Repositioning Electricity Regulation in Anticipation of Data-Based Disruption

Power Systems Issues Guest Lecture at AUT, Auckland

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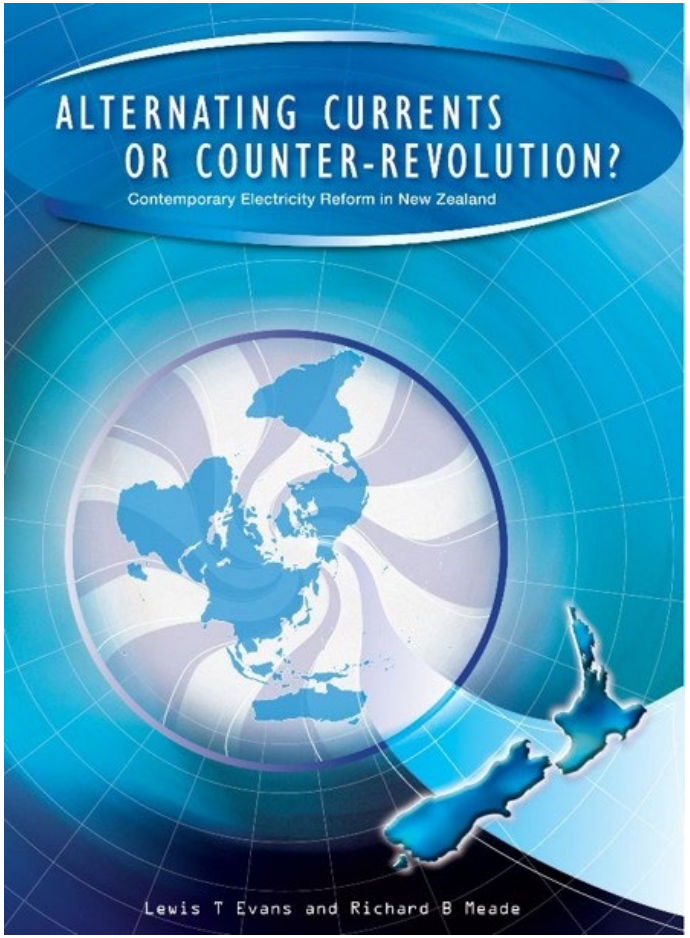
Background

- Been active in electricity sector research, consulting and/or transactions since 1988:
  - Including first career in investment banking with CSFB – advised on Victorian generator privatisations, etc.
- Overlaps with my wider consulting and research in the economics of competition and regulation:
  - Reflected in my PhD in industrial organisation and regulation from Toulouse School of Economics – focus on utility sectors like electricity.
- Since 2015 have been heavily involved in thinking about the regulatory and competitive implications of "disruption":
  - In transport and electricity – which share many overlapping issues (e.g. EVs as mobile *source* of electricity …).

Background (cont'd)

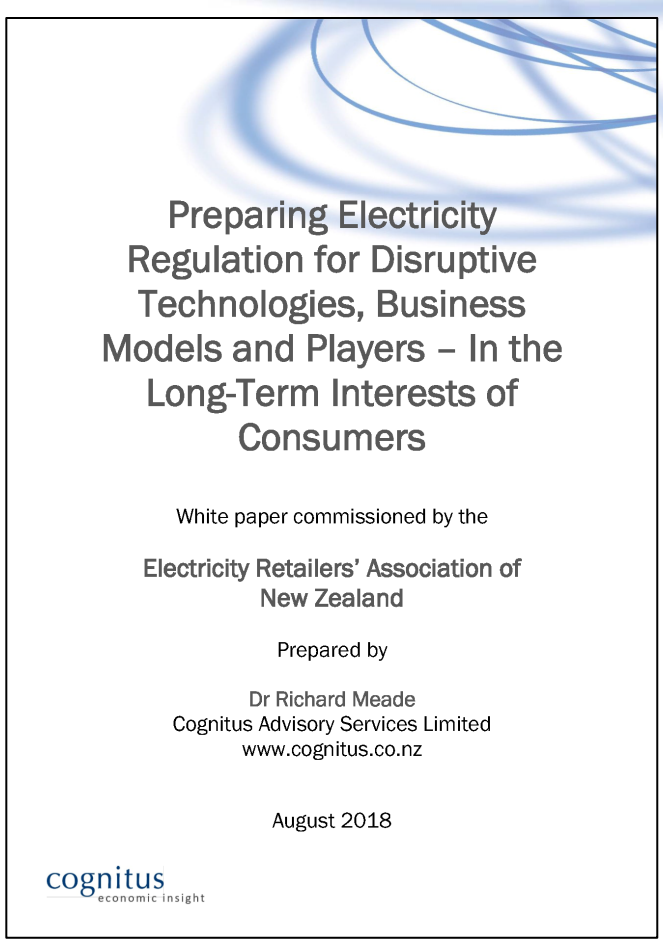
- In 2005, when Lew Evans and I assessed New Zealand's electricity reforms, technologies like PVs and batteries/EVs were not close to commercialisation.

- 15 years on, these new technologies are enabling viable and disruptive business models (not least in Australia …).



Background – ERANZ White Paper

- ERANZ commissioned me in 2017 to produce an independent regulatory think piece/white paper:
  - On how electricity sector regulation needs to be repositioned with the advent of DERs – PVs, batteries, EVs/AVs, etc;
  - Report finalised 2018, and public release approved 2019 (subject to usual disclaimers …).



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

White paper commissioned by the

Electricity Retailers' Association of New Zealand

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August 2018

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Background – ERANZ White Paper (cont'd)

- Very early in the project, ERANZ asked me to provide an outline of my thinking:
  - Fair to say they were not supportive of regulated Electricity Distribution Businesses (EDBs, = DNSOs) entering into DER use/supply – I took a balanced approach, recognising strong possible consumer benefits as well as possible harms …
- I quickly concluded that my analysis needed to start from:
  - Technologies like DERs being only peripherally interesting:
    - What really matters is how they change consumers into *"prosumers"*, but more so the *new business models and players* those technologies enable; and
  - In consequence, *electricity sectors being ripe for the sort of disruption sweeping many other sectors around the world …*

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Obvious New Technologies

- *PVs* – enable decentralised (e.g. household) generation.
- *Batteries* – allow time-shifting production, arbitraging of time-varying tariffs, going "off-grid", etc.
- *EVs/AVs* – as for batteries, but with potential for physical energy transportation (possibly set and forget).
- *Question is "when", not "if"*, these technologies will become widespread, based even just on private incentives.
- Raises numerous issues for incumbent firms, including need for "coordination":
  - Some "aggregators" are more compelling than others …

Obvious New Technologies (cont'd)

BI-DIRECTIONAL CHARGING IS GOING TO CHANGE THE WAY WE THINK ABOUT WHAT A CAR IS (IMAGE: SUPPLIED).

More than a set of wheels: How electric vehicles could soon power your home

Source: New Nissan Leaf allows V2G bi-directional charging, www.thespinoff.co.nz, 19 September 2019.

