retailing (see below) for which generation is an input;

2. *Transmission* – Transpower, a state-owned nationwide monopolistic firm, transporting high-voltage electricity over long distances across the national transmission grid from generators to (and conceivably from) large industrial customers, and to smaller residential and commercial customers via separately-owned local, low-voltage distribution networks (as an input into retailing);

3. *Distribution* – 29 local monopolies (EDBs), some owned by investors, others by their customers, communities or local city councils (sometimes with investors too), transporting electricity generated by others from grid connections to residential and commercial customers across shorter, low-voltage distribution networks, as an input into retailing;

4. *Retailing* – a variety of firms, mostly owned jointly with generation (via so-called "gentailers", including all the major generators), who hold contractual relationships with residential and small commercial customers – and sometimes even large customers – for the retail supply of transported electricity (sometimes bundled with other offerings, such as reticulated natural gas or LPG supply, internet services, etc).

Figure 4: CURRENT ORGANISATION OF THE NEW ZEALAND ELECTRICITY SECTOR



Source: www.mbie.govt.nz.

Not apparent from the above schematic is a number of mechanisms to facilitate the reliable and competitive operation of the sector. These include:

1. The trading of electricity through a centralised real-time/energy-only wholesale electricity market, enabling the centralised dispatch of generators on a least-cost basis, and in a way that ensures technical operating constraints on the national transmission grid are respected;

2. The forward trading of wholesale electricity via long-term contracts, including hedging instruments that enable market participants to hedge price risks, and trading with vertically-separated retailers that lack generation capacity of their own;

3. Administrative and market-based measures enabling Transpower as the grid operator to procure grid support services from third parties, such as options to shed demand from willing customers, as needed and at a price, to maintain grid reliability; and

4. A price-comparison website to assist retail customers in finding the cheapest available retail options.

The figure also does not highlight how new technologies such as PVs and storage

(including EVs) are already beginning to change the above organisation of the sector. Smaller scale generation will become increasingly common, and located near demand (in many cases, literally at the homes of residential customers). This means an increasing number of parties will become involved in generating electricity, either for their own consumption, or possibly for trading with other customers (e.g. through local, internet-based P2P trading platforms) or providing local network support services. The historical uni-directional supply of electricity from large generators to ultimate consumers may become much more organisationally decentralised, and bi-directional.

3.3 Main regulatory actors

3.3.1 Regulatory actors with direct sector interests

Also not apparent from Figure 4 are the main regulatory actors with direct interests in the New Zealand electricity sector. These include:

1. The Electricity Authority (EA), which:

   (a) Has a statutory obligation to "promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers";[28]

   (b) Is responsible for overseeing and regulating the New Zealand electricity market;

   (c) Develops, administers and enforces rules in electricity markets, and contracts service providers to operate the electricity market and system; and

2. The Commerce Commission, which applies:

   (a) General competition laws – which have the purpose "to promote competition in markets for the long-term benefit of consumers within New

[28] Section 15 of the Electricity Industry Act 2010.

Zealand";[29] and

(b) Industry-specific price-quality regulation – in sectors such as electricity transmission and distribution, which have historically been "natural" monopolies (e.g. it has not been economic to build competing electricity transportation networks) and for which there has been no real prospect of competition;

3. The Ministry for Business, Innovation and Employment (MBIE), which:

   (a) Is an arm of government – unlike the EA and Commerce Commission, which have greater political independence;

   (b) Has a pan-sectoral/economy-wide purpose, namely to (sustainably) grow the New Zealand economy to provide a better standard of living for all New Zealanders (rather than electricity consumers per se);

   (c) Contributes to its purpose by delivering trusted, competitive and well-regulated markets, including in electricity; and

   (d) Sets the strategic direction for the energy sector, including in electricity.

To this list could be added the Energy Efficiency and Conservation Authority (EECA), which has the objective of improving energy efficiency in homes and businesses, and to encourage the uptake of renewable energy. However, it has more of an educational purpose, and less ability to compel behaviours and enforce compliance than the EA, Commerce Commission and MBIE. Notably, given the increasing importance of DERs, EECA has no explicit brief regarding the impact of renewable energy on long-term consumer interests.

3.3.2 Regulatory actors with indirect sector interests

The New Zealand electricity sector is affected by cross-cutting, or generic/pan-sectoral regulation that affects its organisation or operation. By way of example, these include:

[29] Section 1A of the Commerce Act 1986.

1. The Privacy Commissioner, responsible for overseeing privacy laws – of increasing relevance in industries where firms are using more and more personal data as part of their delivery of goods and services, and consumers supply such data in (part) consideration of those offerings;

2. Worksafe New Zealand, responsible for enforcing workplace health and safety regulation;

3. Local authorities, responsible for implementing resource management and planning obligations – as well as MBIE via its interest in building rules; and

4. The Ministry for the Environment (MfE), which currently administers resource management law, and leads New Zealand's response to climate change issues.

These are just some of the agencies sitting outside of formal electricity sector regulation that potentially have an impact on the sector's development and operation.

To these could also be added overseas regulators, such as the Federal Communications Commission (FCC) in the US, or European Commission, to name just two. Initiatives by the FCC to remove "net neutrality" on the internet has the potential to affect the nature of data-based competition and the IoT emerging in the New Zealand electricity sector, given the likely importance of developments in the US for global development of the internet.[30] Likewise, overseas competition authorities such as the US Department of Justice, and the EU's competition directorate of the European Commission, have the capacity to allow or disallow major mergers. The EU's recent introduction of new privacy regulations could reach far beyond Europe given its impacts on global service providers. These could affect the global competitive landscape involving tech giants and other global, data-based competitors, with likely impacts on future competition in the New Zealand electricity sector.

[30]Noting that elements of net non-neutrality are already emerging in New Zealand, such as through Spark and Vodafone offering add-ons that give buyers more data to access certain websites at a price.

3.4 Principal elements of New Zealand electricity sector regulation

3.4.1 Overview

The principal elements of electricity sector regulation in New Zealand are:

1. Industry-specific legislation, principally:

   (a) *The Electricity Industry Act 2010* – providing a framework for electricity sector regulation, including:

      i. The establishment of the EA, and its creation of a Code governing industry participants' conduct (or exempting individuals from that code);

      ii. Reaffirming earlier legislative provisions requiring the separation of EDBs from competitive activities like generation and retailing (more below); and

      iii. Powers for the creation of industry regulations; and

   (b) *The Electricity Act 1992* – formerly providing a framework for electricity sector regulation, but now largely focused on the regulation and control of electrical workers;

2. Generic/pan-sectoral legislation, including the:

   (a) *Commerce Act 1986* – containing general rules to protect competition, but also (in Part 4) industry-specific provisions regulating prices, quality (i.e. reliability) and investment by Transpower, information disclosures by all EDBs, and prices and quality of non-exempted EDBs (more below);

   (b) *Privacy Act 1993 (under amendment)* – setting out principles governing the collection, use and storage of personal information. The legislation is currently being amended, recognising its creation long-before the creation of modern, data-based services, though not in radical ways;

(c) *Fair Trading Act 1986*, and *Consumer Guarantees Act 1993* – respectively to prohibit misleading or deceptive conduct in trade, and to provide statutory guarantees that goods or services supplied to consumers are fit for purpose;

(d) *Resource Management Act 1991* – among other things, affecting emissions from thermal power plants, and managing hydro resources needed for hydro generation schemes; and

(e) *Energy Efficiency and Conservation Act 2000* – establishing EECA, and providing a foundation for a national energy efficiency strategy.

3. Industry regulations, notably:

   (a) A low fixed charge tariff (LFCT) option for domestic electricity consumers – requiring retailers to offer domestic consumers with annual electricity consumption below certain thresholds a tariff with a fixed charge capped at $0.30/day, and EDBs to offer retailers or customers a tariff with a fixed charge capped at $0.15/day; and

   (b) Regulations imposing certain levies on industry participants to fund the costs of regulation, as well as certain EECA activities.

To the generic legislation affecting New Zealand's electricity sector could be added climate change legislation, since this affects New Zealand's efforts to decarbonise its electricity generation and transport sectors, with implications for the ultimate uptake of low-carbon land transport technologies such as EVs.

3.4.2 Part 4 of the Commerce Act 1986 – Regulation of transmission and distribution

Part 4 of the Commerce Act sets out key features of regulation affecting Transpower and EDBs. It enables the Commerce Commission to introduce price-quality regulation in sectors such as electricity transmission and distribution where:[31]

[31] Section 52G.

1. Goods or services are supplied in a market with little or no competition, and for which there is little or no likelihood of a substantial increase in competition;

2. There is scope for the exercise of substantial market power in the provision of those goods or services; and

3. The benefits of regulation exceed its costs.

To avoid such regulation becoming entrenched indefinitely, it can only be introduced with a sunset clause requiring its expiration by no later than 20 years after commencement.[32] It can also be targeted at specific classes of customers, rather than customers generally.[33]

The Commerce Commission can introduce only three types of regulation,[34] namely information disclosures, compulsory negotiation between suppliers and customers backed up by the threat of binding arbitration, and price-quality regulation. In practice it requires Transpower and all EDBs to make information disclosures, and subjects Transpower and non-exempt EDBs to price-quality regulation.[35] Certain EDBs that meet strict thresholds as to size, and degree of consumer control, are exempt from price-quality regulation.[36]

The main features of price-quality regulation include:

1. The development of input methodologies intended to provide regulated parties with certainty as to regulatory rules, requirements and processes (section 52R), and which must not unduly deter investment in unregulated activities;[37]

2. Specifying:[38]

   (a) Maximum price or prices, and/or maximum recoverable revenues – which maximums are permitted to increase at the rate CPI-X where X is deter-

[32] Section 52N(5).
[33] Section 52N(3)(c).
[34] Section 52B(2).
[35] Section 54.
[36] Sections 54D and 54G(2).
[37] Section 52T(3).
[38] Section 53M(1).

mined based on the long-run (historical) average productivity improvement rate achieved by either or both of suppliers in New Zealand, and suppliers in other comparable countries;[39]

(b) Quality standards that must be met; and

(c) The regulatory period over which (a) and (b) apply – being 3-5 years;[40] and

3. Empowering the Commerce Commission to request and approve grid upgrade proposals by Transpower,[41] and requiring it to prepare an input methodology specifying requirements for Transpower's capital expenditure proposals.[42]

The Commerce Commission may include incentives to maintain or improve lines services quality,[43] but may not use comparative efficiency benchmarking when setting price-quality regulation characteristics.[44]

Notable features of Transpower's capital expenditure input methodology are that it must consult with its customers about the need, and options, for any grid upgrades. Transpower must also clearly set out non-transmission alternatives to grid upgrades, and why proposed grid upgrades are to be preferred over those alternatives.[45]

3.4.3 Part 3 of the Electricity Industry Act 2010 – Unbundling of distribution services from competitive activities

Another key element of New Zealand electricity sector regulation is requirements under Part 3 of the Electricity Industry Act 2010 for distribution services to be "unbundled" from competitive activities such as retailing and generation. The purpose of these rules is to promote competition in retailing and generation by precluding EDBs from using their market power in distribution to reduce competition in these other activities. Unbundling distribution from these other, competitive activities,

[39] Section 53P(4).
[40] Sections 53M and 53W.
[41] Section 54R.
[42] Section 54S.
[43] Section 53M(2).
[44] Section 53P(10).
[45] For example, see Schedule I of Commerce Commission (2015).

reduces EDBs' incentives to impose less favourable terms on competing generators or retailers, or to deny them access to their lines.

The main unbundling rules are that EDBs must:[46]

1. Not share common ownership with generators having more than 250 MW of capacity;

2. Conduct any generation activities involving a capacity of more than 50 MW, or retailing activities involving an annual supply of more than 75 GWh, through separate companies to those owning their distribution activities, and are subject to "arm's-length" rules (schedule 3) concerning transactions between those related companies; and

3. Have use-of-system agreements that do not discriminate in favour of their own retailing or generation activities if they retail more than 5 GWh per year through their own connected retailer.

While not stated in Part 3, a related feature of New Zealand electricity sector regulation is that Transpower is not to be involved in competitive activities such as generation or retailing. This is similarly intended to avoid Transpower having incentives to use its market power in transmission to impede competition by other parties in those areas.

3.5 Discussion – Key regulatory objectives, and their origins and trade-offs

New Zealand has a highly centralised wholesale electricity market, and tightly-coordinated system operation. This reflects the country's relatively long and "stringy" transmission network, which makes it relatively more difficult to achieve reliable electricity supply. Its reliance on hydro generation with volatile inflows and limited storage has in some years resulted in tight supply conditions and high wholesale prices. These prices have in general not been constrained (e.g. by wholesale price

[46] Section 72(2).

caps), meaning that sustained price rises in times of shortage have provided investment signals and funding, precluding the need to introduce separate capacity mechanisms to support generation investment.

Much of the industry structure, and many of its regulatory arrangements, reflect objectives and concerns arising with the sector's liberalisation commencing in the late 1980s.[47] The New Zealand sector at that time was dominated by the state-owned monopoly in generation and transmission, Electricity Corporation of New Zealand. Meanwhile, distribution and retailing was combined in multiple local monopolies, often community controlled (mainly electric power boards).

To pave the way for competing generation, transmission was vertically separated from generation, state-owned generation was horizontally separated into competing firms, and wholesale market arrangements were developed.[48] Some state-owned generation was privatised, with subsequent partial-privatisations also occurring (though Transpower remains wholly state-owned).

Political frustration at the slow pace at which retail competition was emerging resulted in 1998 reforms forcing the unbundling (i.e. vertical separation) of distribution from relatively more competitive generation and retailing activities. This coincided with generators being permitted to own retailing, and resulted in the rapid vertical integration of generators and retailers, providing generators with a natural hedge against wholesale market price volatility.

Subsequent political frustration with EDB performance resulted in all EDBs being subjected to CPI-X regulation, as was Transpower, cementing the presumption for policy purposes that electricity transportation activities were natural monopolies, and not likely to become otherwise. However, later provisions enabled certain consumer-owned EDBs to be exempted from price regulation in recognition of the natural protection they provide their customers against market power abuse (e.g. because they return monopoly profits to consumers via lower prices and/or distri-

[47] See Evans and Meade (2005) for a history and analysis of New Zealand's electricity sector reforms. A more recent chronology of those reforms can be found on the information and services pages of `www.mbie.govt.nz`.

[48] Notably, the wholesale electricity market was developed as an industry-lead initiative.

butions from profits).

These liberalisation measures reflected emerging international understandings about how to transition from highly monopolised, centralised and "bundled" state-owned electric utilities, to more decentralised arrangements with competition where possible. Competition in generation – including by privately-owned firms – was expected to result in operational efficiencies and lower wholesale electricity prices. Likewise, competition in retailing was expected to emerge, facilitated by access to supply contracts from generators in the wholesale electricity market, resulting in lower retail electricity prices.

Unbundling transmission from generation, and distribution from significant generation or retailing, was regarded as important for achieving competition in both generation and retailing. However, these potential competition benefits came at the cost of lost coordination benefits between the unbundled activities. Only recently has evidence emerged as to the scale of this trade-off, with the implicit judgement at the time of New Zealand's and other countries' reforms being that the likely benefits of greater competition would outweigh the costs of losing such coordination benefits.[49]

The vertical integration of generation and retailing occurred as a natural way of hedging wholesale market price volatility absent reliable contracting alternatives.[50] This has the natural consequence of reducing wholesale electricity volumes available for trade in the wholesale electricity market, and therefore making it harder for entry into retailing by stand-alone retailers.[51]

On the other hand, to the extent that market power arises in both generation

[49]See Gugler et al. (2017) for evidence on the coordination benefits between generation and transmission. Meyer (2012) provides a comprehensive survey of the theory and evidence on coordination benefits between different parts of the electricity system. As to the scale of competition benefits, evidence from reformed electricity systems in the US provides a bleak assessment, with retail prices not found to have been lower across the board, or over time, as a consequence of retail competition (see Su (2015)). However, this may reflect particular features of US electricity market liberalisations, such as requirements for incumbent utilities to offer default tariffs, which serve to dampen customer switching.

[50]See Meade and O'Connor (2011) for a discussion of why vertical integration offers benefits over forward contracting in electricity markets, and Howell et al. (2010) for a similar application to telecommunications.

[51]Relative to a vertically-separated industry structure, holding all else constant.

and retailing, vertical integration has the additional benefit of improving vertical coordination between these activities, and in particular reducing retail prices by eliminating double marginalisation.[52] In the case of vertical integration between generation and retailing, the trade-off has been in favour of the benefits of improved hedging and reduced double marginalisation through vertical integration, over the costs of reduced retail entry and competition. Much evidence from a range of sectors points to that being a worthwhile trade-off.[53]

These considerations are relevant to considering how new technologies, business models and industry players affect the trade-offs either implicit, or unintentionally arising, in New Zealand's electricity sector arrangements. By understanding the context of New Zealand's electricity sector regulatory and other arrangements, it is easier to understand how those arrangements remain appropriate in the face of likely sectoral disruptions, and where they might require changing. These are the subjects of the following sections.

[52]Double marginalisation refers to the practice of a firm with market power adding a margin over costs when setting prices for another firm it supplies. If that firm also has market power then it adds its own margin over cost to that price, resulting in two profit margins being applied when setting ultimate prices faced by consumers. Both consumers and firms enjoy better outcomes when only a single margin is applied over both industry levels, as can occur when those two firms are vertically integrated. See Meade et al. (2017) for further discussion.

[53]See Meade et al. (2017) for a survey of studies on the benefits of vertical integration, and also contractual alternatives to vertical integration that in some cases resolve vertical coordination issues under vertical separation.

This section's main findings are:

- The main regulatory actors with sector-specific interests in electricity are the EA and Commerce Commission (both of which seek to promote the long-term interests of consumers), under the oversight of MBIE;
- Regulatory actors with significant indirect interests in the electricity sector are activity-based regulators such as the Privacy Commissioner, Worksafe New Zealand and MfE, and local authorities and MBIE (via planning and building rules) – not to mention overseas regulators affecting global goods and services providers;
- Key elements of New Zealand's electricity sector regulation include regulations like the LFCT, Part 4 of the Commerce Act 1986 which regulates transmission and distribution pricing and quality, and Part 3 of the Electricity Industry Act 2010 which limits the extent to which distribution services can be combined with competitive activities like generation and retailing; and
- Current industry arrangements reflect reforms commencing in the 1980s to introduce competition in generation and retailing, while limiting possible harms from natural monopolies in transmission and distribution. These reforms involved vertical separation between monopoly and other activities, but allowed vertical integration between competitive activities – all of which may face renewed challenges and imperatives in the face of new technologies, business models and players.

4 Issues for electricity regulation presented by new technologies

This section focuses on how new technologies such as DERs affect the trade-offs underlying existing New Zealand electricity regulation (leaving a fuller discussion of disruptive new players and business models to Section 5). It discusses how these new technologies:

- Challenge how we think about consumers, since they might also become both producers and consumers (i.e. "prosumers");
- Create consumer benefits that hinge on a range of factors, including who owns and controls the technologies (and in what sequence);
- Will change the nature of competition for existing industry players, how we think of transmission and distribution networks, and lead to increasingly more decentralised and algorithmic electricity trading; and
- Blur sectoral boundaries and create pan-sectoral issues, elevate the importance of the consumer, and increase uncertainty.

4.1 Major themes

This section discusses a range of issues for New Zealand electricity regulation presented in particular by new technologies. It leaves to later sections to discuss issues presented by new business models and players, as well as how well-suited New Zealand's current regulatory arrangements are for responding to these issues (and how those arrangements might be improved). An important objective of the discussion is to identify where the trade-offs discussed in Section 3, that underlie existing electricity sector arrangements, are likely to change as a consequence of these innovations.

The discussion is based around the following major themes:

1. New technologies such as PVs and storage (including EVs) – i.e. DERs – potentially change the character of consumers who adopt them in ways that challenge how regulators should view those parties, both in isolation, but also relative to consumers who don't or can't adopt them;

2. Whether or not these new technologies improve long-term consumer welfare hinges on a range of factors, including how quickly and widely they are adopted, who owns and operates them, and under what (e.g. contractual) conditions;

3. In turn, the impact on consumer welfare of different parties owning and operating new technologies turns on whether those technologies complement or substitute for those parties existing activities (or both), and the nature and extent of any market power they already possess;

4. Network topologies are likely to change significantly, becoming much more dynamic and bi-directional – causing distribution network operation to look more like that of transmission, and possibly materially changing the topology of the grid itself;

5. Trading in electricity and network support services is likely to become much more decentralised and algorithmic as customers increasingly take up DERs and related offerings;

6. The boundaries between the electricity and other sectors are likely to become increasingly blurred, and the regulatory issues they face increasingly shared;

7. The electricity sector is, more generally, likely to become much more like other, fast-moving and consumer-focused sectors are becoming; and

8. New business models and industry players could radically alter the location and type of market power in the industry, disrupting the competitive, ownership and regulatory landscapes of the sector as much as it does current industry players.

These themes are individually substantial, and together even more so. However, they represent just a sample of the major themes that are likely to arise with the advent of new technologies, business models and industry players. Many other major themes are likely to have not yet materialised, highlighting the significant uncertainty facing the sector, and the regulatory issues it is likely to confront. Yet these themes represent good places to start, since we can anticipate the issues they present for electricity sector regulation, based on emerging research, emerging experience and practice from overseas jurisdictions, and experience from other sectors. Each of these themes is now discussed in turn, except the final theme regarding industry disruption. That is of sufficient significance that it is discussed separately in Section 5.

4.2 Changing nature of the consumer

4.2.1 Sources of consumer differences, and existing ways to measure them

Even without new technologies or business models, electricity sector regulators cannot assume that the interests of all consumers are aligned. Differences between consumers in terms of ability to purchase energy-efficient homes, vehicles and appliances are one source of difference.[54] Renting rather than owning accommodation is another, affecting consumers' ability to make long-lived and location-specific investments in energy efficiency. Climatic variations, and access to alternative energy sources (e.g. gas), create further differences, to name just a few.

When suppliers lack technologies to identify different customer interests, these differences can be obscured. Faced with these technical limitations, suppliers have historically often adopted "one-size-fits-all" approaches, such as uniform electricity tariffs across different customer types and times of day. To some extent they can compensate for their lack of customer knowledge – if not technical constraints such as measuring real-time electricity usage of whole households (let alone individual consumers) – by offering customers menus of electricity tariffs. By self-selecting

[54] See Meade (2017a) for further discussion.

into these menus, customers enable suppliers to better screen at least classes of customers and tailor offerings to those classes, if not to individual consumers.

4.2.2 Better consumer data redefines consumers as individuals

One way in which new technologies and business models are likely to change this is by offering suppliers the potential to better understand even individual consumers. Industry initiatives to improve smart metering technologies (e.g. by shifting to more frequent data capture) are helpful, but inherently limited in this regard. Smart meters capture data at the level of installation control point (ICP), a supply- rather than customer-focused concept. While important for accurately measuring electricity usage, a service underpinning system-wide reconciliations of who owes what to whom, existing smart meter technologies can help suppliers understand consumers at the aggregated, ICP level, but not as individuals.

Home energy management systems represent a step jump in terms of knowing which consumers are using how much energy, in what appliances, and at what time (or possibly even under what circumstances – e.g. temperature). The ubiquity of smartphone technologies likewise leapfrogs ICPs to the level of the consumer, and offers the potential (e.g. through integration with home energy management systems) for suppliers to measure individual consumer's electricity consumption behaviours. Newer technologies, such as voice-activated digital assistants like Amazon's Alexa, potentially leapfrog both sets of technologies, and establish a beachhead in consumers' homes enabling individual-level, real-time measurement of the uses of a wide array of energy-consuming home services (heating, cooking, entertainment, etc).[55]

Knowing individual consumers allows suppliers to better tailor their offerings to those consumers. In principle, and importantly, this could enhance overall consumer welfare, by enabling offerings in such a way as to expand service to customers that

[55] This may not produce as accurate energy consumption data as smart meters, but is likely to be able to estimate such consumption data fairly accurately given known specifications of appliances, and possible knowledge of not just their usage but also their use environment. Access to large consumer datasets will enable the accuracy of such systems to be improved.

are otherwise under-served when one-size-fits-all solutions like uniform pricing or only limited menus of tariffs are adopted absent better customer information.

However, it also enables suppliers to better target – or even personalise – their pricing. This involves charging lower prices to customers who have low willingness-to-pay but could only be offered higher uniform prices absent better customer data (and vice versa). Furthermore, to the extent that certain customers opt in to using such new technologies and allow their preferences to be better known, this raises the possibility of "waterbed" effects in which suppliers understand that other customers have relatively higher willingness-to-pay, and adjust their prices to those consumers accordingly. The net effect on consumers as a whole is ambiguous, and depends on the relative sizes of "winners" and "losers". In particular, it hinges on the extent to which more targeted pricing enables firms to serve a greater range of customers (relative to more uniform pricing, which excludes some customer groups).[56]

Either way, regulation might impede such innovations, such as when it proscribes certain kinds of price offerings, or limits "unprivacy" (e.g. privacy regulation setting a floor on how much privacy we can trade for services – see Section 5.4 for more). To the extent they occur, however, the consumer is defined at an increasingly granular level, certainly by suppliers, begging the question as to why regulators should treat them at more aggregated levels. An increasing challenge for regulators wanting to serve consumer interests is therefore to understand those customers as suppliers do, and to assess whether, and how, different customers are affected differently by industry and regulatory changes.

4.2.3 Prosumerism – consumers' dynamic roles

New technologies have the potential to radically alter the nature of consumers who can, and choose to, adopt them. DER technologies like PVs and storage – including EVs, which can be thought of as mobile storage – offer the potential for consumers who adopt them to inject electricity into distribution networks rather than simply

[56] Assessing "winners" and "losers" from more targeted pricing also depends on whether some groups enjoyed undue pricing advantages, such as through unintended consequences of regulated prices (e.g. the LFCT).

consume electricity from those networks. They remain consumers of network transportation services, albeit potentially in different directions at different times and under different circumstances (e.g. weather or network conditions). However, they might also supply network support services by providing backup supply capacity when networks are otherwise constrained or suffering interruptions – as could consumers using new technologies to allow their demand to respond to price signals or network circumstances (perhaps algorithmically).

Hence regulators may need to think of traditional electricity consumers more in terms of being:

1. "Small-scale connecting parties" – to designate those who permanently or temporarily (e.g. in the case of EVs) connect to electricity networks, at least for as long as they do connect; and

2. "Small-scale non-connecting parties" – to designate those who do not connect to electricity networks, but who still derive benefits from electricity consumption (e.g. through islanded self-supply, or connection to independent micro-grids).

In either case these "parties" are not necessarily "consumers", at least not in the conventional sense of simply consuming electricity supply or transportation, and not all the time.

Electricity sector regulators should be concerned for the welfare of such parties, to the extent they remain concerned with the safe, efficient and reliable supply of electricity, but only to the extent that those parties are demonstrably vulnerable in some way (e.g. to market power abuse by suppliers). However, that vulnerability, and hence the nature of the regulator's concern will be tempered by the ability of those parties to protect themselves. That ability will depend on whether or not small-scale parties:

1. Participate in some form of aggregation that relieves their vulnerabilities, or face little barrier to doing so if they should wish to;[57] and

[57] This might also hinge on how aggregators are owned, with customer-owned aggregators likely

2. Self-supply electricity for their own consumption, or to enjoy additional benefits from selling that electricity or other services such as network support, rather than simply paying for energy they consume.

4.2.4 Conclusion – tailoring regulation to distinctive and multidimensional "regulatory clients" vs amorphous and unidimensional "consumers"

Whether due to better customer knowledge or the rise of prosumerism, regulators need to better distinguish the interests of different types of "consumer" (i.e. of the parties in whose interests they are regulating) and their exposure to – or even creation of – market failures.[58] Regulatory issues will not be one-size-fits-all in a world of "regulatory clients" (as opposed to "consumers") that have substantially differing interests and activities. Moreover, as more and more "consumers" adopt new technologies and their characters change, so too will their requirements as "regulatory clients" (perhaps removing their need to benefit from regulation). Regulatory solutions to those issues will likewise need to become much more tailored to these differences, and evolve as "consumers" do.

4.3 Consumer welfare impacts of new technologies

4.3.1 General reasons why DERs might deliver fewer consumer benefits than they should

It is tempting to assume that all new technologies and business models arising under competitive innovation will ultimately benefit consumers (persisting with common usage, despite the discussion in Section 4.2). This is certainly the case where consumers adopt those new technologies voluntarily. After all, it would seem strange

to present less regulatory concern than if they were investor-owned. See Meade (2005), Hansmann (1996).

