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ENERGY

Regulatory Blueprint to meet today's customer expectations

Final Report
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Presented to: Vector

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Context and Mandate

The energy teams of FTI Consulting LLP and Compass Lexecon (together "FTI-CL Energy") have been engaged by Vector Limited to provide expert advice and services in relation to the regulation of Electricity Distribution Business ("EDBs") in New Zealand.

This Report outlines our views on:

- Main transformational changes of customer expectations and implications for the potential evolution of the New Zealand regulatory framework for EDBs;
- Different performance-based regulatory regimes and regulatory tools/mechanisms; and
- An assessment of a range of potential regulatory tools to identify those that are likely to be suitable to be implemented in the New Zealand context in order to provide an environment in which customer-centric behaviour is recognised and rewarded.

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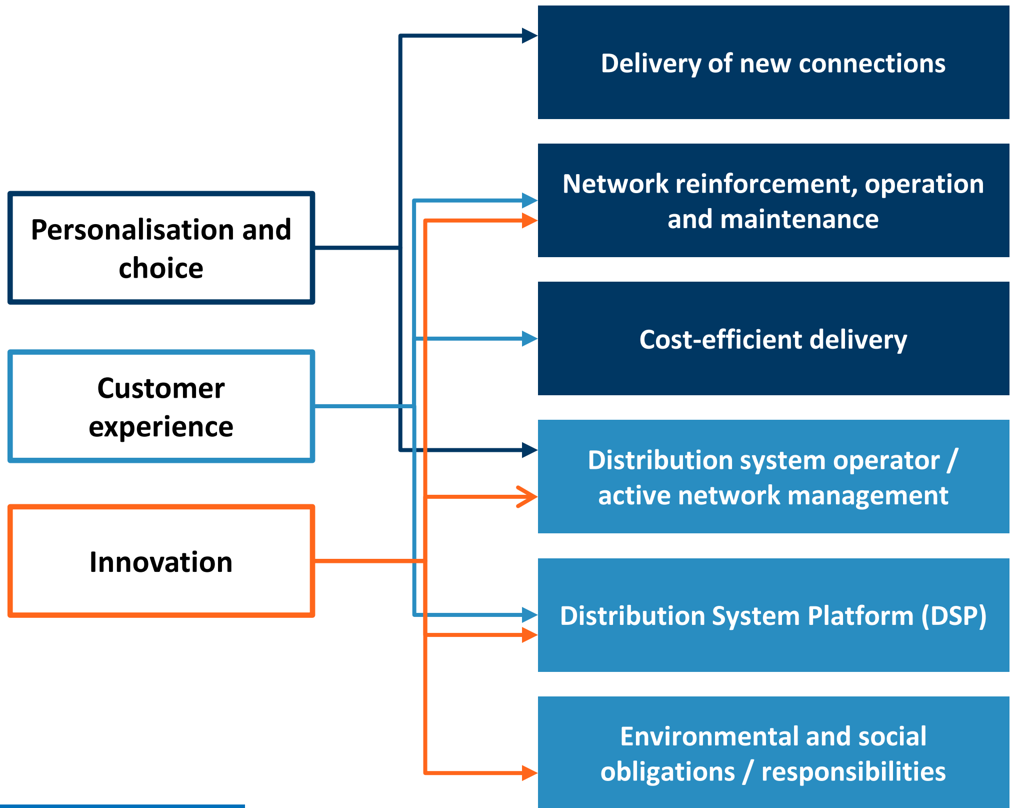
Figure 1: Application of regulatory tools to EDB roles

New customer expectations are emerging, driven by technology developments and experience from other industries…

…which drives the need for **traditional and new/emerging EDB roles** to evolve and adapt to deliver on those expectations.

The regulatory framework therefore needs to adapt to support EDBs in delivering these roles. Not all of the **regulatory tools** reviewed in this report are equally suited to provide this support, and no single tool is sufficient to address all the needs. To deliver on all of the EDB roles, a combination of different tools is likely to be appropriate.



EDB role	1 Enhanced reliability	2 Customer satisfaction	3 Innovation mechanisms	4 Uncertainty mechanisms	5 Totex
Delivery of new connections		✓		✓	✓
Network reinforcement, operation and maintenance	✓	✓	✓		✓
Cost-efficient delivery					✓
Distribution system operator / active network management	✓		✓	✓	✓
Distribution System Platform (DSP)		✓	✓		✓
Environmental and social obligations / responsibilities		✓	✓		

Six-page storyline (1/6): Technology developments and new customer expectations are changing traditional EDB roles….

Introduction: technology developments and customer expectations

As part of a global trend, the electricity market in New Zealand is undergoing significant change driven by **technological advancements** (e.g. smart meters, electric vehicles and storage), **customer behaviour**, and the **decarbonisation agenda**. The challenges associated with the deployment of intermittent and distributed generation are well documented and actively discussed in the New Zealand context.

At the same time customers expectations are increasing due to services they receive from companies outside of the regulated energy space. Our case studies suggest that EDB customers increasingly expect more **personalised services**, **innovation** and a better overall **customer experience**.

EDBs cannot safely disregard changing customer expectations, as customers have the option to reduce their total consumption or even to disconnect from the grid, thus bypassing the EDBs. A potentially shrinking pool of connected customers may represent a significant revenue risk to EDBs.

In light of these developments, the roles played by EDBs are likely to change. As such, the regulatory framework may need to evolve to provide an **environment in which customer-centric behaviour is recognised and rewarded**. EDBs as regulated monopolies may not be able to deliver these outcomes alone (e.g. in the absence of adequate funding being approved by the regulator). Therefore, a supportive regulatory framework is needed to support the transition to enable EDBs to serve customers better.

The upcoming price control review in New Zealand presents a significant opportunity to design and implement **new regulatory tools** that could set the appropriate financial and incentives to **meet the rapidly evolving customer expectations** in New Zealand and deliver a co-ordinated and customer-centric network in a **cost-efficient** manner.

In this context, the energy teams of FTI Consulting LLP and Compass Lexecon (together "FTI-CL Energy") have been engaged by Vector to identify potential regulatory tools to enable New Zealand EDBs to transition to a digital, decentralised, and customer-centric energy future.

Evolution of traditional EDB roles

From the perspective of customers, EDBs traditionally delivered new connections and network reinforcements, while minimising costs, driven by incentives that were designed to achieve these objectives. In this framework, the customer has been a relatively 'passive element'.

However, as customer expectations evolve, EDBs may need to deliver more within the confines of their traditional roles:

- **Delivery of new connections**. To ensure customer needs are met in a timely fashion, EDBs are likely to need to constantly develop pre-application support, greater choice and flexibility in the range of solutions offered, as well as effective, timely and proactive communication and support.
- **Network reinforcement, operation and maintenance.** The design and operation of distribution networks may need to change to ensure that customer objectives can be met in a cost-effective and pragmatic way. For example, with more asset data available, EDBs can better use data to create new customer experiences. While EDBs already provide some information to stakeholders, this process can be enhanced to provide greater upfront visibility of planned spend/activities. Similarly, a move from condition-based maintenance towards the measurement of total risk across EDBs' asset base could unlock not only more efficient spend, but better tailoring of expenditure to customer needs.
- **Cost-efficient delivery.** What customers consider to be an 'optimal' or 'cost-efficient' service level may no longer be based on the traditional asset-heavy solution and it may no longer be uniform across all customers. On the first issue, EDBs may need to open up the delivery of network requirements to new non-wire solutions and customer-sided solutions. On the second issue, customers now have growing expectations that they can choose the price-quality combinations that suit their individual preferences (albeit with geographical differentiation) and EDBs may need to adapt accordingly.

Six-page storyline (2/6): …and create completely new roles for EDBs, both of which require the regulatory framework to adapt.

New and emerging EDB roles

The electricity system is becoming increasingly integrated, and the traditional boundaries between energy participants are starting to blur. Power flows are no longer one-directional (from centralised generators to consumers), making the task of operating them and maintaining reliable supplies more complex and potentially more costly in the absence of new innovative solutions.

It may no longer be sufficient for EDBs to deliver solely on their three ‘traditional’ roles, but rather the **range of activities and roles that EDBs need to play in the future may need to expand** to deliver customer expectations and to transition cost-effectively to a low-carbon energy system.

We have identified three such roles for EDBs:

- **Distribution system operator (“DSO”).** Traditional boundaries between different players across the electricity system are being blurred and EDBs may need to expand their roles, acquire new tools and skills to quickly respond to the evolving customer needs. As DSOs, EDBs could take on an extended role in directly procuring services (e.g. flexibility) to support their operation of the distribution grid. We have identified four potential areas that may need to be considered: the transmission – distribution interface; a more ‘active management’ role; a market ‘architect’ role; and a more coordinated relationship between EDBs and secondary networks.
- **Distribution system platform (“DSP”).** EDBs are likely to evolve towards platform business models which integrate new and innovative energy resources. In this role, EDBs could act as neutral enablers for market participants to connect with each other and compete on a level playing field.
- The key difference between the DSO and DSP roles is that under the DSO role, EDBs would interact directly with a variety of market participants and potentially procure services from them; whereas in the ‘platform’ role, EDBs would facilitate direct interaction among non-EDB market participants. In the new DSP role, EDBs could also facilitate the development of neutral markets for more efficient whole system outcomes – effectively enabling other market participants to connect to each other (although customers may still expect to “trust” EDBs who may therefore need to provide quality control).
- **Environmental and social obligations.** Customers may increasingly expect EDBs to provide an enhanced level of information on their approach to conducting business ethically and with sensitivity towards social, cultural, economic, and environmental issues.

The need for evolution of regulatory framework

There is no single ‘best’ regulatory practice, and regulators need to apply judgement to determine an appropriate mix of regulatory components (such as base revenue, capitalisation rate,[1] weighted average cost of capital and incentive rewards) to use in particular circumstances. However, regulators typically aim to ensure that efficient companies are able to finance their regulated activities.

To meet this objective, it is generally not appropriate for regulators to consider individual regulatory tools in isolation. Rather, it is necessary to consider the different elements of the price control package **“in the round”** — as part of a balanced approach to the overall settlement.

Regulatory frameworks can be mapped out on a spectrum ranging from: traditional **input-based frameworks** with limited set of customer-centric objectives; to **output-based frameworks** with a stronger focus on delivering outcomes that matter the most to the end customers. Input based frameworks are designed to encourage cost-efficiency, subject to achieving a certain level of service quality (e.g. through SAIDI/SAIFI measures). While this approach has been generally successful in reducing total costs, it is now becoming insufficient to meet the new industry challenges **to meet evolving customers expectations**.

The two frameworks are **not mutually exclusive**. Rather, the transition from an input-based to an output-based regulatory framework can be seen as an evolution of the traditional framework that includes additional and complementary output-based regulatory tools, such that the overall regulatory outcomes are focused on customers.

The analysis in our report considers whether (and where) **elements of an output-based regulatory framework might be attractive** for potential implementation in New Zealand.

1) *Capitalisation rate is the proportion of the EDB expenditure that is included in the Regulatory Asset Base during a regulatory control period.*

Six-page storyline (3/6): Case studies identified five regulatory tools, assessed against principles of good regulation.

Consideration of regulatory tools

Good regulatory practice relies on the key principle that the **risks should be allocated to the party best able to manage them**. Building from this principle, there are range of possible tools that can be used to address a range of risks. In this report we focus primarily on the issues related to the **risks that are fully and/or partially controllable by EDBs** (rather than pass-through costs for non-controllable risks), as these are less straightforward to design than pass-through costs.

In our analysis of individual regulatory tools we therefore assess the overall balance of risks allocated to consumers as opposed to the regulated entities (noting that the overall quantum of risk does not change).

Spectrum of regulatory tools

Regulatory tools can be designed and deployed in a variety of ways, and the selection of the most appropriate one(s) depends on regulatory/policy objectives, availability of data, desired risk allocation and the type and ‘sharpness’ of incentives the regulator seeks to use.

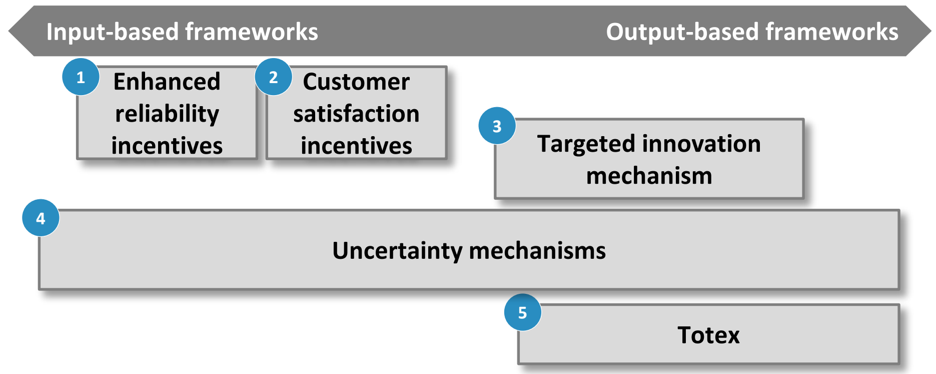
The tools we have selected and analysed represent, in broad terms, an **evolution from a pure input-based model towards a fully-fledged output-based framework** (although in some cases the tools are not “sequential” along this path) and thereby indicate a **potential pathway** for regulatory tools that could be implemented, potentially **over the course of several price control periods**.

In this report we have focused on following five tools and associated case studies:

1. **Enhanced reliability incentives** Energimarknadsinspektionen Swedish Energy Markets Inspectorate
2. **Customer satisfaction incentives** Ofwat
3. **Targeted innovation mechanisms** ofgem
4. **Uncertainty mechanisms (case study: GB-Ofgem – RIIO[1])** ofgem
5. **Totex**

Figure 2 below summarises where, on a spectrum between input-based and output-based frameworks, the five regulatory tools can be placed.

Figure 2: Spectrum of regulatory tools



Assessment criteria for regulatory tools: four key principles

We assessed the regulatory tools based on the following principles of good regulation:

Transparency: The tool needs to be based on outcomes that are measurable and observable, with sufficient and accurate information available to set the key tool parameters.

Efficiency: The outcomes targeted by incentives need to correspond to outcomes which are within EDB influence (and which customers are willing to pay for).

Proportionality: The intensity, level of effort and timescales of the tool need to reflect customer preferences and be relatively straightforward to implement / monitor.

Simplicity and consistency: The outcome and the incentive must be sufficiently simple and consistent to allow customers to recognise its value, to be practical to implement, and to avoid ‘gaming’ by EDBs.

Building from these four key principles we have adopted a **traffic light rating system** to indicate alignment with our criteria. The definition of the scores is intuitive: with green representing full alignment of the tool with the principle of good regulation and red representing a significant deviation from the defined key principle.

1) *Ofgem is the energy regulator in Great Britain. RIIO is the regulatory framework and stands for Revenue = Incentives + Innovation + Outputs*

Six-page storyline (4/6): Based on the assessment, we identified the range of potential short-term and long-term changes.

Assessment of regulatory tools

Enhanced reliability incentives, where necessary and appropriate, can be implemented as an **"add on" to the existing framework in New Zealand**. This could represent simple design changes (e.g. the inclusion of **new metrics** such as Customers Experiencing Multiple Interruptions). More complex variants that allow for **price-quality differentiation** would need to take into account customer interests, and are likely to only be suitable for implementation in the medium term.