Other Key Technologies

- Internet of things (IoT), home energy management systems, Alexa, etc:
  - Emerging ability to remotely monitor, control and coordinate intra-household electricity demand/supply;
  - "Set and forget" – or even "leave it to us" – convenience;
  - Complemented by smartphones – individual-level/spatial.
- P2P trading platforms, blockchain, etc:
  - Decentralised bi-directional trading, etc;
  - Enhances DER attractiveness – by enabling "set and forget"/algorithmic (e.g. "leave it to us") micro-profit opportunities …

Other Key Technologies (cont'd)

HITACHI Heat Pumps Ducted Systems Cassette Systems Sizing Guide Where to buy

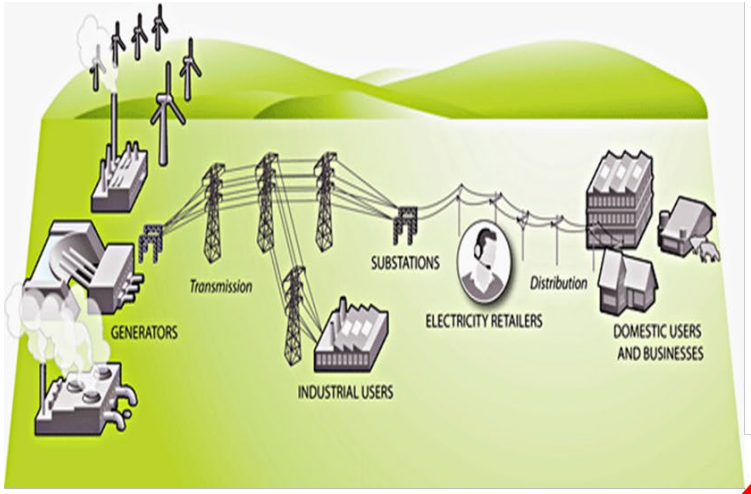
Voice Assisted Operation

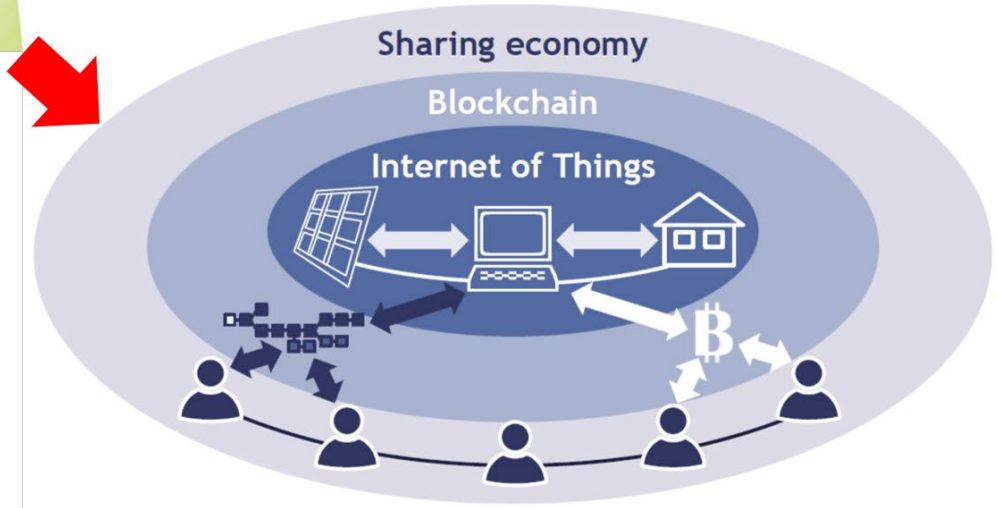
Control your air conditioner with just your voice.

airCloud Home is compatible with Google Assistant and Amazon Alexa, enabling you to change the temperature hands-free.

(This ad "happened" to pop up on one of my newspaper websites the same day I was discussing this topic with a local EDB …)

Other Key Technologies (cont'd)





Sources: www.mbie.govt.nz , and Burger et al. (2015), The "Big Beyond", ESMT.

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Beyond Technologies – Data-Based Disruption

- Just as important are disruptive new players and business models – all of which prioritise tailoring to consumer preferences:
  - *Uber vs taxis* – and public transport, and delivery services;
  - Alipay et al. vs banks – payment systems;
  - *AirBnB vs hotels* – and traditional landlords/renters;
  - *Netflix vs free-to-air broadcasters* – and video/music stores, cinemas/restaurants, etc;
  - *Facebook vs traditional news organisations and broadcasters*; and
  - *Crowd-funding vs traditional capital markets* – and charitable sectors …

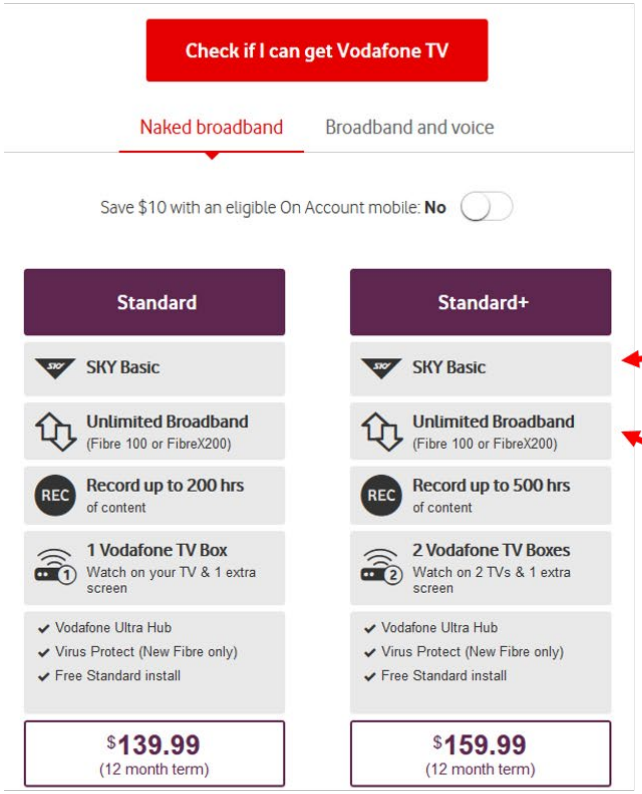
Data-Based Disruption – Hallmarks

- Using "big data advantage" to leapfrog incumbents in not just *understanding* and *predicting* – but also *influencing* – consumer preferences and behaviour (in *real time*, at *highly granular* level):
  - Alibaba CEO: *"The most important thing is not meeting the demand but creating the demand."*
- Lessons I took from Netflix's *The Great Hack* on the Cambridge Analytica "scandal":
  - CA described itself as an agency using big data and analytics ("psychographics") to *change behaviours*;
  - Their "weapons-grade communications techniques" needed UK official approval for export because of national security implications;
  - Effectively CA applied military-style "psyops" to the mass consumer market, for political purposes.