[58] For example, this might involve regulators – like firms in many industries – contracting with DBDs to enable access to their substantial accumulations of consumer data and consumer knowledge (discussed further in Section 6). Alternatively, it might involve regulators commissioning specialised surveys to identify and measure different consumer preferences, as is sometimes already done to estimate non-market values for things like electricity reliability. Either way, regulators are likely to need to make greater investments in understanding those they regulate, just as firms are making greater investments in understanding their customers as the costs of doing so fall (and the strategic costs of not doing so rise).

that consumers adopt a new technology if they might have preferred a different one. However, history is replete with examples where competitive innovation proves to deliver fewer benefits than it might have, or carries with it costs that offset its benefits (at least to some degree). This is particularly where new technologies involve "network effects", meaning the benefits to individual users hinge on how many other users also adopt the technology.[59] Common examples include:

1. The QWERTY keyboard – which was developed to avoid typewriters becoming jammed, but which could be more efficiently configured for typing in the computer age; and

2. JVC's VHS technology for video cassette recorders – its main rival at the time of introduction, Sony's Betamax system, was potentially superior in quality, but lost the "standards war", with consumers, manufacturers and content providers opting for VHS regardless.[60]

These examples illustrate two points, both of which are compounded or exacerbated by the presence of network effects, and any switching costs or other forms of lock-in (e.g. exclusive supplier contracts) impeding consumer change:

1. New technologies can involve coordination issues (e.g. regarding choice of standards) that are not necessarily resolved to consumers' long-term benefit through the competitive process alone – standards-setting bodies, whether industry- and/or regulator-lead, and often at a global level, can play very important roles; and

2. Path dependencies in new technology adoptions can have lasting impacts on consumer welfare – e.g. because it is too costly for individual users to migrate to new technologies even if superior, when the benefits of those technologies are tied to how many other users also migrate, and that migration is slow to

[59] Telephones and fax machines are obvious (historical) examples.

[60] Nobody ask a user of Apple's operating system for their opinion about its virtues relative to Microsoft's. Disclosure – this report was created using the latter, though not with Microsoft's word processing software.

emerge.[61]

These issues are only further accentuated when competition itself involves lock-in effects, such as the creation of "data moats" through the accumulation of hard-to-replicate volumes of consumer data (as discussed further in Section 5).

4.3.2 Particular reasons why DERs may have ambiguous electricity consumer benefits

Individual consumers' choices can give rise to benefits to other consumers (positive externalities) but also possible costs to other consumers (negative externalities). New DER technologies such as PVs, storage, and EVs (as both storage, and an extra source of electricity demand), are likely to produce a wide range of both types of externality. For example, distributed generation (DG) and storage/EVs is likely to enhance supply reliability for consumers other than just those who adopt the technologies, whether or not they are fully compensated for providing those benefits.[62]

Conversely, customers with the resources to adopt new technologies might – as an artefact of EDB regulation and pricing methodologies, if not otherwise – shift an increasing burden of network cost recovery onto those who don't, with the latter more likely to be low-income and/or renting households.[63] Whether or not new technologies provide net benefits for all customers, rather than just some, hinges on

[61] Meade and Grimes (2017) show that consumer welfare can in fact also benefit from such path dependencies. They analyse investments in competing infrastructures (in their case, rail and road networks) and related downstream investments (i.e. train and truck rolling stock). Investments in rail that were made before the advent of road-based competition prove to be higher than they would have been had rail operators anticipated such competition. This distorts investments in rolling stock (i.e. more-efficient trucks to better compete with excessive rail capacity), but also increases consumer welfare due to providing benefits from historical over-investment in legacy technology network capacity (rail).

[62] This is because consumers adopting such technologies become more energy self-reliant, which serves to improve reliability for other consumers to the extent peak demands on distribution networks decrease.

[63] This is a form of "waterbed effect". See Concept Consulting (2017) for extensive analysis of the likely extent of this burden-shifting. Some authors suggest this could lead to a "death spiral" in the provision of regulated network services, since regulated cost recovery of network costs falls increasingly on a decreasing share of consumers that have decreasing ability to pay for them. This hastens the need for those consumers to also adopt the new technologies – i.e. "grid defection" – further exacerbating the problem. For example, see Darghouth et al. (2016), though contrast Costello and Hemphill (2014).

the relative impact of external benefits and costs, not just the private net benefits of adopting consumers (with complicated regulatory questions, like how the relative net benefits of different parties should be weighed).[64]

Research is emerging on the circumstances under which storage, in particular, might be welfare-reducing. A number of studies assuming perfectly competitive generation or (grid-scale) storage find that storage is never welfare-reducing.[65] This is despite it serving to iron out price differences between peak and off-peak demand periods as a consequence of the energy price arbitrage it enables, the profits of which contribute to welfare. However, Sioshansi (2014) provides preliminary/suggestive evidence that storage can be welfare-reducing when it is deployed competitively rather than strategically, as might be the case if it is adopted by many small users and its deployment is not coordinated. [66]

Likewise, research is emerging on the possible strategic costs of intermittent DG (such as small-scale PVs, or wind). Ambec and Crampes (2015) show that the advent of non-strategic intermittent DG, such as uncoordinated residential renewables-based generation, can over-induce a tightening in conventional generation capacity. This is because thermal generators whose capacity is required to provide balancing supply when intermittent sources are not generating can charge higher prices if they have less available capacity in those periods.[67] Hence the benefits offered by competitive small-scale intermittent DG must be weighed against potential costs, such as increased non-intermittent generator market power being exercised when those sources are not able to supply, with potentially ambiguous net effects on consumers.

Finally, as mentioned in Section 2, new entrants often incur fixed costs, which must

[64] This raises the risk of regulation being vulnerable to swings in political cycles, with risks to investment and innovation – hence dynamic efficiency – if associated rules are not clear and enforceable.

[65] E.g. see the survey in Sioshansi (2014).

[66] See Sioshansi's Lemma 3 – intuition for these results is yet to emerge. This suggests the possibility of strategic storage capacity being able to countervail against generator market power, echoing the predictions in Meade (2014b) regarding the welfare-enhancing effects of strategic overbuying in forward markets by vertically-separated retailers (i.e. in either case, forward buying, or storage, can be used to increase wholesale market competition).

[67] This further requires that thermal generators do not face the possibility of rivals investing to make up for any capacity reductions they attempt to make – a possibility arising with competitive, rather than monopoly generation.

be weighed against the benefits of their new or lower-priced services.[68] Hence, individual consumers might find it privately beneficial to adopt new technologies because it lowers their private costs of electricity supply, and generates additional private benefits from production or consumption. However, they each incur fixed costs of purchasing and installing those new technologies, and early-adopters in particular may do so without full knowledge of their overall costs. From a societal viewpoint this may result in excessive fixed costs being incurred, even if those consumers then enjoy electricity at virtually nil marginal cost, and ignoring any net benefits or net costs their private choices create for other consumers.

4.3.3 Impact of ownership and control on consumer benefits from new technologies

As mentioned above, the welfare impacts of new technologies is affected by whether or not its owners act competitively or strategically, and how they interact with other strategic parties (such as generators) – ironically with better outcomes when strategic activity is more widespread (i.e. balanced across players). It should be expected that the precise identity of the parties owning and controlling different types of new technologies – as well as those with whom they are interacting – will play a role in the benefits those technologies create. Emerging research offers insights into these questions, but to date has only scratched the surface.

Strategic generation

Sioshansi (2014) has already been mentioned, providing suggestive evidence that storage can be welfare-reducing when it is deployed competitively rather than strategically in the presence of strategic generation.

Relatedly, Schill and Kemfert (2011) show that strategic generators have incentives to under-utilise storage they own and control, even though consumers still gain from this ownership and use. This is because storage enables generators to enjoy profits

[68] Mankiw and Whinston (1986).

from arbitraging electricity price differences over time, but it also smoothes out those price differences when storage is deployed. That smoothing creates welfare gains for consumers, but offsets generators' own storage-related profits, inducing generators with market power to limit their storage use.

The above studies relate to stand-alone generators with market power. To date there have been no studies looking at how generators being vertically integrated into retailing affects the consumer welfare effects of generation owning and operating DERs, or the impact of DERs being owned strategically or otherwise by consumers. This case is pertinent in New Zealand, and is discussed further in Section 7.6.

Regulated distribution

Studies are also emerging on the welfare impacts of new DER technologies being owned by regulated distributors. Munoz-Alvarez et al. (2017) consider the case of a monopoly retailer-distributor that is permitted by regulation to earn only "fair" profits. They show that whether or not DERs are owned and controlled by the regulated firm, or by its customers, has no impact on overall welfare, provided the firm's tariffs optimally combine variable charges set at marginal cost, and fixed costs set only to recover fixed costs. Variable charges are the same whether the DERs are owned by the firm or its consumers, but fixed costs are higher when consumers own DERs, since in that case the regulated firm does not enjoy DER revenues to offset its fixed costs (which it therefore recovers from consumers through its regulated prices).[69]

Earlier studies have considered the strategic implications of (regulated) firms with market power entering into new technologies more generally, as opposed to DERs in particular. For example, Brennan (1987) argues that regulated monopolies can use their ability to recover investment costs from their captive customer bases through

[69] In a related study, Munoz-Alvarez and Tong (2016) show that DERs owned and operated by a regulated firm's customers can be welfare-*reducing* when the firm charges consumers a single regulated price, instead of separate fixed and variable tariffs (set optimally). This is because, in this case, the firm recovers its fixed costs via a mark-up on its variable charges. This reduces consumption, and hence consumer welfare, relative to the case in which there are no DERs. Conversely, DER ownership by the regulated firm improves consumer welfare relative to no DERs.

regulated prices as a way to cross-subsidise their provision of new, competitive technologies. This serves to increase prices for the regulated customers, while allowing artificially low prices to be charged for the competitive technology. These artificially low prices deter rival suppliers who do not enjoy the same ability to cross-subsidise (but presumably not rival regulated firms who might be able to). However, the feasibility of this approach rests on regulators allowing the regulated firm to socialise its costs of investing in the new technology to all customers, while not requiring it to pass on its profits on the new technology to customers through lower prices (which would be the case if regulation allows only "fair" profits to be realised, as in Munoz-Alvarez et al. (2017)).[70]

More formally, Carlton and Waldman (2002) show that firms with market power in an existing technology (e.g. distribution) can in some circumstances find it profitable to tie its supply with that of new products involving rapidly changing technologies (e.g. DERs). This is particularly the case when the new technology is complementary to its existing technology (i.e. consumers derive extra benefit if they consume the two products together), and particularly when consumers face costs in switching between suppliers. Despite this strategic motivation for the firm to tie the new activity to its existing one, however, the impacts on consumers are not found to be clearly positive or negative in all circumstances.[71]

Other ownership scenarios

There have been no formal studies on the impact of customer-owned distributors – regulated or otherwise – owning and operating DERs instead of their customers doing so. However, it should be expected that results in that case would be similar to those found in Munoz-Alvarez et al. (2017), except to the extent that investor-

[70] Also, rival suppliers might ultimately benefit from these cross-subsidised investments if they lead to earlier development of infrastructures supporting new technologies, or develop overall demand for new products and services (just as one EV manufacturer benefits if another establishes recharging infrastructure, or otherwise stimulates EV demand). This is more so if newer technologies offer significantly better value than older ones.

[71] Gryzbowski and Verboven (2015) provide evidence of similar effects in telecommunications markets. They found that incumbent fixed line suppliers entered into mobile telephony in part to protect their existing fixed line monopolies. However, the penetration of both types of telephony increased as a result, potentially benefitting consumers.

and customer-owned firms involve significantly different governance and incentive costs.[72] This is because customer-owned distributors are likely to maximise customer welfare subject to a break-even constraint, much as those authors assumed for optimally-determined regulated prices.[73] To the extent that a customer-owned firm does not set its tariffs optimally – for example because regulation precludes it from doing so – then the neutrality between firm and customer ownership of DERs should be expected to fail. This case is pertinent in New Zealand, and is discussed further in Section 7.6.[74]

To date there have also not been any studies considering the impact on consumer welfare of unregulated distribution companies owning and operating DERs. Nor have there been any on the effects of regulated distributors doing so, in cases where their regulated prices cannot be assumed to have been set optimally (i.e. to maximise consumer welfare, subject to the firm's break-even constraint). The latter case remains pertinent in New Zealand, and is discussed further in Section 7.6.

Finally, there is currently an important gap in research into the comparative welfare impacts of different types of DER ownership. For example, no existing studies *simultaneously* compare the consumer welfare impacts of DER being owned and operated by consumers, distributors (regulated or otherwise), generators (vertically-integrated into retailing or otherwise), or third parties.[75]

Those third parties could be merchant DER providers, such as those with no other strategic interests in the sector, but which can profit from arbitrage opportunities created by storage. Alternatively, they could be offered by other parties having market power in other sectors that see opportunities to profitably enter into DER ownership. The latter case is given particular attention in Section 5.7.

[72] For theory-based predictions on this point, see Meade (2014a).

[73] Some support for this is provided in Meade and Söderberg (2017), who find that customer-owned EDBs charge lower average prices than their investor-owned counterparts.

[74] A remaining point of difference is that Munoz-Alvarez et al.'s analysis combines retailing and distribution, whereas New Zealand EDBs are separated from retailing unless it falls below conservative regulatory thresholds – see Section 3.4.3.

[75] An early and partial attempt is Sioshansi (2010).

4.3.4 Possible dynamic impacts of ownership and control on consumer benefits from new technologies

Just as existing studies of DER ownership impacts on consumer welfare are limited, other significant research gaps remain.

For example, there is presently little research on dynamic impacts such as how different types of DER ownership affect entry into DER supply by competing providers. More specifically, little is currently understood about whether DER ownership by distribution companies might create lock-in effects that deter competing DER ownership from arising in the future (e.g. by consumers, generators, merchant providers, or others). Such lock-in effects might occur, for example, due to:

1. *Exclusive contracting arrangements*;[76]
2. *Incumbency/first-mover advantages for initially-adopted technologies* – e.g. due to the limited availability of suitable sites (i.e. sunny roofs to mount PVs, or unused garage walls for mounting batteries) at which to deploy DERs;[77]
3. *Foreclosure by distributors* – i.e. distributors with DER investments of their own offering discriminatory terms to other parties seeking to deploy DERs on their networks (depending on whether regulation prevents such foreclosure opportunities from arising).[78]

Likewise, there is currently little research on the dynamic impacts of customer,

[76] It should be noted that exclusivity arrangements can be welfare-enhancing for consumers. See the findings of Chen and Fu (2017), who model exclusivity arrangements such as those used by Apple with mobile phone operators for sales of its iPhone.

[77] Even the limited availability of suitable sites for DERs may not decisively create lock-in effects for first-movers. If later generations of DER technology are sufficiently superior to earlier ones, then it could prove profitable for rival DER suppliers to "leapfrog" the earlier technologies and induce the owners of those sites to breach any exclusivity or fixed-term arrangements they have with earlier DER suppliers. In fact, those earlier arrangements could serve to force later entrants to share a greater part of any increased DER profitability with site owners. Furthermore, Meade and Grimes (2017) show that investment in an older infrastructure (in the present case, early-generation DERs) could be consumer-welfare enhancing if it proves to have been excessive when an alternative technology arises unexpectedly (in the present case, unexpected, later-generation DERs). Failure to anticipate the new technology distorts downstream investments (in the present case, electrical appliances and other technologies supplied by DERs), and investment in the later technology. However, the over-investment in initial infrastructure proves to benefit consumers.

[78] Riechmann (2000) shows that regulated monopolies facing global price caps rather than caps on specific prices (such as in New Zealand) can have incentives to strategically price or subsidise market segments.

generator, or third-party ownership of DERs (i.e. of lock-in or strategic effects affecting subsequent DER provision by other parties). Conversely, there is little available research on the question of whether consumers gain by enjoying earlier uptake of DERs than might otherwise occur if parties with either market power (EDBs, generators, etc) or favourable regulation use it to accelerate that uptake. These are all potentially important dynamic effects, and our current lack of clear findings on them represents an important gap in research.

An important aspect of these impacts will be the trade-offs – under one ownership type relative to another – of the coordination benefits of vertical integration, against the costs such integration creates by potentially restricting competition. If a generator, for example, vertically integrates into DER ownership, this gives rise to certain coordination benefits. These include possible synergies between peaking generation and intermittent renewable DG, for example. However, a generator that integrates into DERs in this way potentially faces incentives not to supply electricity to a rival retailer (for example) that might also wish to integrate into DER supply, albeit with ambiguous implications for consumer welfare.[79]

Likewise, if an EDB integrates into DER ownership, this creates potential coordination benefits in terms of providing network services (at both technical and pricing levels). But it might also create incentives to foreclose rival DER providers from accessing its network (e.g. generators or other EDBs). As a consequence, the DER ownership configuration that maximises long-term consumer benefits will hinge on the relative extent of these trade-offs. In other words, are the benefits of vertical coordination – net of the costs associated with foreclosing rival DER owners – higher or lower for one ownership type than another (i.e. generation versus distribution, or vice versa)? There is currently little formal research to clearly resolve this question, which is explored further in Section 7.6.

[79]Foreclosure is a natural incentive of vertically-integrated firms – though commonly not to the harm of consumers, even if it impedes retail competition. This is because, all other things being equal, an integrated firm enjoys higher profits – and consumers enjoy lower prices – if it sells through its own retailer than via a separated retailer. This is because it can avoid "double marginalisation" when selling via its own retailer, but not otherwise (in which case consumers face higher prices, and firms enjoy lower combined profits). In this case the benefits of improved vertical coordination (in pricing or output decisions) outweigh the detriments of limiting non-integrated retail supply.

4.4 Competitive implications of new technologies for existing industry players

Related to the discussion in Section 4.3.3, a key determinant of the consumer welfare impacts of different types of DER ownership is the extent to which DERs substitute for, or complement, pre-existing activities of their owners and operators.

If DERs *substitute* for its owner's existing activities, then increasing DER adoption risks predating – i.e. competing with – the owner's existing activities. Hence, to the extent that the owner has market power, it may choose to limit DER in order to protect those existing activities. So, for example, if PVs, storage and/or EVs reduce the need for conventional distribution services, then an EDB that owns DERs may choose to adopt them so as to deter others from introducing them to their network, but under-adopt them relative to the level that other owners might provide.

Conversely, if DERs *complement* a firm's existing activities, for example by reducing its costs of supplying its existing products or services, then that firm has a stronger incentive to adopt those new technologies.[80] If that firm has market power in its existing activities, it may even attempt to leverage that market power into DERs as well – either to protect its existing market power, or to extend it into the new activity.[81]

A major complicating factor in the context of DERs is that they can simultaneously substitute and complement for existing activities, or either substitute for or complement them at different times, or in different circumstances. This chameleon-like quality of DERs complicates analysis of their competitive implications. As stated by Castagneto-Gissey et al. (2018, p. 784):

> "There is a fundamental question about the role of storage which remains unanswered, in whether it provides an add-on service, in competition on the margin with networks and generation, or whether it instead

[80] Relatedly, Mai (2017) presents evidence from telecommunications sectors that mobile and fixed-line broadband services are complementary rather than substitutes – i.e. customers who enjoy high-speed internet at home also enjoy it when away from home, and vice versa.

[81] E.g. see Carlton and Waldman (2002) for an analysis of strategic incentives, and Gryzbowski and Verboven (2015) for evidence from telecommunications.

complements networks and generation."

Similar to the discussion in Section 4.3.4 (as explored further in Section 7.6), whether DER ownership is more or less beneficial for consumers under one ownership type or another (i.e. consumers, generators, EDBs, third parties) boils down to comparing the balancing of these considerations. The DER ownership that best serves consumer interests is that for which any consumer benefits of complementarity (e.g. enjoying lower-cost services) – net of any consumer costs of substitution (e.g. suffering reduced DER offerings) – are maximised.

4.5 Changing network topologies – reinventing transmission and distribution

As discussed in Section 3, New Zealand's centralised wholesale electricity market and dispatch of generation in part reflects the "long and stringy" nature of the country's transmission grid. Historically much generation is concentrated around large hydro-schemes in the lower parts of the South Island, while much demand is centred in the upper North Island (e.g. Auckland). This gives rise to various transmission constraints, such as across the inter-island high-voltage direct current (HVDC) link, which was built mainly to enable south-north flows, but which also enables reverse flows such as when southern hydro lake levels are low.

As and when DERs become more common, particularly in major centres of electricity demand like Auckland, this could significantly shift the balance of generation and demand across the grid (i.e. change its topology), as well as remove or relieve existing constraints. In turn this could reduce the need for generation to be centrally dispatched, and enable more decentralised dispatch (e.g. self-dispatch, as in some EU electricity systems). However, the level of DER penetration would likely need to be substantial before this effect was observed at the grid level.

In fact some degree of dispatch decentralisation is likely to become necessary in any event. This is because DERs present the very real potential to realign local distribution network topologies, by embedding DG and storage throughout those networks.

Furthermore, EVs represent both mobile storage and mobile demand, since they might provide networks with both features wherever they choose to connect to the network.[82] As a consequence, distribution network topologies will not just change over long time-frames in response to gradual DER penetration. They will also change in real-time depending on how DERs are deployed, and also depending on how EVs relocate around networks on an intra-day basis.

These possibilities mean that DER owners will have the ability to self-dispatch DER services to some degree, whether or not these provide networks (or the grid) with complementary services, or place additional demands on networks (or the grid). They may do so manually, but possibly also automatically/algorithmically – either way, at a highly decentralised (e.g. household) level.

Conversely, they may cede such operation to third parties, such as when DERs are owned and operated by EDBs or others (such as DBD aggregators – see Section 5.5.5 for more). Even if DER operation is controlled by third parties, DER dispatch is still controlled at a decentralised level, rather than centralised as it is presently for non-DER related generation and demand.

These changing topologies of the grid, and of distribution networks, will necessarily affect the competitive makeup of the electricity system at a national level, but also at the level of individual distribution networks (and even just parts of those networks).

4.6 Decentralisation and automation

4.6.1 Decentralisation

With the increasing penetration of small-scale DERs, the production of electricity and network services has the potential to become much more small-scale, and located at the level of individual households. At an intermediate level, it will also

[82] Indeed, it can be expected that EV owners' vehicle location choices will respond at least partially to pricing and other network signals, rather than be dictated solely by vehicle trip choices. Should EVs also become autonomous, they might even relocate autonomously – and possibly automatically/algorithmically – throughout each day to different parts of the network, to maximise revenue-generating opportunities from storage services, or to minimise costs of recharging.

become more "medium-scale" in the form of grid-scale DERs, such as grid-scale batteries being embedded in distribution networks. This could also involve community or small-scale commercial PV schemes, to name just a couple of other possibilities.

From the perspective of network operators, coordinating the operation of these small- and medium-scale DERs will be important for ensuring network reliability, not to mention to maximise any network-related benefits from DER services (e.g. lower-cost provision of reliability). Unless the network operators own and control all DERs, this necessarily means they will need to rely on other mechanisms for coordinating DER usage.

Creating P2P platforms for trading DER services is an important possibility, facilitated by falling costs in creating such platforms (e.g. due to the availability of Blockchain technologies to secure and decentralise tracking of transactions).[83] Whether or not network operators create such platforms, they will certainly need to engage with them if they wish to influence DER usage patterns. Acting as a buyer of DER services on such platforms is a natural way they might do so.

4.6.2 "Set and forget" – algorithmic trading/automation

Medium-scale and some small-scale DER owners may also wish to actively engage as sellers and/or buyers with P2P trading mechanisms for DER services. However, some if not all of them may seek to do so through "set and forget", algorithmic technologies, particularly where the value of any one trade might be too small to bother with if executed manually.

For example, a household may wish to charge their storage and/or EV from the network provided the cost of doing so falls below some pre-specified threshold (e.g. using night rates). Conversely, they may choose to discharge their storage into the network or sell surplus PV generation if the price rises above some other, higher, pre-specified threshold. This is facilitated by Blockchain technologies, which can involve the use of "smart contracts" that enable such "set and forget" automation.[84]

[83] See Figure 8 of Burger et al. (2015) for a depiction of a decentralised, P2P-based electricity system – what they call the "Big Beyond".

[84] With the transactions costs of such trading being very low, this broadens the range of po-

With both decentralisation and automated trading, electricity systems are likely to undergo the sorts of changes already confronted by securities markets with the advent of both day-trading and algorithmic trading (known also as high-frequency trading). The latter, in particular, has been the subject of much policy attention and research, given worries about the impact of algorithmic trading on market volatility.[85]

Caivano (2015) surveys existing studies on the impact of high-frequency trading in financial markets, concluding that it has not been shown to unambiguously increase market volatility. Hence it remains to be seen whether algorithmic trading of decentralised DER services (e.g. through P2P markets) serves to allow better coordination of those services, contributing to network reliability, security and efficiency of electricity supply, or creates the risk of increased (possibly sporadic) unreliability and insecurity, and wholesale market volatility. Much will depend on the precise details of the trading platforms and algorithms concerned.

4.7 Blurring sectoral boundaries and shared issues

4.7.1 Blurring boundaries

Electricity sector regulation has already had impacts on other sectors. Most sectors of the economy rely on a safe, reliable and efficient supply of electricity in order for them to produce their own goods or services, so regulatory impacts in electricity can have wide-ranging impacts across the rest of the economy. Increasingly, however, the electricity sector is likely to be affected by regulatory and other developments in other sectors, and start to share regulatory issues across sectors. If regulators apply narrow sectoral remits when addressing such issues, they fail to account for the impacts of their decisions on other sectors. Such regulatory "silo-isation" could result in significant unintended consequences for other sectors. This affects consumer welfare

tentially profitable trades. Hence, low-cost and automated trading could be an important source of efficiency in DER use (i.e. enabling even small efficiency-enhancing trades to not be left unexploited).

[85] This concern dates back to the 1987 sharemarket crash, in which algorithmic trading was suspected of exacerbating market falls.

by distorting (positively or negatively) the availability and uptake of new technologies and business models that depend on regulatory arrangements in multiple sectors, and motivates the use of less sector-specific regulation.

Pan-sectoral regulation

Some regulation is already "horizontal" (i.e. pan-sectoral), rather than "vertical" (i.e. sector-specific). Examples include competition regulation as performed by the Commerce Commission, and workplace safety and health regulation as performed by Worksafe.[86] The Commerce Commission potentially has a key role to play in shaping the future of electricity sector organisation, particularly if it faces disruption by non-traditional, data-based competitors (discussed further in Section 5).

Such disruptive entry could cause existing firms in the industry to regroup in order to head off the threat of such entry, either pre-emptively or reactively. Either way, the Commerce Commission's stance on mergers and takeovers among existing firms – which may currently enjoy significant (relative) market power, but may lose that advantage in the event of disruptive entry – could be decisive in determining the pace and nature of change in the industry.[87]

Workplace safety and health regulations may prove to be relevant to the uptake of DERs. Specifically, when consumers become prosumers and sell electricity from their DERs, there is the possibility that they are deemed to be a "person conducting a business or undertaking" (PCBU) under the Health and Safety in the Workplace Act 2015 (HSWA). Among other things, a PCBU has duties towards other parties who might be at risk from their "work" (in this case, including producing or trad-

[86] More generally one can think of tax, companies and privacy law as also being forms of pan-sectoral regulation. In the case of tax laws, however, relevant provisions are often sector-specific.

[87] It is instructive to note that the Commerce Commission has blocked two recent mergers involving incumbent firms pre-emptively and defensively responding to entry by non-traditional rivals (Fairfax/NZME and Vodafone/Sky). Vodafone and Sky have since attempted to create some of the proposed outcomes of a merger via contracting. This may prove to be a higher-cost way of achieving the same ends, but may also create competition concerns and attract Commerce Commission attention. By contrast, the Australian Competition and Consumer Commission (ACCC) has been instructed to investigate Facebook and Google over disruption to media, following concerns about the future of journalism (*Australia Investigates Facebook and Google over Disruption to Media*, `www.independent.co.uk`, 4 December 2017). Also, the AT&T/Time Warner merger was recently cleared in the US on the basis that incumbent firms face new competition from Tech Giants (see "The World this Week", *The Economist*, 16 June 2018).

ing electricity), including the general public.[88] Hence if DERs should electrify an islanded section of network, following a storm or accident for example, the DER owner may face liabilities under the HSWA if that should cause injury or death to a member of the public.[89]

Transport regulation

An example of cross-cutting sector-specific regulation affecting electricity regulation is transport regulation. Vehicle fuel efficiency standards, and other policy or regulatory measures affecting the rate of EV uptake, will have implications for the electricity sector.[90] For example, to the extent that the economics of PVs are affected by access to storage (e.g. by allowing energy to be used when needed rather than when the sun shines, or sold when prices are highest), the rate at which the existing vehicle fleet changes to partly- or fully-electric vehicles could affect the uptake of PVs (and/or the rate of other storage uptake).