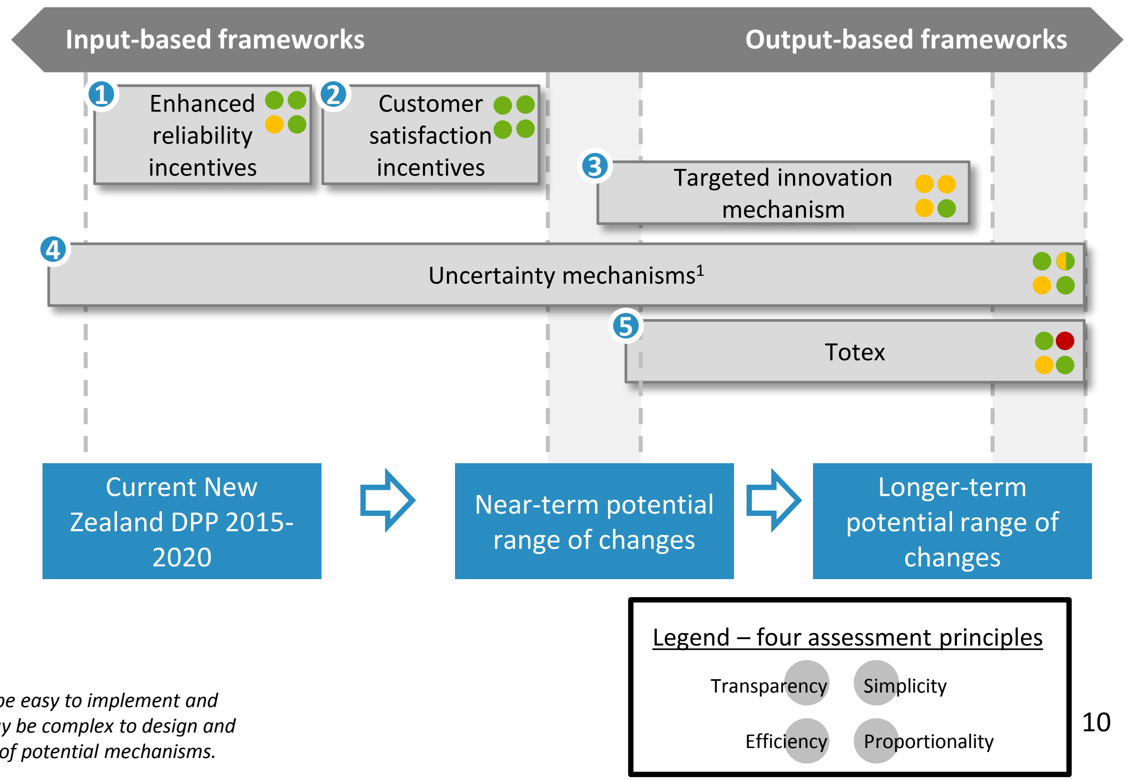
Customer satisfaction incentives directly encourage EDBs to serve their customers better, and have the potential to provide the **appropriate level of funding for meeting evolving customer expectations**. There are a number of well established precedents can could be used as a starting point for the design of this tool in New Zealand. In addition, the conceptual objectives are straightforward to articulate and explain to stakeholders.

Targeted innovation mechanisms represent a purpose-built tool to deliver the sole **objective of increasing the level of innovation** within the industry. This tool is relatively broadly focused – by its nature, innovation can deliver improved customer outcomes both in the current EDB roles (e.g. innovation in the delivery of new connections of network operation) as well as the new and emerging EDB roles (e.g. innovation in the DSO role and DSP role). Some of the simpler variants are relatively straightforward to implement in the short run, but more complex variants (e.g. competition among EDBs for a fixed pot of innovation funding) may be more suitable for the long term.

Uncertainty mechanisms ("UMs") introduce **flexibility to deal with identified uncertainties** by balancing the risks between customers and EDBs. This tool is highly versatile and can be applied to manage a wide spectrum of risks with varying levels of complexity. Volume driver adjustments, for example, are relatively narrow-focused and are most suitable for outcomes related to the delivery of specific level of output where high uncertainty is observed (e.g. uptake of electric vehicles). More complex uncertainty mechanisms would require extensive consultations to be undertaken, but **could be considered for the long term**.

Totex is a relatively novel regulatory tool that (excluding GB) has not been tested extensively by regulators and is not, as yet, part of the 'standard' regulatory toolbox. It **places the onus on EDBs to select the optimal set of solutions**, and as such is likely to be highly effective in enabling EDBs to deliver on their traditional roles. However, due to the **limited international precedent** we consider that a Totex approach **could be considered in the long term**, but not in the short term. Italy's example shows that there is long lead-in period to implementing Totex, with a number of preliminary activities that need to be initiated well ahead of the actual implementation date. These five regulatory tools (and the potential implementation timelines) are summarised in Figure 3 below.

Figure 3: Spectrum of regulatory tools and recommendations



1) There is a wide range of potential Uncertainty Mechanisms, some of which may be easy to implement and understand, but for other variants, specific quantitative mechanism parameters may be complex to design and agree on. The scoring of UMs against the principle of 'simplicity' reflects this range of potential mechanisms.

Six-page storyline (5/6): Changes in customer expectations and EDB roles drive Blueprint levers: recommendations for New Zealand

Implications for DPP in New Zealand

The current DPP is largely an input-based framework with basic network reliability incentives, as well as some simple uncertainty mechanisms (such as indexation and re-openers in relation to catastrophic natural events).

Based on the analysis in this report, we consider that there are **opportunities for new and additional regulatory tools to be introduced** that would reflect evolving customer expectations and wider changes in the New Zealand energy market.

It is unlikely to be appropriate for all of the proposed regulatory tools to be introduced at the same time – some of them are more suitable for the near term (as they require relatively limited preliminary activities and consultations), while others require extensive public consultation and careful design to be implemented.

In any event, each of the recommendations proposed below needs to be considered in the context of the wider regulatory framework, to ensure that the detailed design complements the existing features of the regulatory framework in New Zealand and the regulatory settlement works well "**in the round**".

However, New Zealand appears to be **well placed to introduce some of these tools**, including **customer satisfaction incentives** (with designs that can be 'borrowed' from other jurisdictions), **UMs** and **enhanced reliability incentives** (both facilitated by smart meter data), and some of the simpler variants of targeted innovation incentives. In addition, **groundwork could be initiated in the short term** to set the industry on a path towards more complex output-based regulation (e.g. more complex UMs, innovation incentives and Totex).

Key recommendations

The five regulatory tools assessed in this report may be introduced at different timeframes, supporting different customer expectations of personalisation, customer experience and innovation.

Based on the analysis in this report we recommend the following:

1) Introduce **enhanced reliability incentives** to encourage EDBs to deliver reliability outcomes that are more tailored to customer preferences, thus supporting customer expectations of **personalisation** and **customer experience**.
2) Introduce **customer satisfaction incentives**, based on a combination of qualitative and quantitative metrics, to encourage EDBs to collect, analyse and respond to information on customer preferences. This could support the evolving expectations of better **customer experience**.
3) Consider introducing **incremental targeted innovation-focused incentives** (e.g. an allowance subject to cost-benefit analysis) in the short term, to support customer expectation of **innovation** but also to improve **customer experience**. Reserve more complex innovation tools (e.g. competition for funding) for the longer term, so that EDBs have time to prepare and to avoid undue regulatory disruption in the industry.
4) Build on existing experience with uncertainty mechanisms to introduce **volume-based mechanisms**, e.g. those that link directly to customer-driven uncertainty (such as deployment of EVs or DER), to support customer expectations of better **customer experience** and deliver more **innovation**.
5) Consider preparing the industry for a **transition towards a Totex output-based regulatory model**, by introducing new data collection requirements in the short term, but reserve the full introduction for the longer term. The implementation of Totex in the long run could support customer expectations of **personalisation**, **customer experience** and **innovation**.

Six-page storyline (6/6): To implement the Blueprint EDBs need to deliver appropriate outcomes: this report presents illustrative metrics

We have identified in Figure 4 below **examples of potential metrics** that can be applied to assess the performance of EDBs in their traditional and new/emerging roles, subject to a detailed consideration by the regulator and consulted on appropriately to ensure that their implementation aligns with the needs of New Zealand customers.

Figure 4: Examples of potential customer metrics

EDB roles	Suitable regulatory tools	Example metrics
Delivery of new connections	Customer satisfaction incentives Targeted innovation Uncertainty mechanisms	Speed of connection Proactive communication using preferred medium Customer satisfaction score
Network reinforcement, operation and maintenance	Enhanced reliability incentives Targeted innovation Totex	Reduce number of “worst served” customers Speed of reconnection Automated notifications Quantifiable target for consideration of non-wire solutions
Cost-efficient delivery	Totex	Price-quality differentiation Customer bill itemisation Ex-ante Totex sharing factor e.g. 55% of any underspend is retained by EDB

EDB roles	Suitable regulatory tools	Example metrics
Distribution system operator / active network management	Targeted innovation Uncertainty mechanism	Number of new services/products/markets offered (e.g. flexibility service, demand reduction) Customer-specific approach to monetising assets (e.g. PV)
Distribution System Platform (DSP)	Customer satisfaction incentives Targeted innovation	EDBs’ customer details enabling timely communication (measured by % of customers ‘up to date’) Third party flexibility services
Environmental and social obligations / responsibilities	Targeted innovation	Diversity and inclusion metrics Simple metrics to set targets and track progress in reducing waste and emission of CO_2 & SF_6

Legend – customer expectations
Personalisation
Customer experience
Innovation

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Chapter 2: Introduction

Introduction and background

Introduction and background

As part of a global trend, the energy markets in New Zealand are undergoing significant changes driven by technological advancements, customer behaviour, and the decarbonisation agenda.

Electricity Distribution Businesses ("EDBs") have a key role in delivering electricity to a growing number of end **customers**[1] who are, however, increasingly becoming more flexible in the way they consume energy both in terms of time and the volume of their electricity consumption.

Technology and customer changes

The shift towards a more decarbonised, decentralised and digitalised electricity system is accelerating. In addition, new technologies have the potential to transform how distribution networks are operated. The **decentralisation of energy** (distributed generation, storage and demand-side participation) means that a greater proportion of electricity flows and activity occurs at the distribution level. In addition, distributed energy resources are often intermittent in nature, making flows across the electricity network much more complex to predict.

At the same time, the rise of the **energy-efficient 'prosumer'** and the **digitalisation of operations** means that EDBs are now increasingly in a position to take on a more active role in their networks. For example, as power flows are no longer one-directional (from generators to customers), the task of operating them and maintaining reliable supplies is becoming more complex, and potentially more costly in the absence of new innovative solutions. **Smart meter** data has the potential to provide new and better quality information about customers' use of electricity, facilitate the development of new business models and give customers more control over their consumption. New Zealand has been a success story in terms of deploying smart meters (although network innovation has, to date, not occurred, or been enabled, to a significant extent).[2]

The nature of investments is likely to change with altogether **new asset classes** emerging, and **new customer needs** being addressed, but this is happening in the context of **significant uncertainty** as to what the future networks may eventually look like. **Innovation** is expected to play a critical role in how distribution companies evolve and adapt to the new challenges arising from changing customer expectations, digitalisation and technological developments. Yet, it has historically been limited in the EDB sector.[3]

Implications for the regulatory framework

To undertake new and uncertain investments, network companies need to be incentivised appropriately to benefit both their current customers and prepare their networks for future customers' needs.

A regulatory framework needs to evolve to better recognise that the **uncertainty is now greater than ever before**. Such a framework could encourage EDBs to build closer links with all of their customers, but also provide a framework in which customer-centric behaviour is recognised and rewarded. One option to deliver this would be to develop a revised framework underpinned by **performance-based incentives**, with a particular focus on shifts in technology and the evolution of customer expectations, and reward those companies that best adapt to the new energy landscape.

Immediate opportunity to act

The current regulatory regime for EDBs in New Zealand, set by the Commerce Commission, known as the Default Price-Quality Path ("DPP"), seeks to meet a series of objectives for the long-term benefit of consumers.

The upcoming DPP reset period in April 2020, presents a significant opportunity to design and implement **new regulatory tools** that could set the appropriate financial and incentive structure to **meet the rapidly evolving customer expectations** and deliver a co-ordinated and customer-centric network fit for the 21st century in a **cost-efficient** manner.

1) *In this report, we define 'customer' as the downstream end user of electricity distribution networks, i.e. households or businesses that offtake electricity from the grid (or, in the case of 'prosumers', also produce it). Retailers and generators are excluded from the definition of 'customer' for the purposes of this report.*
2) *New Zealand achieved over 80% deployment of smart meters among household consumers by the end of 2017 (Electricity Authority, 2018, link).*
3) *For example, in 2018, EDBs spent 3% of their total regulatory expenditure on "e-tech" – such as network batteries and smart grid assets - link.*

Approach and methodology

The main objective of this report is to identify appropriate regulatory tools to enable New Zealand EDBs to transition to a digital, decentralised, and customer-centric energy future. Our analysis followed a three-step approach, as set out below. In Phase 1 of our work, we developed an understanding of the emerging challenges in the market, stemming particularly from evolving customer needs. We assessed a number of international case studies (**Chapter 3**) and explored how the traditional EDB roles are now increasingly supplemented with new and emerging EDB roles (**Chapter 4**). In Phase 2 of our work, we considered how other jurisdictions have addressed similar challenges and analysed the relevant regulatory tools used to deliver customer-focused outcomes (**Chapter 5**). Finally, in Phase 3 of our work, we assessed the extent to which different regulatory tools may be suitable for implementation in New Zealand (**Chapter 6**).

Phase 1

1 Emerging transformational challenges and the need to adapt the regulatory framework

- Based on a selection of international case studies from energy and non-energy sectors, we identified how EDB customer expectations are likely to change and grow, driven by the level and quality of services they receive from other companies in other sectors.
- We selected five case studies, in collaboration with Vector, and analysed them to understand how technology change allows companies to innovate and to meet, exceed and even create altogether new customer expectations.
- Against the background of the current regulatory regime in New Zealand, we have identified areas where new customer expectations and/or new roles played by EDBs are likely to require that different customer outcomes be delivered in the future.

Chapter 3
Chapter 4

Phase 2

2 Regulatory tools to deliver good customer outcomes

- In the second phase, we developed a framework for mapping different regulatory tools applied in electricity distribution networks in other jurisdictions.
- We have focused on five regulatory tools, identified in collaboration with Vector, that illustrate the key areas in which EDBs in New Zealand could be incentivised to deliver customer-focused outcomes in the future.
- For each of the tools, we assessed its relative advantages and disadvantages and illustrated their practical application by reference to a specific case study.
- Based on general principles of good regulatory practice we assessed how appropriate the regulatory tools might be as mechanisms to support EDBs' performance objectives going forward.

Chapter 5

Phase 3

3 Evaluation of potential regulatory options for a New Zealand Blueprint

- Based on our findings in Phase 1+2, we evaluated the regulatory tools that would effectively facilitate the transformational changes identified in Phase 1.
- We identified regulatory tools that could be suitable to implement in New Zealand in the short term, but we also set out a roadmap that could be followed in the longer term.
- Regulatory tools were selected based on:
  - Clarity and data availability to be implementable ("transparency");
  - Ability to accommodate new technologies and changing customer behaviours ("efficiency");
  - Being commensurate with the objectives they aimed to achieve ("proportionality"); and
  - Practicality to apply to numerous EDBs in the short run ("simplicity and consistency").

Chapter 6

Chapter 3: Changing customer expectations

Emerging transformational challenges and the need to adapt the regulatory framework

Fundamental changes in the market

In common with many other parts of the developed world, New Zealand's energy market is undergoing unprecedented change in the transition to a low carbon electricity supply system.

Technical, environmental, political and economic factors are driving changes in the way electricity is produced, with a growing emphasis on **renewables production** such as solar photovoltaic ("solar PV") and wind generation, as well as the progressive retirement of aging generation (as renewables are increasingly getting closer to being economically viable).

Customer needs are also evolving with the roll-out of smart meters, increasing digitisation and the potential large-scale transition away from the internal combustion engine to electric vehicles ("EVs").

Technological developments in **batteries and other storage assets** mean electricity may increasingly be stored in greater volumes (and more cheaply) than has historically been possible.

Customers have also increasingly displayed an appetite for gaining greater self-sufficiency, or at least **reducing their dependence** on the traditional grid-provided electricity, through a combination of own generation and storage assets.[1]

In the context of the drivers above, distribution networks still need to be developed in a way that enables electricity to be supplied reliably and cost-efficiently, despite the challenges raised by greater intermittency, reverse power flows, the increasing penetration of distributed generation, and greater customer engagement with the market (e.g. as enabled through smart metering and demand-side response ("DSR")).

Customer expectations are being shaped by other service providers' delivery

In addition to the drivers of change that are specific to the electricity supply sector, the expectations that customers have of the services delivered by distribution network companies are also evolving in response to changes taking place in other sectors.

Rather than being satisfied with the services that EDBs have historically provided, customer expectations appear to be increasingly shaped by reference to the services provided other companies, often outside of the regulated energy space. This reflects new levels of service that were historically under-provided.

For example, customers increasingly demand personalised goods and services, effective and proactive communication and seamless integration of products and services (e.g. technology upgrades) they receive. Moreover, customers appear to be increasingly willing to share some of their personal data in exchange for better service.