Data-Based Disruption – Hallmarks (cont'd)

- DBD enjoys powerful "network effects" – the more users on a platform, the greater the benefits it can offer:
  - Induces "get big fast" – data gold rush;
  - Favours "winner takes all" competition (*for* the market, vs *in*), "tipping to monopoly" protected by "data moats";
  - Powerful economies of scope – not hard to roll out elsewhere.
- DBD also enables highly differentiated product and service offerings – targeting specific consumers with offerings tailored to their preferences ("personalisation", a.k.a. "discrimination"):
  - Relatedly, enables highly tailored *bundling* of goods and services, especially of grudge purchases with pleasure purchases – another form of personalisation;
  - cf shipping costs being bundled when buying books (etc) …

Data-Based Disruption – Hallmarks (cont'd)



What consumers want:

- Paying a fixed monthly fee for this (and ability to access similar web-based content)

What consumers need to get what they want:

- Getting this bundled/included with what they actually want;
- Do the same with electricity?*

* E.g. standard fixed price heating and lighting package, with add-ons for EVs, DERs, spa pools, differentiated by customer/household demographic …

Data-Based Disruption – Hallmarks (cont'd)

- When entering new sectors, data-based disruptors yield so much retail power they can drive hard bargains with suppliers (and will probably cut their lunches longer-term anyway):
  - cf concentrated supermarkets vs farmers;
  - Amazon vs USPS/FedEx;
  - Big Tech firms and financial services …
- Backed up by credible threat of *backward integration*, e.g.:
  - Supermarkets into store brands;
  - Facebook and Microsoft into Trans-Atlantic fibre, low-orbit satellites;
  - Amazon integrating into logistics (US$25b in 2017) – what about into PVs and batteries/EVs …

Data-Based Disruption – Hallmarks (cont'd)

Electric car owners 'can drive for free by letting energy firms use battery'

Savings from a new scheme will cover the £350-£400 annual cost of charging a Nissan Leaf, says electricity supplier Ovo

Ovo will offer the 'vehicle-to-grid' service to buyers of the Nissan Leaf from next year. Photograph: Okauchi/Rex /Shutterstock

Electric car owners will be paid for letting an energy company use their vehicle's battery in a pioneering scheme to increase take-up of the cleaner vehicles and

Source: The Guardian, 2 October 2017.

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Electricity Sectors Ripe for Disruption

- Nobody buys electricity because they like electrons:
  - Doing so is a means to an end, powering the devices that we combine with our labour and other inputs to generate the services we enjoy – entertainment, comfort, etc;
  - Legacy supply-side baggage means retailers are often still "catching up" when it comes to achieving consumer focus.
- Electricity retailing is a business model – a deregulatory artifact I would say – that makes sense for generators (risk-management, etc), but is an inherently unappealing proposition for consumers:
  - Marginal consumer benefits (e.g. time savings, billing convenience) arise by bundling other utilities (internet, etc), but this risks creating *unattractive* bundles of multiple grudge purchases;
  - Retailers differentiate at the margin, but fundamentally they are still just selling electrons (or ways to conserve them, with limited upside).

What might Disruption look like in Electricity?

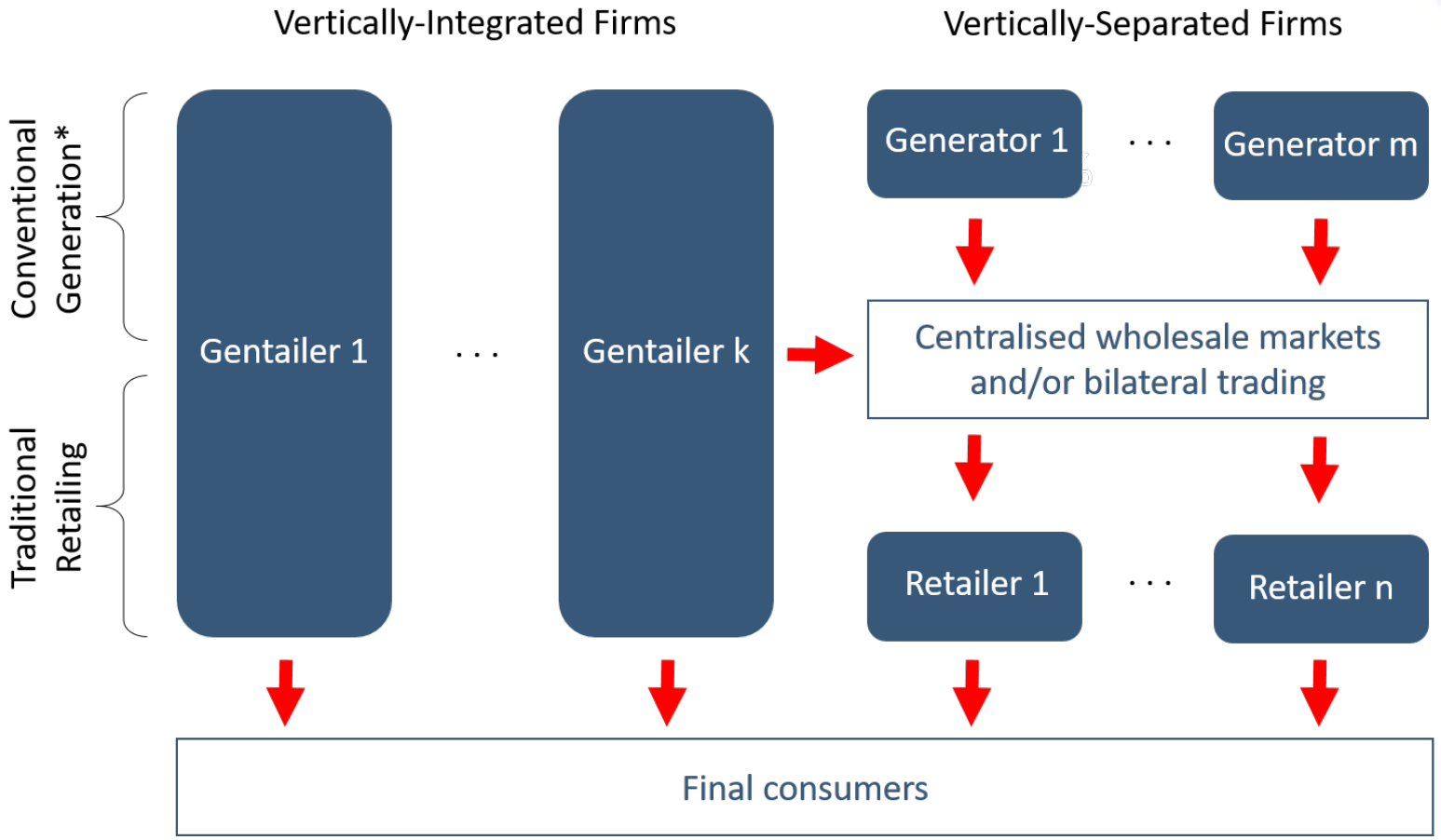
- "Imagine (e.g.) Amazon using new techs like Alexa and its Big Data advantages to:
  - Offer households an all-up electric [heating, lighting and appliances] package for [$100] per month on a [24 month] plan;
  - Predict who is about to put on their oven when wholesale prices are high, but persuade them to stream a show instead;
  - Turn down the brightness of their screen(s) by [5%] to imperceptibly shave extra consumption savings;
  - Manage their PV or storage to supply what they need, and draw some off for sale to reinforce the network or supply other users' energy; and
  - Measure and aggregate this in real time, arbitraging wholesale prices as a "Virtual Power Plant" or algorithmically trading P2P, and bulk-buying supply …".
- In fact, I would imagine this all being bundled with other consumer-oriented offerings – e.g. entertainment (etc), also bundling all-you-can-eat data …