The converse is also true – to the extent that electricity sector regulation (e.g. distribution pricing and investment) affects the uptake of PVs, this could affect the rate at which EVs replace existing vehicles.[91]

Telecommunications regulation

Another example is telecommunications regulation. The ability of electricity sector firms to implement technologies like smart metering, home energy management

[88] For example, see the quick reference guide to health and safety at work, available from `www.worksafe.govt.nz/hswa`.

[89] DERs raise other thorny liability issues. These include whether a household's home and contents insurance covers them for fires or other failures related to DERs if they are used for business purposes, or controlled by third parties (i.e. EDBs, generators, aggregators, etc) which could affect DER life, performance or safety.

[90] International Energy Agency (2017) notes that the impact of EV uptake on electricity demand is highly unclear, with projections ranging from a large increase to a sizeable decrease. While increasing penetration of EVs raises demand for extra electricity supply, the rise of MaaS and vehicle sharing platforms means total car ownership could fall. The net impact on electricity demand of an increasingly electrified transport system remains to be seen. In part this will reflect he impacts of regulatory choices, such as transport regulators' attitudes towards MaaS and vehicle sharing.

[91] Concept Consulting (2017) analyse how the LFCT serves to over-induce PVs, since that enables avoidance of the relatively high variable lines charges resulting from that tariff. Conversely, current distribution pricing tends to over-recover network costs from EV owners who charge overnight, thus disincentivising EV uptake.

systems and DERs requires access to mobile and/or fixed internet connectivity. Hence, telecommunications sector regulations, such as those affecting the rollout and pricing of mobile (including next generation 5G) and fibre-based broadband, will have increasingly important impacts on the uptake of the IoT and other smart electricity sector technologies.[92]

Telecommunications regulation could also affect electricity sectors via its impact on the uptake of autonomous vehicles (AVs), which are likely to be increasingly electric. Some AVs rely on vehicle-to-vehicle (V2V) and/or vehicle to infrastructure (V2I) communications technologies. Presently these technologies for Japanese manufacturers rely on radio spectrum that in New Zealand is allocated for mobile phone operation.

As a consequence, Japanese vehicles imported into New Zealand with these technologies must have them disabled. Since New Zealand is heavily reliant on imported used vehicles from Japan to update its vehicle fleet, this could delay the uptake of AV technologies, and hence the uptake of autonomous EVs as they become available, with implications for electricity demand (e.g. by deferring a shift to MaaS and vehicle-sharing).[93]

Energy efficiency standards and housing development rules

Energy efficiency standards for appliances and new dwellings have the potential to impact electricity demand, though possibly positively as well as negatively. Passive energy efficiency measures have potential to reduce electricity demand (e.g. better housing insulation reducing demand for heating). However, some energy efficiency investments such as heat pumps have the potential to increase electricity demand, or at least reduce expected savings. This is because their efficiency reduces the

[92] Mai (2017) argues, for example, that local loop unbundling with regulated access prices, as adopted for fixed line broadband in the EU, has not encouraged innovation as expected. Entrant firms have preferred to rent network access from incumbents instead of developing their own networks. Mizuno and Yoshino (2015) show that such regulation can lead to a downward spiral in network investment.

[93] This raises the issue of whether it is less costly to simply adopt AV technologies not reliant on this spectrum, or for a competent regulator to negotiate with the spectrum owner to share some of the social gains from reassigning the spectrum to an alternative use.

unit cost of providing heating services, so users may choose to use them to produce warmer homes (rather than just the heating level produced by less efficient technologies at a cheaper price) – so-called "rebound" or "backfire" effects.[94]

Likewise, housing development rules could impact on the uptake of DERs. If developers of subdivisions must provide electricity infrastructure based on traditional technologies, this could delay the uptake of alternatives such as DERs. Conversely, new developments – especially those without access to existing network infrastructures – might become natural opportunities to roll out DERs, including community-owned DERs (e.g. medium-scale DERs owned by all homeowners in new subdivisions), provided development rules do not insist on traditional infrastructures.[95] Similarly, building standards might evolve to better support DERs. This might include the mandating of multiple circuits – e.g. for DER infrastructure, DC and/or AC supplies, high and/or low voltages, etc). It could prove important if existing requirements for just AC mains voltage supplies reduce flexibility for accommodating new technologies.

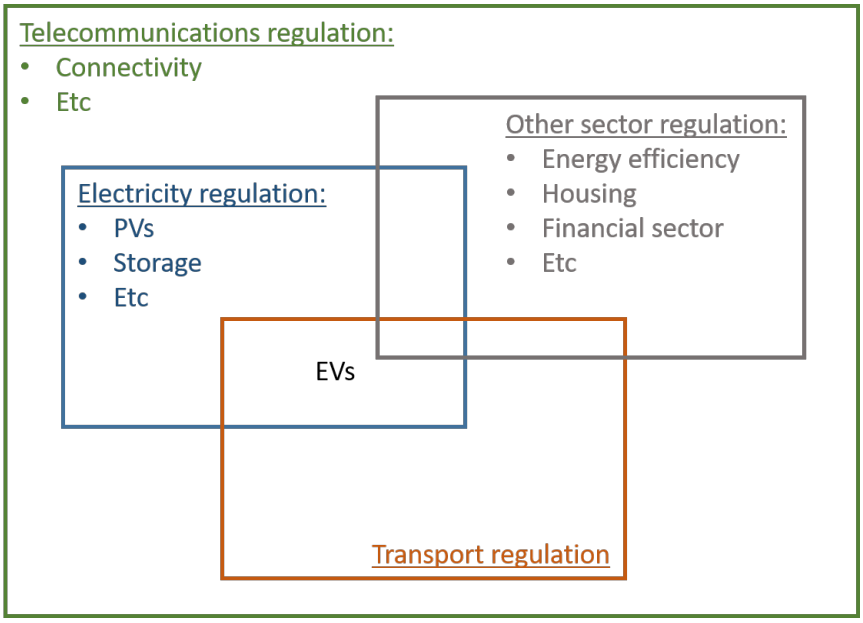
Financial sector regulation

To conclude this selection of possible ways that regulation in other sectors might affect electricity regulation (and vice versa), the regulation of payment systems such as crypto-currencies like Bitcoin is of relevance. Such currencies, based on the Blockchain's secure, decentralised system for tracking transactions, could be the cornerstone of decentralised P2P trading of DER services. This is particularly because such systems can be combined with "smart contracts" that enable algorithmic trading (International Energy Agency (2017)). Hence, financial sector or other regulations affecting these technologies – including their legal status (e.g. enforceability of smart contracts) – could have important implications for the uptake of DERs.

[94] See Meade (2017a) for further discussion.

[95] Community solar projects might also be important to enable access to new technologies (and reduce exposure to being stranded on old ones at potentially worsening pricing) by consumers lacking resources to invest in private DERs, such as low-income consumers, and/or those who do not own their home.

Figure 5: OVERLAPPING SECTOR-SPECIFIC REGULATION



These overlaps between sector-specific regulations are illustrated in Figure 5.

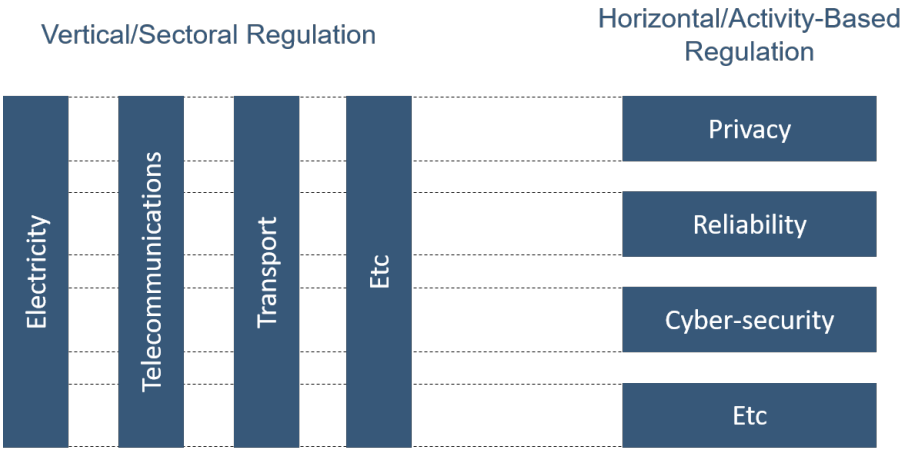
4.7.2 Shared regulatory issues

Finally, it should be noted that a number of regulatory issues arising in increasingly "digitalised" electricity systems will be shared with many other sectors. These include:

1. *Privacy and data protection* – with the sharing of consumer data (i.e. "unprivacy") becoming an important "currency" for purchasing data-based services and facilitating innovation, as discussed further in Section 5.4;

2. *Reliability and security of supply* – as other sectors become increasingly electrified (e.g. transport), and as the electricity sector becomes increasingly reliant on communications infrastructures, reliability and security of supply will become issues more shared and inter-related across electricity, telecommunications and transport;

Figure 6: VERTICAL VS HORIZONTAL REGULATION



3. *Cyber-security* – will likewise become an increasingly pan-sectoral issue, with the potential for cyber-attacks to simultaneously damage energy, telecommunications and transport systems.

Increasing inter-dependencies across sectors, in terms of shared regulatory objectives like these, will complicate measures to achieve them through silo-ised approaches. Increasingly horizontal, or activity-based regulation for these objectives is therefore likely to be required. This is instead of the more traditional vertical, or sector-based regulation. These alternatives are illustrated in Figure 6, and discussed further in Section 7.7.5.

Vertical regulation addresses all regulatory issues within a single sector, placing a premium on sector- rather than activity-specific regulatory skills. The former, horizontally-based regulation, instead prioritises regulatory skills for dealing with specific regulatory issues over sector-specific knowledge, as well as the benefits of improved horizontal coordination across sectors. The trade-offs in choosing one approach over the other are likely to shift in favour of a greater degree of horizontal regulation as digitalisation of all sectors serves to homogenise the issues that arise across sectors, and gives rise to greater need to consider regulatory im-

pacts across multiple sectors. Conversely, persisting with sector-specific regulation, despite growing linkages across sectors and sharing of regulatory issues, risks inadvertently impeding innovations and investments that could otherwise result in significant consumer benefits.

4.8 Increasing rate of change and increasing consumer focus

4.8.1 Rapid change the constant

Finally, this section's survey of major themes affecting future electricity regulation is rounded out with a discussion of factors presaging the in-depth discussion in Section 5 of likely new business models and players that could disrupt the electricity sector. Specifically, the scope and pace of technological change – and associated changes in business models and competitors – is only gathering pace. Advances in artificial intelligence (AI, whether simply machine learning or true artificial "intelligence"), and possibly in quantum computing, hold the promise of accelerating this gathering pace. This has two important implications for electricity:

1. The future electricity sector is unlikely to resemble the sector of the past, founded as it has been on technologies that have been relatively stable for decades in many cases; and

2. That future electricity sector is unlikely to remain as stable as its predecessor has, with rapid change likely to be the new constant.

Technical supply-side innovations are likely to continue apace. These include better technologies for generating, storing and trading/transporting electricity.[96] However rapid these supply-side developments, they should be expected to be accompanied with rapid and likely even more significant innovations on the demand side. Either way, what constitutes "long-term" is being redefined, with the lifetime of any one

[96] These might include solid state or graphene-based battery technologies, for example. They might also include the development of other new storage technologies, such as supercapacitors, or clean hydrogen production (opening the door on truly decarbonised hydrogen fuel-cell vehicles), with hydrogen "storing" electrical energy in that it can be created using electricity, physically stored/transported for later use, and then converted back into electricity using fuel cells.

consumer likely to involve multiple changes in both technologies, business models and players on the one hand, and their preferences for what they deliver on the other (including for new products and services that simply were unimaginable in even the recent past).

4.8.2 Supplier-responsiveness to consumers vs demand-responsiveness to suppliers

Traditional electricity sector policy discussions often conceive of demand-side innovation in supply-side terms – e.g. how demand-side improvements like price-responsive demand, and real-time retail pricing, might deliver supply-side benefits such as reduced capacity requirements. However, the real innovation will be in freeing consumers from having to think about electricity at all, and instead focus on delivering them a much more diverse range of services that happen to consume electricity, but which deliver the consumption benefits about which consumers actually care.

At its heart, this latter transformation will involve truly making the consumer the centre of attention, and treating supply-side issues (e.g. reliability, or price-responsiveness) as mere details about which consumers should not be bothered. If incumbent electricity sector players are unable to make this transition, there is little doubt that non-traditional players will – those starting with advanced technologies for understanding consumer preferences, and tailoring products to their needs, regardless of the specific sectors that traditionally have supplied those needs.

This section's main findings are:

- Consumers who adopt DERs will become "prosumers", at various times either competing with, or providing complementary services to, traditional electricity service suppliers;
- This requires much more nuanced/layered understanding of different consumer types' interests, their need for protection as "regulatory clients", and of possible regulatory issues that they create;
- Consumer benefits from new technologies are not assured, at least not uniformly so, and will hinge on factors such as who owns and controls them, and how coordinated is their usage;
- DER uptake will result in much more decentralised production and trading of electricity services, causing distribution networks to have increasingly bi-directional flows, and with algorithmic trading of electricity services having the potential to create new forms of instability (or stability);
- Boundaries between regulation in electricity and other sectors are likely to blur – especially those with transport, telecommunications and housing regulation – and issues like privacy, reliability and cyber-security will increasingly become pan-sectoral issues; and
- New technologies will lead to increasing levels of uncertainty in electricity sector evolution, while increasingly placing the interests of differing consumer types at the fore.

5 Issues for electricity regulation presented by disruptive business models and players

This section extends the discussion of new technologies in Section 4 to the case of disruptive business models and players. It:

- Characterises data-based competition – as well as its merits, and potential pitfalls (such as tipping to monopoly which then risks being entrenched due to "data moats");
- Analyses private and social trade-offs when ceding our personal data – i.e. creating "unprivacy" – highlighting how our data is both a currency for purchasing data-based services, and a key input in their production (challenging traditional conceptions of privacy and its regulation);
- Describing how electricity sectors – particularly retailing – are ripe for disruption, and discusses what form that disruption might take; and
- Highlights how data-based disruption is likely to cause a seismic shift in the balance of market power in electricity sectors, and spawn both entry from other sectors, and pre-emptive tie-ups involving incumbent electricity firms.

5.1 Major themes

Much of the discussion in Section 4 suffers the shortcomings of many sector-specific analyses – it narrowly considers the incentives, strategies (and regulatory issues) of *incumbent* industry players. However, it overlooks the possibility of disruptive entry by non-traditional *entrant* players, and the new business models they are likely to introduce.

This section explores this question in detail. The major themes are:

1. Consumer-level competition across a wide range of sectors is becoming in-

creasingly data-driven, and dominated by large international firms with comparative advantages in "big data" who can not just predict consumer-level demand, but influence it;

   (a) Associated with this change is the growing trend towards decentralised, P2P trading and the associated "sharing economy";

2. Data-based competition has inherent features driving it towards high levels of market concentration, at least in the consumer segments which take up their offerings;

3. It also uses consumers' personal information as both a form of currency, and a co-investment in innovation and hence product quality, challenging conventional notions of the value of privacy:

   (a) This will likely give rise to increasing "unprivacy differentiation" – with consumers favouring privacy either persisting with traditional service offerings or paying for them with money, while those more relaxed about sharing their data or having fewer financial resources pay for new offerings with their data;

4. Electricity sectors are ripe for entry by DBDs, who are likely to re-invent electricity retailing around highly consumer-focused offerings, and will leverage their market power from data into both retailing and DER aggregation;

5. This entry could cause a seismic shift in the balance of electricity sector market power, and likely result in a substantial realignment of industry ownership (or exit);

6. Existing firms might forestall such entry through:

   (a) Mergers with existing firms in other sectors that have superior access to consumer data and technologies for creating tailored consumer offerings, provided ownership constraints (e.g. state ownership) or competition

regulators do not block such mergers – e.g. if such mergers' inherently defensive nature is not recognised; or

(b) Tie-ups with DBDs – although experience from other sectors suggests this might simply assure eventual disruption through direct DBD entry; and

7. Electricity sector disruption by DBDs could have very uneven short- to medium-term consumer impacts, though it has the potential to bring very considerable consumer benefits (at least for those adopting their services, and prepared to part-pay for them with their data).

5.2 The rise of "Big Data" and P2P platforms/sharing economy

5.2.1 Data-based competition

As discussed in International Energy Agency (2017), electricity sectors around the developed world are increasingly experiencing the sort of disruption already experienced in other sectors. It attributes this disruption to what it calls "digitalisation", but which can be described as "data-based competition". Either way, firms such as the so-called "tech giants" – currently Apple, Google, Microsoft, Amazon and Facebook (the "Big Five") in the West, and Alibaba, JD and Tencent in China, have entered, and often quickly dominated a range of sectors traditionally served by other firms.

This prospect, combined with how these firms compete, has implications for how electricity sectors should be regulated, which is the subject of the following sections.

5.2.2 "Big data" advantage

These DBDs have been successful due to their competitive advantage in "big data", namely:

1. Virtually impregnable accumulations of consumer-level data, including real-time and locational data;

2. Unmatched skills in analysing and using that data for commercial purposes; and

3. Access to vast computing power to support the above.

5.2.3 Technologies for prediction, and persuasion

It is widely held that a key advantage enjoyed by firms engaging in "big data" is that they can measure consumer preferences and predict consumer behaviour in real-time (e.g., so-called "now-casting"). Indeed, Amazon has developed predictive distribution systems in which it ships items in anticipation of consumers buying them. However, more recent developments suggest that these firms have moved beyond mere *prediction* of consumer behaviour. They now use "persuasive technologies" to induce consumers to act. For example, the CEO of Alibaba has been quoted as saying:[97]

> "The most important thing is not meeting the demand but creating the demand."[98]

5.2.4 P2P platforms and the sharing economy

An associated trend is for the creation of P2P trading platforms giving rise to the "sharing economy". Firms like Uber and Airbnb create marketplaces for owners of spare capacity (in their cases, passenger vehicles and accommodation respectively) who are prepared to combine it with their own labour to provide services to users for money (passenger transport, and temporary accommodation). They provide

[97] "China: The Everywhere Stores", in "The New Bazaar", an e-commerce special report in *The Economist*, 28 October 2017.

[98] The ability of tech giants to influence behaviours extends well beyond just inducing consumption decisions. The role of social media and big data analytics in influencing the outcomes of the 2016 US presidential election, and UK's Brexit referendum, has received increasing political attention, and could be the catalyst for tighter regulation of how the tech giants operate (e.g. being made liable, in the US at least, for false or misleading content, for which they have not previously been liable).

matching and payment technologies to facilitate trade, as well as pricing algorithms to maximise the value of exchanges.[99]

More importantly, they use (in Uber's case) technologies such as driver and passenger identification and ratings, and GPS-based route plotting, to build the reputations of service users and providers, and trust. These represent new technologies for addressing public safety issues that are typically addressed more administratively in the traditional, regulated sectors with which they compete.[100]

In many cases regulation paves the way for such firms to enter industries traditionally dominated by others, such as when it requires incumbent operators to use specific technologies, limit supply, or bear specific charges or taxes. This often leads to backlashes by incumbent operators, especially when facing the double disadvantage of regulatory impediments as well as inferior technologies.[101] As a consequence, industry regulators often find themselves in the position of having to assume the role of de facto competition regulator. However, they do so with public safety or other narrow considerations – or even the interests of incumbent firms – as their objective, rather than the wider objective of maximising long-term benefits of consumers.[102]

5.3 Likelihood of data-based competition "tipping" to monopoly

5.3.1 Causes of tipping

The business model of DBDs is often predicated on providing platform services – otherwise known as two-sided markets – in which they act as digital intermediary between large groups of "buyers" and "sellers".[103] Such platforms exhibit two key

[99] For example, Uber uses peak pricing during times of elevated demand to induce greater supply and reduce more price-sensitive demand – in effect using prices to equate supply and demand, rather than queues.

[100] E.g. police record checks for prospective taxi drivers.

[101] Einav et al. (2015).

[102] Witness the consumer and Uber driver backlash in the UK when Transport for London chose not to renew Uber's operating licence – "Record-breaking Uber petition to reverse ban in London hits 600,000 signatures as backlash grows", *The Telegraph*, 24 September 2017.

[103] Amazon is a clear example, bringing together sellers of a wide variety of goods on one side of the platform, and buyers of those goods on the other. Uber and Airbnb are also examples, bringing together service providers and users.

features favouring their rapid expansion and industry dominance:

1. *Economies of scale (and scope)* – the larger they are the more data they collect, so the better they are at understanding their consumers (and the easier they find it to generate new products and services tailored to those consumers); and

2. *Network effects* – in this case including *indirect* network effects, by which users on one side of the platform enjoy greater benefits when there are more users on the other side.[104]

Both of these features incline DBDs to "get big fast", and to engage in "winner takes all" competition. This in turn inclines the markets in which they operate towards "tipping" to monopoly, and provides strong "first-mover advantages".[105]Their vast data accumulations can be hard to replicate – representing "data moats" that deter entry, and entrenching DBD market power once secured (i.e. reducing market contestability). This raises questions about balancing incentives for data-based innovation against the costs of markets becoming more inclined towards high levels of hard-to-unsettle concentration – with features similar to the trade-offs encountered with intellectual property rights (e.g. time-limited copyright).[106]

5.3.2 Strategies for tipping

The strategies used by such firms to rapidly attain scale include charging low or even negative prices to attract users on one side of the platform.[107] This then brings greater benefits to users joining on the other side. In some cases, the currency provided by users is not money but their personal data (e.g. for sale to advertisers),

[104]Haucap and Stühmeier (2016). For example, Uber customers benefit by there being more Uber drivers, and vice versa.

[105]See Cennamo and Santalo (2013), and Prüfer and Schottmüller (2017). Such tipping is clearly not a new phenomenon, with the victory of JVC's VHS over Sony's Betamax in the standards war for video cassette recorders providing a well-known example. What is new is that economies of scale and network effects in data-based competition are becoming much more pronounced, thus increasing the inclination of competition in markets with such competition to tip.

[106]Prüfer and Schottmüller (2017) show that innovation incentives are low in tipped markets, and provide criteria for when mandating open access to big data can improve welfare.

[107]Usually the side with the more price-responsive demand.

as discussed further below. Either approach complicates the analysis of these firms' competition, and consumer welfare effects.[108]

5.4 Personal data as innovation input and form of currency – rethinking privacy

The firms with a comparative advantage in predicting, and even influencing, consumer preferences and behaviours, are those with expertise in "big data", and "data-based competition", such as the so-called "tech giants". An inherent feature of these firms' business strategies is to obtain and analyse insurmountable accumulations of consumer-level data. That data forms part of the "currency" with which consumers access their services, which are often free, or have negative monetary prices (i.e. are, in effect, subsidised).

The use of private information as a form of currency in data-based service provision presents challenges for competition authorities (what is monopoly pricing when price is negative?), but also for privacy regulators.[109] Three in particular are:

1. Consumers ceding their private information – i.e. creating "unprivacy" by giving up privacy – as a form of payment to data-based service providers has dual characteristics:

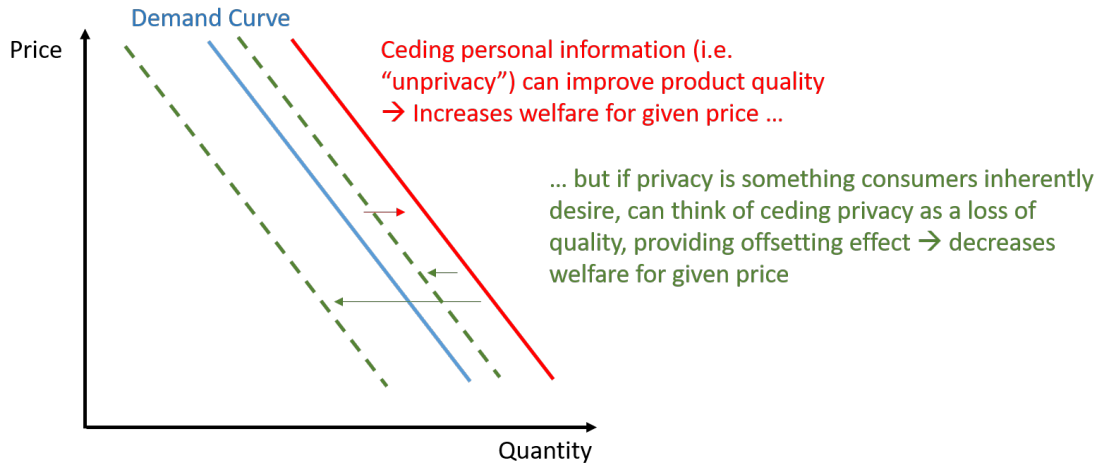
   (a) It represents a true cost in the sense that some amount of privacy has been foregone, and consumers might derive inherent benefits from remaining private; and

   (b) It also represents a form of co-investment in service quality, since consumers' private data is combined with data-based service providers' other consumer data, and algorithms to process it, in order to produce data-based services;

2. This dual characteristic of ceding privacy has ambiguous impacts on consumer welfare – particularly if consumers with fewer financial resources (e.g.

[108] Cowen (2017).
[109] This discussion draws extensively on Meade (2017b, 2018).

Figure 7: AMBIGUOUS CONSUMER WELFARE EFFECTS OF "UNPRIVACY"



Source: Meade (2018).

the young/students) willingly pay for DBD services by ceding their personal information to a greater degree; and

3. Individual consumers' preferences about ceding privacy might not align with society's, meaning too little privacy – or not enough – might be ceded to data-based service providers.

Measuring the consumer welfare impacts of ceding privacy is complicated by the fact that different consumers have different preferences for privacy, and place different weight on the benefits of data-based services (e.g. younger generations might be more in favour of the benefits those services provide, while older generations might place greater weight on privacy). Setting such differences aside, the ambiguous effects on consumer welfare of ceding privacy are illustrated in Figure 7.

Consumer welfare is often measured as the area under a demand curve, which shows the relationship between the quantity demanded of a good or service, and the price of that good or service, holding all other determinants of demand constant (i.e. incomes, prices of substitute goods, etc). Changes in consumer welfare can be

proxied by shifts in a demand curve, holding all other things constant (e.g. the price of the good or service).

Supposing we start with an initial situation in which demand – e.g. for services requiring electricity – is as shown in blue, but that product quality is improved when consumers cede their privacy (i.e. enable the provision of data-based services that use electricity, such as sensor-controlled automated home lighting or heating). This is represented by a shift in the demand curve to the red curve at the right. If this were the only impact of ceding privacy, it could be concluded that consumer welfare increases from the improved product quality, holding all other things constant.

However, if consumers inherently value privacy (i.e. they don't like their movements around the home to be tracked and made known to third parties), then a second, offsetting effect occurs, represented by a shift from the red curve to one of the green dotted curves to the left. Effectively, ceding privacy can be thought of as lowering the product quality.[110] The net effect of ceding privacy is that demand could remain to the right of the original demand curve (the right dashed line), or might even be to its left (the left-most dashed line – depending on the specific, data-using application). In the former case consumer welfare increases through ceding privacy, while in the latter case it falls, holding all other things constant.

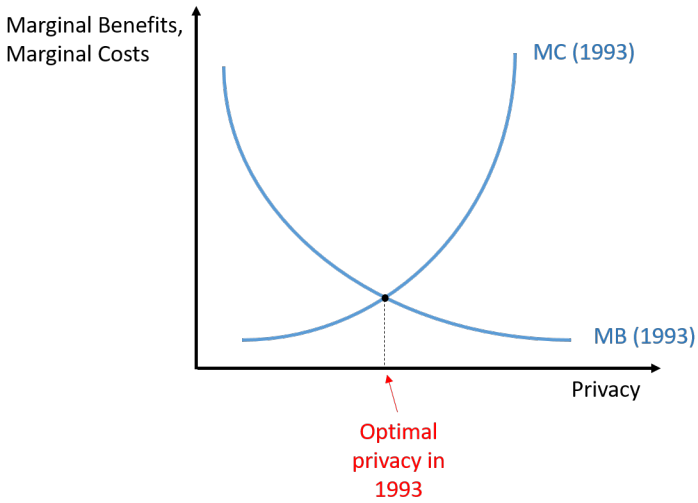
In general terms, the optimal level of privacy is determined where the marginal benefit of privacy equal its marginal cost (i.e. where the benefit of an extra unit of privacy equals the cost of that extra unit). At this point the benefits of privacy, net of its costs, are maximised. Supposing the Privacy Act struck the correct level of privacy in 1993, this is illustrated in Panel (a) of Figure 8, where the marginal cost (MC) and marginal benefit (MB) of privacy intersect.