EDB customers do not compare Vector's performance to other EDBs, but rather to services they receive from other providers.

1) *Janet Stephenson (2018) Insights on Residential Demand - A High-level Summary of Otago's Work in the GREEN Grid Project to Date. Presentation at the GREEN Grid Conference 2018.*

Evolving customer expectations and their impact on EDBs are a key focus of this report

To assess the extent to which the current regulatory framework for EDBs in New Zealand is well placed to meet the new challenges arising from technological developments and changes to customer expectations, we set out, in the diagrams below, the emerging challenges that the EDBs faced. We consider that the technological drivers are relatively well known and familiar in New Zealand.

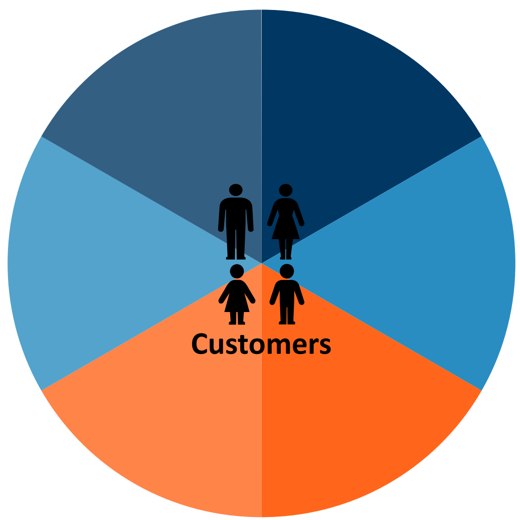
As a result, this report focuses primarily on the less well-documented issue of **changing customer expectations**. In particular, this report seeks to set out how the services delivered by other companies (often entirely distinct and separate from the electricity distribution business) may have a role to play in influencing and shaping EDBs customer expectations.

Technological drivers of change

Growth of distribution-level intermittent generation and behind- meter generation

Digitalisation of services across all industries

New technologies (EVs, heat pumps, storage and smart homes) customers are increasingly interested in



Experience from other industries

Personalisation & choice: Goods and services are increasingly personalised to their individual needs.

Customer experience: Customer expectations now transcend industry boundaries, with the belief that every digital initiative is due to have the end-customer experience at its core.

Innovation: Customers actively seek innovation and new services based on their needs and new technology.

- These changes are well documented and actively discussed in New Zealand…
- …therefore we have not explored them in greater detail.

- These changes are new and less well known and understood in the New Zealand context…
- …the following slides therefore present a framework for understanding how technological advances re-shape customer expectations…
- ….as well as five case studies that demonstrate how EDB customer expectations are shaped through their experiences in other industries.

The framework for assessing the evolution of customer expectations focuses on personalisation, experience and innovation

Figure 5: New customer expectations in the digital age[1,2]

New and evolving customer expectations:[1]	Uniform	Unintended	Insight driven	Tailored customer experience
Personalisation & choice Goods and services are increasingly personalised to their individual needs.	No attempt to understand different customer needs	Late payment penalties or bad debt costs or different tax treatment	Some attempt to understand different customer needs with broad customer segments	Understanding individual needs from precise data driven insights and customer engagement
Customer experience Customer expectations now transcend industry boundaries, with the belief that every digital initiative is due to have the end-customer experience at its core.	No direct contact or support	Reactive only	Clear, informative and relevant service information	Information at the tip of the customer's fingers and timely responses and feedback
Innovation Customers actively seek innovation and new services based on their needs and new technology.	"No investment"	Reluctant investment to maintain the status quo	Proactive investment to increase productivity	Redefine what is possible in terms of the service experience

Adapted from:

1) *World Economic Forum (2016), Digital Transformation of Industries: Digital Consumption - White Paper.* http://reports.weforum.org/digital-transformation/digital-consumption/

2) *Salesforce (2018) What are customers expectations (and how have they changed).* https://www.salesforce.com/research/customer-expectations/

We selected five case studies on customer expectations to illustrate how widespread the changes are in geographic and sectoral terms

Context

Customers do not consciously distinguish between regulated and non-regulated sector and therefore, when they observe high-quality service from a particular company, this is likely to naturally 'raise the bar' for other companies in the sector to potentially meet, as customers expectations adapt (regardless of whether there is a direct read-across between industries). This is why the performance of companies unrelated to electricity distribution, such as Spotify or Amazon, can influence New Zealand customer expectations of services they receive from EDBs.

Selection of case studies

We have selected five case studies from across a number of countries and industries to illustrate how customer expectations evolve in response to services offered by different companies. In some cases, we found that companies create entirely new sets of expectations.

The case studies illustrate the three categories of new customer expectations summarised in the previous slide: personalisation of services, customer experience and innovation. We explain the rationale for each of the case study in Figure 6 opposite.

Relevance for New Zealand EDBs

These case studies are not isolated examples of changing customer preferences and expectations and are not specific to particular countries or jurisdictions. Therefore, they provide relevant insights for New Zealand EDBs and the following slides set out where this is the case.

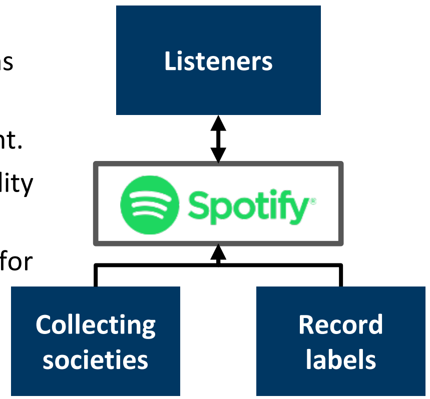
Figure 6: Case studies on customer expectations

1	Spotify	This case study shows that customers increasingly expect highly personalised and tailored service, including price-quality differentiation.	Personalisation; Customer experience
2	amazon	This case study shows that an effective combination of physical and digital networks (e.g. warehouse and online platforms) can serve more complex customer needs.	Personalisation; Customer experience; Innovation
3	sonnen	This case study shows that new business models that harness new technologies can disrupt existing energy markets and that EDBs are not immune from this risk.	Personalisation; Customer experience; Innovation
4	vodafone	This case study illustrates the challenges and the need for companies to continuously evolve "with technology" by considering the case of Internet of Things ("IoT") services.	Innovation
5	WESTERN POWER DISTRIBUTION — Serving the Midlands, South West and Wales	This case study shows a direct precedent for EDBs: distributors can excel in meeting customer expectations as long as the regulatory framework is supportive.	Customer experience; Innovation

Spotify's platform delivers a high level of personalisation to better predict and shape customer expectations

Spotify Proposition:

- Large content library which provides streaming or download options but only via Spotify platform.
- Learns user preferences and exposes users to new unknown content.
- Allows easy exploration of music (e.g. moods, genres, etc.) with ability to create and share playlists and music.
- Simple and transparent subscription models where consumers pay for continuous, personalised application of algorithms to enable distribution of continuously changing performance in the physical world.



Regulation

Copyright rules in various countries tend to be based on pre-existing industry standards.

Royalties are paid to both collecting societies[1] (representing songwriters, publishers, etc.) and record labels (representing artists), for musical compositions and sound records respectively. The licences detailing these royalties are likely to involve both 'mechanical' (when a song is reproduced) and 'performance' (when it is played) elements.

Copyright owners in the industry are now starting to create licenses customised for streaming services.

	Customer expectations in the related business		Future EDB customer expectations
	Before	**After**	
Personalisation	Customers have to regularly switch radio stations to find a song they prefer. Customers find it hard to discover new music or a broader selection of music.	**Spotify is a key differentiator which proactively drives customers expectations** Customers get to listen to whatever song they want on demand and can easily explore or be exposed to music unprompted from data insights that aligns with music they are likely to prefer.	Leveraging customer insights, facilitated by increased digitalisation, can enable EDBs to create a **platform** to articulate better ways of meeting customer demands.
Customer experience	Customers experience irrelevant advertising or miss their favourite music-related event.	**Proactive communication with customized advertisement** Customers find it useful to learn about relevant music events related to the music that they prefer.	Transition towards EDBs acting as system '**operators**' would shift EDBs towards a role where EDBs would be developing and managing new markets (e.g. for new flexible services – DSR, embedded generation, *etc.*).
	There is no interaction between the customers/demand and the supply.	**Effective communication enabled by the platform** Customers may interact by sharing their playlists. Customers are informed about outages of service.	By acting as a '**platform**', linking generators with customers, EDBs could improve forecasting of unplanned outages and update automatically to any changes to customer behaviour over time.

1) *Collecting societies are more likely to have effective local monopolies over musical compositions. Disputes for musical compositions are therefore more likely to be subject to Copyright Tribunals. Copyright Tribunals assesses if musical compositions are licensed on Fair, Reasonable and Non-Discriminatory ("FRAND") terms.*

Case study 2

Amazon leverages an online digital platform and physical infrastructure to redefine the retail experience

Amazon Proposition:

- Online retail and cloud computing platform with an extensive distribution network.
- Amazon Web Services ("AWS") provides on-demand cloud computing platforms on a paid subscription basis.
- Amazon Prime, a "tiered" service with increased focus on convenience.
- Tiered pricing, building on low pricing base to attract customers to use Amazon platform when they interact with third parties.
- Real-time communications.

Regulation

Competition law is the current approach for regulating Amazon (ex-post regulation).

However, as Amazon expanded its digital platform across different jurisdictions, it has triggered ongoing reform in the application of taxes to online purchases that occur across borders.

As a digital platform, Amazon is also expected (but not mandated by the regulation) to perform quality control of the seller products that use its platform.

	Customer expectations in the related business: Before	Customer expectations in the related business: After	Future EDB customer expectations
Personalisation	Customers receive irrelevant advertisement and only buy the products they know/need.	**Customer data generates targeted advertisement** Recommendations for future purchases based on past activity of the customer.	Use of customer data to tailor their activities to better match customer preferences (or to introduce **price-quality differentiation**) could be replicated by EDBs to and enable **cost-efficient** delivery e.g. improved scheduling of planned outages.
Customer experience	The hassle (and lack of trust) of online ordering - long waiting time for product to arrive and no information on the order status - and hassle to return products.	**Leveraging of digital platforms to ensure effective communication and deliver trusted online experience[1]** Status of purchase order is proactively communicated; any issues in the transaction are addressed promptly Direct communication between buyers and sellers facilitated through the platform.	Tomorrow's customer may wish to have continuous **pro-active communication** from EDBs about disruptions and real time updates about when power is expected to be restored. Customers may also want to know how EDBs' activities support societal outcomes such as **environmental and social** obligations and responsibilities.
Innovation	Online sellers required to develop their own capabilities such as inventory management and stock management.	**Integrating physical infrastructure into the digital platform to provide richer service** Amazon manages through its warehouse capability inventory, stock management and product data analytics and provides this to platform users.	EDBs may be expected to be able to seamlessly **integrate new customer energy technologies** on the network and to manage any associated technical issues.

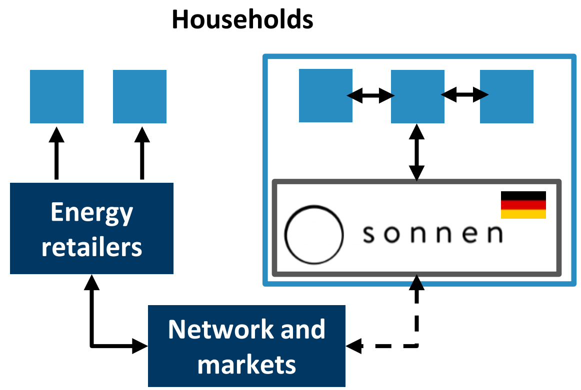
1) 'Trust' is a key concept here: the implication for EDBs is that the management of the platform puts a "trusted" party to ensure both physical transfers and balancing and financial balancing occur without incident .

Case study 3

Sonnen harnesses new technology to enable customers to access the market in new ways and engage with a wider pool of counterparties

Sonnen Proposition

- Provides 'tangible' renewable electricity by delivering local generation.
- Enables customers to share electricity within the community.
- Controls and optimises energy usage on behalf of customers, even to provide network and market services, using a virtual power plant ("VPP") model.
- Simple, accessible and affordable proposition enables to access new technology.



Regulation

Sonnen operates on the periphery of the traditional electricity supply chain which enables them to penetrate both unbundled and vertically integrated markets.

Deregulation/unbundling enables Sonnen to enter and disrupt the market in Germany, where it is actively delivering local renewable energy customers and ancillary services to the system operator.

Vertical integration acts as a barrier to market entry in the US. However, Sonnen has announced that it plans to power a new residential suburb in Arizona, as a VPP of 3,000 homes with solar PV and storage.

	Customer expectations in the related business		Future EDB customer expectations
	Before	**After**	
Persona-lisation	Customers have little interest in energy consumption and its origin ('all electrons are equal').	Customers share electricity with their neighbours, may prefer low-carbon electricity sources and have the choice to become more self-sufficient ('electrons are differentiated').	Enabled by new technology, customers request choice and value, thus creating a growing need to share data between EDBs, customers and retailers to enable **active network management.**
Customer experience	Customers are concerned about long-term performance of new technology and lack of qualified servicemen.	**Proactive automatized customer service** Digitalisation enables continuous performance monitoring, automated and remote maintenance and reparation, and if necessary, automatic scheduling of servicemen visit.	Proactive involvement of EDBs, enabled by **automatisation** and clear communication on the actions undertaken to take care of problems, could improve customer satisfaction.
Innovation	Customers find it too complex to optimise their energy use and see little value in another party doing it on their behalf.	**Customers become engaged 'prosumers'** Sonnen provides them the choice of acting as both producers and consumers depending on their needs. **Customers value the service of energy usage control and optimisation provided by another party** Sonnen offers the energy optimisation service with no action required from the customer.	Some customers are turning into 'prosumers' who see value in becoming more self-sufficient and independent from conventional retailers and networks. Transition towards EDBs acting as **system 'operators**' would require developing and managing new markets (e.g. flexibility services) at the local level.

Case study 4

Vodafone is reinventing its global network footprint originally designed for mobile telecommunication to deliver data and IoT services

Vodafone Proposition

- Global leader in IoT.
- Integration of physical assets and monitoring software through SIM IoT cards.
- Offer of digitalised and automated commercial processes with instant remote control - IoT.
- Network footprint with cellular networks in 25 countries (in whole or in partnership).
- Importance of data quality (video and buffering), representing a shift from traditional communications services which relied on coverage as main measure of network quality.

IoT device(s): connected cars, connected homes, industrial fridges, freight, manufacturing processes, building automation

↕

vodafone

Mobile communications network(s) in 25 countries | Global backbone | IoT platform

↕

IoT control

Regulation

Cellular network development touches upon many aspects of regulation - access to national radio-spectrum resources, call carriage services across different communications networks, local town planning rules for antenna deployment in urban landscapes and the regulation of roaming services - which have been relatively "light-touch".

In addition to these features of regulation, signal protocols have been subject to technical regulation which has defined the technology pathway across the different generations of mobile network technology.

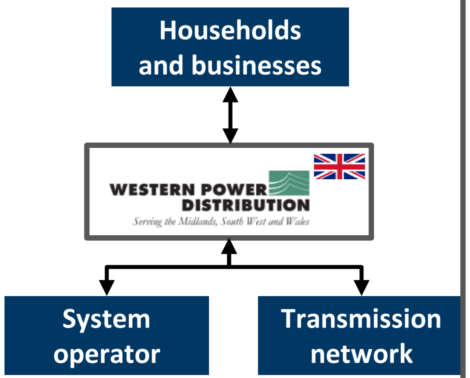
	Customer expectations in the related business: Before	Customer expectations in the related business: After	Future EDB customer expectations
Innovation	Limited customer expectations for telecommunications services (availability of mobile network). No expectation of extended entertainment services relying on data services.	**Improved quality of service creates more customer needs** Customers expect to be always contactable (e.g. remote areas or overseas), seeking higher throughputs (enabling data rich services, such as video with limited buffering).	**The electricity distribution network are likely to become a <u>platform</u> for orchestrating the energy resources of the future.** EDBs may need to recognise the evolving customer needs and expectations, and develop new / better services to match them. These new expectations may depend on customers' category (households or businesses) and on the availability of related products (e.g. a more developed network experience from other industries drives more complex customer expectations and needs from EDBs).
	Before IoT, there was no digital interpretation or automation with process and remote control and acceptance of human error.	**High quality data networks allow providers to offer new services** Customers independently operate their IoT networks (using remote control with low tolerance for human error) relying on high quality data services, which continue increasing their expectations for data rich decision-making services and automated processes.	