What might Disruption look like in Electricity? (cont'd)

- With possibilities like these, DBDs could *re-invent electricity retailing around highly consumer-focused offerings*:
  - And will leverage their market power from data into both retailing *and DER aggregation* (vs stand-alone aggregation).
- DBD entry could cause a *seismic shift in the balance of electricity sector market power*:
  - Away from generation – and even natural monopoly functions (is market power leveraging by EDBs/DNSOs comparable? redundant?) – towards retailing;
  - Would likely result in a substantial realignment of industry ownership (or exit) …

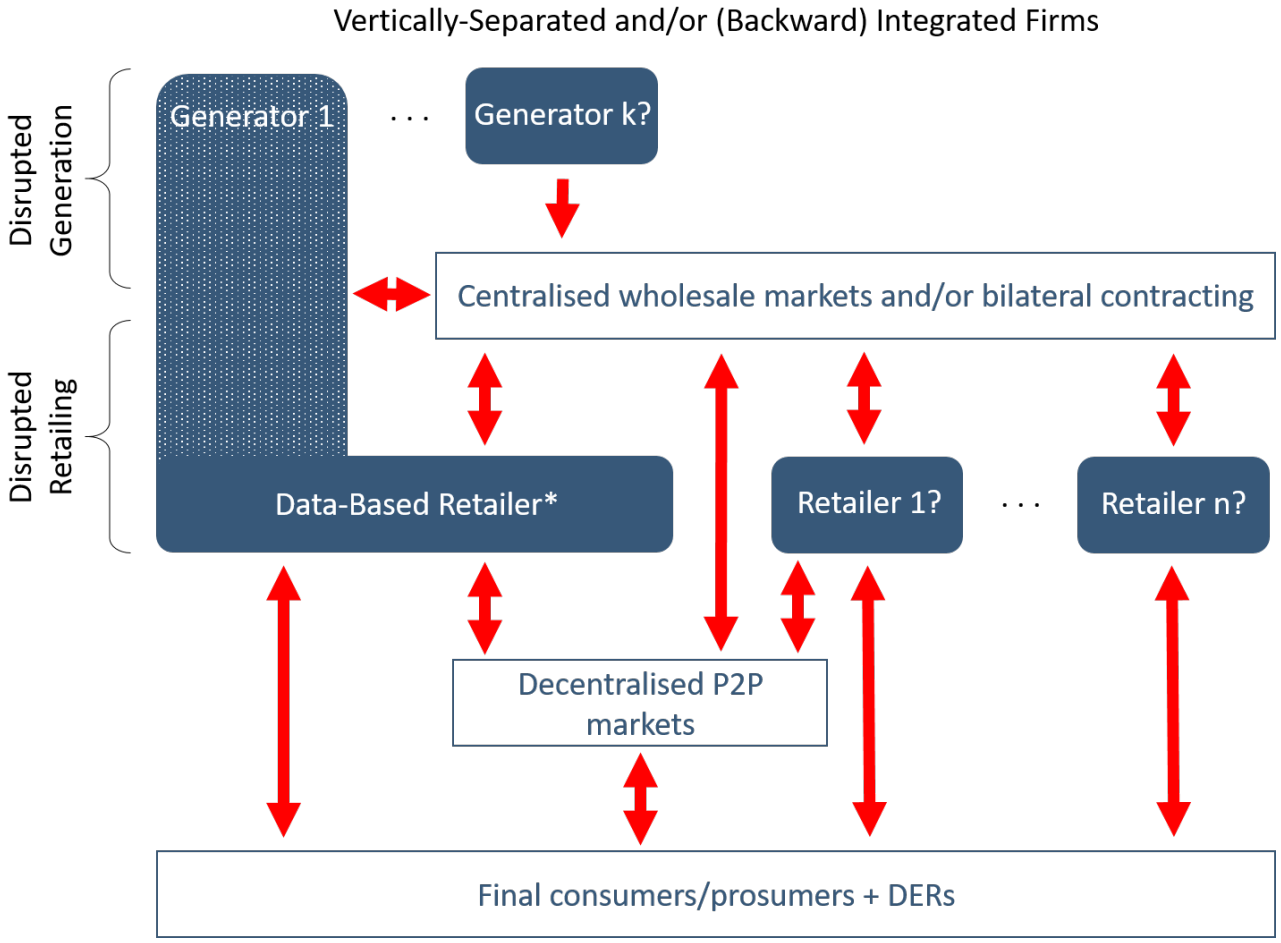
What might Disruption look like in Electricity? (cont'd)

Electricity sectors now …

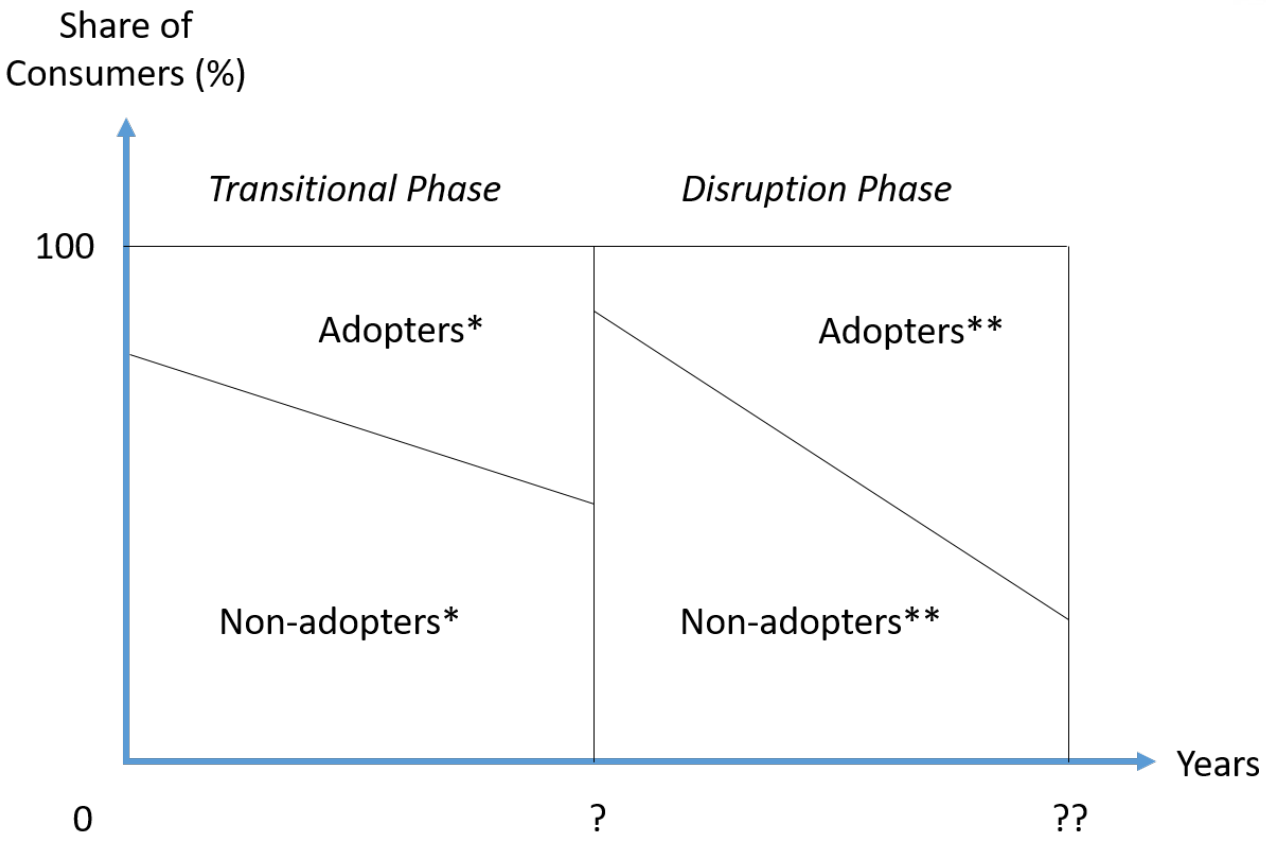


What might Disruption look like in Electricity? (cont'd)

… disrupted electricity sectors?