Panel (b) of the figure illustrates how the optimal level of privacy may have changed

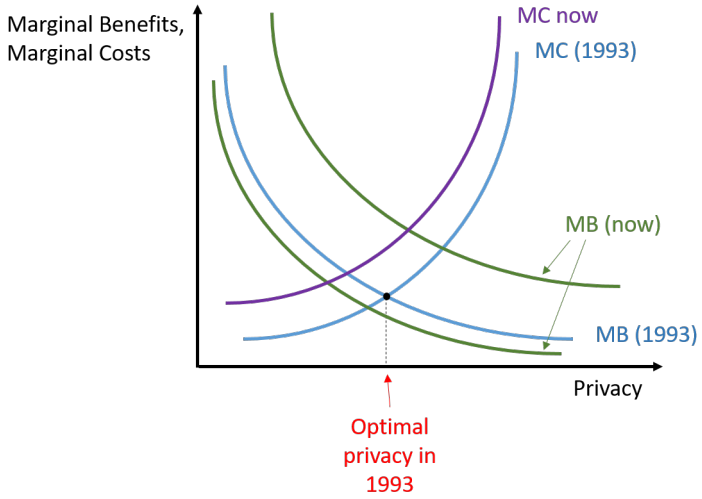
[110] In practice, if a consumer is offered two internet-based services – one that involves their data being sold to third parties, and another which does not – then they may well regard the quality of the former product as inferior. This is why some consumers pay Google for Gmail services in which their data is kept confidential, while others who care less about privacy, or have fewer financial resources, opt for the free gmail service in which it is not.

Figure 8: CHANGE IN OPTIMAL LEVEL OF PRIVACY DUE TO NEW TECHNOLOGIES

Panel (a) – Optimal Privacy when Privacy Act enacted in 1993



Panel (b) – Change to optimal privacy with advent of data-based services



Source: Meade (2018).

with the advent of data-base services since 1993. The marginal cost of privacy is now likely to be higher, represented by an upward shift in the MC curve to the purple curve. This is because internet-based firms now have multiple ways to track consumers' behaviours and preferences, making it more difficult to remain anonymous in the connected age.[111]

However, as in Figure 7, the marginal benefits of privacy – i.e. the benefits that ceding privacy now provides – could be either higher or lower (represented by the two green curves). This will depend on the particular data-based service in question, as well as the preferences for that service of individual consumers. Either way, where the MB and MC curves now intersect is either to the left or the right of where they did in 1993. In other words, depending on how strongly consumers perceive net benefits from ceding privacy, the optimal degree of privacy in an age of data-based service provision could be either higher – or lower – than before the advent of such services. This means the balance struck in the Privacy Act 1993 – and the presumptions on which the balance was struck – can no longer be assumed to apply.

To further complicate matters, individual consumers may prefer different levels of privacy to those which maximise the welfare of all consumers. For example, if all users of personal health monitors freely shared their health data, then this raises the possibility of earlier breakthroughs in medical research. In the case of electricity sectors, sharing personal data relating to electricity consumption might result in more efficient ways to provide electricity reliability, by better understanding consumption patterns and drivers. Hence, individuals' private preferences for privacy might not be the same as society's, with society preferring lower levels of privacy – i.e. greater "unprivacy" – in order to enable the achievement of greater societal benefits.

How privacy regulation affects the use of consumer-level data in the electricity sector has important ramifications for how data-based competition might evolve in that sector (as discussed further in Section 7.7.5). This begs the question as to whether existing privacy laws – which in New Zealand's case were enacted in 1993

[111] Even if an individual incurs costs to remain private, they are more likely to be frustrated in a world of ubiquitous smartphones, facial recognition software and listening technologies, and social media for hard-to-control data sharing.

with the Privacy Act – continue to appropriately reflect these trade-offs, and are flexible enough to reflect the increasing levels of "unprivacy differentiation" exhibited by both consumers and firms. Recent amendments to update the Privacy Act continue to apply privacy principles created before the internet rose to today's level of prominence, and its purpose is "protecting and promoting individual privacy". This seems to somewhat miss the point.

Presuming that privacy is a fundamental human right, and setting uniform minimum privacy standards for all consumers of data-based services on that basis, is akin to prescribing a "privacy floor" – or "unprivacy cap" (analogous to a price cap). Intentionally or otherwise, this appears to be the approach taken in the EU's general data protection regulation (GDPR), which took effect in May 2018. Such a cap precludes consumers with fewer financial resources – or lower preferences for privacy – to use their "unprivacy" to acquire data-based services, potentially limiting their access to such services. In this way, well-intended but outmoded privacy regulation could inadvertently give rise to distributional concerns in a world of increasingly data-based product and service offerings, including in electricity.

5.5 Electricity sectors are potentially ripe for disruption

5.5.1 Innovation and disruption have been relatively slow to emerge

Electricity sectors have been relatively untouched by DBDs, although signs of entry are emerging. International Energy Agency (2017) discusses the increasing interest of the Big Five US Tech Giants and other data-based firms in electricity. This includes their:

1. Investments in, or acquisitions of, energy-related companies; and
2. Direct investment in electricity generation, especially renewables-based DG, to power their headquarters, or energy-hungry data centres.

Examples of the former include:

1. Oracle's 2016 purchase of Opower, a leading US provider of customer engagement and cloud-based energy efficiency services to electric utility customers; and

2. The 2014 acquisition by Google of Nest, a supplier of home services such as thermostat control, and home monitoring/security, which can be controlled by Google's voice-activated digital assistant, Google Home.[112]

In New Zealand there are signs of emerging DBD entry in the form of:

1. Incumbent electricity retailers such as Meridian offering Nest (owned by Google's parent company, alphabet) home security and safety system; and

2. Amazon announcing the New Zealand pricing and local customisation for its Amazon Echo smart speakers, powered by its digital assistant Alexa.[113]

In part, this slow rate of disruption could reflect impediments created by the highly regulated nature of electric utilities in many parts of the US.[114] Global innovators naturally target the most lucrative markets first, so smaller markets such as New Zealand's are likely to be served only once technologies and business models have been perfected for larger markets. The marginal cost of DBDs then rolling out such technologies or business models to New Zealand would be relatively low, requiring only small changes in the approaches developed for larger markets to reflect local circumstances.

The slow rate of disruption might also reflect the fact that innovations such as smart metering and home energy management systems (e.g. allowing appliances to be controlled via mobile apps or digital assistants) have taken time to emerge. This means electricity consumers and their behaviours remain relatively under-measured, compared with other sectors such as online retailing.

[112] Google may re-merge with Nest after having in 2015 split it into a separate subsidiary of Google's parent company, Alphabet, to better enable it to develop smart home products.

[113] "Amazon reveals Echo NZ prices and Alexa's Kiwi jokes", *Stuff*, 18 January 2018.

[114] Indeed, EV recharging plans offered by Tesla sometimes charge by minutes of recharging time rather than KWh of energy supplied, depending on the jurisdiction, to avoid it being deemed a regulated electricity supplier.

A consequence of this is that electricity retail offerings remain relatively untailored compared with those in other sectors where consumer behaviour is much better measured and understood, and innovative offerings have been slow to emerge. To date they have included multiple fuel offerings, as well as broadband services. Pricing innovations include wholesale-price tracking energy tariffs, rather than traditional fixed tariffs. Time-varying tariffs, including in real-time, are also emerging in various jurisdictions.

5.5.2 Factors favouring disruption

Two factors suggest that electricity sectors are potentially ripe for disruption by data-based competitors:

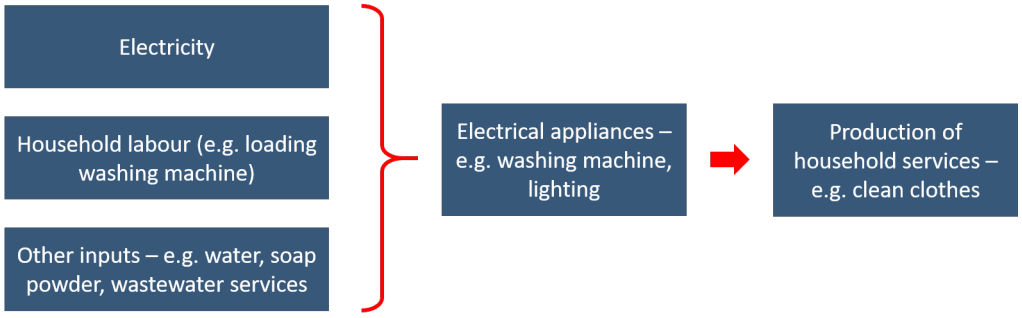
1. Electricity customers represent a large, relatively untapped pool of latent demand for innovative, electricity-consuming services; and
2. Aside from sector-specific innovations such as smart metering and home energy management systems, smartphones and newer technologies like voice-activated digital assistants are emerging as a new, home-based platform for better access to consumer data (e.g. electrical appliance usage), and enabling integration with a wide range of home-based activities (including those using electrical appliances, particularly the increasing range of internet-connected appliances, as well as more general advances in the IoT).[115]

5.5.3 Re-inventing electricity retailing – bundling electricity with appliances and home services

Importantly, the confluence of these two features is likely to result in a paradigm shift in how consumers think about electricity. Until recently, consumer purchases of electricity have simply amounted to a "tax" or "grudge purchase" for the ability

[115] The development of voice-activated digital assistants is likely to be an important innovation. This not only provides a convenient interface for controlling a wide range of internet-connected devices without the need for screens and keyboards. It also enables continuous monitoring of customer environments and interactions (digital assistants listen as well as speak), providing additional sources of personal data to DBDs, with obvious privacy trade-offs – see Section 5.4.

Figure 9: EXAMPLE OF AN ELECTRICITY-CONSUMING HOUSEHOLD PRODUCTION PROCESS



to enjoy the benefits of modern living. No consumer has bought electricity because they want electricity per se – in the same way no online purchaser of goods would purchase postage and packaging in its own right. Rather, electricity is simply a key input to be combined with electrical appliances and household labour in the "household production" of a range of services.[116] These services include (e.g.):

1. Warmth;
2. Clean dishes and clothes;
3. Home security;
4. Entertainment; and
5. More recently, with the availability of EVs, transport services.

This household production process is illustrated in Figure 9.

The demand for electricity and its transportation is thus a *derived* demand, reflecting households' choices over electrical appliance and other home investments (e.g. insulation), and the services they wish to produce using those investments.[117]

[116] E.g. see Davis (2008).

[117] See Meade (2017a) for further discussion, and an analysis of how appliance choices affect cost of living. In the same way, demand for postage and packaging is a derived demand reflecting consumers' choices over which products they wish to buy online, and the costs of making purchases in person from traditional retailers (including transport and travel time costs).

Recognising this, innovative DBDs have the potential to disrupt traditional electricity retailing.[118] Increasingly they may offer subscription-based packages that bundle electricity with the supply of the services consumers actually wish to buy (home security, heating, entertainment, etc). Examples suggesting that this possibility might emerge include:

1. Amazon Prime's bundling of postage and packaging for online purchasers of goods; and
2. EV manufacturers such as Tesla and Nissan offering free recharges to EV buyers,[119] or attractive pricing plans for recharging.[120]

Amazon might even choose to bundle electricity for free if that helps to generate economies of scale and network effects, such as by attracting sufficient customers that appliance manufacturers cannot avoid using their platform to access those customers.[121]

Indeed, as DBDs establish "beachheads" in households with platform technologies such as smartphones or voice-activated digital assistants and "smart speakers", this paves the way for other service providers to also offer bundled offerings using those platforms. Hence, for example, appliance manufacturers will increasingly choose to make smart appliances that connect with particular DBD platforms.[122]

Just as Amazon already offers online sellers of goods advantages in terms of its logistics, it should be expected that if such DBDs bundle electricity supply with other services, they may pass on any advantages they have in procuring or self-supplying electricity to third-parties who also choose to offer bundled services across their platform.[123]

[118] See Sandys et al. (2017) for similar arguments to those here.

[119] Seba (2016). Relatedly, UK electricity supplier Ovo has offered Nissan Leaf owners free recharges in exchange to access to energy stored in their batteries – "Electric car owners 'can drive for free by letting energy firms use battery"', *The Guardian*, 2 October 2017.

[120] Some manufacturers of liquid fuel vehicles also offer free fuel to new car buyers. In each case, limits tend to apply.

[121] A related example in New Zealand is Vodafone bundling unlimited broadband with entertainment packages provided by Sky TV, at a fixed monthly fee.

[122] For example, LG manufactures a smart refrigerator that works with Amazon's Alexa.

[123] Doing so creates economies of scale for Amazon in procurement or self-generation, and makes its platform more attractive to third-party sellers.

5.5.4 Leveraging market power from data to electricity retailing

DBDs leverage their market power in accumulated consumer-level data, and predictive and persuasive technologies, to enjoy market power in other sectors – as they might in electricity.[124][125] In fact, such disruptors have certain natural advantages over incumbent electricity sector firms that extend beyond their better ability to measure and understand consumer behaviour and preferences.

Being able to *predict* consumer-level appliance use and hence electricity consumption behaviour has the advantage of enabling better management of any exposure to wholesale electricity prices in the case that disruptors wish to trade spot (i.e. without relying on the purchase of forward supply contracts from incumbent suppliers, or other price-hedge instruments).

However, being able to *influence* that behaviour using persuasive technologies offers data-based disruptors even greater market power. They could actively manage consumer-level appliance use, and hence electricity consumption, affording them innovative ways to not just create demand-side responsiveness – a long-sought "holy grail", or at least unfinished business, in many reformed electricity sectors – but to actively manage that demand. That too offers such disruptors unrivalled ways to manage their exposure to wholesale electricity prices, making them potentially potent "retailers".[126]

[124] Choi and Jeon (2016) show that such leveraging can be a profitable strategy in two-sided markets (i.e. platforms), even if it is not in other types of industries featuring market power.

[125] Prüfer and Schottmüller (2017) discuss this feature of data-based competition more generally. Bundling can also serve as a device to enable more refined targeted pricing by DBDs – i.e. charging individualised prices to customers based on their specific WTP, rather than uniform prices. This can result in more customers being served (e.g those who would not purchase at uniform prices that exceeded their WTP), and increase profits.

[126] Aside from influencing consumer behaviours, other technologies are also emerging to actively manage their electricity consumption. For example, a special report on technology in Africa, published in *The Economist* on 11 November 2017, discusses UK-based company, Azuri Technologies. It has developed systems not just to forecast household electricity usage, but also to adjust the brightness of lighting, or television screens, to manage households' power consumption.

5.5.5 Leveraging market power from data to DER aggregation – DBDs as natural "aggregators"

As well as having advantages as data-based retailers, DBDs are also natural parties to be "aggregators" of small-scale DERs (which could form part of their overall role as retailer). This is not just because of their market power in predicting and influencing consumer behaviour, but also because of their ability to leverage that market power into a wide range of sectors. Merchant DER aggregators profit by trading aggregated DER services such as:

1. Supplying electricity;
2. Arbitraging price differentials across time using storage; and
3. Providing network support services.

Data-based aggregators can do likewise, but with superior technologies for managing the supply of those services. Additionally, data-based aggregators enjoy the prospect of additional revenue streams through monetising their superior accumulations of consumer-level data. Hence there are reasons to expect that merchant aggregators – like traditional electricity retailers – will be at a significant disadvantage relative to DBDs in the aggregation of DERs.

5.6 Implications of data-based disruption for electricity sector organisation

5.6.1 Re-aligning market power

The inherent market power of DBDs, combined with their comparative advantage in aggregating DERs, has a range of important implications. Specifically:

1. If data-based disruptors enter electricity sectors, this potentially fundamentally re-aligns market power between generators, grid and network owners, retailers and disruptors – e.g. large, data-based aggregators might enjoy significant "buyer power", enabling them to negotiate favourable supply terms

with large generators and/or distributors (especially if they can back up their bargaining position by the threat of directly entering into other parts of the sector, including DER supply);

2. The particular source of data-based disruptors' market power lies in their accumulated consumer-level data, which they might leverage through exclusive dealing arrangements (e.g. tying electricity supply with the purchase of specific appliances or services); and

3. The economies of scale and network effects exhibited by data-based competition could incline data-based "retailing" towards tipping to monopoly – made worse by insurmountable "data moats" that entrench that monopoly and protect it against further entry.

5.6.2 Re-aligning ownership

As a consequence, entry into electricity sectors by DBDs has the potential to cause a seismic shift in the ownership of the sector. For example:

1. Generators have traditionally enjoyed market power due to large economies of scale in generation, whereas retailing is relatively competitive (due to low entry barriers) – hence market power in the industry may increasingly be relocated towards data-based retailing, with the balance of market power reversing from upstream generation to downstream retailing;

2. As a consequence of increased retailing market power, generators may be forced to *defensively* merge to increase their bargaining position vis-a-vis large, data-based retailers – although the consumer welfare impacts of this remain to be researched, and constraints such as state ownership of key gentailers may impede this;

3. For similar reasons, existing retailers (vertically integrated into generation or otherwise) may also seek to merge, to enable them to better compete with data-based retailers, or simply exit the industry (either selling out to

disruptors, or closing down) – alternatively, they may become legacy retailers to customers that are yet to adopt new technologies or switch to DBDs (e.g. because they place a relatively high value on privacy);

4. If data-based retailers have sufficient ability to manage real-time demand, then the traditional rationale for the vertical integration of generation and retailing is undermined – integrated gentailers may choose to exit retailing, both because they no longer need it for managing wholesale market price risks (e.g. if they can instead sign long-term supply contracts with data-based retailers), and because data-based disruptors have a substantial comparative advantage in offering value-added services to consumers, and managing demand and pricing risk (especially if they also enter into DER aggregation, which would be natural for them to do).[127]

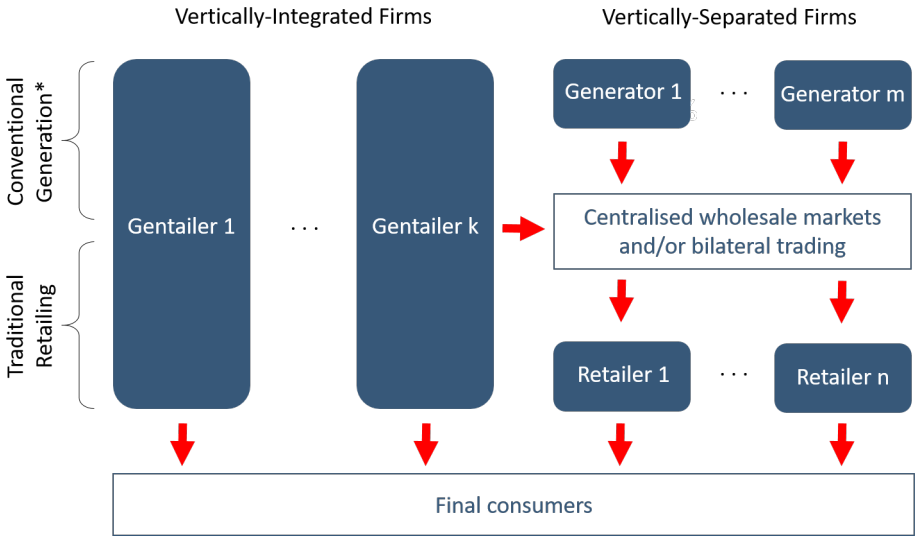
5. Furthermore, consumers with DERs are themselves increasingly vertically integrated into generating, which means they are able to hedge wholesale price risks for that part of their own electricity consumption that they are able to produce – this further reduces the rationale for conventional generators to be vertically integrated into retailing (since consumers with DERs can self-produce some of the price risk insurance formerly provided by retailers).

Hence the possible consequences of data-based disruption in retailing (and aggregation) include reversal of the balance of market power from generation to retailing, increased concentration in generation ownership, voluntary vertical separation of generation from retailing, and legacy retailers either being sold, shut down, or confined to serving customers yet to adopt new services and new services offered by DBDs. These possible changes are illustrated in Figure 10.

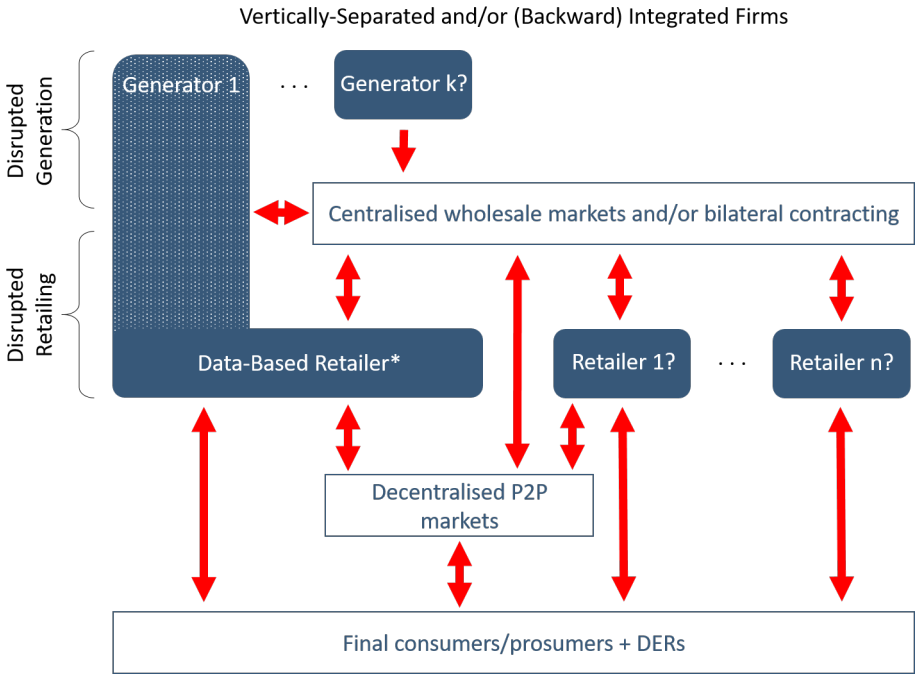
[127] Nardotto et al. (2014) examine how unbundling of retail from network services affected telecommunications sectors. While they found no increases in retail penetration as a consequence of unbundling, they did find lasting quality improvements, mainly because retail entrants differentiated themselves on quality. The argument above paints this story in reverse – that high-quality data-based entrants is likely to cause vertically integrated firms to voluntarily unbundle, but potentially with increased sales as a consequence of the entrants' higher-quality retail offerings.

Figure 10: POSSIBLE CHANGES TO ELECTRICITY SECTOR OWNERSHIP DUE TO DATA-BASED DISRUPTION IN RETAILING

Panel (a) – Existing sector ownership



Panel (b) – Possible future sector ownership



* Market power in the sector relatively more concentrated here.

In fact there is reason to believe that DBDs will not stop simply at disrupting retailing, and leave other parts of the industry to respond. As already indicated, part of DBDs' retailing disruption is likely to include DER aggregation, as well as electricity supply being bundled with other services (either by the DBDs themselves, or by third-party suppliers that use their platforms to access customers). While DBDs might leverage their market power in retailing to secure favourable terms from generators and, if regulation permits, distributors, there may come a point where direct entry into large-scale generation is also profitable.[128] Reasons for such entry include:

1. Achieving better terms for energy supply[129] – although this might also be achieved by investing in DERs as their costs fall;

2. Risk management – i.e. to avoid the risk of unfavourable pricing from spot market purchasing, or at the expiration of fixed-term supply contracts; or

3. Resolving hold-up risks – i.e. the risk that generators may initially agree favourable supply terms that induce irreversible investments by DBDs but not do so later, undermining those investments, or (perhaps more realistically) vice versa.[130]

This entry could involve acquiring existing generators, or direct investments in new generation capacity.[131]

For similar reasons, the entry of DBDs might also lead to ownership changes in EDBs. If DBDs are able to exert buyer power in bargaining for lines services – e.g. with unregulated EDBs – then affected EDBs may need to consolidate with other

[128] Compare this with the entry of Tech Giants in the US (Amazon) and China (Alibaba and JD) into logistics. See "Thinking Outside the Box", *The Economist*, 28 April 2018.

[129] Compare this with Amazon's ability to strike better terms with the US Postal Service than the service's smaller customers.

[130] See Meade and O'Connor (2011) for a comparison of vertical integration versus long-term contracting in electricity sectors, including an assessment of how each approach addresses hold-up risks. Howell et al. (2010) provide a similar discussion in relation to telecommunications.

[131] A constraint in this regard for New Zealand is the market's relatively small scale. That might delay entry of DBDs into retailing, although once DBDs have an established model for retailing disruption in larger jurisdictions the costs of rolling out that model in smaller jurisdictions is relatively low. It might also impede their entry into generation, especially if it involves complications such as the need for specialist expertise in securing local fuel supplies (e.g. hydro or geothermal resources), which potentially leaves an advantage to local generators.

EDBs. This is both to improve their own bargaining position, but also to secure necessary economies of scale and enhanced efficiencies if they face lower, negotiated supply revenues. It might also be to enable sharing of capital resources to make any necessary network or DER investments (especially for customer-owned EDBs, which are less able than investor-owned EDBs to raise equity capital due to their ownership structure).

Finally, just as DBDs might ultimately seek to vertically integrate with conventional generation, they might too with EDBs (e.g. to resolve hold-up risks associated with any specialised network investments that might be required to support new technologies and business models).[132] That is, if DBDs choose not to build their own network infrastructures, either as a bargaining discipline on existing network firms, or simply to have better control over network quality and service levels to support their products and services.[133]

5.7 Other scenarios – entry from other sectors, and pre-emptive tie-ups

5.7.1 Entry from other sectors – telecommunications

The discussion in this section thus far assumes disruptive entry into electricity retailing by DBDs. Other alternatives are also likely, even if only transitional. One, in particular, is the possibility of entry by telecommunications operators into electricity. Such operators bring three relevant sets of expertise:

1. Systems and skills in providing network services;

2. An understanding of regulatory processes; and

[132] Subject to the Part 3 limits on common ownership of distribution and competitive activities (assuming DBD activities are caught by the definition of either) – see Section 3.4.3.

[133] New Zealand's small scale is the main obstacle to such investments. However, the possibility of such investments has already been shown, with Facebook and Microsoft's collaboration with Spanish telecommunications infrastructure firm Telxius. In 2017 these partners laid a 6,600 km transatlantic undersea cable between the US and Spain, capable of transmitting data at speeds of up to 160 terabits per second (`https://thenextweb.com`). The increasing cost-effectiveness of low-orbit satellites such as through New Zealand's own Rocket Lab raises the prospect of such infrastructure investments, possibly to bypass existing local infrastructures.

3. Access to real-time consumer-level data (e.g. through smartphones), and growing skills in analysing customer preferences and tailoring product offerings to their needs.

To date, a number of players in the New Zealand electricity sector have provided offerings that bundle electricity as well as telecommunications services (e.g. broadband). However, telecommunications companies have a longer track record in offering highly-tailored pricing plans and customer engagement that mean they have some of the comparative advantages of DBDs – relative to electricity companies – if not all.[134]

Hence entry of telecommunications companies into electricity represents a potential form of "disruption lite". This could serve as a partial deterrent to full entry by DBDs. Alternatively, it might simply delay that entry.

Recent merger decisions by the Commerce Commission raise the question as to whether such cross-sectoral mergers or acquisitions might be blocked on competition grounds. The Fairfax/NZME and Vodafone/Sky mergers were blocked on the grounds they could result in existing market power increasing, or being leveraged from one sector to another. This was despite the increased competition they already face from DBDs (e.g. news feeds on Facebook in the former case, and entertainment streaming services in the latter), or the potential for increased such competition in the future.[135] A proposed merger between electricity and telecommunications firms might give rise to similar concerns, even if the threat of entry, or actual entry, by

[134] An example of telecommunications firms bundling network services with value added services include Vodafone TV, advertised as the "ultimate entertainment and broadband package". For a fixed monthly fee subscribers access entertainment services with unlimited broadband already included (which, of course, can then be used for other internet-based activities). This enables existing market power to be leveraged by bundling partner services, in this case in the form of Sky Sport and Soho from Sky TV. Telecommunications companies have long-since transitioned from charging per unit of data transferred to capacity-based charging (i.e. connection bandwidth). There is clear potential for this to occur in some parts of electricity (e.g. network services), and possibly more widely (i.e. energy, with technology-based solutions for "traffic management" of consumption).

[135] In effect, the mergers were blocked due to the risk that they could lead to a substantial lessening of competition, the Commerce Commission's relevant test. However, with increased DBD competition either apparent or a real prospect, perhaps all these mergers might have done is deter or delay an increase in data-based competition (and risk of that competition subsequently tipping to monopoly). Either way, assessing the quality and privacy impacts of a merger – or of a merger being blocked – should form a major part of the assessment.