Case study 5

Western Power Distribution shows that a well designed regulatory framework can incentivise EDBs to meet new customer expectations

Western Power Distribution Proposition

- Electricity distribution in the Midlands, Southwest and Wales.
- Customer centric network operator with proactive stakeholder engagement.
- Coordination with other parts of the industry helps establish visibility of platforms for suppliers, aggregators and customers to offer non-network solutions to the distribution company.
- First network in GB to receive regulatory approval of data privacy plan for accessing household electricity smart metering data.



Regulation

Regulation of electricity distribution networks in GB determines an allowed revenue based on efficient costs and on quality objectives.

Customer satisfaction is one of the objectives monitored by the GB regulator.

Output-based Totex approach in setting total allowance with ex-ante efficiency incentive rate set at 70%.

	Customer expectations in the related business: Before	Customer expectations in the related business: After	Future EDB customer expectations
Customer experience	Customers have the ability to complain about poor service after an incident has occurred, but they are not notified prior to the interruption.	**Maximise customer satisfaction through proactive communication** WPD is incentivised to minimise customer complaints through effective communication on interruptions, connections, *etc.*	Proactive engagement from EDBs with a customer-centric focus could enable them to better anticipate changing customers needs and incrementally upgrade network **efficiently** as the customer need dictates, minimising the risk of stranded assets.
Innovation	Customers pay for a standard service, receiving electricity within the predefined offer (assumed number of interruptions).	**Active role at the local level, moving closer to a Distribution System Operator role** Offer of flexibility and reserve products to allow customers to connect larger-than-conventional capacities of EVs, solar PVs and storage Development of a market platform at the distribution level, to connect buyers and sellers of flexibility services.	EDBs are likely to need to take on a more active role in **balancing at the local level** and in establishing new commercial arrangements with customers to promote **cost-efficiency**. EDBs may need to develop **new commercial models** and **new technical solutions** that facilitate customers' choice (e.g. non-firm connections for low carbon technologies, or services provided by large energy users to increase demand[1] at times of high renewable output).

1) In GB, the system operator procures 'Demand turn up' services, for example overnight or during weekend afternoons in the summer (link).

Chapter 4: Traditional and new/emerging EDB roles

Traditionally, EDBs focused on a relatively narrow set of outcomes, within the confines of their traditional network roles (1/2)

As set out in the introduction, the shift towards a more decarbonised, decentralised and digitalised electricity system is accelerating. In light of these changes – both technological and in terms of customer expectations – the role of electricity distribution network also needs to evolve.

From customers' perspective, the key roles[1] played by traditional network owners and operators relate primarily to the overall economic efficiency in terms of finding the right balance between the cost of operating network infrastructure against the security benefits delivered to customers.

In all three of these roles, the customer has traditionally been a relatively 'passive' element and the quality of service has typically been determined based on a combination of regulatory oversight (that sets the minimum performance standards, often in technical terms) and the economic principle of cost minimisation.

First, **delivery of new connections** focused on the tried-and-tested methods of connections (with limited innovation), and the performance thresholds (e.g. time to connect new customers) have not been directly tied to the regulatory deal (e.g. allowed revenues). As a result, EDBs have had limited incentive to consider customers' preferences and/or to innovate. This may need to change to meet customer expectations on a more timely and proactive basis.

Second, **network reinforcements, operation and maintenance** focused on average measures of the network performance (such as frequency and duration of outages). With evolving customer expectations, EDBs now have a growing incentive to improve their quality of service, customer communication or other aspects of outage management.

Third, **cost-efficient delivery** focused on delivering minimum levels of service subject to the (typically regulator-set) technical parameters. There are now growing incentives to consider price-differentiation over quality (often to meet universal service obligations) and/or to innovate (insofar as any cost savings would be clawed back by the regulator).

In the following three subsections we describe how the changing environment re-shapes EDBs' three traditional roles. This evolution is important considering the changes that have occurred in other industries (e.g. music, online retail and other industries, as illustrated in the case studies in the previous section). The traditional EDB roles therefore increasingly need to meet new customer expectations of personalisation and choice, customer experience and innovation.

The following sections set out each of these three roles. Figure 7 in Slide 29 summarises the three roles, their objectives and how they might evolve in response to changing customer expectations.

1) Delivery of new connections

EDBs are facing a significant increase in the volume of new connections, and significant change in the type of new connections (e.g. renewables or EV chargers). This is driving a greater need for EDBs to change how they interact with customers.

Within the traditional approach to delivery of new connections, if significant works on the network needed to be undertaken, it could have taken significant amount of time (months, or even years) for a connection to be completed. However, if EDBs focused more on customer expectations, they may be able to avoid such delays if, for example, new network capacity is created in anticipation of future connection requirements. Alternatively (or as a complement), if EDBs found innovative ways to reduce the need for additional capacity (e.g. by actively helping customers to manage their load profiles), this could also speed up the process (for example, by reducing the volume of reinforcements required to deliver new connections).

To ensure customer needs are met in a timely fashion, EDBs are also likely to need to constantly develop and improve pre-application support, greater choice and flexibility in the range of solutions offered as well as effective, timely and proactive communication and support in providing network connections.

1) *In defining EDB roles we were guided by what is visible from customers' perspective, rather than by the EDBs' own perspective. This means that the shares of different roles in EDBs' overall activities, and subsequent cost, are not evenly distributed across the three traditional and three new / emerging roles.*

Traditionally, EDBs focused on a relatively narrow set of outcomes, within the confines of their traditional network roles (2/2)

2) Network reinforcement, operation and maintenance

Network reinforcement, operation and maintenance purely based on deterministic principles (such as the maintenance of an N-1 or N-2 technical standard) alone are no longer likely to be sufficient to meet changing customer expectations.

Rather, the quality of the network services is now a potential differentiator for EDBs to retain and grow their customer base. This is because customers who are poorly served by their network company (e.g. by deteriorating quality or by having to pay for 'gold-plated' design) are more likely to invest in back-up generation, reducing their off-take and thereby undermining the financial viability of EDBs (insofar as network charges are linked to the volume of energy consumed).

In parallel, together with the development of physical networks (EDBs' traditional role), new digital networks[1] are also being developed. The latter connect, for example, customer data (from smart meters) and new power delivery components (DSR, storage) to enhance control and monitoring of power flows and enable more informed customer options.

As a result, changes in how distribution networks are designed and operated may be required to ensure that the customer objectives can continue to be met in a cost-effective and pragmatic way. For example:

- With increased volume of data collected from their assets EDBs can better understand how to use data to create new customer experiences. While EDBs already provide some information to stakeholders, this process can be enhanced to provide greater upfront visibility of planned spend/activities.
- A move from condition-based maintenance towards measurement of total risk across EDBs' asset base could unlock not only more efficient spend but better tailoring of expenditure to customer needs.[2] This, in turn, would help increase customer confidence that their needs are being proactively managed by EDBs and that the quality of service is likely to be maintained and/or improved.

3) Cost-efficient delivery

The traditional focus on cost-efficient delivery may change going forward in terms of the types of solutions provided by EDBs, and in terms of price-quality differentiation. These two issues are explored in turn below.

First, the 'business-as-usual' asset-heavy network investments by EDBs may no longer represent the optimal solution for customers. This is because traditional asset-heavy solutions (such as new lines) may not be flexible enough to suit a range of uncertain future outcomes in the network (leading to the risk of asset stranding), and may therefore place unacceptable levels of risk and cost on existing and future customers. To address this issue, EDBs may need to open up the delivery of network requirements to new non-wire solutions.

Second, what customers consider to be an 'optimal' or 'cost-efficient' service level may no longer be uniform across all customers. Customers now have growing expectations that they can choose the price-quality combinations that suit their individual preferences. As a result, EDBs may vary the levels of service across groups of customers depending on their preferences. However, as this would deviate from established practice (a single-average-service standard), the actual implementation of any price-quality differentiation would need to consider universal supply obligations (for example, a minimum level of service – potentially with geographical differentiation – but enabling 'extras' to be delivered to customers who are willing to pay for them).

1) *The new and emerging network roles that EDBs may play in the future are considered in the following slides.*
2) *As an example in the UK, EDBs are reporting a range of Network Output measures (NOM) – NOMs are mechanisms that provide a means to monitor and assess overall network asset management outcomes. They represent the service delivery resulting from companies' asset interventions, and can be considered as a forward-looking indicator of network performance.*

A change of focus in delivering EDBs' traditional roles would be needed to meet evolving customer expectations

Figure 7: The evolution of traditional EDB roles and their typical objectives in response to new customer expectations

	Description of the traditional role and its focus	Evolving customer expectations from EDBs
1 **Delivery of new connections**	■ Focus on connecting customers using tried-and-tested methods. ■ Performance thresholds (e.g. time to connect new customers) not tied to the regulatory deal.	Going forward, EDBs may need to change processes to deliver: ■ Timely / speedy connections to enable economic growth and help to decarbonise energy consumption ■ Clear communication of the need for EDBs' involvement (e.g. why a tree needs to be removed); and ■ Effective and timely support from the EDB when customer upgrades / changes their consumption (e.g. installs solar PV, EV chargers).
2 **Network reinforcement, operation and maintenance**	■ Focus on a secure and reliable operation of the distribution system and of all its components and on minimising duration and frequency of interruptions while maintaining safety of the public and its workforce. ■ Focus on complying with determinist planning and strict technical standards, and on delivering agreed service thresholds. ■ Outage management and optimal planning of network works based on pre-set outage thresholds (SAIDI and SAIFI).[1] ■ Reactive customer communication (e.g. customer had to contact the EDB to enquire about outage).	Going forward, EDBs may need to : ■ Consider the distributional aspects (e.g. invest where customers suffer the most); ■ Develop a flexible risk-based approach to asset management; ■ Deliver clear, proactive and efficient communication regarding both planned and unplanned outages using customer's preferred medium; and ■ Deliver new types of assets to meet customer needs.
3 **Cost-efficient delivery**	■ Minimise cost of delivery of investment / avoid gold-plating. ■ Limited incentive to understand customer preferences and innovate accordingly (and the regulator is presumed to "know" customer preferences).	Going forward, EDBs may need to recognise that: ■ Cost-efficiency increasingly leads towards considering price differentiation as customers may prefer to choose different levels of service at different prices; and ■ Customers' preferences need to be understood (either 'automatically' through better use of data such as smart meters, or 'manually' through customer surveys).

1) *These metrics are System Average Interruption Duration Index ("SAIDI") the System Average Interruption Frequency Index ("SAIFI").*

Going forward, EDBs may also need to deliver on new and emerging roles in the context of a rapidly evolving energy landscape (1/2)

As shown in the previous slides, the fundamental technological and customer preference drivers have significant impact on the delivery of EDBs' traditional roles. In addition, these drivers mean that it may no longer be sufficient for EDBs to deliver solely on the three 'traditional' roles of needs, but rather that the range of activities and roles that EDBs may need to play in the future may need to expand.

In this section we set out new and emerging roles that EDBs that depart significantly from EDBs' traditional roles. Traditionally, the electricity transmission system has the role of active network management ("ANM") and system operation, while EDBs have had a more limited and mainly passive role in operating energy system. Similarly, environmental and/or social obligations were not traditionally the core outputs EDBs were required to deliver (although, in some cases, they would undertake these roles on a voluntary basis).

However, going forward, the evolving market environment is likely to require EDBs to embrace these new and emerging roles and start delivering new outcomes for customers. We have identified three such roles for EDBs:

- **Distribution system operator (DSO).** As DSOs, EDBs would take on an extended role in directly procuring services (e.g. flexibility), in maintaining voltage stability and in managing peak demand to support their operation of the distribution grid. As a result, the physical networks may increasingly need to be complemented by data networks and flexibility networks.
- **Distribution system platform (DSP).**[1] EDBs are likely to evolve towards platform business models which integrate new and innovative energy resources. In this role, EDBs would act as neutral enablers for local market participants to connect to each other and compete on a level playing field.
- The key difference between the DSO and DSP roles is that in the DSO role EDBs would interact directly with a variety of market participants and potentially procure services from them; whereas in the 'platform' role, EDBs would facilitate direct interaction among non-EDB market participants. However, the platform may need to give customers sufficient "trust", for example by providing quality control, and EDBs are likely be the ones expected to perform this assurance function.
- **Environmental and social obligations.** EDBs may need to recognise that customers increasingly expect that EDBs implement designs, processes and solutions that maximize the efficient use of natural resources, and also actively deliver on a variety of social obligations such as diversity of workforce, human rights, etc.

In the following subsections we describe how the changing market environment requires EDBs to take on three new roles. These are numbered (4), (5) and (6), as they are additional to the traditional EDB roles already described. Figure 8 in slide 32 summarises the three roles and how they might evolve in response to changing customer expectations.

4) Distribution system operator and Active Network Management

The nature and the roles of distribution systems are changing driven technological developments and shifting customer expectations. As a consequence, EDBs may need to expand their role into areas that were previously the responsibility of different parties to facilitate technology adoption. In turn, they may need to acquire new tools and skills to be able respond to the changing customer needs.

In addition, while traditional network asset-heavy solutions can deliver some inherent system flexibility, cost-efficient solutions are increasingly likely to require a more agile coordination and interaction of the energy supply and customer demand together with traditional assets on a localised basis.

There are two new roles for the traditional DNO to play:

- **Active Network Manager** role represents active control systems that enables full dynamic control of the network, generation and demand; and
- **Distribution System Operator** role builds on the ANM role above, but is much broader as it includes market arrangements to coordinate the operation and interaction of generation supply and demand of customers and assets on a localised basis.

1) *Several utilities in US (e.g. National Grid and ComEd in Illinois) started exploring the merits of transitioning the traditional utility business model towards a platform model.*

Going forward, EDBs may also need to deliver on new and emerging roles in the context of a rapidly evolving energy landscape (2/2)

5) Distribution System Platform

The availability of data on consumption, quality of supply and various other measures has been growing rapidly, and is increasingly provided by range of market participants (customers, EVs, battery storage operators, EDBs, etc.). In particular, as smart meters are increasingly deployed, the amount, quality and timeliness of information has been improving at unprecedented speed and creates new opportunities for this information to be used in optimising the overall system outcomes.

This is not unique to the energy sector and customers are familiar with how other service companies are using better and faster data to meet customer expectations. As a result, customers are now likely to expect EDBs to use the new data (some of which customers provide themselves) for their (customers') benefit.

In their new roles as DSPs, EDBs would facilitate the development of neutral markets for more efficient whole system outcomes – effectively enabling other market participants to connect to each other. Unlike the DSO role (which is effectively a 'radial' network from the DSO outwards to market participants), the DSP role would create a 'meshed' energy market that connects multiple parties to each other rather than connecting them to the DSO alone. In turn, this would be expected to drive competition and efficiency across various aspects of the energy system.

For EDBs to be able to play the DSP role, they are likely to need to invest in the creation of a platform to collect, manipulate and disseminate information among multiple parties. This cost would need to be considered against the expected benefits of the platform. Such benefits may include, for example, an opportunity for customers to monetise their existing (and new) assets, similarly to the way that Sonnen does (see customer expectation case studies) and also more active customer and third party engagement to support an efficient energy system.

6) Environmental and social obligations

Based on their experience from other (non-energy) companies, customers expect EDBs to provide enhanced information regarding EDBs' approach to conducting business ethically and with sensitivity towards social, cultural, economic, and environmental issues.

Customers may also expect proactive communication and interaction with EDBs on these matters, particularly insofar as they see such communication from other service providers.

As a result, EDBs may need to, going forward, demonstrate their commitment and measures taken to mitigate the (potentially adverse) impacts that electricity network activities may have on the environment. EDBs may also need to actively identify, measure and mitigate Corporate Social Responsibility and environmental risks.