Incumbents might Fight Back, but for How Long?



* Of bundled variable-price "utility" offerings by traditional firms, including electricity.

** Of bundled fixed-price value-added product/service offerings by DBDs, including electricity.

Incumbents might Fight Back, but for How Long? (cont'd)

Shell Energy is offering 700,000 UK homes 100% renewable electricity for first time

Oil giant to take on UK's heavily criticised 'Big Six' suppliers which have lost millions of customers in recent years

Ben Chapman | @b_c_chapman | 1 hour ago |

Like

Royal Dutch Shell has announced its arrival as a household gas and electricity supplier, moving 700,000 First Utility customers to its Shell Energy brand.

All of Shell's residential energy customers will be supplied with 100 per cent renewable electricity. Shell Energy customers can take advantage of a 3 per cent discount at Shell petrol stations, as well as discounts on home technology like smart thermostats and electric vehicle chargers.

Shell Energy chief executive Colin Crooks said the company would use fuel forecourts to promote the new offer.

Source: The Independent, 26 March 2019.

Aside: Dilemmas for Competition Authorities …

- Traditionally vertical mergers raise foreclosure concerns – but what if they are defensive (e.g. against muscular disruptors)?
  - If competition authorities block ownership-based mergers, can/should they allow contractual tie-ups – a less-efficient alternative?
- Should authorities worry about competition *in* the market if there is likely or actual competition *for* the market?
  - Don't authorities make disruptive entry more likely by blocking defensive incumbent tie-ups? Perhaps they should!?
- New Zealand taking different stance to the US:
  - AT&T/Time Warner merger allowed – how will Vodafone/SKY(merger blocked, but contracting allowed) fare against the merged entity, Netflix, etc …

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Regulatory Architecture (mainly WP s. 7)

- Focus on six broad aspects of "regulatory architecture" that are likely to need rebalancing in anticipation of data-based disruption:
  1. Better understanding who needs what type of regulation – unpacking the "consumer" (WP ss 4.2, 4.8, and 7.2-7.3);
  2. Wider range of regulatory tools (WP s. 7.7.1);
  3. Relatively greater reliance on general competition regulation than on industry-specific regulation (WP s. 7.7.2);
  4. Greater flexibility and responsiveness, and performance focus (WP ss 7.7.3-7.7.4);
  5. Increasingly "horizontal"/pan-sectoral regulation rather than "vertical" regulation, and international focus (WP ss 7.7.5-7.7.6); and
  6. Related to (3) and (4), the need for "efficiently dynamic regulation" (EDR; WP s. 8).

Unpacking the Consumer (WP ss 4.2, 4.8, and 7.2-7.3)

- New technologies, business models and players create increasingly divergent consumer interests:
  - Indeed, new technologies enable much greater personalisation;
  - Regulators need to account for this just as businesses do – perhaps using DBDs' tools …
- Willingness and ability to pay will become increasing drivers:
  - E.g. some households cannot afford PV panels, don't own a roof to put them on, or live where the sun doesn't shine;
  - However, DBDs offering affordable fixed-price bundles might dampen any equity issues arising.

Unpacking the Consumer (cont'd)

- Personalisation is increasingly the new "normal":
  - In principle this is not bad for welfare, and could lead to currently under-served customer classes being better served.
- Regulatory challenge – what are the price-quality trade-offs and other regulatory needs of households with DERs versus those without?
  - Conventional consumers like low energy prices and relatively low variable lines charges – prosumers will likely prefer (relatively) high ones.
- Regulation needs to be much more nuanced, based around better understanding of different types of "consumer" – some of whom are more like "competing firms".

Unpacking the Consumer (cont'd)

$$x^*(p, r; K_j, \Phi, y, \gamma) = \frac{\beta(1-\alpha)}{1-\alpha\beta}\left[\gamma K_j + \frac{(y - rK_j)}{p}\right]$$

$$K^*(r; M, \theta) = \int \frac{M(1-\theta)}{1 + e^{\alpha\beta - 1}\left(1 + \frac{(\gamma_i p - r)K}{y_i}\right)} dF_y(y)\, dF_\gamma(\gamma)$$

$$W(p, r; M, \theta) = M\theta \int U^*(.)\, dF_y(y)\, dF_\Phi(\Phi) + M(1-\theta) \int U^*(.)\, dF_K(K)\, dF_\Phi(\Phi)\, dF_y(y)\, dF_\gamma(\gamma)$$

$$U^*(.) \equiv U(f(x^*(.); \Phi), y - rK_j - p(x^*(.) - \gamma K_j))$$

Source: Meade, 2019, *Measuring Prosumer Welfare: Modelling Household Demand for Distributed Energy Resources and Residual Electricity Supply*, March.

Wider Range of Regulatory Tools (WP s. 7.7.1)

- EDB regulation in New Zealand (Part 4 of the Commerce Act) is largely "flat-footed" (i.e. presuming competition will not emerge), but it does anticipate regulatory alternatives which might become increasingly relevant and viable, e.g.:
  - *Negotiate/arbitrate* as an alternative to price-quality regulation – e.g. where formerly individual "consumers" combine forces through P2P platforms and/or aggregation by DBDs or others;
  - *Information disclosures* – e.g. lines network "hot spot" maps highlighting profitable entry points for entrant suppliers;
  - *Regulation exemptions* for specific customer classes – e.g. "prosumers" with sufficient capacity to be net sellers enough of the time (or at the right times).
- These could be complemented by other increasingly prominent regulatory tools – e.g. (un)privacy regulation (WP s. 5.4), open access and data portability rules, etc.

More Antitrust and Less Industry Regulation (WP s. 7.7.2)

- Competition/antitrust regulation is typically applied *after* the fact, in whichever sector where problems arise:
  - Contrast industry-specific regulation – applied *before* the fact, presuming there is a problem which regulation solves.
- Accordingly, competition regulation is horizontal and "responsive", whereas industry specific regulation is vertical and often "prescriptive":
  - With increasingly rapid and cross-sectoral change, regulation needs to be relatively more responsive and horizontal.
- This implies a relatively greater reliance on antitrust regulation, and relatively less reliance on industry regulation.