DBDs should provide either countervailing power or compensating competition.[136] Whether or not a pre-emptive, defensive merger by existing firms is blocked on competition grounds, it is a relatively open question as to how this might affect long-term consumer welfare. In part this would hinge on which of the following is more beneficial:

1. The longer survival of traditional firms:
   (a) That are then able to offer better quality and more diverse products and services, and force DBD entrants to offer even higher-quality offerings in order to induce consumers to switch to them;
   (b) But which are merged, and with greater market power (possibly across different sectors); and
   (c) Perhaps with delayed entry by DBDs; or
2. The sooner dominance of one or only a few DBDs:
   (a) Through initially-increased competition between entrants and incumbents, but in a market more inclined towards tipping to hard-to-unsettle monopoly;
   (b) With such firms offering innovative services funded (though also created) to a much greater degree using consumers' data; and
   (c) With traditional firms possibly retrenching to more limited roles (e.g. serving consumers who cannot or do not wish to adopt DBDs' services), and merging, if possible, to countervail against DBD market power.

5.7.2 Pre-emptive tie-ups by electricity players

Incumbent electricity firms are not likely to remain flat-footed in the face of potential or actual DBD entry.[137] Even ahead of DBD, entry they can be expected to

[136] It is notable that the AT&T/Time Warner merger was recently cleared in the US on the basis that incumbent firms face new competition from Tech Giants. This then paved the way for Comcast to similarly bid for 21st Century Fox. See "The World this Week", *The Economist*, 16 June 2018.

[137] Subject to constraints such as state ownership of key gentailers, and customer ownership of many EDBs.

increasingly offer bundled offerings and their own value-added services, based on the best available consumer data and data analytics they can either produce or acquire.

Another possible alternative is for existing electricity sector players to seek pre-emptive tie-ups with DBDs. This provides a way for electricity players to access the vast customer data and analytical capabilities of DBDs without needing to try to develop those expertise in-house.[138]

Experience from financial sectors suggest this strategy – even if unavoidable – could ultimately backfire. DBDs have directly entered into services such as retail banking and insurance after having been used by financial sector firms to improve their customer engagement.[139] Indeed, experience from financial sectors suggests DBDs prove to be more disruptive than sector-born disruptors (i.e. fintech startups), further highlighting their disruptive potential.

In short, DBD-initiated entry can be contrasted with sector-initiated bundling or tie-ups in the following terms:

1. DBDs can leverage their pan-sectoral market power in data-based competition into specific sectors such as electricity – having successfully disrupted one sector, it is in fact easier for them to disrupt another, given their strong scale economies and network effects;[140]

2. Conversely, incumbent electricity players can try to leverage their electricity sector market power into other sectors (such as telecommunications and alternative fuels), or try to deter DBD entry by bundling their market power with that of DBDs.

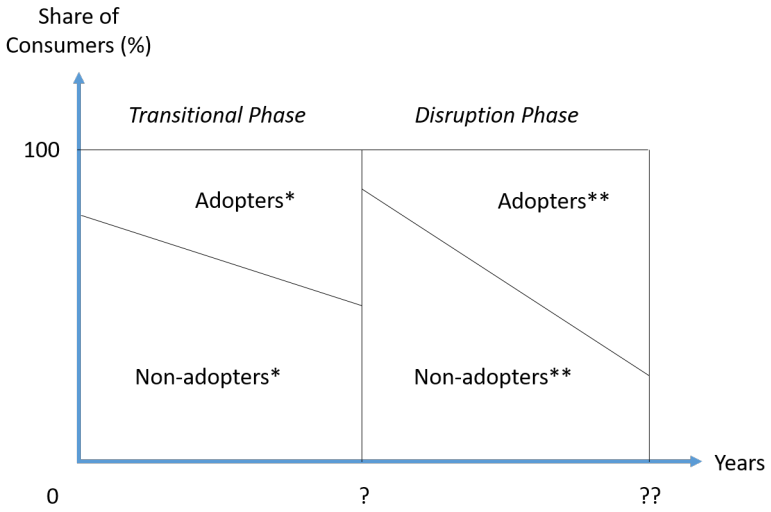
The success of the latter strategies, particularly tie-ups with DBDs, will hinge on whether electricity sector market power is sufficient to countervail that of data-based competitors should they wish to expand their electricity presence.

[138]Some degree of in-house upskilling in obtaining, analysing and using consumer-level data is inevitable in any case, as all firms face shared competitive pressures to do so. However, leapfrogging in-house development to access the existing specialist skills of third parties is likely to prove unavoidable, if only because of their already insurmountable accumulation of consumer-level data.

[139]World Economic Forum (2017). In effect, tie-ups with DBDs might represent a short-lived Faustian bargain for incumbent electricity sector firms.

[140]This argument applies equally to countries as well as sectors.

Figure 11: POSSIBLE PHASES OF TRANSITION AND DISRUPTION



* Of bundled variable-price "utility" offerings by traditional firms, including electricity.
** Of bundled fixed-price value-added product/service offerings by DBDs, including electricity.

A possible sequencing of these transitions is illustrated in Figure 11. Initially some sort of transitional phase can be anticipated, in which incumbent providers transform their offerings in competition with each other, and adopt more data-based approaches as technologies permit and competition dictates. A disruption phase is likely to follow, featuring outright DBD entry that forces incumbent firms to transform themselves even more to remain viable.

5.8 Conclusions

Electricity sectors globally, as in New Zealand, are relatively ripe for disruption. At its heart this disruption involves collecting better consumer-level data and using it to predict or influence consumer behaviour.

Evidence of that disruption already starting to emerge from within electricity sectors is growing. However, experience from other sectors suggests that skills in customer engagement can prove to be decisive in determining whether incumbents can con-

tinue to control that process, or face disruption – potentially by their own suppliers of customer engagement services.

There is evidence already emerging of DBDs taking steps to enter into electricity sectors, as they have in many other sectors. Furthermore, their relatively greater dominance of the customer relationship than incumbent firms, in electricity or other sectors, means they have the potential to dislodge currently dominant firms, and relocate where market power is strongest (in the case of electricity, from generation to retailing, and perhaps also from distribution to retailing).

The impact of disruption on consumer welfare is likely to be very positive for some consumers, but potentially negative for others (at least in the short- to medium-term). Reasons for the latter include possible distortions created by regulation (e.g. distribution network cost recovery falling on shrinking pools of customers). They also include waterbed effects, such as customers who uptake new products and services receiving favourable bundle pricing, in part because they are paying for them with their data, while those who do not potentially face increased prices (e.g. because they can be identified as being less price-responsive).

As and when such DBD entry occurs in electricity, it should be expected to cause seismic shifts in how the sector is owned, and who – i.e. regulators or DBDs – is best placed to address market power issues in the sector. It could also cause new regulatory issues such as the risk of tipping to monopoly in retailing, waterbed effects (for customers who choose not to or cannot uptake DBD technologies), and greatly reduced privacy. These factors suggest that new business models and players could:

1. Reduce the need for certain types of electricity-sector specific regulation;
2. Raise the need for new types of such regulation – e.g. if DBD entry gives rise to undesirable waterbed effects; and
3. Increase the likelihood of pan-sectoral regulation – such as competition or privacy regulation – playing an increased role in electricity.

This section's main findings are:

- Data-based competition is characterised by the use of "big data" to enable technologies for both prediction and persuasion;
- Strong network effects and economies of scope mean data-based competition encourages races to "get big fast", and "winner takes all" competition that risks tipping to monopoly, with resulting dominant firms hard to unsettle due to "data moats";
- The dual use of data by DBDs – both as a form of "currency" with which consumers buy data-based offerings, and a means by which consumers contribute to the quality of those offerings – challenges traditional conceptions of privacy, and highlights how treating privacy as a fundamental human right could have unintended adverse consequences;
- Electricity sectors are ripe for data-based disruption, including through the use of value-added offerings that bundle electricity supply with products or services of greater inherent interest to consumers;
- DBDs can be expected to enter into electricity retailing, leveraging their "big data advantage" into an otherwise competitive sector, and shifting the balance of market power in the sector towards retailing – potentially alleviating existing market power issues, but also giving rise to new ones;
- Subject to constraints such as state or customer ownership, or backward-looking merger screening, actual or threatened DBD entry into electricity retailing will cause existing firms to consider pre-emptive tie-ups with providers of complementary offerings (e.g. telecommunications), and/or ownership changes such as possible voluntary vertical separation of gentailers; and
- These changes in the nature, location and ownership of market power and other regulatory concerns mean that electricity sector regulation will likewise need to adapt for it to continue to best serve long-term consumer interests.

6 How suited is current regulation for the changing environment?

Sections 4 and 5 set out likely challenges to electricity sector regulation arising from both new technologies (e.g. DERs), and the disruptive business models and players they are likely to spawn. This section:

- Summarises both general and specific strengths and weaknesses of New Zealand's existing electricity regulation, focusing first on those of the Electricity Authority and Commerce Commission;
- Highlights issues with New Zealand's current electricity regulatory framework, with particular focus on price-quality regulation, but also more widely; and
- Discusses issues such as limited recognition of differentiated consumer interests, the need for distribution networks to be treated more like the grid, DER investments possibly being distorted by regulation, regulatory waterbed effects, regulatory definitions not reflecting emerging realities and possibilities, and the absence of a rules-based pathway to transition from regulation to competition.

6.1 Introduction

Sections 4 and 5 survey a range of innovations – in technologies, business models and players – that will likely re-align the competitive (and non-competitive) landscape of the New Zealand electricity system. This helps to understand regulatory challenges and opportunities such as:

1. What sorts of traditional regulatory issues will remain relevant in light of these innovations, and for whom;
2. What new regulatory issues might these innovations give rise to; and

3. Possibly, what new regulatory tools might become available – to address traditional regulatory issues, or new ones.

A clear understanding of these challenges and opportunities is necessary to determine what ideal regulatory arrangements might look like. This is because, without that understanding, it is only possible to discuss ideal regulatory arrangements for addressing existing regulatory issues, rather than those that are likely to emerge (or disappear).

Furthermore, failing to recognise how the pace of change in regulatory challenges and opportunities is likely to increase could result in unduly static regulation, rather than the dynamic regulation required in response to any increasing pace of change.

Before turning in the following sections to how New Zealand's electricity sector regulatory arrangements might be improved in response to these challenges and opportunities, this section:

1. Summarises those key challenges and opportunities; and
2. Discusses:
   (a) Strengths of the existing regulatory framework in responding to them; and
   (b) Key issues with the current framework that need addressing.

6.2 Summary of key regulatory challenges and opportunities

From Sections 4 and 5, the key regulatory challenges likely to arise with new technologies, business models and players are:

1. Consumers' interests will become increasingly differentiated and time-varying, and potentially production- rather than consumption-oriented (especially for those adopting DERs relative to those who don't) – complicating the identification of the "long-term interests of consumers";

2. The long-term welfare enjoyed by "consumers" from DERs will be affected by who owns and controls them, as well as regulation, and it is not assured that their adoption will improve welfare in all cases – further complicating who it is that regulators are serving, and what interests are to be served;

3. DERs both substitute for, and complement, the activities of incumbent players such as generators and distributors, possibly in ways that vary over time and with circumstances – this complicates assessment of who should own and control DERs, and how they should (or need not) be regulated;

4. Distribution network topologies will become much more like that of the grid, with increasingly bi-directional energy flows – complicating distribution network management;

5. Trading in electricity and network support services is likely to become much more decentralised and algorithmic – raising the risk of more severe systemic events, but also possibly more effective tools for achieving reliability;

6. The boundaries between the electricity and other sectors are likely to become increasingly blurred, and the regulatory issues they face increasingly shared – accentuating the limitations of silo-ised, industry-specific regulation (e.g. due to regulators with narrow sectoral remits failing to account for how their decisions affect other, increasingly-interconnected sectors);

7. The electricity sector is likely to become much more like other, fast-moving and consumer-focused sectors – forcing regulators to likewise keep pace with understanding (changing) consumer preferences; and

8. New business models and industry players – in particular, DBDs – could become dominant in the industry – creating new issues such as:

   (a) Markets for DBD offerings tending toward high levels of harder-to-unsettle concentration – complicating the analysis of mergers between existing firms that might only pre-emptively and defensively create market power

to balance against that of DBDs, especially if the market power impacts of DBDs remain to be seen (and raising questions about how to balance the benefits of innovation against the costs of greater market concentration); and

(b) Charging customers in non-monetary terms, especially in terms of "unprivacy", i.e. accessing, using and trading their personal data – complicating the measurement of "price" in the provision of increasingly diverse and differentiated data-based services, and measuring the consumer costs and benefits of those services;

Some key regulatory opportunities presented by new technologies, business models and practices include:

1. Much more consumer-responsive and innovative service provision, providing quality benefits that compensate for higher consumer costs (in terms of pricing, or loss of privacy);

2. New business models and industry players – in particular, DBDs – could seize the balance of market power in the industry, potentially alleviating existing issues of market power in generation and networks that regulation would otherwise need to address (hence reducing the need for such regulation), though possibly at the expense of winner-takes-all competition in data-based offerings;

3. The possibility of adopting more decentralised network management approaches, given the impact of DERs on network topologies, and growth in technologies such as P2P platforms with "smart contracts" for (automated) decentralised trading – each of which could provide new or more efficient ways of achieving reliability; and

4. Providing regulators with new regulatory tools, such as contracting with DBDs who have unmatched consumer understanding to induce them to use that

superior data to deliver desired regulatory outcomes (rather than fruitlessly trying to replicate that understanding).

6.3 Strengths of the current regulatory framework

6.3.1 General strengths

The electricity sector regulatory framework in New Zealand has a number of strengths for responding to new challenges and opportunities to the long-term benefit of consumers. At the most general level these include:

1. A stable, open and pluralistic democratic government, with non-federal structure (making it easier to implement nation-wide changes);
2. An independent judiciary drawing on precedent from other common law countries, with reliable contract enforcement, and respect for property rights and the rule of law; and
3. A flexible economic system (e.g. not hide-bound by regulation) – even with the scope of regulation continuing to grow, the economy is not as inflexible as before the country's major economic reforms starting in the 1980s.

These help to ensure that New Zealand's regulatory regimes are well-designed and implemented, and relatively robust against capture by special interests (to the detriment of consumers).

More specifically, the sector's main regulatory actors also enjoy certain strengths. At a high level:

1. Both the EA and Commerce Commission have the long-term interests of consumers in their statutory purposes, and have accumulated significant industry-specific expertise to enable them to discharge their regulatory obligations; and
2. MBIE, as the agency responsible for New Zealand's regulatory frameworks, has the scope to refine electricity sector regulation for the sustainable and widely-enjoyed increase in New Zealanders' standard of living (which is sufficiently

broad as to include the long-term benefit of consumers, to at least some degree).

6.3.2 Specific Electricity Authority strengths

The EA's regulatory framework also has certain delegated discretions affording flexibility and responsiveness. For example, the EA can:

1. Recommend new regulations to its Minister, who has power under legislation to impose them without need for legislative change;
2. Amend the electricity industry participation code that governs the conduct of electricity industry participants; and
3. Exempt individual industry participants or classes of participant from the requirements of the electricity industry participation code (which could be helpful to avoid consumers, or firms, being subject to the code when the costs of compliance outweigh their benefits).[141]

The EA is required to have regard to statements of government policy. This potentially means it is more attuned to changing circumstances and consumer preferences, as mediated through the political process.

An additional strength of ex ante regulation by the EA is that having clear, prespecified rules helps to reduce investment uncertainties (for example, in contrast to ex post competition regulation by the Commerce Commission, which can create investment uncertainties and delays).

6.3.3 Specific Commerce Commission strengths

The Commerce Commission's regulatory framework includes certain delegated discretions, which affords flexibility and responsiveness without need to amend slow-

[141] This is potentially the case with DERs, although creating incentives for DER aggregation such as through imposing code compliance costs could result in significant benefits, especially where there are strong social benefits from DER coordination.

to-change primary legislation.[142] For example, the Commerce Commission can:

1. Shorten regulatory sunset periods if unexpected changes in technologies, business models or players make "regulatory stranding" more likely;
2. Apply its Part 4 regulation using performance- rather than process-based approaches – enabling technology agnosticism;
3. Distinguish different classes of consumer, and apply different types of regulation to those different classes;
4. Likewise, distinguish between different types of regulated firm, and regulate them accordingly;
5. Change regulatory periods at least five yearly – limiting distortions should technologies suddenly change, or their adoption take off; and
6. Amend input methodologies to reflect changing circumstances.

6.4 Issues with the current regulatory framework

6.4.1 General issues

Some of the features of the New Zealand regulatory framework that give rise to general strengths also give rise to general issues. For example:

1. The country's non-federalised governance arrangements also reduce the ability to trial regulatory experiments at sub-national level – such experimentation could be a useful tool in trialling different regulatory approaches to see what works best; and
2. The ease of changing primary legislation (relative to jurisdictions with multi-level lawmaking), and rules and regulations made under such legislation, potentially provides too much regulatory flexibility – i.e. insufficient regulatory commitment.

[142] Legislation can take years to design and implement, and is therefore often intended to last for many years (possibly decades). Creating a robust framework is therefore an important goal of legislation.

The latter is potentially more of an issue in the past, when technologies have been relatively more stable, and long-term regulatory commitment to support long-lived irreversible investments has likely been more important than regulatory flexibility and responsiveness.

The general ease with which New Zealand can change its regulatory frameworks gives the country the chance of charting its own course. However, in an increasingly internationalised environment, particularly in relation to new technologies and their governance, this risks New Zealand becoming out of step with major international partners and competitors.[143]

Furthermore, it is possible that the current mergers regime in New Zealand is unduly biased against mergers, or lacks tools which might enable them to be cleared when otherwise they might not. These include:

1. A low bar being set (e.g. relative to Australian competition rules) on when the Commerce Commission must decline a merger if it is "likely" to substantially lessen competition; and

2. No provision for the Commerce Commission to accept behavioural undertakings that might enable a merger to proceed – unlike other jurisdictions.

Keene (2017) discusses possible amendments, to sections 27 and 69A of the Commerce Act respectively, to remedy these possible shortcomings. As for the Vodafone/Sky and Fairfax/NZME mergers which the Commerce Commission blocked, any pre-emptive and defensive mergers in the electricity sector in response to actual or possible entry by DBDs might similarly be blocked. This is despite that entry potentially increasing competition overall, despite any merger of incumbents (or of electricity incumbents with incumbent firms in other sectors, such as telecommunications).[144]

[143] One benefit of this might be greater protection against global systemic risks, such as exploitation of flaws in commonly-used software and systems. Conversely, going it alone raises the risk of creating unique vulnerabilities.

[144] Indeed, as was accepted in the US antitrust with clearance of the AT&T/Time Warner merger in early 2018.

Finally, it is timely to consider if the course of major competition law developments in New Zealand, and current limits on the ability of competition decisions to be challenged on their merits, well-position New Zealand for impending new challenges such as those detailed in Section 5. Section 7 argues for a shift in the boundary between competition regulation and industry-specific regulation, in favour of greater reliance on the former. This will necessarily require that competition regulation is sufficiently reliable and effective to discharge its extra responsibilities.

6.4.2 Specific issues – price-quality regulation

Limited recognition of differentiated consumer interests

In principle Part 4 of the Commerce Act, which provides for price-quality regulation,[145] allows for the Commerce Commission to regulate only certain classes of customer. In practice, however, the Commission lacks refined methodologies for understanding the preferences of different customers – even for relatively "simple" things like reliability.[146]

Just as both incumbent firms and entrants are likely to become increasingly consumer-oriented, using individual-level data to distinguish different consumer types, so too should regulators. This will be facilitated – and ultimately necessitated – by new technologies for understanding and distinguishing consumer interests, whether regulators acquire that understanding themselves, or source it from third parties. That will enable them to discern the interests of different customer classes, and to weigh their respective welfare impacts from industry or regulatory changes. As customers become increasingly differentiated, this will become increasingly important – to do otherwise is to treat consumers as an undifferentiated "black box", or to resort to crude rules of thumb to account for differentiated interests (which will become less tenable – and more open to challenge – as refined approaches become viable).

[145] See Section 3.4.2 for further background.

[146] Examples include contingent valuation or discrete choice techniques for estimating consumer preferences. The former requires data from specially-designed surveys. The latter uses either survey data, or data on actual consumer choices, that can reveal information about preferences for price and non-price product attributes.

EDBs as "black boxes"

On the supply-side, the existing Part 4 arrangements make less onerous demands on EDBs than are made in relation to the national grid operator, Transpower. The latter computes wholesale prices at multiple nodes around the grid, providing locational signals as to the location of grid congestion, which can be used to identify where investments in transmission, or transmission alternatives, are of most system-wide value. No such equivalent requirements are made of EDBs, in part due to the cost and complexity of implementing nodal pricing at network level, and also because, until now, only EDBs have been in a position to make investments relieving network constraints.

However, that need not preclude simpler alternative measures, such as network "heat maps", to signal where distribution network constraints are most acute. As DERs become more viable as alternatives to network investments (just as generation investments can substitute for grid investments), and to ensure DERs are incentivised to be deployed where they are most valuable, the availability of such spatial signals will become more important. This would allow the efficiency of EDB investments in DERs to be assessed, and could also induce third-party DER investments where they might viably compete with networks, and/or efficiently provide network support services.

Work therefore remains to refine transparency arrangements surrounding EDB network status, and to ensure that DER investments by either EDBs or others are efficiently directed to where they generate the most value.

EDB-level reliability obligations

Price-quality regulation, as well as information disclosure rules, place EDBs at the centre of responsibility for distribution reliability. The increasing adoption of DERs will complicate the discharge of that responsibility, since such resources potentially relieve – or create – network demands in ways that need not be under the automatic control of EDBs.

Absent decentralised mechanisms for coordinating DER usage, such as P2P trading platforms and/or algorithmic trading (e.g. through "smart contracts"), these reliability obligations make it more likely that EDBs will seek direct control of DER resources. This is even if doing so reduces the value of those resources to consumers (i.e. limiting their uses such that they enhance network reliability, but cannot be used otherwise). In turn, such direct control could "crowd out" the development of other DER uses which may provide consumer benefits even if they complicate the achievement of network reliability.

Hence there is need to assess how best reliability obligations – or unreliability liability – be devolved in networks with growing and increasingly decentralised DERs.

Possible cross-subsidisation of EDB investments in DERs

DER investments are likely to generate a range of services that either compete with, or complement, network operation. EDBs should place a high value on the latter, but lower value on the former.

Either way, those EDBs that are subject to price-quality regulation, and which have the capital and managerial resources to invest in DERs, might be able to use regulation to facilitate their DER investments in ways other parties cannot. Specifically, where DER investments provide network services, the cost of EDBs' DER investments can be added to their regulatory asset base, and recovered through allowed regulated lines charges.[147]

This raises the possibility that DER costs become "socialised" across all of a EDB's customers, even if the benefits of those investments are for particular customers or groups of customers. This could distort DER investments by regulated EDBs, and result in EDB investments in DERs being more attractive for the consumers they benefit than if third-parties made the investments, and recovered investment costs only from those consumers.[148]

[147] This is a possible example of price-quality regulation unduly *supporting* investment in unregulated activities, rather than unduly *impeding* them (which section 52T(3) of the Commerce Act 1986 seeks to prevent).

[148] Third parties such as gentailers could also, in principle, cross-subsidise DER investments by

As discussed in Sections 4.3.3-4.3.4, the consumer welfare impacts of any such cross-subsidisation are complex, and potentially quite divergent depending on which consumers benefit from DERs, and which bear their costs. In part these welfare impacts will also depend on dynamic impacts, such as whether earlier DER adoption produces benefits that offset any welfare losses arising from locking-in inferior technologies or uses, or preclude other parties from making efficient DER investments.

Assessing those welfare consequences is further complicated by the difficulty in objectively allocating DER costs and benefits between network-related activities – which might be subject to price-quality regulation – and other activities, which are not. This raises the need for greater clarity around how different DERs costs and benefits are to be treated for regulatory purposes, to ensure any consumer-welfare reducing distortions from cross-subsidisation are avoided.

Such distortions are likely to be further exacerbated by the impact of the LFCT, which reduces daily fixed charges for some customers, and therefore increases the amount of EDB fixed charges that are recovered by way of variable (i.e. per KWh) charges. Munoz-Alvarez and Tong (2016) show that recovering fixed costs via variable charges departs from the socially-optimal pricing scheme for network-owned DERs, under which variable distribution charges should reflect marginal supply costs only. The LFCT therefore likely adds distortions over and above any caused by cross-subsidised DER investment.

Waterbed effects

In principle, price-quality regulation under Part 4 of the Commerce Act can be applied at the level of pricing for specific customer classes. In practice, however, caps are applied at the level of revenues or average prices only. This means EDBs subject to such regulation have considerable discretion as to how costs are recovered

allocating investment costs across their retail customer bases. However, retail customers are contestable, in that they might be lost to competing retailers if they face inflated energy costs to fund DER cross-subsidies. Until DER costs fall sufficiently to allow efficient network bypass by individual consumers, EDB customers are not so contestable, and so are more captive to any such cross-subsidisation.

from particular customer classes.[149]

Part 4 price-quality regulation has the effect of enabling EDBs to recover their costs of allowed investments, including a fair rate of return thereon, at least for any given regulatory period. To the extent some consumers make DER investments and reduce their consumption of electricity transported across distribution networks, this reduces their contribution towards fixed network costs that are recovered via variable charges. As a consequence, remaining consumers must bear a greater share of fixed network charges recovered via variable charges.[150]

This serves to increase the inefficiency of variable charges that are set above marginal supply costs.[151] As above, the LFCT serves to even further exacerbate this effect. Since it is an example of some consumers receiving a better deal, with other consumers then facing a worse deal in compensation, it constitutes a form of "waterbed" effect. In turn, these distortions artificially hasten network defection by all consumers – by those who can afford to because it benefits them, and ultimately even by those who cannot afford to, simply because the alternative of bearing an increasing share of network costs becomes unbearable.

This raises the regulatory challenge of applying price-regulation at a more decentralised level, e.g. applying to prices for specific consumer classes to ensure that those not adopting DERs are not unduly disadvantaged by those who do.[152] At the same time, to the extent fixed network costs should be recoverable (see the discussion below re stranding), it may be necessary to allow this to a greater degree through fixed charges. Once again, the LFCT presents an obstacle to this.

[149] EDBs not subject to price-quality regulation also have this ability, but as a consequence of being exempt from that regulation, rather than because of it. While those EDBs enjoy market power over their customers, they are also those EDBs that have high levels of consumer control. Hence they are constrained in their ability to allocate costs arbitrarily across consumer classes.

[150] Concept Consulting (2017) quantifies the effects of this distortion for representative consumer groups in selected parts of New Zealand, showing that it tends to affect less wealthy consumers to a much greater extent than wealthier consumers.

[151] As shown in Munoz-Alvarez and Tong (2016).

[152] Recognising that if customers migrate from existing lines services to alternative supply models, eventually there is a point where it becomes cheaper to provide existing lines services using lines alternatives for any remaining customers (e.g. those who do not have the capital to invest in alternatives, or lack the ability to do so, such as renters). This raises the question as to whether EDBs should be relieved of any remaining supply obligations for those customers at that point?

Possibly undue protection against asset stranding

Price-quality regulation under Part 4 has the effect of allowing regulated EDBs to recover allowed investment costs from customers, at least during a given regulatory period. As and when DERs make some or all of networks obsolete, and do so to the long-term benefit of consumers, this raises the possibility of existing network investments becoming "stranded". As a matter of efficiency, regulation should not guarantee EDB recovery of investment costs, unless that was part of a regulatory compact to induce that investment.[153] In general, EDBs should understand that regulation does not ensure the recovery of investment costs if those investments prove to be inferior to newer technologies. This serves two purposes:

1. It avoids more efficient investments being crowded out by earlier ones; and
2. It creates strong incentives on EDBs to invest in the best available technologies for delivering network services, and to build flexibility into their investments to allow for uncertainty about their future prospects.[154]

There is need for greater clarity under Part 4 on the circumstances under which investment costs will not be recoverable should new technologies render older ones inferior for long-term consumer welfare.

Absence of rules-based pathway for transitioning from regulation to competition

Related to the above, while the Commerce Act contains provisions that might be applied to shorten the life of regulation for selected or all consumers, it contains no guidance on the circumstances in which this might occur, and how a transition will be made. In other words, it has no established framework to guide any transition from regulation to competition, should new technologies either provide meaningful

[153] Even then, if consumer-welfare enhancing innovations arise which render those investments redundant, efficiency is enhanced if those inferior investments are "bought out" using a share of the benefits of the newer technologies.

[154] Boyle et al. (2006) present a real-options analysis framework for assessing network investments under uncertainty.

competition, or would if they arose (which might be delayed due to regulation itself, or regulatory uncertainty – discussed further in Sections 7.2 and 8).