Evolving market environment drives EDBs to embrace new and emerging roles and start delivering new outcomes for customers

Figure 8: The evolution of new and emerging EDB roles and their typical objectives in response to new customer expectations

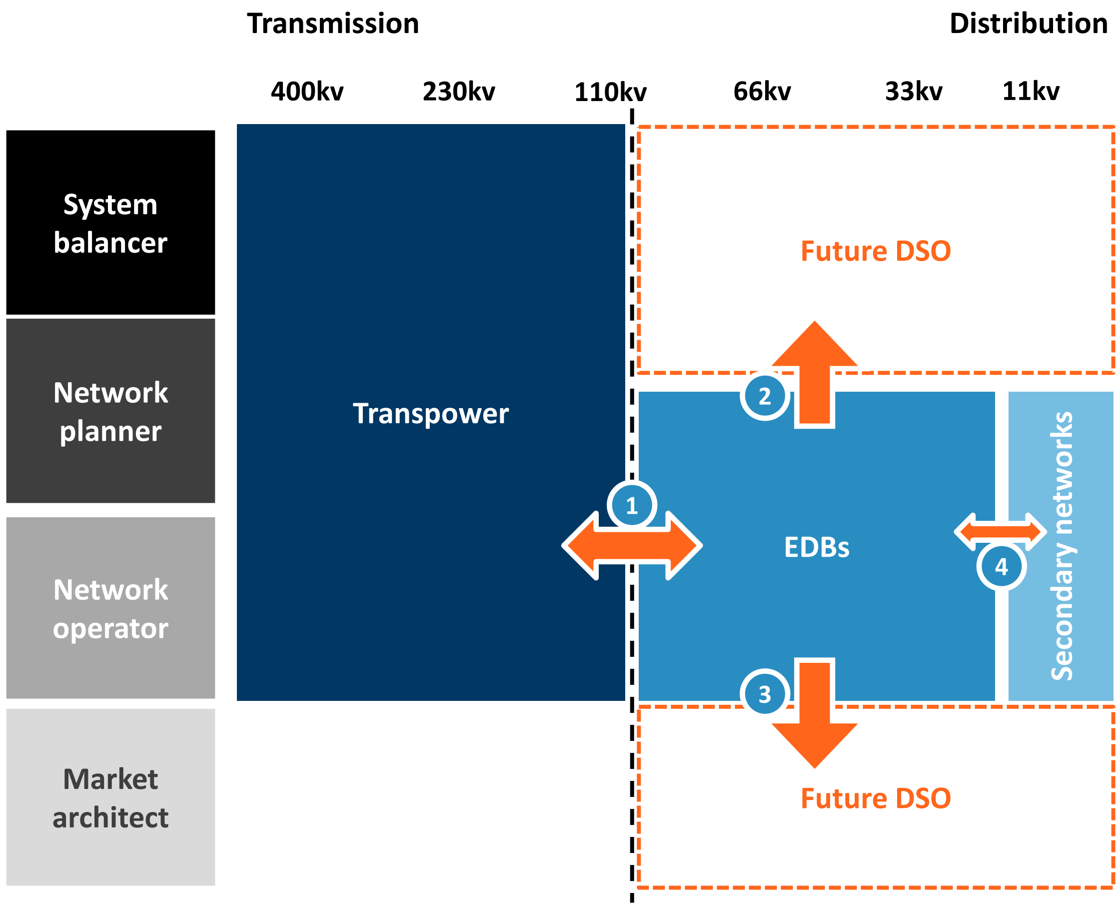
	Description of the new and emerging role and its focus	Evolving customer expectations from EDBs
4 **Distribution system operator / Active network management**	■ Historically, distribution network operators were mostly passive and focused on network building to deterministic planning standards, dimensioned primarily for load growth. ■ In the new role, DSO securely develops and operates an active distribution system comprising networks, demand, generation and other flexible distributed energy resources ("DER"). DSO also procures services directly from a variety of market participants.	Prosumers expect to benefit from the grid 'offtake' of excess power, despite the intermittency / reverse power flow issues they may cause. They also expect support from EDB in facilitating the use of new types of assets(e.g. monetising battery) and non-asset solutions. Going forward, EDBs may need to change processes to : ■ Proactively manage demand and supply balance locally; and ■ Use non-network solutions.
5 **Distribution System Platform**	■ Historically, EDBs had limited technical ability for EDBs to access, collect, link and utilise flexible, distributed resources… ■ …but increased digitalisation creates new opportunities, for example to create data platform to enable informed participation by users, competitive access to markets and optimal use of DER to deliver security, sustainability and affordability. DSP may also act as a facilitator of interactions among non-EDB market participants.	Data-sharing among EDBs, retailers, customers and 3rd parties to provide a better and more bespoke service is needed as customers have grown used to sharing their personal data (in a safe manner) to obtain better services. EDBs may need to: ■ Develop new DER management systems and use geospatial models of connectivity / control technologies so customers can interact with the EDBs / new commercial providers. ■ Create 'trust' in customers (e.g. by using technical standards to ensure seamless inter-operability, or by overseeing disruptive / intermittent DER).
6 **Environmental and social obligations / responsibilities**	■ Historically, EDBs' involvement was based on a voluntary approach – they would choose whether / how much to be involved. ■ However, EDBs now may play an active role in addressing social obligation challenges such as customer vulnerability (e.g. low-income, youth / elderly, disabled etc.) as well as environmental concerns (e.g. by considering cost of carbon in their decision making).	Customers are increasingly familiar with Corporate Social Responsibility, health & safety and diversity objectives of other firms. Going forward, EDBs may need to : ■ Improve the assistance they provide to vulnerable customers to ensure they have access to support that is available; and ■ Identify opportunities to enable energy solutions for vulnerable households.

Traditional boundaries between different players across energy system are blurring driven by a shift towards distribution system operators

In acquiring new DSO responsibilities we have identified following areas that need to be considered in terms of the design (summarised in Figure 9 on the right-hand side):

1. Transmission – distribution interface. With increased customer flexibility and penetration of DER there is a need for closer coordination between national and local balancing and congestion management. Maintaining a decoupling between local and national functions may, in the future, lead to an inefficient operation of the overall system.
2. *Move to a more 'active management role'.* Greater decentralisation could mean that EDBs could in the future provide more value by taking on a greater network planning role and system balancing role (e.g. running local flexibility markets, taking over some system operation activities). The regulatory framework would need to evolve (alongside the development of suitable incentives) for EDBs to compare and assess asset-heavy vs non-wire solutions on a like-for-like basis.
3. *Need for a market architect.* The increasing prevalence of distributed technologies (generation, storage etc.) mean that EBDs might need to take on a 'market architect' role to ensure (i) a level playing field for market access, (ii) efficient siting decisions, and (iii) strategic investments to ensure system security / favour key distributed technologies (e.g. EVs)
4. *Relationship between EDBs and secondary networks.* While secondary networks currently play a relatively marginal role in the overall electricity supply chain, greater 'off-grid' actions invisible to EDBs may affect the management of flows and provision of balancing services. It also affects how EDBs might engage with customers as customers take on a more active 'prosumer' role. In the interest of overall system efficiency, regulatory arrangements might be required to 'reveal' actions of secondary networks (e.g. requirements to participate in local services).

Figure 9: Areas of focus for emerging new EDB role - Distribution system operator



To incentivise EDBs to deliver against new and more complex customer expectations, the regulatory framework may need to adapt

Differences between regulated and competitive firms

Regulated monopolies face different economic incentives compared to non-regulated companies in competitive markets. The latter have an economic incentive to adapt and evolve in response to changing customer expectations (such as personalisation, customer experience and innovation) in order to maintain or even gain market share and they do so without a regulator's involvement. Companies that fail to adapt in this manner (e.g. Kodak) risk falling victims to Schumpeterian 'creative destruction'. However, EDBs do not naturally face such incentives to deliver against new customer expectations.

Rather, EDBs in a number of jurisdictions tend to be incentivised to focus on the delivery of outputs specified by the regulator, such as SAIDI and SAIFI. However, EDBs cannot safely disregard evolving customer expectations, as customers can, due to technological developments (notably renewables and storage), increasingly reduce their total consumption or even choose to go off-grid and thus bypass the EDBs. A shrinking pool of connected customers would represent a significant revenue risk to EDBs. Regulators, insofar as they represent customer interests, therefore face a (growing) need to closely consider and better serve evolving customer expectations.

While this incentive is not perfect, it is possible to complement the economic pressures with the right regulatory incentives to deliver customer-focused outcomes.

EDBs may benefit from stronger incentives to deliver outcomes that customers expect (and are willing to pay for)…

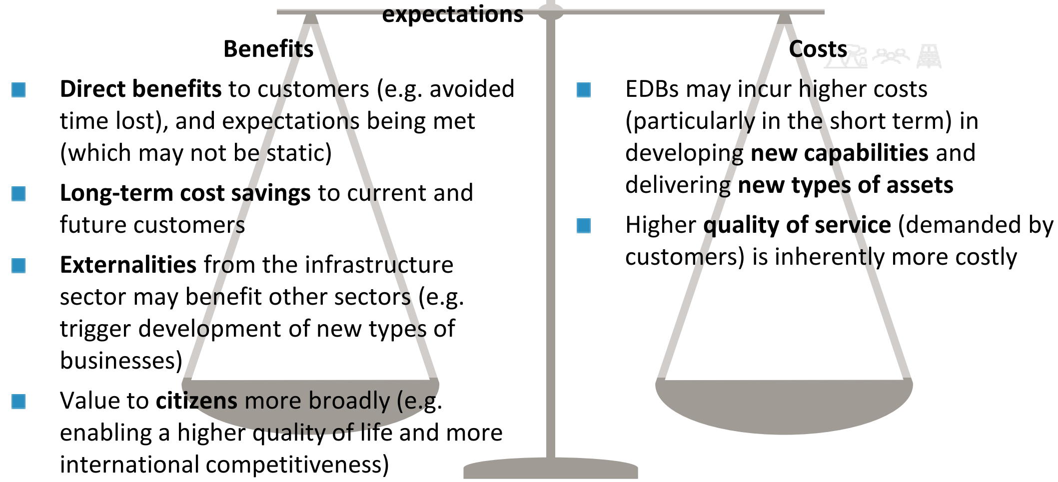
…otherwise they risk investing in programmes aimed at outputs that customers do not value.

Delivering desirable customer outcomes through a regulatory framework

Despite the differences between regulated monopolies and non-regulated companies, the regulatory framework can be set up in a way that mimics, albeit imperfectly, competitive outcomes for customers. There are three steps to this process, set out below.

First, the regulator needs to identify the costs and benefits of meeting new customer expectations. This is illustrated in Figure 10 below.

Figure 10: Comparison of costs and benefits of meeting new customer expectations



Second, the regulator needs to determine which customer outcomes – given changing expectations – are in fact desirable based on, inter alia, information on customers' price-quality preferences (which may need to be elicited from customers). The regulator may also need to recognise that a minimum level of service may need to remain in place to enable EDBs to fulfil their social obligations. This is intended to identify outcomes that mimic those of a competitive market.

Third, the regulator needs to **design and implement a regulatory framework that enables EDBs to achieve desirable customer outcomes. This third step is the focus of the remainder of this report.**

Chapter 5: Regulatory tools: framework and case studies

Regulatory tools: choosing the appropriate tool

Consideration of regulatory tools in the round

Electricity networks provide essential services for the environment, economy and, more generally, for a well-functioning society. However, they also tend to be natural monopolies and to be economically regulated.

For the overall regulatory framework to be efficient, it needs to take all the relevant factors into proper consideration. Regulators typically aim to ensure that efficient companies are able to finance their regulated activities.

Regulators often rely on incentive regulation to achieve incremental efficiency improvements through multi-year price control periods. In setting these price controls, regulators typically rely on a range of components such as base revenue, capitalisation rate, weighted average cost of capital ("WACC"), incentive rewards or penalties for over- or under- delivery, etc. The choice of the appropriate set of regulatory parameters and tools is a complex issue and, despite the extensive research on the subject, there is no single 'best' approach for regulation.

To meet this efficiency objective, it is generally not appropriate for regulators to consider individual regulatory tools in isolation. Rather, it is necessary to consider the different elements of the price control package **in the round — as part of a balanced approach to the overall settlement, given that many of the assumptions in a price control are uncertain.**[1]

Given the broad nature of network regulation, there are numerous overlaps and dependencies between price control and overall strategy for regulating the future energy system. With changing customer consumption and behaviour, special care needs to be taken around network charging and cost recovery to avoid distortions, maintain fair treatment for all system users, and allow innovation to meet customer expectations.

Wide spectrum of regulatory tools to manage different cost risks

In selecting a particular regulatory tool (or combination thereof), regulators effectively choose how much of the cost risk is allocated to customers as opposed to the regulated entities (noting that the overall quantum of risk does not change – it is the allocation among different parties that matters).

The two types of cost risk (to customers) can come both from under-investment in networks and from over-investment in networks.

Under-investment in networks may reduce short-term costs, but could increase congestion or quality of supply in the long run, leading to more frequent and/or expensive emergency responses, which could ultimately cost the end-user more.

Conversely, **over-investment in networks** may occur where, for example, the investment delivers outcomes that the customer does not desire ('gold-plating' or focusing on measures related to an outdated understanding of customer expectations). The topic of excessive investment is live and active topic of debate in other countries (e.g. Australia).[2]

In the following section, we consider how different regulatory tools can be used to manage different types of cost risks.

1) *For example, some of the assumptions underpinning the price controls, such as expected deployment of EVs or the level of the equity beta, cannot be observed directly and have to be forecasted or estimated.*

2) *Grattan Institute report recently discussed the issues related to the risk of future asset stranding (link) – see Section 6.2.*

Incentive mechanisms and uncertainty mechanisms are key tools regulators can choose to manage efficiently uncertain outcomes

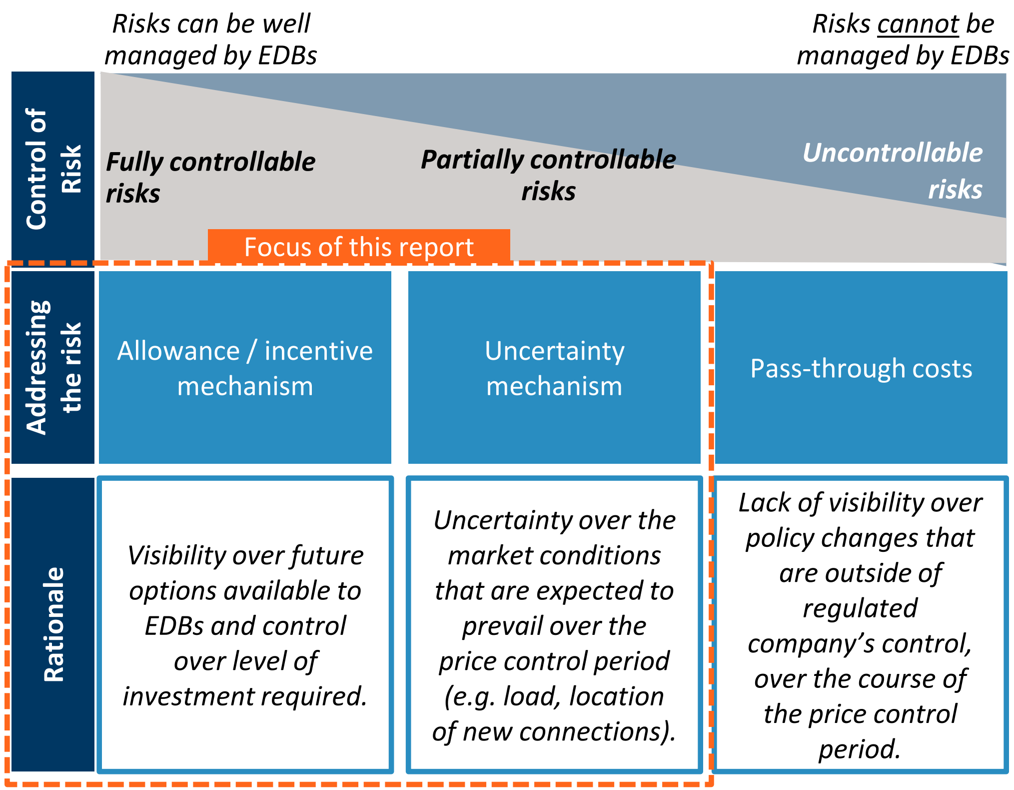
Not all customer-focused outcomes are equally as 'controllable' by EDBs.[1] Good regulatory practice relies on the underpinning principle that **risks should be allocated to the party best able to manage them**. Building from this principle, there are range of possible tools that can be used to address a range of risks. Each tool can be used in a variety of circumstances and, generally speaking, they are not mutually exclusive. The key requirement for selecting and designing an appropriate combination of regulatory tools is to have an understanding of the source of uncertainty and their implication for customers and EDBs.