More Antitrust and Less Industry Regulation (cont'd)

- It means the "comp-reg boundary" shifts in favour of greater reliance on competition regulation (see graph later):
  - I.e. towards greater "regulatory forbearance";
  - In a world where consumer-enhancing innovations are becoming more common, it can be more important to allow innovation than to address static market power concerns.
- If DER disruption is likely to be beneficial, use less Part 4 (industry-specific) and more general competition regulation – i.e. become relatively:
  - Less tolerant of regulating against market power in contexts where it could turn out to be not such an issue, e.g. due to innovation ("Type I error"); and
  - More tolerant of failing to regulate against market power in contexts where it could turn out to be an issue, e.g. due to non-innovation ("Type II error").

Greater Flexibility/Responsiveness, and Performance Focus (WP ss 7.7.3-7.7.4)

- Relatedly, with increasingly uncertain future technologies, business models and players, a rebalancing is required:
  - From certainty and predictability – which usefully supports long-term investments;
  - Towards greater flexibility and responsiveness – which avoids entrenching outdated ways of doing things when better alternatives emerge.
- What is a "long-term" investment anyway, in an increasingly uncertain environment?
- Investment certainty matters, as does coordination, but regulation shouldn't insure businesses against inherently increasing technology risks.

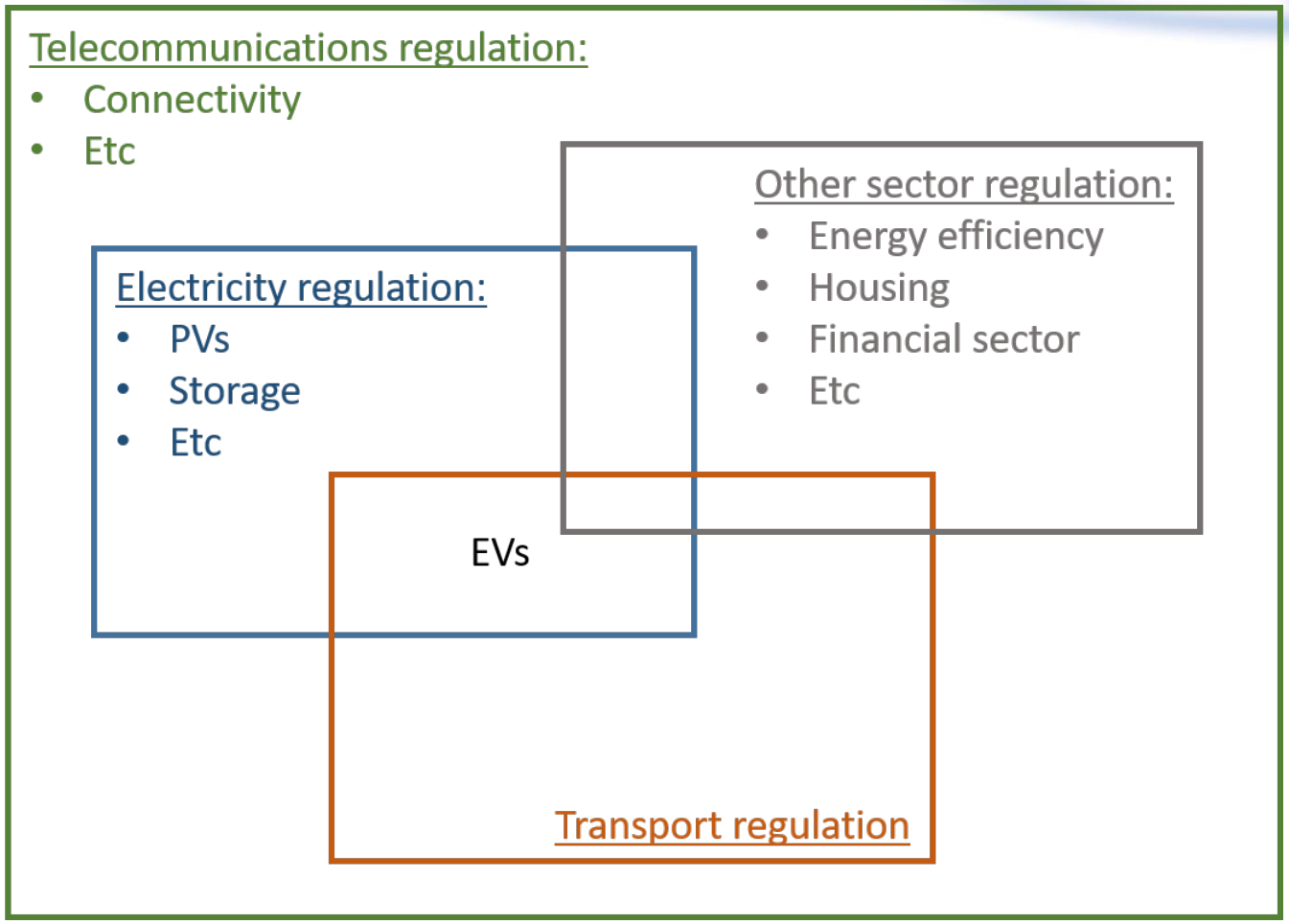
Greater Flexibility/Responsiveness, and Performance Focus (cont'd)

- Likewise, new technologies, business models and players require – and enable – a rebalancing:
  - From *process-based* regulation – i.e. regulating how things are done;
  - Towards greater *performance-based* regulation – i.e. regulating what is done.
- The former is easier to achieve when defining and monitoring performance are hard:
  - But it impedes innovation by entrenching certain technologies.
- The latter is more viable when technologies enable better performance measurement (as they do), and induces innovation.

Increasingly Pan-Sectoral Regulation (WP s. 7.7.5)