This is in contrast to the Telecommunications Act 2001, which requires the Commerce Commission to assess whether competition may have developed to such an extent that continued regulation is no longer needed to promote competition in telecommunications markets for the long-term benefit of end-users. Even this provision might be unduly flat-footed, in that it requires only an ex post assessment of whether competition has developed to a sufficient degree, not whether it might going forward (and how regulation itself affects that very prospect).[155]

In any case, as the electricity sector faces increasing technology change and the advent of new business models and players, it becomes increasingly urgent that regulation provides a clear pathway forward in terms of how regulated activities will be deregulated as competition evolves – or is likely to evolve – to a sufficient degree. This includes a reassessment of whether the EA and Commerce Commission are subject to sufficient oversight of MBIE, and sufficiently clear and enforceable rules for choosing (not) to adapt regulation to emerging realities or possibilities. It also requires assessment of whether MBIE itself is subject to sufficiently clear and enforceable rules for allocating and demarcating industry-specific regulation, activity-based regulation, and competition regulation, between these two and other relevant agencies.

6.4.3 Other electricity-specific issues

Low fixed charge tariff

The discussions above already describe how the LFCT exacerbates other distortions created under existing price-quality regulation. More directly, the LFCT constrains fixed network tariffs, and therefore requires a greater share of fixed network charges to be recovered via inflated, distortionary variable charges.

[155] Similarly, the Dairy Industry Restructuring Act 2001 provided for ex post assessments of whether competition in milk supply had emerged to a sufficient degree that Fonterra no longer needed to be subject to regulation.

While these inflated variable charges are inherently distortionary, they also distort the uptake of new technologies.[156] One particular distortion is that they accelerate the uptake of DERs, since avoided variable lines charges provide part of the economic case for DER investment.

As noted by Concept Consulting (2017), the LFCT is of questionable purpose given it does not assist the very users it was intended to (i.e. less wealthy customers). In part this is because less wealthy consumers do not necessarily have low consumption – e.g. because they are less able to afford energy-efficient appliances, and/or they do not own their own home and therefore cannot make long-lasting efficiency investments (e.g. home insulation). The fact that the LFCT is also inherently distortionary, and specifically distorts DER adoption, means there are strong grounds for a review of its impact and rationale.

Smart metering and data sharing

The New Zealand electricity sector has been notable in rolling out smart metering technologies without regulatory mandate, unlike other jurisdictions. While these technologies enable more timely collection and remote reporting of electricity consumption data, they involve inherent limitations. Foremost is the fact that smart meters collect data at ICP level, not consumer level. As such, they face being leapfrogged by technologies that enable real-time, consumer-level electricity consumption to be estimated (if not measured).

These technologies could be as simple as being able to remotely identify what internet-connected devices a consumer is using at any given time, given the known power consumption characteristics of a given device. Hence, competition to understand consumers' behaviours and preferences is likely to advance through technologies other than smart metering, raising questions at a regulatory level about their importance in achieving competition, DER coordination, demand-side responsiveness, etc.

[156] See Concept Consulting (2017) for a detailed assessment.

Relatedly, access to data collected from smart meters is currently uneven. EDBs have access to that data for all retailers supplying customers on their network, but in principle should only use that data as required for billing, reconciliation and network planning purposes. Retailers, by contrast, have access only to metered data in respect of their own customers. This raises the regulatory question of who should have access to ICP-level data, and whether it should be open access to enable innovation (or treated as proprietary, to preserve incentives for investments in obtaining better data).[157]

These questions are likely to become moot, however, as and when alternative technologies give rise to superior data, at least to DBDs. Given the inherent limitations of smart metering, even incumbents might wish to invest in those alternative technologies either for competitive advantage, or to minimise competitive disadvantage relative to DBDs. In the short-term, however, these questions are very much live, and may become more so as privacy issues relating to data-based competition become more pronounced.

Also relatedly, the current electricity industry participation code is predicated on consumers having only one retailer, and the EA is exploring if and how to allow multiple trading relationships. As discussed in Section 5.5.3, what constitutes a retailer is likely to change markedly as and when the sector faces entry by DBDs, and more generally. This may include DBDs and/or their partner suppliers who use their platforms (such as digital assistants) offering consumers value-added products or services bundling electricity supply. Hence the reality may be that any given consumer (let alone ICP) may be buying electricity on a bundled basis or otherwise, from multiple suppliers, each of which constitutes a retailer. Regulatory treatment should be amended to allow for this possibility, and to ensure regulation does not impede it – in each case provided that is in the long-term interests of consumers.

[157] Privacy Commissioner (2017) recommended that individuals have a right to data portability – similar to that introduced in May 2018 under the EU's GDPR. That implicitly deems – if not explicitly considers that – investment incentives will be sufficiently preserved by breaching proprietary data rights. Some support for this position is provided by Prüfer and Schottmüller (2017). However, this recommendation was not included in amendments to the Privacy Act introduced to Parliament in March 2018.

Centralised operation and control

The currently high degree of coordination of major generation and transmission assets through centralised dispatch could, if also required of highly decentralised DERs, delay their uptake. While this would ensure greater coordination of DERs, it has two potential costs:

1. Delaying DER deployment pending the development of feasible centralised control might needlessly preclude short-term consumer benefits; and
2. Insisting on centralised control might impede the development of more decentralised approaches, which may prove more cost-effective as P2P, smart contracting and other technologies develop to enable such decentralisation.

Since such technologies and associated business models for their use should be expected to arise, this suggests regulatory focus should be on facilitating greater decentralisation of DER use and coordination. This in turn might be facilitated through EDB consolidation, since EDBs are likely to form a natural level of coordination, though might also be achievable through other approaches (e.g. DBD aggregation). Conversely, EDBs or others might form cooperative ventures for consolidating DER coordination across multiple networks, which could achieve the same end. In any case, regulatory attention needs to turn to how decentralised coordination of DER resources can be achieved so as to best serve long-term consumer interests.

Inconsistent definitions with possible unintended consequences

DERs raise interpretational questions which are not easily addressed under existing legislation and other regulatory frameworks in the New Zealand electricity sector. Resources such as storage, and prosumerism, challenge the technological and organisational presumptions of existing definitions, and potentially give rise to unintended consequences. For example:

1. Is an EV with discharging ability, by virtue of its mobility and ability to connect at different parts of a network, involved in the "conveyance of electricity" and therefore a "line owner" and provider of "line function services" under the Electricity Act 1992 – or not a "distributor" under the Electricity Act 2010 because they are not conveying electricity on lines?

2. Likewise, is a prosumer a "generator" under the Electricity Industry Act 2010 – being a business engaged in the generation of electricity that is fed into the national grid or a network – with the consequence that they are an industry participant under section 7 of that act even if not in business?

3. Or are prosumers an "electricity retailer" under the Electricity Act 1992 because they are "a person who supplies electricity to another person or other persons for any purpose other than for resupply by the other person or persons"?

4. Is a PV and/or storage/EV owner (e.g. inadvertently, during faults) or prosumer (deliberately) an "electricity generator" under the Electricity Act 1992, because they are a "person who owns or operates a generator connected to distribution or transmission lines"?

It is therefore timely to review existing regulatory frameworks to better align definitions of different market services and industry participants to accommodate the varying and novel roles likely to arise with new technologies, business models and players. In part this is already under way via the EA's consideration of participant types as part of its mass participation project.

Ripple control

A major component of distribution-network level load management is hot water ripple control for consumers with the required technology installed. Increasingly, smart household appliances and the uptake of home energy management systems will enable the remote control of consumer loads by whoever consumers consent

to having that ability. Until then, however, ripple control remains the purview of EDBs, and is not used on a competitive basis or otherwise contestable.

Making this technology available for use by third parties could speed DER deployment, by making a fuller range of load available for management, including by DBDs. As above for DERs, coordination of ripple control usage will be important to achieve or improve network reliability. However, this may be achievable at more decentralised and contestable levels as P2P, smart contracting and other technologies emerge, and that emergence may be accelerated if it can be applied to a fuller range of network services such as ripple control. Hence the regulatory arrangements surrounding ripple control contestability merit reconsideration.

Penalties based on worldwide turnover

Finally, sections 80 and 87 of the Electricity Industry Act 2010 provide that pecuniary penalties for violations of Part 3 of that act (see Section 3.4.3 for further background) can be up to 10% of the offending party's turnover instead of three times their commercial gain, if that gain is not readily ascertained. This might needlessly deter entry of global DBDs into distribution activities, given the scale of their worldwide operations.

Such vertical integration may be of less importance than disruptive entry into retailing, but might still prove to be of importance for the long-term interests of consumers, especially since it might result in infrastructure-based competition in distribution, directly challenging the premise of EDB regulation under Part 4 of the Commerce Act. Hence, there is reason to consider possibly limiting the extraterritorial reach of Part 3 penalties (e.g. ring-fencing them to New Zealand turnover only) so as not to unduly deter entry by global DBDs.

This section's main findings are:

- Current frameworks and entities implementing electricity sector regulation in New Zealand have a number of general strengths, such as relative ease of changing course, and the EA's and Commerce Commission's statutory focuses on consumer interests;
- Possible general weaknesses include a lack of clear and enforceable rules, responsibilities and processes for creating, removing and demarcating regulatory responsibilities in the face of changing circumstances – including the lack of a rules-based pathway for transitioning from regulation to competition (discussed further in Sections 7.2 and 8);
- Merger rules require reassessment to ensure that they properly reflect the impact of non-traditional entrants which are likely to create significant competition to incumbents;
- Price-quality regulation needs to have much greater regard to increasingly differentiated consumer interests, and to how it potentially distorts reliability provision and DER investments by EDBs, and creates (e.g. via the LFCT) or allows waterbed effects between different consumer types; and
- Other regulatory issues needing reconsideration include the importance of smart metering given the emergence of superior technologies, the viability of ongoing centralised industry coordination in the face of decentralised offerings, and regulatory definitions that inconsistently or inadequately capture emerging technologies or players.

7 How can our regulatory framework be improved?

Previous sections outline the chellenges that new technologies, business models and players are likely to present for electricity sector regulation. This section proposes possible solutions, including:

- Identifying differentiated consumer interests, improving pricing efficiency, enabling decentralisation, and taking more refined approaches to EDB regulation;
- Weighing the different trade-offs associated with DER investments – by either DBDs, EDBs, gentailers, or separated generators and retailers – to help pinpoint where regulatory issues arise; and
- Rebalancing overall regulatory approach.

7.1 Key themes

The preceding sections:

1. Clarified when regulation might be useful (Section 2);
2. Provided a background on New Zealand electricity sector regulation (Section 3);
3. Highlighted changes in new technologies (Section 4), and in business models and players (Section 5), that are likely to have important implications for future electricity sector organisation and performance, and hence long-term consumer welfare; and
4. Summarised a selection of regulatory challenges and opportunities flowing from those new technologies, business models and players (Section 6).

This section sets out ways that current New Zealand electricity sector regulation might be improved to better respond to these regulatory challenges and opportu-

nities. If focuses on a selection of the key regulatory challenges and opportunities, and leaves one particular set of issues – improving the dynamics of regulation – to Section 8. Key themes in this section are:

1. Electricity sector regulation needs to be much more tailored to increasingly differentiated consumer interests and offerings – new technologies and business models might provide the required tools;

2. Price regulation, in particular, needs to avoid creating or worsening any waterbed effects associated with consumers adopting new technologies and service providers to differing degrees;

3. Increasingly decentralised decision-making by both consumers and firms is not only likely to be inevitable, but also better enabled by new technologies, business models and players;

4. A corollary of such decentralisation is that the sort of transparency currently attaching to decision-making around the national grid is likely to be of increasing benefit at distribution level; and

5. Different regulatory issues arise with DER investments by different types of incumbent firms, or by DBDs, requiring different regulatory responses.

Other regulatory changes that are likely to maximise long-term consumer benefits from new technologies, business models and players are:

1. The use by regulators of a wider range of regulatory tools to better suit the issues confronting different consumers;

2. Greater regulatory focus on future changes affecting industry performance and regulatory issues:

   (a) Including greater "regulatory forbearance" – knowing that new technologies, business models and players have the potential to give rise to new forms of competition, but also that existing regulation can impede their development; and

(b) With proactive management of issues straddling the boundary between competition and regulation;

3. More flexible and responsive regulation, including relatively greater reliance, than now, on competition law than industry-specific regulation – while ensuring that competition regulation is sufficiently reliable and effective to discharge its extra responsibilities;

4. A clearer focus on regulating for performance, which is technology-agnostic, rather than by (technology-specific) process;

5. Paying greater regard to regulatory issues shared across sectors or with impacts across sectors, notably to avoid unintended consequences, and to better assess privacy trade-offs, and reliability and cyber-security issues, associated with new technologies and business models; and

6. Recognising the increasing importance of international regulation of technologies, business models and players.

7.2 Better recognising the different interests of different customers

Regulators will find it increasingly difficult to serve consumer interests if those interests are not well-identified or wrongly assumed to be coincident. As discussed in Section 4.2, identifying those interests will become more challenging as they become more differentiated, such as when some consumers uptake DERs and new services while others do not. This is particularly important in measuring "quality" for regulatory purposes – simple reference to reliability will prove increasingly inadequate as services including/bundling electricity supply become increasingly differentiated and value-added.

As Section 4.2 noted, regulators will therefore need to make greater use of existing tools for assessing consumer preferences, and clearly distinguish the regulatory issues confronting different classes of consumers. This means regulators, like firms, will

need to become increasingly data-focused, as a means of becoming more effectively consumer-focused.

This is not to suggest that regulators should attempt to amass vast amounts of consumer data as DBDs are doing. Even incumbent firms are likely to lack the resources and incentives to effectively replicate what DBDs already have a competitive advantage in doing – regulators even more so. Instead, it points to changing informational asymmetries that require regulators to be more adept at inducing regulated parties with superior information to use it towards achieving regulatory objectives.[158]

One approach might include regulators – like incumbent firms – drawing on the consumer-level data and analytical expertise held by DBDs themselves (i.e. by outsourcing aspects of regulation to parties with the best available data and analytics). Risks of regulatory capture under this approach are clear. However, self-regulation such as this commonly arises in situations where industry parties have superior information to regulators. The rationale for this approach does not subside just because that informational asymmetry becomes more severe – in fact, the approach may become more necessary precisely because the information asymmetry is so severe.

7.3 Improving pricing efficiency, and dealing with waterbed effects

The need for a greater understanding by regulators of increasingly differentiated consumer interests is associated with an equal need to take a more "tailored" approach to regulation, and to avoid "one-size-fits-all" solutions. This is particularly the case where the adoption of new technologies and services by some consumers might lead to waterbed effects – in the sense that non-adopting consumers face less favourable offerings just as adopting consumers face better offerings.

Regulation itself can lead to such waterbed effects, or fail to address them. Consumer welfare is best served when waterbed effects caused by regulation are avoided,

[158] For a general discussion of the types of tools required, see Laffont and Martimort (2002), or Bolton and Dewatripont (2005).

and when EDB pricing in particular is as efficient as possible. Specific regulatory improvements in this regard include:

1. Closely assessing whether the LFCT is meeting its intended objectives, and if it is not, remove it so as to enable a more efficient balance of fixed and variable network charges (in particular, with variable charges reflecting marginal supply cost, and fixed charges recovering fixed costs);[159]

2. Introducing price-quality regulation for EDBs at the level of specific consumer classes, particularly distinguishing consumers who do not adopt new technologies and services – and are therefore more vulnerable to waterbed effects – and applying revenue or price caps for those classes;[160] and

3. Identifying conditions under which consumers with access to DERs and related services no longer require regulatory protection, or if they do, what sort best serves their interest.

In the latter case, alternatives might include the use of negotiate/arbitrate rather than price-quality regulation, particularly if their DERs are aggregated, or even reliance on just information disclosures (if any regulation is needed at all). The kinds of conditions to identify include thresholds for when consumers have sufficient access to DERs and associated services, either through direct investments or via others, that they are no longer exposed to market power abuse. Distinguishing customer- from investor-owned EDBs will continue to be relevant in identifying the extent of any existing exposure to such abuse.[161]

Finally, regulators will need to pay increasing regard to the "price" represented by consumers ceding privacy to service providers, and the innovation implications of

[159] Unison's "solar charge" has received adverse media attention for apparently discouraging PV uptake. However, it could equally be seen – if struck at the right level – as a measure to remedy waterbed effects caused by current regulation (i.e. the LFCT) and pricing structures (relatively high variable lines charges). These waterbed effects disadvantage customers who do not, or cannot, adopt PVs.

[160] Taking great care to avoid unintended consequences. Regulatory measures such as default tariffs and universal service obligations can simultaneously lock in certain customer classes while making others even more "ripe" to "cherry-picking", with potentially adverse impacts on those served by the regulated offerings.

[161] See Meade and Söderberg (2017) for evidence that customer-owned EDBs charge lower prices on average than their investor-owned counterparts.

greater data sharing. This price can be measured in the same way (i.e using the same methodologies) that WTP for non-price attributes is usually estimated, treating privacy as a relevant service attribute.[162] Failing to do so will likely cause substantial bias in assessments of the true price paid by consumers for services provided by DBDs, affecting the assessment of whether such services require regulation. The innovation implications of "unprivacy" could be more challenging to gauge, but of increasing importance as electricity sector offerings become more value-added and data-based.

7.4 Enabling decentralisation

The electricity sector will become more decentralised simply due to the increasing adoption of DERs – unless regulation should halt that adoption, e.g. by imposing a requirement for centralised DER control. This means that greater decentralisation will be a growing reality, with a need for new ways to coordinate the use of those decentralised resources.

EDB-level coordination of DERs might be necessary absent alternatives such as even more decentralised alternatives like P2P trading and smart contracts for DER services. It might also crowd out the development of such alternatives. The development of these alternatives does not hinge on regulation, just as the wholesale electricity market was developed as an industry-lead initiative.

However, regulation – particularly at the policy level (i.e. MBIE), but also at the market regulation level (i.e. the EA) – might play a role in assisting and enabling industry initiatives to agree standards and governance arrangements for decentralised trading platforms. Should these developments be deemed sufficiently important, regulation could back such self-regulation with regulatory defaults, providing a backstop solution for consumers if industry interests cannot align on a voluntary solution.

Regulation might also play a role in the coordination of DERs at a decentralised level. Facilitating the creation of standards and default terms for P2P platforms

[162] I.e. using discrete choice analysis techniques, with data on actual consumer choices, or using data from specially-designed surveys. For example, see Train (2009).

and smart contracts is one approach, as is clarifying the legal status/enforceability of smart contracts. Another is assisting with the formation of coordination arrangements among groups of EDBs, recognising that ownership constraints such as those associated with customer-owned EDBs might be overcome through cooperation via collective governance arrangements. This could help smaller EDBs in particular achieve the scale required for efficiently coordinating DERs, especially if their customer bases are too small for DBDs to provide aggregation services.

Further incentives for the decentralised coordination of DERs could be provided – at the EA and Commerce Commission levels (with MBIE taking a coordinating/oversight role) – by considering imposing obligations on DER users not to create unreliability (e.g. through imposing charges for intermittency). This would serve the dual purpose of internalising any unwanted externalities from DERs, and provide further incentive for storage investments, and the participation by DER owners in mechanisms to coordinate DER use. It would also relieve the current bias of EDBs towards controlling DERs (or impeding the uptake of DERs they do not control), given their need to at least maintain current reliability levels under existing regulation.

As and when decentralised trading and coordination arrangements for DERs arise, regulators – particularly the EA – may also need to consider whether special arrangements are warranted to mitigate possible systemic risks created by algorithmic trading. Lessons might be drawn from financial market operators, such as "circuit breakers" and other forms of trading halt during episodes of marked volatility.

Finally, just as DER coordination will necessarily arise at more decentralised levels than current generation coordination, regulation itself – by both the EA and Commerce Commission – may need to become more decentralised as customer-level information becomes more critical to industry performance. As suggested above and discussed in Section 2, industry self-regulation is sometimes the preferred approach when industry players have specialist skills, or much superior information than regulators. It is often backed up with the threat of more explicit regulation should industry-lead solutions fail to achieve regulators' stated objectives. With

incumbent firms becoming more consumer-focused, and the likely entry of DBDs, increasingly decentralised consumer-level data will play a more important role in achieving industry outcomes.

Regulators are in general unlikely to be able to recover any disadvantages they face vis-a-vis these other players in obtaining and understanding such data. Hence, greater reliance on these third parties to achieve regulatory objectives may become more necessary – either through contracting those parties to provide regulatory services, or through greater reliance on industry self-regulation (perhaps backed with threat of direct regulation).

7.5 Opening up EDB "black boxes"

Associated with increasing decentralisation is the likely need to replicate arrangements currently applying at grid-level to distribution networks. This is because energy flows in such networks will become more bi-directional as a consequence of DER uptake, and coordination and investment issues at distribution level will become more pronounced, including the efficiency and contestability of those investments.

Hence, in general terms, EDBs may need to be treated more like Transpower, e.g. with:

1. Requirements for greater transparency about network issues and investment requirements – e.g. publishing real-time heatmaps highlighting network constraints, or perhaps even nodal pricing at distribution level;

2. Investment tests with requirements to consider non-distribution alternatives, and to demonstrate least-cost approaches (including through the use of tendering for DER provision);

3. Clearer financial transparency to distinguish regulated from non-regulated costs and revenues; and

4. Creating a more general framework for EDBs' efficient and non-discriminatory acquisition of network support services – including making the acquisition of ripple control and other interruptible load services more transparent and contestable.

Such measures are more likely to be relevant for larger and/or investor-owned EDBs. There is likely to remain a case for smaller and customer-owned EDBs to be exempt from such requirements, if only on de minimis grounds. To the extent they were subjected to them, this could necessitate ownership – or at least management – consolidation in order to achieve scale economies in compliance.

7.6 Ensuring DER benefits maximised ...

Ensuring that consumers enjoy long-term benefits from DERs will hinge on regulators being attentive to the implications of DER ownership by different classes of owner, and any market power they enjoy (which affects their incentives and ability to distort DER investment). Focusing in turn on DBDs, EDBs, gentailers, and separated generators and retailers, the following discussion summarises their main trade-offs, and what sorts of regulatory changes might be required to address them.

7.6.1 ... when investments made by data-based disruptors

Trade-offs

For DER ownership by DBDs, the trade-offs affecting long-term consumer welfare are:

1. On the one hand, benefits such as:

   (a) An expanded range of value-added consumer services;

   (b) Possibly accelerated DER investment;

   (c) Likely sophisticated models of DER aggregation;

(d) Increased retailer market power to countervail against the market power of incumbent gentailers and network operators; and

2. On the other hand, costs such as:

   (a) Increased downstream concentration – with data-based market power leveraged into retailing;

   (b) Reduced consumer privacy;

   (c) Potential waterbed effects for non-adopters; and

   (d) Increased risk of tipping to monopoly, with possibly insurmountable "data moats" – with likelihood of backward vertical integration to further leverage retail-level market power into both generation and distribution.

Possible solutions

The case for regulating DER investment by DBDs is complicated by the facts that:

1. They are likely to produce very high net benefits – as perceived by adopters of their services; and

2. The international character of DBDs makes it difficult to impose peculiar local regulatory solutions while still attracting them to New Zealand's relatively small market.

Unless regulation simply sought to block entry by DBDs, perhaps the most regulation might achieve while allowing DBD entry is the avoidance of waterbed effects for non-adopting consumers, as discussed above. Other measures, such as mandating that consumer data held by DBDs be made open access to third parties (e.g. to reduce risk of tipping to monopoly, or reducing entry barriers if tipping occurs) is unlikely to be feasible in a small jurisdiction like New Zealand.[163] Data portability is a potential, intermediate measure with greater prospect of being implementable locally, given steps in this direction taken in larger jurisdictions (i.e. the EU's GDPR,

[163] Despite the measure possibly being in consumers' interest - see Prüfer and Schottmüller (2017).

which became operative in May 2018 and has changed the approach adopted by some global data-based firms beyond just the EU).

In any case, general competition laws will continue to apply, of relevance to managing the impacts of DBD entry on the location of market power in the industry. New Zealand is yet to face a major test case with DBDs of the sort already encountered in the EU or US.[164]

7.6.2 ... when investments made by EDBs

Trade-offs

For DER ownership by EDBs, the trade-offs affecting long-term consumer welfare are:

1. On the one hand, benefits such as:
   (a) Improved coordination between DERs and networks – with the prospect of improved network performance, and enhanced network services;
   (b) Possible lower-cost alternatives to traditional network investments;
   (c) Potential acceleration of DER (infrastructure) investments and development of DER demand through possible cross-subsidisation of DER costs; and
2. On the other hand, costs such as:
   (a) Possible foreclosure or pre-emption of superior DER investments by other parties – including through any cross-subsidisation of DER costs; and
   (b) DER benefits being limited to only those complementing, rather than substituting for, network services – maintaining network-related market power for longer than might otherwise be the case.

[164] See Cowen (2017) for a summary.

Possible solutions

In principle, these trade-offs are already catered for under Part 4 of the Commerce Act 1986 (see Section 3.4.2), and Part 3 of the Electricity Industry Act 2010 (see Section 3.4.3). For example, relevant provisions include the ring-fencing of DERs from network service activities should relevant thresholds be breached under Part 3, and methodologies for separating regulated assets, revenues and costs from non-regulated under Part 4.

In practice, however, these provisions may need augmenting or revising, as discussed in Section 6.4.2. Possibilities include:

1. Greater transparency about network issues and requirements, and EDB investment rationales – as already discussed above;
2. Prohibiting EDBs from DER investment;
3. Refining current Part 3 provisions;
4. Imposing open access rules for access to EDBs' DER resources at regulated access prices – similar to the approach often taken in telecommunications; and
5. Separating DER ownership and control through the introduction of new property rights.

The latter four alternatives are discussed further below.

Prohibiting EDBs from DER investment

Under this approach EDBs would be prohibited from investing in DERs – i.e. full ownership separation for all DER investments would be required. EDBs could only then procure DER services from third parties on a market basis (which, incidentally, does not imply a competitive basis).

Such an approach probably too strongly favours the avoidance of competitive harms of foreclosure over the enjoyment of vertical coordination and other network service

benefits from EDB investment in DERs. These coordination benefits, in particular, are likely to be substantial, making an outright prohibition on EDB investment in DERs costly. However, it could better-support DER investments by parties other than EDBs where those other parties are otherwise deterred by the risk of actual or potential EDB investments in DERs.

Refining current Part 3 provisions

A more nuanced alternative to an outright prohibition on EDB investment in DERs is to recognise that greater regulatory concern might arise only in terms of cross-subsidised EDB investments in DERs that limit DER benefits, or risk pre-empting or precluding third-parties from making superior DER investments. Conversely, any regulatory stance towards EDB investments in DERs might be much more relaxed if those investments were clearly resulting in strong consumer benefits.

Accordingly, one way to refine the existing Part 3 arrangements might be to:

1. Raise the current Part 3 exemption thresholds for EDB investments in DERs where EDBs can demonstrate that:

   (a) Those investments can be shown to offer consumer benefits over and above improved network services;

   (b) Third parties have had the opportunity to competitively supply those services; and

   (c) The revenues and costs of DER activities can be clearly separated between network and non-network services, and hence between regulated and non-regulated activities; and

2. Tighten those thresholds in relation to EDB investments in DERs otherwise, particularly since original Part 3 thresholds were set with large-scale generation in mind, long before small-scale DERs became viable.[165]

[165] Contract theory, also called the theory of incentives, offers guidance on how to optimally set these differentiated thresholds, recognising that EDBs will have private information regarding the potential for their DER investments to provide consumer benefits over and above from improved

This approach changes Part 3 from being a one-size-fits-all approach, to one in which clearly beneficial EDB investments in DERs are better enabled, while others are subject to even tighter control.

Imposing open access rules

In many telecommunications markets – including in New Zealand and the EU for fixed-line broadband – the preferred regulatory approach has involved allowing third-parties to access the infrastructure investments of incumbent operators at regulated prices. This is to facilitate services-based competition, in which entrant firms are able to compete in the provision of retail services without the need to invest in their own infrastructure (which would instead provide infrastructure-based competition). In some cases the intention has been that once they have established their retail presence, entrants would subsequently invest in their own infrastructure – the "ladder of investment" approach.[166]

A similar approach could be taken in relation to EDB investments in DERs. Access to those DERs could be made available on non-discriminatory terms to third parties, at regulated access prices, as a means of resolving any concerns about foregone consumer benefits or other inefficiencies associated with such investments.