On the spectrum how the risks are allocated (and the degree to which the cost risks are controllable by EDBs), there are three categories of costs facing EDBs (as summarised in Figure 11 on the right-hand side):

- **Pass-through costs.** For costs that are perceived to be beyond the control of the EDBs, the regulator can choose to apply a direct cost pass-through (subject to standard information quality processes).
- **Partially controllable costs.** For costs that are partly, but not fully, within the EDBs' control, the regulator can apply a range of **uncertainty mechanisms ("UMs")** that differ in terms of the risks borne by the EDBs. Some of the 'automatic' variants of UMs tend to be closer to the pass-through costs, while others can be subject to a significant degree of regulatory discretion. Different UMs can therefore be used to address different aspects of the uncertainty.
- **Fully controllable costs.** For costs that are within EDB's full control (for example labour costs of engineers contracted by the EDB to deliver out-of-working hours services), more of the risks can be allocated to EDBs, with sharper economic incentives to deliver specific outcomes. There is no single definition of **incentives** as various elements of price control can act as incentives (speed of investment recovery, capitalisation rate etc.), but different types of incentive mechanisms can be used to encourage EDBs to behave in a way that is seen as desirable by the regulator.

In the following slides we focus primarily on the issues related to the fully and partially controllable risks (rather than pass-through costs for non-controllable risks), as these are less straightforward to design than pass-through costs.

Figure 11: Designing regulatory framework based on risk allocation



Notes:

1) More detail on the specific sub-variants on incentive mechanisms and uncertainty mechanisms can be found in the Appendix.

2) The mechanisms set out above do not map "one-to-one" to the customer-focused outcomes identified in Chapters 3 and 4. Rather, the same outcome can be motivated in different ways (e.g. a reputational incentive as well as UMs can be used to motivate EDBs to accelerate new renewable asset connections), but not all tools may be equally effective. Similarly, costs associated with natural disasters may be seen as falling into either force majeure events (under pass-through costs), or can be dealt with through regulatory re-openers (under uncertainty mechanisms).

1) *For example, costs driven by extreme climate events are largely beyond EDBs' control, whereas the quality of customer call centres is within EDBs' ability to manage and deliver.*

Historically, regulatory frameworks tended to be input-based but are now shifting towards output-based frameworks

Input-based versus output-based regulation

In many jurisdictions, regulators are motivated by their statutory obligations to consider the consumer welfare – for example in New Zealand regulators aim "*to promote the long-term benefit of consumers in [non-competitive markets] by promoting outcomes that are consistent with outcomes produced in competitive markets*".[1] There are different ways in which consumer welfare can be delivered. We set out below two main approaches to this: input-based approach and output-based approach.

Traditionally, the majority of economic regulators have focused on **'input-based' outcomes** – in simple terms, this meant that the regulator would determine a set of desirable outcomes (often in terms of technical network performance), and subject regulated entities to a framework that would seek to minimise the costs of delivering those outcomes over time.

This approach has generally been successful in reducing total costs, but is now becoming insufficient to meet the new industry challenges. There are two reasons for this: first, insofar as the energy industry is changing rapidly, the retrospective approach to regulation tends to lag behind customers' needs. Second, judging the "right" level of quality of service for EDBs to deliver becomes more challenging when customers' needs evolve rapidly. As a result, metrics such as network sustainability and innovation may not be adequately reflected in the 'input-based' frameworks.

New trend towards more **output-based outcomes**,[2] i.e. with a stronger focus on delivering outcomes that matter the most to the end customers, can support the transition to new EDB roles.

To the extent that the output-based framework is better aligned with actual consumer preferences and expectations (compared to an input-based model, where the objectives are primarily driven by the regulator), this framework is better suited for delivering outcomes that are closer to (or more consistent with) those that would be observed in competitive markets.

The two models are not mutually exclusive. Regulators who use output-based model for certain elements of the regulatory settlements typically retain aspects of the input-based model for other outcomes, such as minimum quality thresholds and cost-reduction incentives (e.g. based on benchmarking and 'efficiency thresholds'). In this sense, the transition from input-based to output-based regulatory framework can be seen as an evolution of the traditional incentive framework to include additional and complementary output-based regulatory tools, such that the overall regulatory outcomes are geared more towards customers.

Implications for EDBs in New Zealand

The current regulatory framework for EDBs in New Zealand is input-based. However, through the case studies in this section, we seek to assess whether (and where) elements of an output-based regulatory framework might be attractive for potential implementation in New Zealand – and could therefore be explored as potential extensions of the current framework.

In our view, it is undesirable for a regulator to "jump" directly from input-based to a fully output-based framework as doing so would create significant disruption in the market, and would be at odds with the principles of predictability and certainty.

However, we assess in the following analysis whether taking a number of successive steps in the direction of output-based regulatory framework, subject to appropriate notices given to the industry at the critical junctures, could be beneficial to New Zealand customers in the long run.

1) *New Zealand Commerce Act 1986, Section 52A.*

2) *CEER (Jan 2017) Incentive Schemes for regulating DSOs – This CEER report concludes that output based approaches have the advantage of considering customer priorities, while leaving DSOs free to determine the optimal set of solutions.*

Various tools can be implemented to support a transition of the traditional regulatory framework towards an output-based model

Regulatory tools can be designed in a number of ways – this depends on the objective of the tool, availability of data, desired risk allocation and the type and sharpness of incentives. We have therefore sought to identify the most salient examples of regulatory tools that have been applied in other jurisdictions and identified lessons for New Zealand.

The tools we have selected and analysed represent, in broad terms, an evolution from a pure input-based model towards a fully-fledged output-based framework (although the tools are not necessarily "sequential" along this path).

Definition of five selected regulatory tools

Enhanced reliability incentives. Network reliability is a key measure of EDB performance and reflects the baseline level of performance. Enhancing and refining reliability incentives to differentiate customer preferences (geographically, by customer type, or otherwise) would enable EDBs activities to better align their activities and investments with evolving customer preferences.

Customer satisfaction incentives. Across regulated industries, not just in energy, different forms of customer engagement and satisfaction incentives are emerging,[1] but not yet in New Zealand.[2] The introduction of customer satisfaction incentives (financial, or reputational) could encourage EDBs to deliver more personalisation / innovation and better customer experience in order to be more closely aligned with customers' needs and expectations.

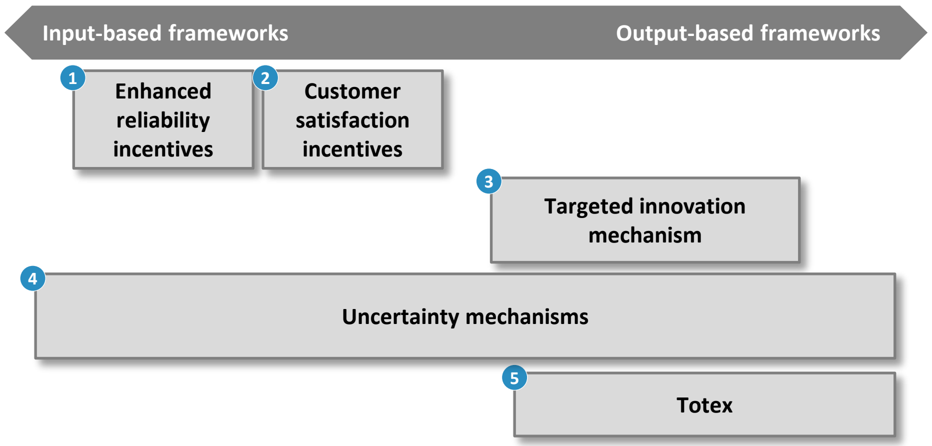
Innovation mechanisms. The use of targeted innovation mechanisms often emanates from policy-makers' concerns that innovation (other than cost-efficient innovation, e.g. service provider contracts) may be overlooked (and under-delivered) under purely input-based regulation. Greater innovation by EDBs is generally seen as desirable, especially in today's environment, as it can enable a successful delivery of a sustainable, low carbon energy supply. However, this tool relies on a degree of 'trust' from the regulator (towards EDBs), as it permits EDBs to spend customers' money on innovative outcomes that are by definition highly uncertain.

Uncertainty mechanisms. Due to the range of inherent uncertainties it is neither possible nor reasonable for either EDBs and regulators to price the full extent of the risks faced by EDBs into their long-term business plan. A range of mechanisms can be designed to protect both the EDBs and customers from significant cost and price risk by recognising that the future is uncertain and by developing an ex-ante mutual understanding that there may be a need for adjusting the revenue allowance of the EDBs within a given price control period.

Totex. This is a solution-agnostic regulatory tool that removes the differentiation between opex and capex in reaching business decisions and places onus on the regulated entity to identify desirable outcomes for customers and invest accordingly. Similar to the innovation mechanism, it is a tool that places greater responsibility on the EDBs to understand and meet customers' needs for personalisation, customer experience and innovation.

Figure 12 below summarises where, on a spectrum between input-based and output-based frameworks, the five regulatory tools can be placed. Figure 13 in slide 42 sets out the case studies we considered for each of the five tools.

Figure 12: Spectrum of regulatory tools



The following slides describe each of the five regulatory tools in more detail.

1) Ofgem – RIIO 1, Ofwat – PR19, and RRFE -Ontario

2) While EDBs may choose to undertake these activities on a voluntary basis, they are not part of the mandatory regulatory framework and are not linked to the regulatory settlement.

Selecting case studies for regulatory tools (1/3): types of tools

1 Enhanced reliability incentives

Enhanced Reliability Incentives

Introduction: Customers are highly dependent on a reliable continuity of supply, and power outages lead to considerable costs for the society. The current regulatory framework in New Zealand recognises the importance of reliability and regulated EDBs are incentivised to meet pre-defined SAIDI and SAIFI performance standards. However, the current approach does not recognise different regional and customer type preferences in determining optimal performance. It also excludes interruptions shorter than one minute and interruptions at voltages below 3.3 kV.

Case study description: Across many jurisdictions, regulators have developed reliability instruments to maintain or improve the quality of supply.[1] More advanced schemes recognise that the costs associated with supply interruption vary by categories of customers and more specific metrics are being developed e.g. targeted at the worst-served customers.

Jurisdictions considered: In selecting the case study we have considered:

- **Germany** – Reliability is driven by strict technical standards rather than specific regulatory incentives.
- **Spain**- Standard SAIDI/SAFI metric is not used. Instead, equivalent interruption time related to the installed capacity is used.
- **Sweden**[2] - more complex and sophisticated variant of metrics compared to other countries that seek to refine the basic SAIDI/SAIFI approach. This includes variations by customer type, location and also a specific incentive to avoid long-duration outages. For the purpose of this report we have selected the Swedish example for our case study.

Key insight: The case study shows that incremental steps are possible to improve reliability performance (e.g. by making it more personalised).

2 Customer satisfaction incentives

Customer satisfaction incentives (backward looking)

Introduction: The need for deeper and more direct engagement with customers has been recognised both by regulators and regulated entities across a range of jurisdictions and industries.[3] Regulated entities increasingly seek to understand customer preferences and how these can be delivered through regulation. Currently, the regulatory framework in New Zealand does not provide a direct incentive for EDBs to engage with their customers, does not reward EDBs who outperform their peers in meeting customers' needs, and may even prevent EDBs from improving their performance (e.g. if the costs of investing in new customer-focused services cannot be recovered).

Case study description: This case study considers a framework for measuring customer satisfaction (including through quantitative and qualitative metrics), improving EDBs' and regulator's understanding of customer preferences and developing incentives for EDBs to increase the satisfaction of their customers.

Jurisdictions considered: Customer satisfaction scores are monitored, with various degrees of granularity in a number of jurisdictions. We have considered:

- **US (JD Power survey)** - Industry-specific comparisons are increasingly used in the US and the specific position in rating table is often used as an evidence during regulatory discussions.[4]
- **GB (Ofgem RIIO)**[5] - The Broad Measure of Customer Service metric used by Ofgem is well known to Vector and Commerce Commission and therefore has not been selected as our case study.
- **GB (Water utilities)** – The Ofwat (water regulator for England and Wales) case study demonstrates that customer satisfaction is also monitored outside of the energy sector, but is subject to ongoing improvements and refinements.

Key insight: It is possible to implement a discrete step towards output-based framework, which is demonstrably customer-focused and highly practicable to deliver in the context of the existing regulatory framework in New Zealand.

1) *CEER (2016) Benchmarking Report on the Quality of Electricity and Gas Supply*
2) *Grahn, Ström & Alvehag – Incentivizing Continuity of Supply in Sweden*
3) *UKRN (2017) Consumer engagement in regulatory decisions*
4) *JD Power - US Electric Utility Residential Customer Satisfaction Study (link)*
5) *Ofgem is the energy regulator in Great Britain. RIIO is the regulatory framework and stands for Revenue = Incentives + Innovation + Outputs*

Selecting case studies for regulatory tools (2/3): types of tools

3 Innovation mechanism

Innovation mechanism

Introduction: Traditional regulation encouraged cost reduction, and innovation was predominantly seen as a tool to support this (e.g. DNOs seeking to improve efficiency with service providers).[1] Innovation is increasingly affecting the entire energy chain as new technologies are introduced, and EDBs may therefore need to develop new products, services, processes and business models that customers expect. However, innovation activities tend to be riskier in comparison with EDBs' business-as-usual activities and as such are likely to require specific recognition within the framework to ensure an optimal customer outcome.

Case study description: Different components of the overall regulatory package can, in principle encourage regulated utilities to innovate (e.g. length of the price control period, share of efficiency gains) but in selecting the case study we have focused on specific tools that directly target EDBs' approach towards innovation.

Jurisdictions considered: Innovation incentives can take very different forms. In selecting the case study we have considered:

- **GB-RIIO –** The Network Innovation Allowance and Network Innovation Competition mechanisms utilised in RIIO, are recognised as the most advanced targeted innovation mechanisms in terms of the design and complexity. The combination of multiple innovation tools provides a range of helpful lessons.
- **Ireland's** approach is opex-based and of limited precedent value.
- **Germany (Gas distribution) –** a relatively simple mechanism that is based on an increased regulatory allowance to cover a fixed portion (50%) of R&D costs.
- **Italy's** approach is not innovation-specific, but it relates to all new investments (including innovation). The framework relies on a positive cost-benefit analysis for individual projects to receive additional allowance.

Key insight: Targeted innovation mechanisms can be used to directly address the need for EDBs to innovatively respond to industry changes and in meeting customer expectations in the context of various industry developments.

4 Uncertainty mechanisms

Uncertainty mechanisms

Introduction: In setting the appropriate level of revenue ex-ante, there is an inevitable element of uncertainty about future changes in costs, demand, and other factors during a price control period. This can frustrate the intention of the multi-year price control period to delivery efficiency. Regulatory frameworks often include a degree of flexibility to deal with the underlying uncertainty.

Case study description: Uncertainty mechanisms are a key tool to manage the inherent uncertainty by balancing the risks between customers and EDBs. While different tools already exist in New Zealand (e.g. pass through and re-openers), a number of new and additional tools can be considered that can be adapted to specific customer-focused outcomes (e.g. EVs, solar PV, etc.). Uncertainty mechanisms can cover different levels of complexity, but in our analysis we focus on the relatively more advanced outcome-based variants which have been applied in other jurisdictions to handle growing uncertainty.

Jurisdictions considered: In selecting the case study we have considered:

- **New York** (Public Service Commission-REV) - Earnings Adjustment Mechanisms (EAMs) represent a system in which revenues are adjusted based on performance against specifically defined metrics (system & energy efficiency, customer engagement and information access).
- **GB (Ofgem RIIO)** - The RIIO framework includes a number of different tools which allow changes to allowed revenue in light of outturn during the price control period. We have selected GB RIIO as our case study as it has a longer history, a wider-ranging set of metrics being assessed and therefore a better source of potential lessons for New Zealand.

Key insight: UMs are versatile and can be applied to manage a wide spectrum of risks (including through relatively complex variants). UMs can also be introduced gradually for different uncertainties, and encourage the adoption of new roles, building on the existing New Zealand experience with mechanistic UMs (e.g. indexation), to avoid undue disruption.