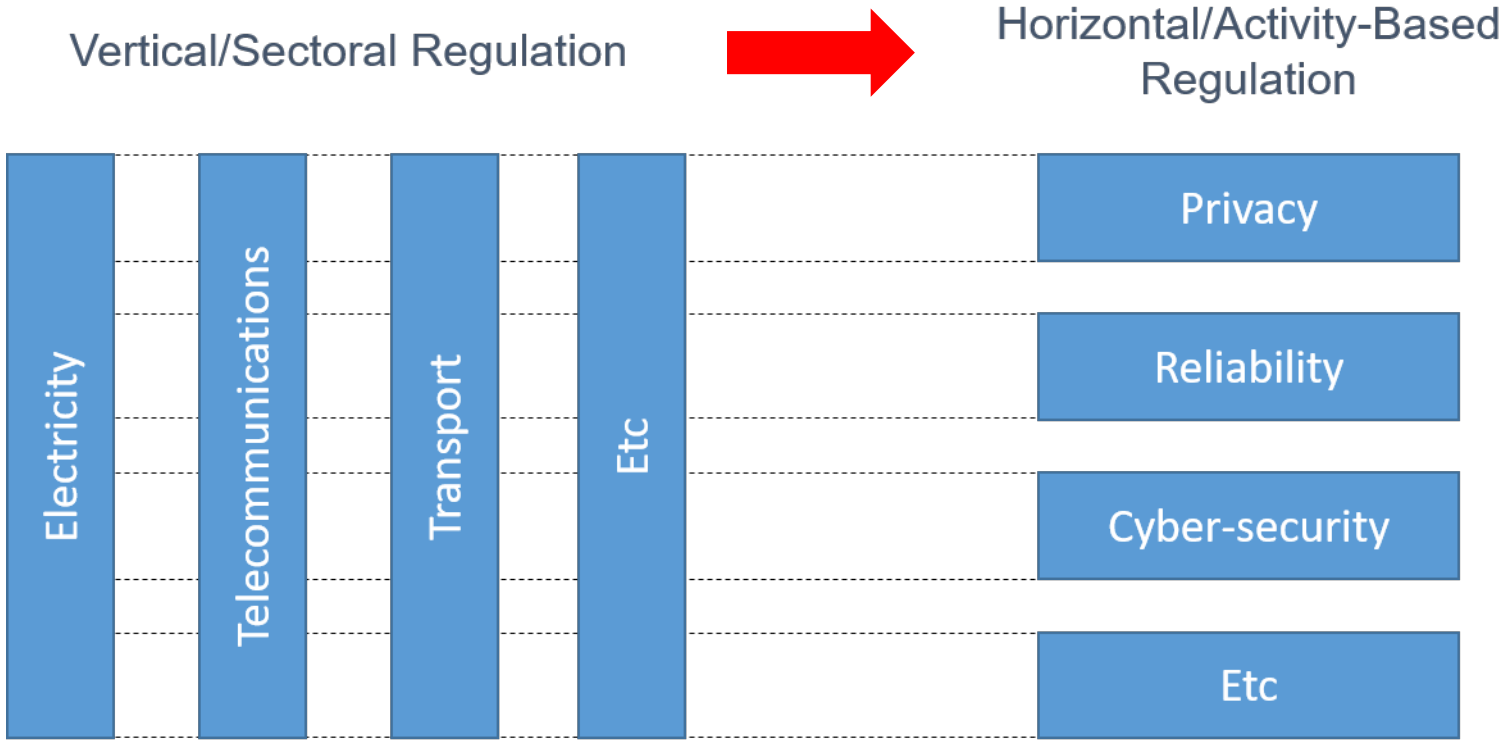
- Regulation can be:
  - *Vertical/sector-specific* – e.g. transport regulation focuses on all matters (safety, reliability, etc) for just that sector; or
  - *Horizontal/activity-based/pan-sectoral* – e.g. privacy, workplace safety or competition regulators focus on one activity, but for all sectors.
- Traditional sectoral boundaries are increasingly blurring – e.g. Uber into deliveries, power companies into broadband, EVs spanning electricity and transport:
  - Potentially heightens traditional regulatory concerns – e.g. safety, reliability – and creates new ones (e.g. privacy);
  - Regulatory choices in one sector affect the other, but often not coherently (or even wittingly, by design).

Increasingly Pan-Sectoral Regulation (cont'd)



Increasingly Pan-Sectoral Regulation (cont'd)

- Should therefore expect to see regulation becoming increasingly horizontal, and decreasingly vertical …



Increasingly International Focus (WP s. 7.7.6)

- New technologies, business models and players oftentimes originate overseas:
  - Data-based disruption is essentially “weightless”, and features strong scale and scope economies; and
  - DBDs likely to develop approaches for high-value markets (e.g. US, EU), and then roll them out to smaller markets (e.g. New Zealand) at low marginal cost.
- Regulation will increasingly confront jurisdictional issues and muscular regulated firms:
  - Instead, international regulatory coordination and cooperation should take a more prominent role – especially to avoid DBD “techlashes”;
  - Also, to encourage local innovation by overseas DBDs, rules may even need to be relaxed (e.g. Amazon facing antitrust penalties in New Zealand based on global profits).

Efficiently Dynamic Regulation (WP s. 8)

- "Set and forget" prescriptive regulation works fine in an unchanging environment:
  - Its "commitment power" can be a virtue when long-lived investments are required of regulated firms.
- But in a rapidly changing environment both the rationale for regulation, and its feasibility, can quickly become outmoded:
  - Potentially becoming impotent (i.e. new technologies leapfrogging/sidestepping regulation) and/or an obstacle to desirable innovations.
- As above, balance of convenience shifts (relatively at least) away from commitment towards flexibility/responsiveness …

From “Set and Forget” to “Predictably Responsive”

- This suggests a shift away from prescriptive “set and forget” towards “predictably responsive” regulation – what I call EDR.
- In an increasingly changeable environment, regulation can’t be flat-footed, and must instead be more nimble and responsive – but in a foresignalled way, and with clearly understood purpose:
  - Such regulation is also strategic – it helps firms and consumers understand how regulators will navigate future uncertainties.
- Contrast telco and EDB regulation in New Zealand:
  - EDB regulation *presupposes change won’t occur*, so effectively ignores it – this is an inadvertent and most likely distortionary choice about uptake; and
  - Telco regulation *presupposes change can occur and plans for it* – i.e. five yearly reviews of whether regulation still needed, though even these are backward-looking (vs EDR).

Second-Order Commitment Power

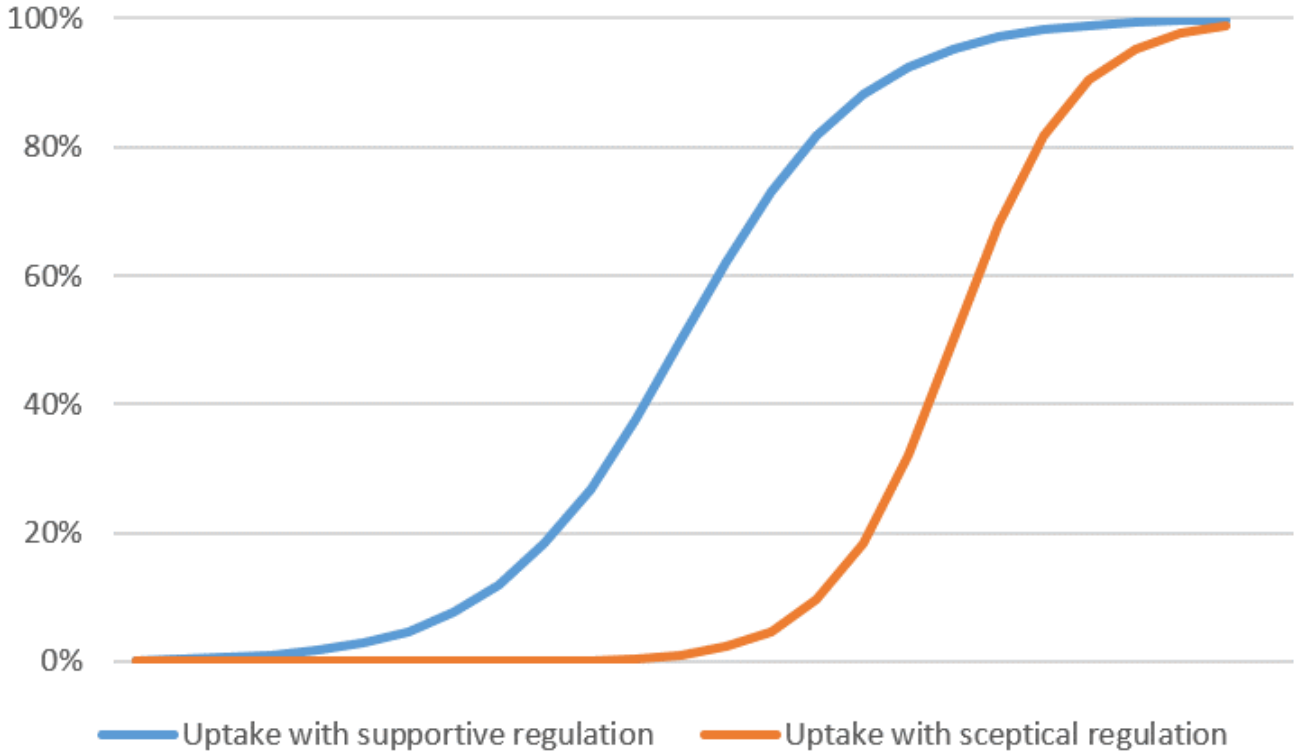
- At the same time, commitment power can be preserved at a second-order level at least.
- Specifically, any regulatory compact between regulators and firms:
  - Qualifies "I promise to allow you to recover reasonable investment costs";
  - By adding "… *provided no technologies or business models emerge that better serve (specific types of) consumers in the long-term*".
- Signalling this in advance as the "regulatory rules of the game" makes it clear that regulators are not going to favour any given firms, technologies or business models:
  - Only those best serving long-term consumer interests.