However, it is not clear that this would avoid the problem of DER investments by EDBs pre-empting investment by others. The "ladder of investment" model enjoys some theoretical support (e.g. see Bourreau et al. (2014)). However, this is not always the case (e.g. see Mizuno and Yoshino (2015)), and empirical research from the rollout of broadband in OECD countries and the EU suggests it has not been effective in inducing investment by entrants (see Bouckaert et al. (2010), and Mai (2017), respectively). Moreover, access pricing regulation in practice is regarded as

distribution services. All other things being equal, the threshold for EDBs investing in DERs with additional consumer benefits should most likely be the same that the regulator would choose as if it had the same information as the EDB (i.e. was fully informed). Conversely, the other threshold should be biased downward from its associated "full information" level, to reduce incentives for an EDB that could invest in DERs with a wider range of benefits from pretending its DERs only provide distribution service benefits. For example, see the discussion of adverse selection models in Laffont and Martimort (2002), or Bolton and Dewatripont (2005).

[166]See Mai (2017) for further discussion of service- and infrastructure-based competition, and the "ladder of investment" approach.

creating significant investment distortions (e.g. see Pindyck (2004)).

Hence, this approach may involve excessive costs compared with alternatives. While it benefits from precedent in telecommunications sectors, determining non-distortionary DER access prices is likely to be highly problematic, and would require novel approaches.

Introduction of new property rights

Finally, another approach for attempting to ensure efficient investment incentives in network contexts is to introduce property rights that enable the separation of ownership and control of infrastructure investments. They do so by enabling the allocation of network-related rents to parties other than the grid owner (subject to restrictions such as ensuring that only available rents are allocated – so-called revenue adequacy). An early example is financial transmission rights (FTRs) in grids with nodal pricing, where nodal pricing provides price-signals about the location of grid congestion, and hence where grid (or grid-alternative) investments are most needed.[167]

Recent research has considered the problem of creating analogous property rights in relation to storage assets – so-called financial storage rights (FSRs).[168] Such FSRs could be used in conjunction with FTRs in distribution networks with nodal pricing. This approach is relatively novel, and still under development. However, it holds the potential for a property-rights based alternative to more traditional regulatory approaches for addressing issues surrounding EDB investments in DERs, provided nodal pricing can be economically extended at distribution network level.

This may become more feasible in the future as decentralised trading technologies become more established. However, it would have to confront the issue of who owns DER-related rents, since creating and allocating FSRs (e.g. through auctioning) would create wealth transfers, and likely affect private property rights.

[167] See Evans and Meade (2001) for a review of FTRs, and appraisal of an early proposal to introduce FTRs in New Zealand.
[168] Munoz-Alvarez and Bitar (2017).

7.6.3 ... when investments made by gentailers

Trade-offs

For DER ownership by gentailers, the trade-offs affecting long-term consumer welfare are:

1. On the one hand, benefits such as:

   (a) Improved coordination between DERs and conventional generation and retailing – such as balancing DER intermittency with peaking generation, or using hydro to provide storage services; and

2. On the other hand, costs such as:

   (a) Possible foreclosure of superior DER investments by others (i.e. parties without strategic incentives to under-provide storage) – such as incumbent consumers, separated retailers, and/or (perhaps) entrant DBD retailers.

Solutions

Both the coordination benefits and competitive costs from foreclosure in this case are likely to be second-order as compared with DER investments by EDBs. In the main this is because gentailers are already competitive rather than monopolistic. They also face growing competitive discipline from both DER investment by others, and likely disruptive retail entry by DBDs with significant countervailing market power. Hence, in principle gentailer investments in DERs should present fewer regulatory concerns than DER investments by EDBs, and possibly also those by DBDs.

7.6.4 ... when investments made by separated generators or separated retailers

Separated generators may have comparable upstream market power to gentailers, but they have different incentives to exercise it given their lack of a retail position.

In particular, they have no incentive to foreclose downstream retailers. However, against this benefit must be weighed their likely lesser ability to resolve vertical coordination issues, in particular regarding pricing and the balancing DER intermittency (absent new contracting or other tools to achieve such balancing). Hence regulatory concerns about DER investment may in fact be greater for separated generators than for gentailers, though as above, probably of an order of magnitude less than for DER investment by EDBs.

Finally, separated retailers could present greater regulatory issues than separated retailers. While they have relatively less market power than generators or gentailers – which could change with DBD entry into retailing – they share separated generators' disadvantages in terms of resolving vertical coordination issues regarding pricing and DER intermittency (absent other solutions emerging). Moreover, as discussed in Section 4.3.2, a lack of DER coordination – such as could arise with DERs being owned and controlled by competing separated retailers – could in fact be disadvantageous to consumers given the presence of market power in upstream industry segments.[169]

Hence, perhaps counter-intuively, DER investment by competitive separated retailers might require as much regulatory scrutiny as that by other parties. For similar reasons, DER investments by consumers may also require regulatory scrutiny. Despite the absence of market power being wielded by individual consumers (though this could change if their DERs are aggregated by larger concerns such as DBDs), they too potentially lack tools to resolve vertical coordination issues such as in pricing or DER intermittency. Regulatory responses could include facilitating solutions to resolve such intermittency, including the entry by or creation of strategic DER aggregation.

[169] Though it is unclear, based on existing research, whether this remains the case when the market power is held by firms operating at multiple industry levels (e.g. gentailers), rather than just at the upstream level.

7.7 Other changes in regulatory approach

7.7.1 Increased range of tools

As mentioned in Section 7.3, regulators will need to adopt a more nuanced set of tools to address the problems presented by increasingly differentiated consumers, and novel business models and players. The entry of DBDs into retailing is likely to provide an important source of countervailing market power to both gentailers/generators and distributors (if not even the grid). Likewise, consumers' direct adoption of DERs will at least somewhat reduce their reliance on supply from others with market power, especially if they coordinate their DER services through organisations or markets (e.g. P2P trading platforms).

This raises the prospect that customers adopting DERs directly, or subscribing to DBD or other service providers that aggregate DER services or have inherent market power, will have less need for regulatory protection (at least in relation to market power issues). Hence, more widespread use should be made of regulatory tools already available under Part 4 of the Commerce Act 1986, in particular:

1. The negotiate/arbitrate alternative to price-quality regulation – e.g. where consumers with DERs aggregate their capacity through either P2P platforms, or via DBDs or other aggregators, and hence have scale-based countervailing bargaining power when negotiating terms for distribution network access and usage (obviating the need for price regulation);

2. Information disclosures – e.g. making distribution network bottlenecks/"hot spots" and investment requirements more transparent and hence potentially more contestable; or

3. Even no regulation at all for particular customer segments – e.g. where DERs and associated business models alleviate market power issues and remove the rationale for regulation (such as might arise if DER penetration rates for particular customer segments are sufficiently great that EDB services effectively become contestable).

In each case, the relevant tool should be targeted to the specific issues facing each distinct class of consumers. Differentiation according to whether consumers have access to DER services, and/or to other value-added services provided by parties with significant countervailing market power, being an important dimension.

Other tools include those directed at addressing data-based market power, if only to avoid DBDs entrenching their market power should they enter electricity markets and cause them to tip to monopoly. As discussed in Section 7.6.1, these include making DBDs' data open access, or more realistically, making consumer data portable. Care would need to be exercised to ensure that any such measures – even if they can be implemented – do not create unintended consequences. These include possible dampening effects on innovation when firms face diminished incentive to invest in proprietary data (e.g. if the firms inclined to make such investments are also the most innovative users of data). They could also include reduced incentives for firms to compete to gain customers if they cannot lock them in by securing proprietary access to their data.[170]

7.7.2 Increased future focus and "regulatory forbearance", with clear competition-regulation boundary

Future focus

Regulation under Part 4 of the Commerce Act 1986 is explicitly predicated on there being little likelihood of competition emerging in sectors which already have little competition. In environments with stable technologies, business models and players, little weight need be placed on the prospect of competition emerging. However, in environments likely to soon face rapid change – as in electricity – it is imperative that regulators have an eye to the future regarding changing competitive circumstances, and hence on the ongoing rationale for regulation (more on this in Section 8).

A particular challenge this presents is for regulators to take a position on the like-

[170] This is analogous to findings in the switching costs literature, which shows that reducing switching costs does not assure better consumer outcomes. For example, see Fabra and García (2012), or Cabral (2013).

lihood of competition emerging. This is particularly if consumer harms from prematurely removing regulation are more easily measured than foregone consumer benefits from failing to allow for competition sooner. However, neither error is without costs, and in times of rapidly evolving value-added consumer services, the latter hard-to-measure foregone consumer benefits might strongly outweigh the former consumer harms.

Indeed, it should also be borne in mind that if regulation is prematurely removed in advance of competitive entry, this could create even stronger incentives for adoption of new technologies and entry by providers of new services (e.g. by allowing formerly-regulated prices to rise).[171]

Hence, to a certain extent, so long as some sort of innovation can be expected, prematurely removing regulation may contain self-correcting elements. In any case, regulators should be increasingly on the lookout for competitive entry, the likelihood of which increases with disruptive new technologies, business models and players, especially when regulation permits such entry.[172]

Regulatory forbearance

Bauer and Bohlin (2008) discuss such "regulatory forbearance" in the context of the US approach to regulation of next generation telecommunications networks. Earlier generations of ex ante US telecommunications regulation arose in more stable technology environments. Such "static" regulation focused predominantly on preventing the exercise of market power while preserving investment incentives for technologies assumed to remain stable. This approach was well-adapted to situations in which new technologies and business models did not emerge to relieve the market power concerns that initially motivated regulation. However, it was not well-adapted where

[171] Oil-producing nations face similar constraints in the face of new technologies such as EVs. If they decrease production too aggressively so as to raise oil prices, they could accelerate the transition to alternative technologies. This shows how such technologies constrain even unregulated prices set by parties with clear market power.

[172] This applies equally to competition regulation as it does to Part 4 regulation. With more forward-looking focus – including in terms of market definition – it is possible that different decisions might have been taken in the Commerce Commission's recent blocking of the Vodafone/Sky and Fairfax/NZME mergers (as was the case in the recent clearance of the AT&T/Time Warner merger in the US).

they did so emerge – giving rise to a "Type I" error, namely the retention of static, ex ante regulation despite the emergence of competition in a dynamically changing environment (possibly to the detriment of such emergence).

These authors note a subsequent change in regulatory stance in US telecommunications, with less reliance on static, ex ante, industry-specific regulation, and greater (default) reliance on ex post, general competition law. In other words, a shift in the "competition-regulation boundary" towards greater, though not necessarily exclusive, reliance on competition law. This approach is well-adapted to situations in which competition does emerge (hence ex ante regulation indeed was not warranted), but not well-adapted to situations where it does not emerge. In the latter case a "Type II" error arises – that of not having ex ante, industry-specific regulation when it could have been used to alleviate market power issues as needed.

This shift can be described as "regulatory forbearance", since it involves regulators giving greater benefit of the doubt to the possible emergence of competition as a result of new technologies, business models and players.[173] If such competition can be reasonably expected, there is less need to regulate pre-emptively to guard against its absence. It is more "dynamic" in the sense that it gives greater space for such competition to emerge (versus the earlier, static approach, which served to dampen the emergence of competition). Bauer and Bohlin explain that US regulatory commentators regard the risk of Type II errors arising under regulatory forbearance as being less severe in a dynamic environment than Type I errors. *In other words, shifting the competition-regulation boundary towards greater reliance on competition law, rather than industry-specific regulation, is to be preferred in changing technology environments.*

Defining the competition-regulation boundary

Key requirements to making such a change operative include:

[173] Regulatory forbearance is a variant on "light-touch" or "light-handed" regulation, though with different motivation and features to the form of "light-handed" regulation formerly practiced in New Zealand electricity (see Meade and Evans (2005) for a discussion of the latter).

1. Clearly stating policy in terms of which types of sectors, activities, firms or consumers – under what circumstances – should be the beneficiaries of regulatory forbearance; and
2. Also having a clear policy statement setting out principles, processes, responsibilities and accountabilities for how "borderline" competition and regulatory issues will be addressed.

The latter is particularly important even now, with novel issues at risk of being indecisively and/or only slowly passed between:

1. Sectoral ex ante regulators – e.g. the EA, and regulation branch of the Commerce Commission;
2. The Commerce Commission as competition authority; and
3. The EA as overarching pan-sectoral regulator, and agency ultimately responsible for long-term decisions as to how the competition-regulation boundary should be defined.

As new technologies, business models and players create more frequent or novel challenges to existing regulatory arrangements, there is a need for both:

1. A clear, up-front statement of how such boundary issues will be resolved; and
2. A mandated, competent, responsible and accountable agency – likely under the auspices of MBIE – to rapidly resolve any remaining boundary issues in accordance with established policy and principles:
   (a) In consultation with the EA and Commerce Commission (and any other relevant regulators depending on the issues); and
   (b) With opportunity for input from industry (including entrants) and consumers.

7.7.3 Greater flexibility and responsiveness

Relatedly, in environments likely to soon face rapid change – as in electricity – regulators should place greater weight on flexibility and responsiveness than they might traditionally (in favour of instead providing regulatory certainty and predictability). This is at least the case in respect of those parts of the industry facing rapid change, if not those which might – for some time longer at least – continue as previously (e.g. continuing to serve consumers who do not adopt new technologies, etc). Doing so means regulation is less likely to impede the adoption of new technologies and services by those who regard their net benefits more favourably than those who do not.

Ways to achieve this include:

1. Adopting a more nuanced and layered regulatory approach, targeted to specific consumer classes, as discussed above; and

2. Relying on ex post competition regulation to a greater degree than ex ante industry-specific regulation.

The latter echoes the discussion of regulatory forbearance in Section 7.7.2. It implies adopting a more supportive (i.e. forbearing) than sceptical regulatory approach (compare Figure 1). This means being prepared to give new technologies, business models and players greater benefit of the doubt, and greater freedom of movement, than might otherwise be allowed under ex ante regulation (which seeks to prevent harms before the fact). It also requires a more forward-looking and lenient approach to ex ante merger controls, when there is a likelihood of significant consumer benefits from innovative technologies and services.

This does not imply a complete abandonment of ex ante regulation, although Bauer and Bohlin (2008) suggest this has been the case in some instances in US telecommunications regulation. Rather it implies a shift in the competition-regulation boundary towards a relatively greater reliance on competition regulation. Such a rebalancing, in favour of regulatory responsiveness over certainty, could dampen

investment incentives for stable technologies, if those technologies in particular do not remain subject to ex ante regulation. However, it is unlikely to materially reduce such incentives for the adoption of new technologies, given they are already inherently uncertain and changing, and with potentially very short lives as a consequence.[174] Greater regulatory flexibility is likely to be relatively more important for supporting investments in such new technologies (e.g. by not precluding them, or favouring existing technologies).

Likewise, greater flexibility and responsiveness is not the same as regulatory carte blanche. Regulatory agencies exercising flexibility and responsiveness should only do so with clear rules, responsibilities, objectives, processes and accountabilities. This is necessary to ensure such regulatory flexibility and responsiveness is exercised according to widely-understood rules, rather than unpredictably, so that both consumers and firms can make investments confident that they at least know how rules might change, if not the precise nature of those changes (discussed further in Section 8).

7.7.4 Clearer performance focus

There is scope under present arrangements for regulation (particularly ex ante monopoly regulation) to be applied to achieve desired performance outcomes, rather than dictating technologies. Doing so can be more complicated than simply specifying allowable technologies, especially when performance (e.g. consumer welfare benefits of improved service quality) is hard to measure. However, as discussed above, addressing such measurement issues is already a necessary part of improving regulation in an environment with increasingly differentiated consumer interests. Hence there are "regulatory economies of scope" involved in measuring consumer welfare.

The chief merits of regulation becoming relatively more performance-based – again, especially in relation to new products or services – are:

[174] Things get more complicated for technologies thought to be stable but which turn out not to be. Meade and Grimes (2017) show that consumer welfare can be increased if firms mistakenly over-invest in such technologies without regard to future entry by competing technologies.

1. This gives room for greater innovation, since regulatory compliance is not tied to using specific technologies; and
2. It means regulation can be agnostic about precise technologies and their associated business models, and focus more clearly on serving the long-term interests of consumers.

While there is scope under present regulatory arrangements for such a performance focus, there is cause to ensure greater clarity around this point. This is because much of the existing electricity sector regulatory framework was crafted long before the disruptive technologies, business models and players were in contemplation. As a consequence, that framework contains many implicit assumptions about how the electricity sector is – or should be – organised, based on the regulatory technologies, as much as other technologies, available at the time of its creation. The interpretational questions raised in Section 6.4.3 illustrate how those implicit assumptions might no longer hold, and why a more clear performance focus of regulation is worth being made explicit.

7.7.5 Developing pan-sectoral approaches for shared issues

Section 4.7 highlighted issues that are already regulated horizontally (i.e. by activity), such as privacy regulation (discussed further in Section 5.4), and workplace safety and health regulation. It also highlighted an emerging range of issues likely to be shared by electricity sector regulators with other sectoral regulators, especially in transport and telecommunications. Foremost issues requiring greater pan-sectoral attention include:

1. Privacy and data protection;
2. Reliability and security of supply; and
3. Cyber-security.

In part these shared issues simply reflect the greater connectivity, electrification and reliance on consumer-level data in an increasing range of activities across sectors.

Regulating these issues horizontally instead of vertically (i.e. by sector), could produce important benefits, such as:

1. Better aligning regulatory skillsets with the required activities, and developing those skillsets; and
2. Helping to identify and mitigate unintended consequences, for one or more sectors, of regulation in another sector.

Achieving this could proceed incrementally, and with relatively low cost. Specifically, in the:

1. *Short-term (e.g. 1-2 years)* – sectoral regulators (e.g. electricity, transport, and telecommunications, as well as privacy) could create informal forums for identifying regulatory issues and efforts benefitting from greater coordination and cooperation, and creating pathways for achieving this:
   (a) E.g. establishing priorities and approaches through memoranda of understanding, such as those already used between bodies like MBIE and the EA;
   (b) Providing opportunities for input from industry (including entrants) and consumer groups;
2. *Medium term (e.g. 2-5 years)* – as and when the relevant issues become apparently more shared than industry-specific, or to identify where they are best treated as shared – sectoral regulators' regulatory or legislative remits could be more formally:
   (a) Harmonised, where they relate to issues shared across sectors or with significant multi-sector impacts, such as through creating consistent definitions, standards or objectives in relation to privacy, reliability, etc; or
   (b) Extended, e.g. to require sectoral regulators to consult with and have regard to the views of regulators in sectors either sharing similar issues, or which affect or are affected by the given sector's regulation; and

3. *Longer-term (e.g. 5+ years)* – these arrangements could become more comprehensively redesigned, for example:

   (a) Through the creation of a horizontal regulator, or regulators:

      i. Dealing with activity- rather than sector-based issues, such as privacy, reliability and security;[175]

      ii. With greater focus on regulated parties' performance rather than processes; and

   (b) Leaving sectoral regulators to deal with clearly isolated issues that are not resolved by new technologies, business models and players, flexibly/responsively, and with greater focus on performance than process, and:

      i. Which have no major linkages with other sectors; or

      ii. For which the benefits of sector-specific regulatory skills continue to outweigh the benefits of activity-based skills or the need to coordinate regulation across sectors.[176]

Hence it is possible to foresee the emergence of a future regulator of (e.g.) supply security rather than separate regulators attempting to address such issues independently in electricity and transport (when in reality inter-dependencies between the two sectors mean neither can achieve their aims without coordinating with the other).

7.7.6 International focus

Many new technologies, business models and players are emerging from overseas, and create regulatory issues across multiple jurisdictions. In the main these issues

[175] Whether or not horizontal activities should be undertaken separately, or bundled, depends on the extent to which regulatory outputs are hard to measure, and whether regulators' efforts to achieve one objective creates conflicts or complementarities with the achievement of others. Meade (2016) discusses this further.

[176] Furthermore, sectoral regulators may also remain more relevant where political independence – which is often greater for competition regulators – is of relatively less importance than sector-specific expertise.

are addressed in specific jurisdictions – either unilaterally for those with sufficient regulatory heft to go it alone (e.g. the US), or collectively (e.g. the EU). Smaller jurisdictions, such as New Zealand, are likely to find themselves – deliberately or otherwise – importers of regulation as much as they are of the new technologies (etc) that are regulated.

In order to gain influence over new technologies, business models and players, New Zealand will need to give greater attention to participation in international forums for dealing with these increasingly global regulatory challenges. It could initiate the formation of blocs with other smaller players, or simply seek to "box above its weight" by directly engaging in such forums. It could also attempt to initiate the formation of such forums if they are not already emerging, and participate in existing forums for international cooperation (e.g. such as for competition regulators).

Two approaches are worth adopting, perhaps in parallel, by New Zealand regulators involved in electricity sector issues. Namely, participating on international forums addressing issues:

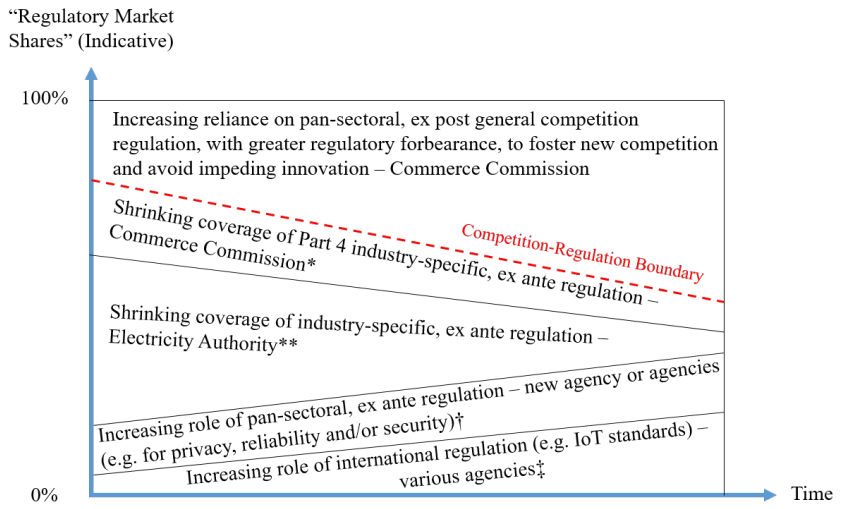
1. Shared across electricity sectors globally – e.g. standards-setting for DER coordination technologies; and
2. Shared with other sectors – e.g. standards setting for the IoT, data-protection or cyber-security.

Either approach should ensure that New Zealand has voice in – or at least understanding of – international developments affecting technologies, business models and players likely to be playing increasingly important roles in the country's electricity sector.

7.7.7 Pulling it all together – Shifting "regulatory market shares"

Figure 12 illustrates the types of changing regulatory demarcations – here, loosely termed "regulatory market shares" – envisaged above as best serving long-term consumer interests in the face of new technologies, business models and players.

Figure 12: SHIFTING "REGULATORY MARKET SHARES" AND THE COMPETITION-REGULATION BOUNDARY



* Anticipating (or observing) that new technologies, business models or players alleviate traditional market power concerns.

** Anticipating (or observing) consumer-benefitting competition emerging from new technologies, business models, and players – but also recognising need for residual ex ante regulation to be more pan-sectoral and/or international.

† Recognising ongoing need for ex ante regulation – which becomes more flexible/responsive and performance-based – but with increasingly pan-sectoral/horizontal focus.

‡ Recognising that (ex ante or ex post) regulation will become more international to some degree due to key technologies (e.g. IoT, 5G, etc), and business models/players (e.g. DBDs), being global, and affected by overseas regulation.

The dashed red line represents the boundary between ex ante regulation and ex post competition regulation (which is the default form of regulation, absent specific ex ante regulation). As illustrated, this boundary is likely to shift in favour of greater reliance on competition regulation. This is due to:

1. The likely benefits of greater regulatory forbearance (Section 7.7.2);
2. The need for greater regulatory flexibility and responsiveness (Section 7.7.3);
3. Increasingly horizontal rather than sector-specific regulation (Section 7.7.5); and
4. The growing role of international, rather than local, regulation (Section 7.7.6).

As noted, some of these changes are warranted simply in anticipation of new technologies, business models or players giving rise to new forms of competition. This does not ignore that they will also give rise to new competition concerns – to be flexibly and responsively dealt with under ex post competition regulation to an increasing degree. But even if these changes are not implemented in anticipation of such new competition, they are likely to arise in response to it, as it arises (albeit more slowly, and probably to a lesser degree, due to barriers and inflexibilities created by existing ex ante regulation).The illustrated shifts in regulatory market shares are only indicative. However, they convey notion such as:

1. While relatively greater reliance should be placed on ex post competition regulation, this is not to suggest that ex ante regulation will not play an ongoing role;

2. Ex ante regulation will potentially be ceding "market share" to either:

   (a) Competition regulation – e.g. Part 4 Commerce Act regulation rebalancing towards general Commerce Act provisions; or

   (b) Other ex ante regulation – e.g. Part 4 regulation rebalancing towards EA oversight, and/or pan-sectoral or international regulation; and

3. The nature of ex ante regulation will also change, with it becoming increasingly both pan-sectoral as well as international, as well as more flexible and responsive, and performance- rather than process-based (Section 7.7.4).

These combined changes leave considerable scope for both types of regulation, but anticipate that their character will change considerably as new technologies, business models and players fundamentally alter the issues that each type of regulation must address (and the tools available to address them).

This section's main findings are that electricity regulation needs to:

- Be more tailored to different consumer interests – including a better understanding of those interests, as well as more efficient pricing (and the avoidance of pricing and other distortions created by regulation itself – e.g. the LFCT);
- Be applied at EDB level more like it is at grid level – looking inside the EDB "black box" – recognising that new technologies, business models and players will make distribution networks much more dynamic, and critical to DER uptake and value;
- Enable greater decentralisation – e.g. through facilitating the creation of standards, default terms and governance for DER aggregation and P2P trading platforms;
- Carefully weigh the regulatory pros and cons of DERs being owned and controlled by parties with differing strategic (or non-strategic) interests – counter-intuively perhaps, non-strategic ownership of DERs (e.g. by consumers, or competitive stand-alone retailers) could be of as much potential regulatory concern as ownership by strategic parties (i.e. those with relatively greater market power, especially EDBs);
- Use a wider set of tools, including those already available such as negotiate/arbitrate, information disclosures (such as grid heatmaps), but others besides (e.g. regarding open data or data portability);
- Be more future-focused, flexible and responsive (in a rules-based way), performance-based and technology agnostic (versus process-based), pan-sectoral and international; and
- Realign "regulatory market shares" between different types of regulation, as well as the competition-regulation boundary, in favour of greater "regulatory forbearance" – i.e. relatively greater reliance on competition regulation.

8 How can we better "future-proof" regulation?

This section extends the findings and recommendations in Section 7 by focusing on the forward-looking aspects of regulation in an increasingly uncertain environment. It:

- Highlights how regulation is strategic, and affects the emergence of new technologies, business models and players;
- Argues for "efficiently dynamic regulation" (EDR) – a form of "regulatory pre-nup" – as being necessary to future-proof regulation in the long-term interest of consumers; and
- Describes key elements of EDR, noting that New Zealand's regulation of certain other sectors contains more of these elements than does electricity regulation at present.

8.1 Efficiently-dynamic regulation

Most of the regulatory improvements discussed in Section 7 could be deemed improvements to "statically-efficient", or "first order", regulation. This is because they improve regulation for an anticipated set of changes.[177]

An important theme stressed in this section is that regulation also needs to be "efficiently-dynamic" – which extends the already-understood concept of dynamic efficiency.[178] This is used in the sense that in an environment in which regulatory challenges and opportunities are hard to predict, but likely to be occurring at an increasing rate, regulation needs to become more "second order" – able to accommodate change that itself is expected, even if its precise form is not. Being forward-looking is a necessary element of this approach (Section 7.7.2), as is being more relatively flexible and responsive than in less uncertain pasts (Section 7.7.3).

[177] The main exceptions being in Section 7.7, which anticipates some of this section's discussion.
[178] I.e. regulation is dynamically-efficient if it maximises consumer welfare over time, taking into account the importance of innovation and investment for welfare.

However, as discussed below, additional elements are required – especially around ensuring such second order regulation is itself rules-based, and well understood in advance.

This idea was foreshadowed in Section 6.4.2, in the discussion of the lack of pathway in current price-quality regulation for transitioning to deregulation as competition emerges – or is expected to emerge, or simply might with far greater probability. It is clearly of great importance for price-quality regulation in particular, as its very rationale is that regulation is needed to substitute for competition in its absence, or where there is little or no likelihood of a substantial increase in competition. The changing technologies, business models and players discussed in Sections 4 and 5 very much change the likelihood, and likely magnitude, of competition across all parts of the New Zealand electricity sector. So what regulatory rules are needed now to "future-proof" regulation – to provide an orderly transition to a new regulatory (or deregulated) environment later?

8.2 Strategic regulation

8.2.1 Regulation affects its very own rationale ...

A theme from Section 2 is that we should only regulate if competition is failing to deliver for consumers, or there are other reasons for inadequate market-based provision (and, in each case, only if regulation can do sufficiently better). Conversely, we should deregulate if there is a reasonable prospect of competition emerging, or of other factors (e.g. new technologies) improving market provision, resolving the issues that regulation sought to resolve.