1) Financial innovation is another example of the efficiency improvements - evidence suggests network companies under traditional RPI-X innovate to achieve costs reductions through operating efficiencies – Ofgem (2009) Performance of the Energy Networks under RPI – X, Section 7 (link)

Selecting case studies for regulatory tools (3/3): types of tools

5 **Totex**

Totex mechanisms

Introduction: Against the background of evolving customer needs and rapid technological changes in the energy industry, a number of regulators are adapting their approach to setting, measuring and reporting expenditure allowances. In particular, as part of this transition, some regulators have sought to remove biases identified within traditional regulatory framework and in particular the (actual or perceived) bias of regulated utilities towards capex engineering solutions.[1] In this way the regulators aim to improve the incentives for regulated entities to invest more efficiently to deliver better outcomes for customers.

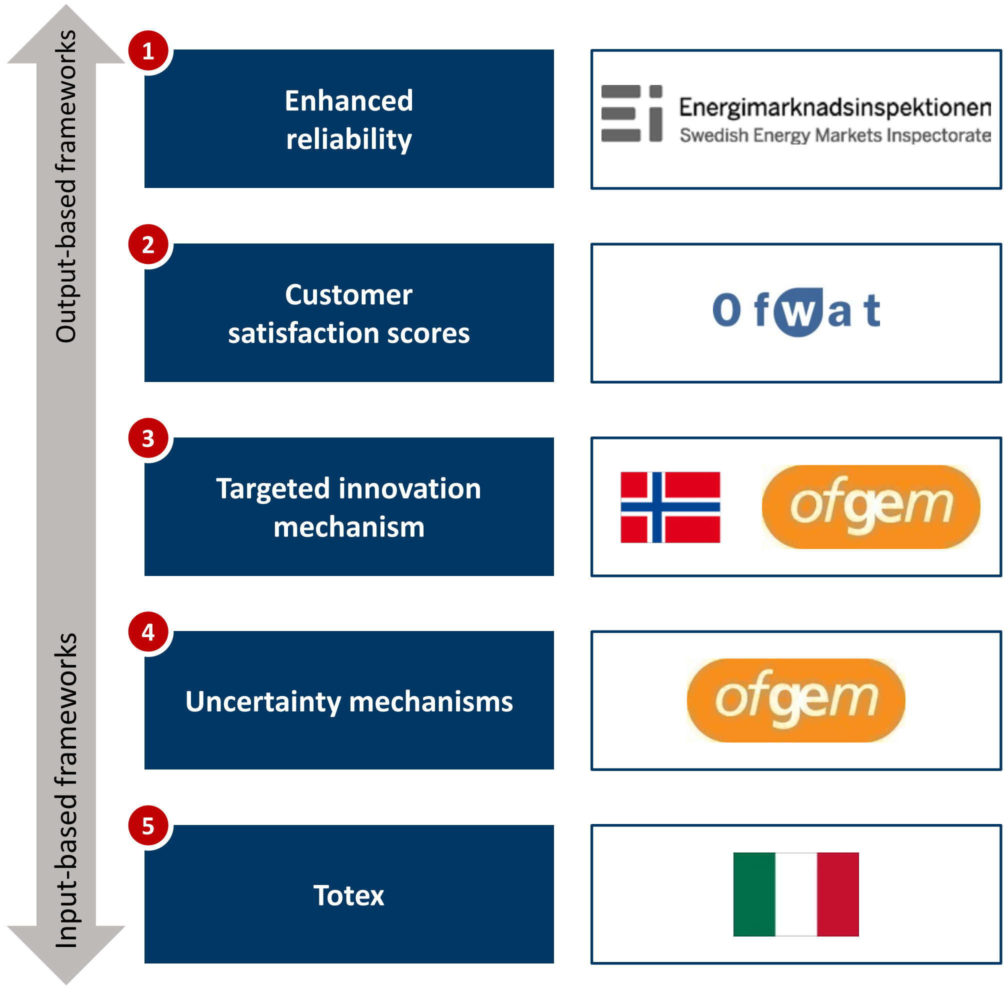
Case study description: Totex represents a relatively new concept, and is currently at the forefront of good regulatory practice (it has only been implemented in a small number of jurisdictions). Totex reduces the need for a project by project engagement from the regulator and places the onus onto EDBs and customers to determine appropriate outcomes.

Jurisdictions considered: In determining optimal case studies we have considered:

- ***GB (Ofgem – RIIO)*** *– This Totex approach is well known to Vector and, as it offers limited additional insight, it is not considered in greater detail.*
- ***Germany/Netherlands*** *– Both jurisdictions have basic Totex approaches in setting allowed revenues but they lack direct link into performance-based outcomes hence lacks the link with customer preferences.*
- ***Italy (Italian Regulatory Authority for Electricity Gas and Water)*** *– In 2015 the Authority decided to adopt Totex regulation, starting from 2020. The approach taken in Italy is helpful in illustrating the length, complexity and challenges of implementing the Totex approach.*

Key insight: There are significant complexities and challenges in transitioning towards such a framework. However, Totex can reflect a long-term vision (direction of travel) for New Zealand.

Figure 13: Summary of the case studies selected (regulatory tools)



1) *The so-called 'capex bias' reflects the historical preference of regulated utilities for investing in capex solutions (as opposed to opex solutions), which are included in the Regulated Asset Base and enable the entity to earn a (regulated) rate of return over an extended period of time.*

Assessment of the regulatory tools for New Zealand: the methodology

Key principles for selecting regulatory tools

We have assessed different regulatory tool options based on whether different tools can enable and support an efficient, secure and reliable electricity distribution system (in the context of changing customer expectations).

We have therefore assessed the five regulatory tools against the following four[1] principles of good regulation of transparency, efficiency, proportionality and simplicity (or consistency).

Transparency: Regulatory tools need to be based on outcomes that are measurable and observable, such that sufficient and accurate information is available to set the tool parameters.

Efficiency: The tool's objectives need to correspond to outcomes which are within EDB influence. In addition, the penalty / reward structure needs to be set such that it provides appropriate incentive for EDBs to change their behaviour. Customers must also be willing and able to pay for the targeted outcomes.

Proportionality: The regulatory tools need to find an appropriate balance in terms of intensity (strength), level of effort (e.g. ease of implementation and monitoring) and timelines. Incentives must not be so complex that they (i) require onerous legislative changes; (ii) rely on extensive information gathering; or (iii) otherwise are disproportionate relative to the expected customer benefits.

Simplicity and consistency: The outcome and the incentive must be sufficiently simple and consistent such that it allows customers to recognise its value, it is practical to implement (e.g. in terms of consultation processes and legislative changes) and is set up in a way that mitigates the risk of 'gaming' by EDBs. This would also support customer (and wider stakeholder engagement) on the delivery.

Assessment of specific regulatory tools for Vector

Having identified the four key principles as the relevant benchmarks for assessing potential regulatory tools, we then considered how to 'score' each of the regulatory tools against defined benchmark. We have adopted a 'traffic light' rating system to indicate the extent to which different tools are aligned with the four criteria. In the case studies we have applied the following definition for each of the scores:

- **Green.** Full alignment of regulatory tool with key assessment principle.
- **Amber**. Good alignment of regulatory tool with key assessment principle but care needs to be taken when considering specific elements of the tool.
- **Red.** Significant deviation from the key assessment principle.

Assigning individual scores is not a mechanistic process and it also needs to take into the account industry structure and nuances of the regulatory framework in New Zealand (for example the DPP in New Zealand is intended to be a "low cost" price control).

We also emphasise that the individual 'traffic light' scores are not intended to be aggregated or averaged to provide a final status for each regulatory tool. The overall suitability of the tool depends on an overall judgment regarding the tool's overall role and impact in the New Zealand context.

1) *Other desirable objectives such as the ability to stimulate innovation, ensure adequate flexibility and robustness in uncertainty, support competition and provide credibility and assurance to investors represent the subset of the above principles and as such are also implicitly taken into the account.*

Tool 1

Enhanced reliability incentives: key principles and assessment

Description of regulatory tool

Context: Monitoring the reliability of the electricity distribution network is essential in the overall supervision of a well-functioning power market. A high-quality and reliable electricity network is able to serve load continuously.

The key measures used by regulators (including in the current regulatory framework in New Zealand) are SAIDI and SAIFI.[1] Monitoring these indices allows the regulator to assess the reliability of the electricity network as a whole.

Incentives based on these indices therefore only reflect the average customer experience and do not differentiate between individual customer experiences and needs. However, growing adoption of smart meters is facilitating data gathering and processing on a much larger scale at the customer level, which means that more granular (disaggregated) indicators and incentives could be implemented in the future.

Objective: By introducing enhanced reliability measures, regulators aim to introduce Key Performance Indicators that seek to differentiate among customers (e.g. by customer type or location) to better address user needs, and may also seek to address quality disparities between different areas in the same network. These may include incentives to reduce the number and duration of outages for individual customers, taking into account the connection urgency and dependency of each customer (e.g. more frequent and longer outages may cause more damage to business customers than households; similarly rural customers may have back-up generators, whereas urban customers may be completely dependent on the network). In addition, more specific and granular metrics on reliability can alter price-quality trade-offs.

Adoption: Basic reliability incentives tend to be widely used, but enhanced reliability incentives are only available in some jurisdictions (e.g. Sweden).[2]

Aspects of enhanced reliability incentive mechanisms

The detailed design of an enhanced reliability incentive is a critical element in ensuring positive customer experiences and EDB behaviour. Key elements that need to be considered are set out below:

Interruption costs for different customer groups	Grid reliability may be valued differently by different customer groups. The optimal level of reliability (and, more fundamentally, the price-quality trade-offs) for each group can vary for example based on customer type (e.g. household, industry, agriculture, retail, emergency or public service) or location. Sufficient penetration of smart meters (in excess of 70%) is likely to be necessary to enable sufficient granularity of data.
Setting targets for network reliability	Selecting appropriate targets is critical in ensuring EDBs focus on the appropriate aspects of network performance. Targets are typically set in reference to a baseline level of performance, which, in turn, are typically based on historical data (e.g. customer density) and may need to be collected.
Determining appropriate penalty / reward	The strength of the financial (or other) penalties and rewards associated with enhanced incentives needs to be determined appropriately to drive a desired change in behaviour. Various options are available: for example, the maximum value of the incentive could be linked to the EDBs' regulatory return on equity or be expressed as a fixed percentage of their allowed revenues.
Guaranteed standards	The level of network reliability achieved with the basic reliability incentives can be set as a minimum mandatory baseline, to discourage service levels from falling below a certain level (e.g. by compensating customers for under-performance).

Key takeaways for Vector

New technologies enable the cost of network interruptions, (and therefore the associated rewards /penalties structure), to be calculated with more granularity. Such enhanced reliability incentives help regulators to link the costs of service interruptions more closely to individual customer experiences.

Transparency: This is an evolution of an existing regulatory tool that is itself based on measurable and observable metrics.

Efficiency: The efficiency of this tool depends on the accuracy and appropriateness of the targets set.

Simplicity: This tool is relatively easy to implement, as it represents a simple extension of the existing regulatory framework.

Proportionality: Enables consistency across industry with targets based on actual performance.

1) *CEER (2016) Benchmarking Report on the Quality of Electricity and Gas Supply. Commerce Commission (2018) Electricity Distribution Services Input Methodologies Determination 2012.*

2) *Wallnerström: The Regulation Of Electricity Network Tariffs In Sweden From 2016.*

Tool 1

Enhanced reliability incentives: Case study
Sweden's refined metrics for continuity of supply

Case Study – Sweden Continuity of Supply Incentives

Context: Sweden has relatively complex continuity of supply metrics. While the main mechanism uses SAIDI, SAIFI and Customers Experiencing Multiple Outages ("CEMI") targets, additional mechanisms incentivise distributors to restore power supply within acceptable time limits or compensate customers directly. Differentiating the targets by customer type and limiting the number of outages per each customer has been facilitated by the data from smart meters (noting that Sweden has been a forerunner in smart meter rollout). In addition, since 2010 the Swedish Energy Regulator ("Ei") has required distribution operators to capture outage data at the customer-level.

Objectives: The reliability metrics distinguish between planned and unplanned outages, and are split by customer type and location (measured as customer density). The CEMI metric counts how many customers that experienced more than 4 outages per year, thus disincentivising operators from only investing in easier-to-service densely populated areas.

Outcome: Sweden implements enhanced reliability measures on a number of fronts:[1,2, 3]

Continuity of supply measures incentivised through the allowed revenue calculations by Ei

- Ex-ante regulation system: Ei approves operators' revenue caps before each 4-year tariff period.
- SAIDI/SAIFI are calculated using a different coefficient for each group of customers (residential, tertiary, industry, agriculture and public service) and outage type (planned and unplanned). All planned outages above 3min and all unplanned outages between 3min and 12h, including those due to exceptional events, are counted. (Outages above 12h are excluded from incentive indicator calculations, as it already requires direct compensation to users).
- Ei sets SAIFI/SAIDI targets separately for different customer density levels. Also, Ei reports annually on continuity of supply indicators and the list of worst-performer distribution system operators distinguish targets and operator groups by customer density.
- Lastly, 11 or more outages per year are evaluated as 'poor quality' electricity supply. Although no specific penalties are incurred, it could lead to an investigation by Ei.

Maximum allowed durations for restoring power supply for each customer type, and automatic compensation for outages longer than 12 hours

- Unplanned outages must end within 12h for customers >50 MW and within 24h for smaller ones. Planned outage limits are 2h for customers >20 MW, 8h for 5-20 MW, and 12h for smaller ones.
- For all outages above 12 hours, customers receive compensation in the form of a discount on the annual network rate. This is 12.5% for outages between 12-24h (cannot be less than €100 for residential customers) and 25% for each 24h with a cap of 300% (12 days).
- If an outage ever exceeds 24h, the operator must identify the concerned area and put in place a specific action plan to improve continuity of supply.

Applicability of the regulatory tool to enable delivery of new and traditional EDB roles

	Rationale	
Delivery of new connections	Reliability incentives are predominantly associated with the performance of existing assets (even though new connections may influence the overall network reliability). Therefore they are unlikely to directly encourage the delivery of new connections.	Red
Network reinforcement, operation and maintenance	Planning new investments, operation and scheduling of maintenance work are all likely to have an impact on the overall network reliability. If well designed, enhanced reliability incentives could be a key regulatory tool in supporting these activities.	Green
Cost-efficient delivery	More complex compliance measures are likely to create higher price trade-offs. This tool is likely to have an indirect impact on cost-efficiency, as reliability requirements are likely to drive the development of an efficient network reinforcement plan, which combines traditional network solutions with market-based non-wire solutions.	Amber
Distribution system operator / active network management	This tool can encourage the adoption of new technologies when efficient – for example to ensure continuity of supply even when parts of the network are not available by utilisation of non-wire solution.	Green
Distribution System Platform	A DSP could provide market access to a range of active customers, who could be compensated for activities that support system reliability. Enhanced reliability incentives are therefore likely to encourage the development of a DSP (but may need to be complemented with higher revenue allowance).	Amber
Environmental and social obligations / responsibilities	Aligning investment and operation plans with direct requirements of specific customer segments could improve social obligation activities (in particular if enhanced reliability metrics are linked with customer vulnerability metrics).	Amber

1) *Law on Elec 1997, Ch.5 para5, Ch.3 para 9 and Ch.10.*
2) *https://www.ei.se/Documents/Publikationer/foreskrifter/El/EIFS_2013_4.pdf and https://www.ei.se/Documents/Publikationer/foreskrifter/El/EIFS_2013_1.pdf (Chapters 4 et 6).*
3) *Grahn, Ström & Alvehag – Incentivizing Continuity of Supply in Sweden.*

Tool 2

Customer satisfaction incentives: key principles and assessment

Description of regulatory tool

Context: To meet rapidly evolving customer expectations, it is becoming increasingly important for EDBs to monitor, understand and improve customer satisfaction (even though this is backward-looking). While the concept itself is multi-faceted, and different metrics of customer satisfaction can be taken into account, the tool itself represents a simple addition to the input-based regulatory framework. It is typically delivered either through reputational incentives such as a publication of leader boards (which tend to be weaker), or through financial incentives such as rewards/penalties triggered by certain thresholds (e.g. average score attained).