Honouring Regulatory Compacts to Preserve Credibility

- Clearly if regulators did make promises to regulated firms in the past, and those promises were relied upon when making long-term investments, those promises shouldn't be lightly broken:
  - E.g. consider New York cabbies who paid $1m for a taxi medallion before Uber turned up.
- Raises questions of how "winners" might compensate "losers who had been made promises":
  - So that welfare-enhancing change can proceed, without regulators' promises being revealed to be unreliable.

Bottom Lines – Regulating Uptake

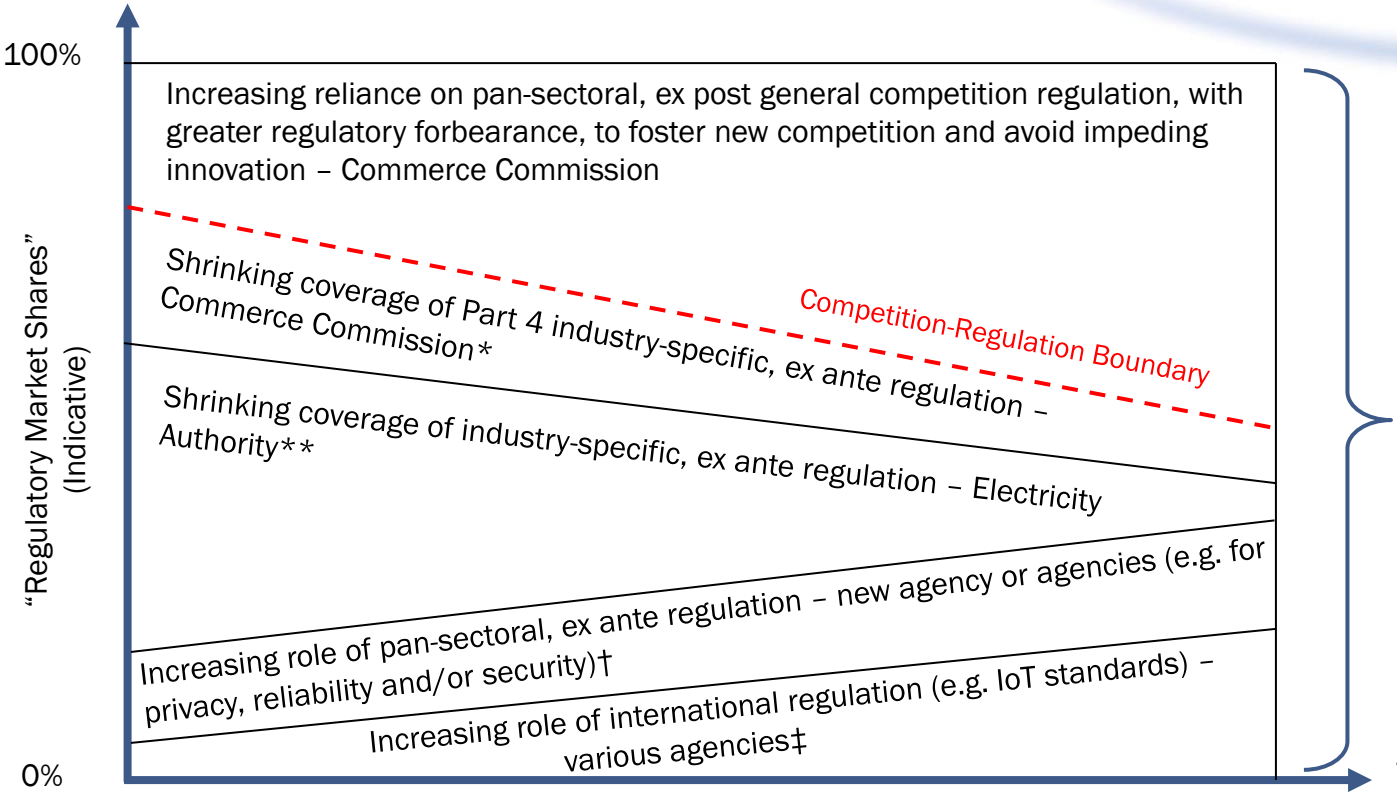
- Even status quo regulation is a choice about the nature and pace of uptake of new technologies and business models – the question is whether it is a conscious one (or a good one)?



Bottom Lines – Regulating Uptake (cont'd)

- Regulators, firms (incumbents and entrants/disruptors) and consumers are engaged in a multiplayer "game":
  - Innovation, entry and uptake of new technologies and business models reflect the combined choices of all three groups.
- Regulation therefore matters, and can play an important role in helping to resolve critical strategic uncertainties:
  - Beta/VHS, CDMA/GSM, BEV/hydrogen represent key strategic choices not clearly best resolved through competition alone;
  - Existing regulation (and approaches for updating it) affects those choices, for better or worse.

“Regulatory Market Shares” (WP Figure 13)



Transition:

- Guided by efficiently-dynamic regulation:
  - Clear (de)regulatory rules, criteria, processes and accountabilities; and
  - Conscious/transparent strategic choices; and
- Subject to clear, pro-active and accountable, pan-sectoral regulatory oversight and policy direction.

* 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.

Outline

Section

1. Background
2. Disruptive technologies
3. Disruptive business models and players – data-based disruption
4. Disruption in electricity?
5. Required high-level changes in “regulatory architecture”
6. Conclusions

Conclusions

- It seems inevitable that electricity sectors will become more consumer-focused and data-based – even if it takes non-traditional entrants to achieve this.
- Regulatory settings should be rebalanced in anticipation, along the lines suggested, unless status quo regulation happens to have gotten it right even though it was designed in a former age.
- The ERANZ White Paper is a monster, but only because it covers a lot of ground:
  - Today's presentation covers just a few of the bases – e.g. see WP ss 4.3.2 and 7.6.1-7.6.4 for pros and cons of new techs being owned by different owner classes, s. 5.4 on rethinking privacy, s. 7.4 on enabling decentralisation, …;
  - Deep dives on other such themes are possible – left for other presentations.