An important complication is that choices about regulation or deregulation inherently affect the emergence of competition, or other solutions, to market failures. For example, as suggested in Figure 1, the impact of regulation on competition or these other solutions can be to:

1. Accelerate competition or other solutions to market-failures – e.g. if regulation

ties the hands of incumbents to deliver low-quality services at high prices which DBD entrants can better; or

2. Impeding competition or other solutions to market-failures – e.g. by:

   (a) Imposing regulation designed for old technologies on new ones – i.e. putting "new wine in old wineskin";

   (b) Creating uncertainty about whether new technologies will be acceptable or not for regulatory purposes; or

   (c) Creating preferences for old technologies – e.g. by allowing existing service providers to recover their past investment costs for technologies which might otherwise be rendered obsolete by new technologies.

8.2.2 ... leading to a regulatory "chicken and egg" problem

This leads to a regulatory "chicken and egg" problem. Should regulation be a:

1. *Strategic leader* – positioned to advance, or at least accommodate, the advent of new technologies, business models and players (even if this challenges the position of incumbents), anticipating that innovations will arise; or

2. *Strategic follower* – positioned to delay, or even impede, the advent of new technologies, business models and players, playing "wait and see" to respond to these innovations as they arise, but not before?

In either case, clear rules, criteria, processes and accountabilities are required to ensure that strategic regulatory choices are made for the long-term interests of consumers (and in what ways for different types of consumers).

A clear example of the former is regulatory decisions to discontinue an old technology in order to accelerate the adoption of another (e.g. digital television). Regulation of this sort provides a "focal point" about which manufacturers, content providers and consumers could coordinate. It helps to reduce adoption costs, improve quality, and hasten uptake of new technologies – by creating economies of scale and

network effects (i.e. the very factors that also lead to the take-off of two-sided markets/platforms characterizing DBDs). Any such strategic leadership should not be undertaken by regulators in isolation. Instead it requires close engagement with firms (including entrants) and consumers to help all parties to coordinate on future pathways most likely to best serve long-term consumer interests, and to share risks of wrong turns (rather than make them unilaterally).

Choosing between these alternatives is in part a question of balancing risk and return, noting that ex ante industry-specific regulation typically seeks to mitigate risks before they arise, rather than respond to them after the fact. A key question is whether the likely benefits of new technologies (etc) are sufficiently great, and their costs sufficiently small or manageable, that regulatory strategic leadership is likely to best serve consumer interests? Or are the likely net benefits so small that regulatory strategic following is best?

8.2.3 Real options value vs first-mover advantage

This choice highlights a tension often encountered by any party making irreversible, multi-period investments under uncertainty. They have a valuable option to wait and see, since this enables them to make better choices in the light of new information when it emerges. However, they have to balance the value of this option against the cost of foregoing any "first mover advantage" they may possess.

In the present case, that advantage lies in being able, through regulation, to set a clear way forward for investments by incumbent and entrant firms, and consumers. This is rather than creating regulatory uncertainty, by waiting and seeing, which causes those parties to delay their own decisions. It is this value that must be weighed against the value of waiting to see how new technologies, business models and players evolve (e.g. do DBDs enter retailing, and if so, with what impact on gentailer and EDB ownership?).

8.3 Moving towards efficiently-dynamic electricity regulation

8.3.1 Innovations likely to provide long-term consumer benefits

The discussions in Sections 4 through 7 point to likely new technologies, business models and players in electricity having the potential to create enormous consumer gains. This is, at least, for those consumers that can and do adopt them. However, these innovations may also lead to costs such as "waterbed" effects for other consumers, in the form of worsened outcomes (such as increased recovery of distribution fixed costs from a shrinking pool of consumers without DERs).

On balance, however, it is likely that these new technologies, business models and players will introduce such strong innovations that long-term consumer benefits are assured.[179] This is not to say that those benefits will be enjoyed evenly or immediately, and protections against "waterbed" effects are worth considering to avoid regulation unnecessarily creating "losers" in any transition to widespread adoption of new technologies and services (such as those as discussed in Section 7.3).

8.3.2 Elements of more efficiently-dynamic regulation

This report argues for regulation to increasingly act as strategic leader, and decreasingly so as strategic follower. Increasingly data- and platform-based competition means the electricity sector – like others – confronts the very real prospect of hard-to-unsettle, winner-takes-all disruption. There is therefore relatively greater rationale than previously – for high-level regulation at least (i.e. at the level of defining and demarcating industry-specific and competition regulation) – to act as strategic leader, with great care to do so in concert with firms (including entrants) and consumers. This is to ensure that regulation at all levels plays a constructive role in efficiently coordinating (e.g. through standards-setting and regulatory sunsets) investments and other strategic choices by both firms and consumers.

[179] It is hard to think of clear examples over long time-frames where innovation has lead to long-term consumer dis-benefits, at least from the perspective of most consumers. E.g. for all its faults, would any clear majority of consumers think the world a better place without the internet? Or for all the dislocation and problems caused by the industrial revolution, would the world have been a better place without mass production and the rapid technical, economic and social advances it enabled?

That would at least reduce the risk of parties coordinating on inferior outcomes, but ideally helps to chart a course for future industry evolution in which long-term consumer interests are best served. By doing so, regulation helps to chart a course for future industry evolution, making it more efficiently-dynamic.

Key elements of more efficiently-dynamic regulation in the New Zealand electricity sector include clear ex ante regulatory commitments to:

1. Conditions under which deregulation would occur – or new regulation would be introduced:
   (a) When, how, and by whom;
   (b) To serve which consumer interests; and
   (c) Balancing the interests of different consumer types in what ways?
2. Conditions under which older technologies might be discontinued and newer ones mandated; and
3. Not favour incumbent technologies, business models or players in the event that changing to new ones offers greater long-term consumer benefits.

Commitments to deregulation could be as simple as providing clear regulatory sunset clauses. These could be of much shorter duration than the 20 years currently provided for under the Commerce Act 1986 to be of practical use, though even generous sunset periods will still serve as a focal point about which firms and consumers start making long-term investment decisions.[180] This element is explicit about determining if existing regulation is still needed, filling a gap in the current drafting of Part 4 of the Commerce Act 1986.

Commitments regarding new regulation could include rules, criteria, processes and accountabilities for identifying market failures and suitable regulatory responses. They would require clear identification of the consumer interests requiring protection, and assessment of whether consumers enjoy net benefits from regulation. This

[180] Noting that signalling the end of regulatory protection may provide the inducement necessary for remaining non-adopters to make the investments required to remove their exposure to market failures.

is particularly important if interventions such as price caps, default tariffs and/or uniform pricing are contemplated. It too extends Part 4, by providing greater clarity about the rules for introducing new regulation, and contemplates the possibility of regulatory options being developed beyond those currently set out in legislation.

Commitments regarding technologies being discontinued or mandated might also be complemented with technology sunsets – e.g. phasing out certain technologies such as fossil-fuelled vehicles older than a certain age over certain time-frames.[181] This allows for the possibility that it is sometimes beneficial to consumers for regulators to "burn bridges" – i.e. make commitments to abandon old approaches or preclude certain new ones, in order to make new, superior ones, more viable (and/or viable sooner).[182]

Commitment to not favouring incumbent technologies, business models or players should include clarity around how long-term consumer interests are measured, and how different classes of such interest will be balanced. This element is needed is to ensure clarity around the "regulatory compact" between regulators and private parties making long-term investments. In other words, there are occasions in which private parties make long-term investments on the strength of regulatory undertakings regarding the returns those investments will provide (or be allowed to earn). As discussed in Section 2.4.1, an important regulatory dimension is regulatory certainty, in the sense that regulators should not "hold up" private investments by reneging on undertakings previously provided to investors.[183]

This last element is critical to avoid misunderstandings about how regulators will respond to innovations that improve consumer welfare. It makes clear that regulatory *certainty* is not the same as a regulatory *guarantee* that investments rendered

[181] Care would need to be taken to ensure that hard sunsets do not lead to perverse behaviours – e.g. holding onto older cars for longer than normal in anticipation of changing to newer technologies.

[182] Various European cities such as Paris, Copenhagen and Oxford have already signalled the end of diesel vehicles in order to reduce air pollution. This is creating or reinforcing focal points about which car manufacturers can change their vehicle technologies (e.g. Volvo committing to producing only hybrid or fully-electric vehicles from 2019). Likewise, it helps consumers to better balance the merits of investing in old or new technologies, and gives them time to adjust to any new requirements.

[183] Doing so undermines investment incentives and, absent corrective measures, results in inefficient under-investment. See Meade and O'Connor (2011) for a discussion.

obsolete by new innovations can have their costs recovered from consumers all the same. In any industry involving long-lived investments there is an ever-present risk that new technologies will render older ones obsolete. This is simply a risk that all investors bear, and it would only be in exceptional circumstances that regulation should seek to interfere with that by guaranteeing investment returns. Hence, a regulatory commitment not to favour incumbent technologies, business models or players in the event that new ones offer greater long-term consumer benefits is an essential element of efficiently-dynamic regulation.

These four elements – together comprising a form of "regulatory pre-nup" – define regulatory commitment in terms of changes, not levels. They are predicated on circumstances not remaining the same, as opposed to simply being uncertain. They provide clarity for all parties – incumbent and entrant firms, and consumers – about how regulation will evolve in response to anticipated, but before-the-fact unknown, changes in circumstances.

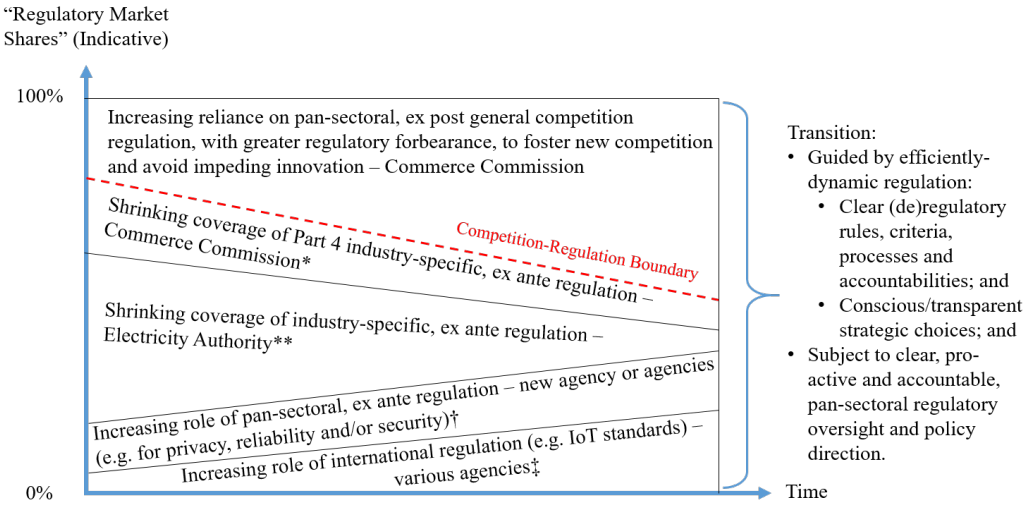
Figure 13 repeats Figure 12, but emphasises how conscious, efficiently-dynamic regulatory choices should underpin any changes in regulatory market shares.

8.3.3 Aspects of EDR in other New Zealand regulation

Introducing such efficiently-dynamic regulation in the New Zealand electricity sector could draw on a specific feature of the country's telecommunications sector regulation (without endorsing that regulation more widely). To a lesser extent, parallels could also be drawn with privacy regulation, with section 26 of the Privacy Act 1993 requiring periodic reviews to identify whether amendments are necessary or desirable (though with little guidance as to relevant criteria, objectives, etc).

Of greater relevance, clause 1(3) of Schedule 3 to the Telecommunications Act 2001 requires the Commerce Commission, as telecommunications industry regulator, to periodically consider whether there are grounds for investigating whether a regulated

Figure 13: SHIFTING "REGULATORY MARKET SHARES" – ROLE OF EFFICIENTLY-DYNAMIC REGULATION



* Anticipating (or observing) that new technologies, business models or players alleviate traditional market power concerns.

** Anticipating (or observing) consumer-benefitting competition emerging from new technologies, business models, and players – but also recognising need for residual ex ante regulation to be more pan-sectoral and/or international.

† Recognising ongoing need for ex ante regulation – which becomes more flexible/responsive and performance-based – but with increasingly pan-sectoral/horizontal focus.

‡ Recognising that (ex ante or ex post) regulation will become more international to some degree due to key technologies (e.g. IoT, 5G, etc), and business models/players (e.g. DBDs), being global, and affected by overseas regulation.

telecommunications service should be deregulated.[184] This is in recognition of the fact that markets evolve, new retail services are developed, and wholesale (i.e. regulated monopoly) service providers can face increased competition.

To discharge its duty, the Commerce Commission reviews each regulated telecommunications service at least every five years. It does so by:[185]

> "assessing whether competition may have developed to such an extent that continued regulation is no longer needed to promote competition in telecommunications markets for the long-term benefit of end-users."

Even this feature falls short of full EDR, since it only assesses whether sufficient competition has *already* emerged to enable regulation to be abandoned. Such a backward-looking approach could in fact impede the emergence of competition. Better still would be a fore-signalled periodic review of whether sufficient competition is *likely* to develop – under either existing or relaxed regulation.

Drawing a parallel between electricity and telecommunications sectors is increasingly relevant. In the past, electricity sector technologies have been relatively slow-moving, and it is only more recently that DERs and new business models and players have emerged (as discussed in Sections 4 and 5). This is in contrast to telecommunications sectors, where long-established infrastructures such as copper networks were long ago disrupted by newer technologies – initially by mobile telephony, but later by competing fixed infrastructures such as fibre (and soon, high-speed 5G mobile technology). Telecommunications regulation has therefore had to have been far more attuned to:

1. How new technologies, business models and providers could resolve historical market failures;

2. The harms to consumers of regulation impeding them from doing so; and

[184] Similarly, section 26 of the Privacy Act 1993 requires five-yearly reviews, though with little guidance as to which criteria should be applied for changes to be recommended.
[185] Taken from the Commerce Commission's website.

3. The need for regulation to facilitate innovation and investment – by incumbents and entrants.

Now that the electricity sector is now facing a more dynamic and innovative environment of the sort long-facing telecommunications sectors, its regulation should likewise incorporate features signalling how regulation itself will evolve, so this can be known by investors and consumers in advance.

This sections main findings and recommendations are:

- Electricity sector regulation can either be a strategic leader or strategic follower – in either case it affects the choices made by firms and consumers, and hence affects the emergence of new technologies, business models and players;
- DBDs can quickly dominate new sectors, with competition inclined towards winner-takes-all monopoly that risks becoming entrenched due to "data moats" – this increases the need for regulation to act as strategic leader (e.g. by facilitating standards devdelopment), playing a coordination role that involves close engagement with firms (including entrants) and consumers to share risks of taking wrong turns;
- In an increasingly uncertain environment, future-proof regulation, or EDR – a form of "regulatory pre-nup" – includes clear and fore-signalled rules, criteria, processes and accountabilities regarding how regulation will be changed, in what circumstances, and in whose interests; and
- Existing regulation of other New Zealand sectors (e.g. telecommunications, privacy) already contains elements of EDR – it is timely for electricty regulation to develop and extend such elements, given it is becoming – or should become – much more dynamic.

9 Conclusions and Recommendations

This section draws together discussions from the preceding sections. It:

- Reminds us that brutal competition was a feature of early electricity systems, and it is likely to be even more a feature with new technologies, business models and players;
- Highlights the resulting shifts in regulatory balance that are likely to be required;
- Acknowledges many important outstanding questions; and
- Makes "low-regret" recommendations – over short- (e.g. 1-2 years), medium- (e.g. 2-5 years) and longer-term (e.g. 5+ years) time-frames – for ensuring that New Zealand's electricity sector regulation best serves the long-term interests of consumers in the light of new technologies, business models and players.

9.1 Re-emergence of brutal competition?

The US electricity industry first began with the construction of Thomas Edison's Manhattan power plant in 1882. It was unregulated private enterprise, and as Stoft (2002) put it, "[i]n the beginning there was competition – brutal and inefficient".[186] Aside from subsequent episodes of industry regulation, deregulation and re-regulation, for most of their lives electricity sectors around the world – unlike many other sectors such as telecommunications – have not experienced major disruptive changes in technologies, business models or players. With the advent of DERs, and the rise of DBDs, electricity sectors could be returning to a period of brutal competition. How efficient that competition turns out to be – in terms of generating greater long-term consumer benefits – will at least partly be determined

[186] Quoted in Evans and Meade (2005), p. 121.

by regulation. This report asks whether New Zealand electricity sector regulation is up to the challenge, and suggests options for how it might be improved where it is not.

9.2 Shifting trade-offs require a change of regulatory focus ...

A key part of the assessment of the New Zealand electricity sector's "fitness for purpose" is its ability to respond to new regulatory challenges and opportunities. Current regulatory arrangements have many helpful elements, such as a clear focus on delivering long-term benefits to consumers, and delegated powers to reshape sector regulation as circumstances change. But they were designed to address historical trade-offs which are now shifting as a consequence of innovation. As a consequence, they include regulatory features that distort the rate of adoption of new technologies, business models and players in unintended ways. And they leave a clear gap in terms of charting a way forward, as the electricity sector is transformed – in unknown ways – from within and without.

Charting this way forward requires a change in focus – from managing status quo regulatory issues, to anticipating how new technologies, business models and players will resolve existing market failures, and possibly create new ones. This cannot be done with a passive, rear-view focus. It demands a more forward-looking and pro-active – though neither unilateral nor unfettered – approach. It also requires a recognition that regulatory choices – whether for the status quo or for change – affect the rate at which new technologies, business models and players will emerge. Regulators face a choice – to be regulatory strategic leaders, working closely with firms (including entrants) and consumers, or regulatory strategic followers. Either way, regulatory choices will affect the strategies of incumbent and entrant firms, and consumers, and hence the pace at which new technologies, business models and players emerge.

9.3 ... to more efficiently-dynamic regulation ...

This report advocates for a shift from statically-dynamic to efficiently-dynamic electricity sector regulation. This goes beyond conventional notions of static and dynamic efficiency, to the efficiency of how regulation responds to changes in uncertainty. This is justified by the increasing pace and uncertainty of changes confronting electricity sectors worldwide. This changing environment means electricity sectors will become more like telecommunications sectors were decades ago with the advent of disruptive technologies like mobile telephony. In fact, they will also become more like other industries such as merchandise retailing, which have already faced major disruption by the entry of highly-customer-focused DBDs or could soon do so. In either case, regulation must become more forward-looking and fleet of foot, providing a clear set of rules, criteria, processes and accountabilities – not just for regulatory conduct, but the evolution of that conduct.

9.4 ... but also more statically-efficient regulation

Advocating for efficiently-dynamic regulation does not imply that static regulatory efficiency is unimportant. This report highlights a number of features of current New Zealand electricity sector regulation that could be improved in the light of emerging technologies, business models and players. The main regulatory challenges and opportunities presented by these innovations have been traversed, and where possible, possible solutions identified. Some of these changes are likely to be inevitable, such as increasing decentralisation and customer differentiation, reflecting the nature of new technologies (i.e. DERs) and players (i.e. DBDs). Others very much reflect strategic choices, to exert some control over industry evolution.

9.5 Some key outstanding questions

Many of the challenges and opportunities are still emerging, even in New Zealand which is a relatively late starter in the process of change, and which can therefore draw on the experiences of other jurisdictions in which change is more well-

established.[187] Consequently, much of the discussion, and hence many of the prescriptions, in this report should be treated as exploratory – a first attempt to chart a course in significantly novel territories. They hopefully clarify the emerging issues, providing a framework for analysis, and offering insight as to how regulatory challenges and opportunities might best be responded to. Ultimately, however, they are offered as suggestions for further discussion, analysis and debate, recognising there are important uncertainties to be resolved, and important questions of strategy to be determined.

Some key outstanding questions that need to be addressed, to ensure that New Zealand electricity regulation best serves the long-term interests of consumers, include:

1. How can regulators better tailor their regulatory offerings to increasingly-differentiated consumers, and balance diverging consumer interests – especially when some of those consumers may also become producers, or are more prepared than others to "pay" for new offerings with their data (i.e. their "unprivacy")?

2. What steps should regulators take to ensure that adopters of new technologies and services do not create costs for others – especially those who do not wish to, or cannot, adopt those technologies and services – including as a consequence of regulation itself?

3. How should electricity sector regulation evolve to simultaneously reflect increasingly-divergent consumer interests, and increasingly-shared issues across different sectors (e.g. transport and telecommunications) – such as the changing private/social costs and benefits of privacy, or security of supply?

4. Are new technologies, business models and players inherently beneficial for long-term consumer welfare – are there particular types of innovation (or

[187] E.g. parts of the US such as California and Texas, Australia, Great Britain, and parts of the EU (especially Germany, France and Spain).

particular owners of new technologies) that maximise consumer benefits while others do not, and how can/should regulation influence this?

5. Should new technologies, business models and players play by existing industry rules (e.g. centralised control), or should those rules be changed to accommodate those innovations?

6. Should regulation lead or follow – do the benefits of cautiously waiting and seeing how new technologies, business models and players evolve outweigh the costs of foregone opportunities (e.g. by failing to more pro-actively facilitate those innovations)?

This report attempts to shed some light on these questions, even if the solutions it offers need further discussion, debate and analysis.

9.6 Recommendations

Despite these outstanding questions, this report makes the following, "low-regret" recommendations that should contribute to ensuring that electricity regulation adapts to best serve consumers' long-term interests. They are divided into the short-, medium- and longer-terms to suggest possible timing priorities, and are predicated on:

1. Neither the Commerce Commission nor the EA being able to unilaterally change their own regulatory remits – this requires decisions to be taken by MBIE, and likely legislative change; and

2. Any changes to Commerce Commission or EA remits benefitting from a co-ordinated assessment of how those remits should be designed to work either together, or independently, to best serve electricity (and other) "consumers"' long-term interests.

9.6.1 Short-term (e.g. 1-2 years)

1. Continue and extend existing processes (e.g. by the EA, Commerce Commission, and MBIE) – in light of the issues and opportunities identified in this report – to ensure (cf Section 6.4.3):

   (a) Consistency of key definitions across electricity sector legislation and regulations;

   (b) That these key definitions accommodate new technologies, business models and players in clear and desirable ways, or are suitably amended where they do not; and

2. Explore any regulatory or other institutional reforms necessary to support – or simply not impede – the efficient and timely evolution of decentralised DER trading and coordination platforms (cf Section 7.4);

3. Create an agency (or section of MBIE) with clear principles, processes, mandate and accountability to define and resolve competition-regulation boundary issues (cf Section 7.7.2);

4. Create informal forums for identifying regulatory issues and efforts benefitting from greater coordination and cooperation, and creating pathways for achieving this (cf Section 7.7.5):

   (a) With leading candidates being electricity, telecommunications, transport and privacy regulators – including opportunity for input from industry and consumer groups.

5. Refine policies for privacy, data ownership and data sharing that are consistent across sectors:

   (a) Appropriately balancing proprietary interests in data against market power issues arising from data aggregation, and the importance of data for innovation.

9.6.2 Medium-term (e.g. 2-5 years)

1. Explore the relative trade-offs of different forms of DER ownership – i.e. DBDs, EDBs, retailers or others – to better identify where regulatory issues arise, or are resolved (cf Sections 6.4.2, 7.5 and 7.6):

   (a) Including the desirability or otherwise of some or all DER costs being included in regulatory asset bases under Part 4 EDB price-quality regulation, and more clearly delineating which should or should not be so included;

2. Review information disclosure requirements under Part 4 of the Commerce Act 1986 and consider whether they need to be extended to include additions such as real-time distribution network "heatmaps" to identify where DERs might be suitable alternatives to traditional network solutions (cf Sections 6.4.2 and 7.5);

3. Examine the desirability of EDB-level DER investment tests, including requirements to (cf Sections 7.5 and 7.6.2):

   (a) Consider non-distribution alternatives;

   (b) Demonstrate least-cost approaches – including through tendering DER requirements; and/or

   (c) Undertake DER investments only if other parties have not;

4. Consider a rebalancing of the Part 3 thresholds in the Electricity Industry Act 2010 to ensure they perform as desired, with DERs changing the nature as well as efficient scale of competitive activities such as generation (cf Sections 3.3.3 and 7.6.2);

5. More formally harmonise and extend different sectoral regulators' regulatory or legislative remits to recognise (cf Section 7.7.5):

   (a) Shared/horizontal regulatory interests; or

(b) Overlapping effects of sectoral regulation;

6. Develop and introduce amendments to Part 4 of the Commerce Act 1986, similar to those contained in Schedule 3 of the Telecommunications Act 2001, for regular reviews of whether new technologies, business models or players (cf Section 8.3.3):

   (a) Reduce – or are likely to reduce – the need for ongoing price-quality regulation, and develop provisions for transitioning activities, customer classes or firms away from Part 4 regulation to the extent they do (cf Sections 3.3.2 and 7.7):

      i. Including clear criteria for conditions under which historical regulated investment costs will or will not be recoverable with the advent of new technologies, business models or players better serving consumers' long-term interests; or

   (b) Create new regulatory issues (such as increased waterbed effects), and develop provisions for addressing such new issues – including:

      i. The development of methodologies for distinguishing different "consumer" classes and their interests, and rules, criteria, processes and accountabilities for determining which consumer interests require regulatory protection (cf Section 7.2); and

      ii. Assessment of how the LFCT and other aspects of EDB price regulation resolve or exacerbate issues created by new technologies, business models and players (cf Section 7.3).

7. Explore the desirability and practicality of extending grid management and regulatory technologies to distribution level in order to reflect (cf Section 7.4):

   (a) Increasingly dynamic distribution network topologies; and

   (b) Bi-directional network flows;

8. Otherwise explore the desirability, targeting and practicalities of adopting alternative regulatory tools (cf Section 7.7.1) and "regulatory forbearance" in both ex ante and ex post regulation as ways of creating efficiently-dynamic regulation (cf Section 7.7.2), e.g. through the:

   (a) Commerce Commission's:

      i. Merger control rules, including market definition tests – e.g.. paying greater regard to the possibility of disruptive entry, even if the form of such entry is not clear;

      ii. Ability to use tools other than price-quality regulation, such as negotiation/arbitration;

   (b) EA's application of the market participant definitions and associated electricity industry Code – e.g. having regard to the desirability or otherwise of (non-aggregated) DERs being required to comply with the same market rules as larger-scale industry participants; and

   (c) Commerce Commission and Privacy Commissioner taking a fresh look at:

      i. The Privacy Act in light of data's dual role as both currency and input in the innovative process; and

      ii. How to strike the right balance between preserving innovation incentives, and avoiding unduly hard-to-unsettle monopolisation of data-intensive offerings.

9.6.3 Longer-term (e.g. 5+ years)

1. Rebalance remaining ex ante regulation so that it:

   (a) Becomes relatively more:

      i. Flexible and responsive – to accommodate and facilitate desirable new technologies, business models and players (cf Section 7.7.3);

ii. Performance-based than process-based – i.e. so as not to favour any given technology, but rather to prioritise preferred outcomes (to the extent regulation is necessary to do so; cf Section 7.7.4); and

(b) Appropriately reflects, influences, and dovetails with, international regulation of relevant global technologies, business models and players (cf Section 7.7.6);

2. Reassign relevant regulatory activities from sectoral regulators to a horizontal regulator, or regulators – where (cf Section 7.7.5):

   (a) Those activities are shared across sectors, or result in significant regulatory impacts across sectors; and/or

   (b) Activity-based regulatory skills become relatively more important than sector-specific skills; and

3. Vigilantly apply ex post competition rules, as required, to new market dominance issues as they arise – e.g. with any DBD entry and disruption of existing market arrangements.

9.6.4 Conclusion

Recommendations such as these, if developed:

1. Should help to minimise unintended adverse consequences of existing regulation – and missed opportunities – as it confronts the issues and opportunities thrown up by new technologies, business models and players;

2. Better identify what types of regulation are, or are no longer, required to address either historical or novel regulatory issues; and

3. Position New Zealand's electricity sector regulation to efficiently and dynamically accommodate, and respond to, new technologies, business models and players, in the long-term interests of consumers.

This section's main findings and recommendations are:

- Electricity sector competition is likely to enter an especially "brutal" phase due to data-based disruption;
- New technologies, business models and players require a rebalancing of New Zealand's electricity sector settings;
- The regulatory challenges and solutions are hard to define with precision, and many important questions remain to be answered;
- There are a number of "low-regret" measures that can be taken over short-, medium- and longer-term time-frames;
- In short, these require regulation to become more tailored, more performance-based and less industry-specific, and forward-looking and dynamic in a disciplined and rules-based way.

* * *

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