Objective: The key objectives of customer satisfaction incentives as a regulatory tool are to:

- **Gather information.** To incentivise regulated companies to monitor their customers more closely so as to simply improve the quality and quantity of information available to senior management to act upon. This may include less tangible aspects of customer service such as quality of communication and perceptions of personalised service. For example, in the future, asset management/network plans may need to get a form of customer endorsement or seek customer input into decision-making.
- **Understand performance.** To enable the regulator to better understand the absolute and relative satisfaction of customers with the regulated company and, thereby, to observe how objective measures of company's performance link to the quantum of revenue/spend.
- **Change behaviour.** Reputational and/or financial incentives can encourage more customer engagement and better customer service, as companies may seek to increase the rewards / reduce penalties they receive as a result of poor customer service.

Adoption: Customer satisfaction incentives as a regulatory tool are used, or are considered to be used, relatively widely both in the energy and non-energy industries, including by Ofgem (RIIO), [1] Ofwat,[2] and the Civil Aviation Authority.[3]

Aspects of customer satisfaction scoring

The detailed setup of a customer satisfaction regulatory tool, used to support an incentive mechanism, needs to consider the four design options set out below:

Quantitative and/or qualitative elements	Customer satisfaction can be measured using either or both of the following metrics: ▪ Quantitative, e.g. unwanted' calls received (e.g. complaints) ▪ Qualitative, e.g. asking customers to score EDBs on a 1-10 scale The selection of specific metrics is critical to ensure regulated companies focus on the 'right' aspects of performance.
Format of assessment	▪ Use of surveys, telephone interviews and/or post-service questionnaire ▪ Sampling, e.g. # customers participating; whether all customers are surveyed, or a sub-set (e.g. those who complained) ▪ Addressing statistical issues (e.g. selection bias)
Aggregation of results	▪ Aggregation of multiple metrics into a single overall score for the EDB; or multiple scoring (e.g. qualitative and quantitative scores reported separately) ▪ Weights attributed to different metrics
Incentive mechanisms applied	▪ Reputational ▪ Financial (link EDB performance on customer satisfaction – either absolute or relative to peer group – to allowed revenues)

Key takeaways for Vector

This tool enables multiple dimensions of customer satisfaction to be measured and subsequently rewarded/penalised. It also improves both the regulator's and EDBs' understanding of customer preferences, which can be leveraged through additional incentives, separately from customer satisfaction.

- **Transparency:** Easy to understand but may increase complexity of regulatory framework.
- **Efficiency:** Direct link to addressing shifting customer expectations.
- **Simplicity:** Relatively easy to implement/understand, as it is a simple extension of the existing framework.
- **Proportionality:** Enables consistency across industry with specific licensee targets or thresholds.

1) *Ofgem – Customer satisfaction with network operators: Electricity distribution (link)*
2) *Ofwat applied Service Incentive Mechanism during PR14 (link), but it consulting on a Customer Measure of Experience (C-MeX) for the upcoming PR19 (link)*
3) *CAA (2016) Future of service quality regulation for Heathrow Airport Limited: Consultation on the design principles for a more outcome-based regime*

Customer satisfaction incentives: Case study
Ofwat's transition from "SIM" to "C-MeX"

Case Study – Transition from SIM to C-MeX in the water sector

Context: In 2017, Ofwat consulted on a potential change in their measure of customer satisfaction, the Service Incentive Mechanism ("SIM") to a more holistic measure that aims to encourage water companies to 'push the frontier' of customer satisfaction and make use of new communication technologies. It has since created the Customer Measure of Experience ("C-MeX"), which is due to replace the SIM in the next price control (PR19).[1]

Objectives: The move from SIM to C-Mex intended to address several shortcomings of the SIM in that the SIM is limited to comparisons within the water sector, does not encourage leading companies to 'push' the frontier of customer service or to innovate customer service, and does not reflect changing communication technology.[2]

Outcome:

SIM: Performance is measured using quantitative and qualitative metrics that, combined, give a score out of 100 (a higher score reflects better performance).[3]

- In terms of relative weighting, as of 2015, qualitative measures are given greater weight than quantitative measures in calculating the final SIM score (75:25 as opposed to previously 50:50).
- Quantitative measures are the number of complaints, with greater weighting given to complaints raised more formally and/or have taken longer to resolve. For example, complaints raised via phone calls are given the lowest weighting, but complaints escalated to the Consumer Council for Water ("CCWater"), a UK consumer body for the water industry, are given the greatest weighting.
- Qualitative measures are in the form of customer surveys (designed and administered by the water companies themselves), in which customers rate their billing and operational experience with the water company using a performance range of 1-5.
- The structure of rewards and penalties is asymmetric: companies with the best SIM scores are awarded a maximum of 0.5% of their revenue, while the worst performing ones are penalised by up to 1% of their revenue.

C-MeX: The exact methodology is still being trialled, but Ofwat's current preferred option includes:[4]

- A quarterly satisfaction survey (based on handling and resolution of complaints) is due to be run via online channels. (with a 50% weighting). A quarterly satisfaction survey of customers who have not contacted their water company is also due be run via phone (also with a 50% weighting). These are planned to be combined into a single score out of 100 and compared to the UK Customer Satisfaction Index ("UKCSI").
- Ofwat is also considering including a metric based on the proportion of customers that would be willing to recommend their water company to another customer.
- The top 3 performers are due to receive a performance payment of up to 1.2% of residential retail revenues. Higher payments of up to 2.4% may be available if a company is within the top 3 performers and at or above the cross-sector threshold. The poorest performers are to be penalised by up to 2.4% of residential revenues.
- Ofwat also plans to publish the volumes of customer complaints, including those made over social media (which were excluded in the previous SIM methodology). This is intended to serve as a reputational incentive.

Applicability of the regulatory tool to enable delivery of new and traditional EDB roles

	Rationale
Delivery of new connections	Customer satisfaction incentives may incentivise positive customer experiences for new connections[5] and they may offer sufficient motivation for EDBs to improve ways of working (e.g. minimise the time between a customer quotation and work commencement).[6] EDBs may also adjust their service offerings to meet the needs of different customer types (e.g. "ask the expert" service).
Network reinforcement, operation and maintenance	Network reinforcement and maintenance can directly impact the satisfaction of customers affected by these activities. Customer service metrics could give EDBs the necessary signals to make changes to their operating models, processes, and service offerings in response to feedback from customers in respect of these activities.
Cost-efficient delivery	There is no direct link between cost-efficient delivery and customer satisfaction incentive although EDBs' overall efficiency influences the total cost customer face, and therefore the general customer sentiment towards EDBs.
Distribution system operator / active network management	Although this tool does not provide a direct incentive to support the development of the new DSO capability, its existence could encourage the development of a DSO in a customer-centric manner.
Distribution System Platform	A DSP could introduce another communication and service channel between customers and EDBs. As such this could have a positive impact on customer satisfaction (although the impact would depend on customer satisfaction with the new service(s) provided by EDBs).
Environmental and social obligations / responsibilities	Environmental/social obligations represent primary customer outputs and therefore they can have a material impact on the outcomes customers are seeking and thus on their level of satisfaction.

1) *Ofwat (2017) Delivering Water 2020 – Appendix 3.*
2) *Ofwat (2017) Delivering Water 2020 – Appendix 3, pg 4.*
3) *Ofwat (2015) Service incentive mechanism – Figure 1, pg 6.*
4) *Ofwat (2017) Delivering Water 2020 – Appendix 3, pg 8-9*
5) *Ofwat is due to introduce in PR19 a D-Max (variant of C-Max) mechanism which would specifically target new connection – Ofwat (2017) Delivering Water 2020 – Appendix 3*
6) *Ofgem - BMCS includes measure of satisfaction with connections work (both new connections and alterations to existing connections).*

Tool 3

Targeted innovation mechanisms: key principles and assessment

Description of regulatory tool

Context: The RPI-X framework incentivises innovation over the duration of the price control (insofar as companies are able to retain savings they make). However, a significant reduction in R&D spend (that is not specifically directed at cost mitigation) is expected to stall innovation in the longer run.[1] As a consequence, a range of targeted innovation mechanisms has been adopted by some regulators to encourage continued innovation for the benefit of the industry and customers.[2]

Objective: While regulation is not itself a barrier to innovation, targeted innovation mechanisms can be introduced to enable step change in innovation required to respond to, for example, technological changes for the benefit of customers. The key objectives of targeted innovation stimuli are to:

- **Make the energy network smarter**. To enable the industry to trial and roll out new technologies to drive the development of a smarter, more capable network.
- **Drive long term improvement in prices and quality service.**
- **Facilitate a culture of innovation.** To provide an incentive for network companies to nurture an atmosphere of innovation within the business and to ensure a rich stream of ideas to flow from diverse sources, both internal and external.
- **Knowledge dissemination.** To share learnings from company-specific innovation so that lessons learned can be applied across the wider electricity sector.

In designing innovation mechanisms, special care needs to be taken to ensure customers do not pay for innovation that could have been funded elsewhere or would have occurred without regulatory support.

Aspects to consider for innovation mechanisms

Eligibility for innovation funding	Traditionally, innovation in electricity distribution has been led by network companies. However, opening access for innovation funding to third parties (academia, technology start-ups etc.) can bring new ideas and help develop new culture within network business.
Sources of funding	Funding can be embedded within the price control allowance (e.g. RIIO Network Innovation Allowance) or it can be added as a direct levy on customer bills (e.g. renewable obligation certificate in GB).
Treatment of benefits	Benefits from innovation can be shared with customers, wider industry or they can stay within EDBs. Upfront regulatory certainty over the treatment of the benefits is required to provide clarity to the industry and in particular to customers, given that they may partially fund the innovation efforts.
Forms of innovation	These mechanisms can support schemes that cover all phases of the innovation lifecycle, or just specific elements(e.g. R&D only or trials only). Alternatively, mechanisms can be structured in blocks so that each supports a different phase.
Assessment	Assessing an innovation project can be performed ex-ante or ex-post. Setting an appropriate assessment methodology would depend on the regulator’s desire to balance regulatory burden, certainty on the treatment of innovation, and certainty over the rewards.

Key takeaways for Vector

Innovation mechanisms can provide clear incentives for EDBs to find better processes, tools and solutions to address evolving customer expectations. They can also encourage better knowledge sharing and a cross-EDB adoption of good industry practice.

Transparency: It may be difficult to directly quantify and observe the outcomes of innovation.

Efficiency: Can provide direct link to addressing customer needs and enables regulatory decisions to be made around customer priorities.

Simplicity: Easy to implement and understand but specific quantitative mechanism parameters may be complex to design and agree on.

Proportionality: Enables consistency across industry with specific targets for individual EDBs.

1) *EPRG Working Paper 0901 (2009) Electricity Sector Liberalisation and Innovation (link)*

2) *USA California Public Utilities Commission- CES-21 innovation arrangements or New York State Energy Research and Development Authority - The Technology and Market Development Program*

Targeted innovation mechanisms: Case study Selection of European jurisdictions

Case Study – Direct and indirect innovation incentives

Context: Innovation incentives can be both 'direct' and 'indirect'. 'Direct' incentives aim to encourage companies to innovate explicitly, while 'indirect' incentives treat innovation as one of many possible instruments to reach a particular regulatory aim. Innovation funding can realise significant savings for customers: for example, independent review of Ofgem innovation funding estimate benefits are at least 3 times greater than innovation investment cost.[1]

Objectives: Regulators aim to encourage innovation to ensure efficient long term outcomes for customers – this can be done through direct or indirect incentives.

Indirect innovation incentives:

Netherlands:[2] Totex regime in the Netherlands indirectly incentivises innovative investments.

Germany:[2] Cost saving innovations are incentivised via the BNetzA's efficiency bonus.

Direct innovation incentives:

Norway: R&D costs are treated as pass-through costs when they fulfil certain conditions:[2]

- R&D costs incurred are useful for grid operation, investments and/or planning;
- R&D costs represent a maximum of 0.3% of the DSO's regulatory asset base; and
- The project is approved by an external body (e.g. the Research Council of Norway)

GB – RIIO: The RIIO price control features three distinct mechanisms that encourage innovation:

- Network Innovation Allowance ("**NIA**") – a portion of allowed revenue that is to be dedicated to: (i) fund smaller technical, commercial, or operational projects that have the potential to deliver financial benefits; and (ii) fund the preparation of submissions to the NIC.[3]
- Network Innovation Competition ("**NIC**") – an annual opportunity for electricity network companies to compete for funding for the development and demonstration of new technologies, operating and commercial arrangements.[4]
- Innovation Roll-out Mechanism ("**IRM**") – enables companies to apply for additional funding within the price control period for the roll-out of initiatives with demonstrable and cost-effective low carbon and environmental benefits. However this is expected to be removed in the upcoming RIIO-2 price control period.[5]

Applicability of the regulatory tool to enable delivery of new and traditional EDB roles

	Rationale
Delivery of new connections	Innovation incentives can encourage EDBs to move away from "business as usual" processes, and to expand their solution toolkits in responding to customers seeking new connections.
Network reinforcement, operation and maintenance	Innovation incentives can support the development of new technologies and tools for managing the network, which can have significant impact on the operational and maintenance practices. Knowing when and where to invest has a key effect on the network reliability and the overall quality of service experienced by customers.[6]
Cost-efficient delivery	This mechanism can encourage EDBs to develop new solutions and processes which can either reduce costs or accelerate meeting customer requirements. However, there is a risk that EDBs retain the majority of the benefits, and savings are not passed on to the customers. (although this can be mitigated with a careful design of the scheme).
Distribution system operator / active network management	The current RPI-X regulatory framework provides limited incentives to invest in capabilities and non-asset solutions. Innovation incentives have the potential to speed up development and deployment of ANM and DSO technologies and capabilities.
Distribution System Platform	Similar to the above, the current framework does not stimulate the adoption of new roles such as DSP. The introduction of an innovation mechanism can enable EDBs to accelerate the adoption and development of new platforms.
Environmental and social obligations / responsibilities	Innovation can encourage the adoption of sustainable technologies (e.g. DSR) while maintaining security and reliability of the network. In addition, innovation can directly lead to social innovation and better management of natural capital, e.g. "ethical" copper.

1) *Ofgem-(2016) – The network innovation review (link)*
2) *CEER (2017) Incentive Schemes for regulating DSOs – Annex 4*
3) *Ofgem – Electricity Network Innovation Allowance (link)*
4) *Ofgem – Electricity Network Innovation Competition (link)*
5) *Ofgem – The Electricity System Operator Innovation Roll-Out Mechanism: Guidance on Submissions (link)*
6) *Independent review of Ofgem innovation funding estimated net benefits are three times larger than the cost of the schemes if they are adopted within individual DNO. The consumer benefits if the innovation is successfully adopted GB-wide would be 5 to 8 times greater than initial investment. (link)*

Tool 4

Uncertainty mechanisms: key principles and assessment

Description of regulatory tool

Context: Uncertainty is unavoidable – it is impossible to predict the future, and the regulatory framework needs manage this uncertainty efficiently. Committing ex-ante to a fixed allowance over a long period of time places greater risks on EDBs and customers. To address this risk, some regulators[1] have implemented within-period adjustments, where a baseline level of revenue is set for the duration of the price control, but uncertainty mechanisms are applied to enable revenue to change during the period (e.g. to reflect different network capacity from the original expectation).

Objective: UMs adjust allowances to reflect specific changes during the regulatory period under predefined criteria or conditions such as changes in cost or output that are outside the control of the companies and have a material impact on the cost of operation. UMs predominantly fall into two main categories:

- **Mechanistic** – allowances are adjusted automatically in response to external metrics or as a result of externally defined costs (e.g. commodity price benchmarks) and include, for example, indexation, pass through costs and volume drivers.
- **Assessed** – allowances are adjusted in response to specific events. These tools, which include automatic triggers, outcome-based adjustments and re-openers, require regulatory determination and tend to be particularly effective in cases with significant ex-ante uncertainty over the likely investment required to accommodate future patterns of electricity use. Regulatory assessment of performance under assessed UMs can be ex-post or ex-ante, but due to the limited predictability and controllability of uncertain investments, more emphasis is typically placed on ex-ante regulatory incentives.[2]

UMs enable risk exposure to be shared between customers and EDBs which can help support the principle that risks should be allocated to the party best able to manage them efficiently. UMs may allow regulators to more effectively balance the cost to consumers and financeability of EDBs and to progress public policy outcomes (e.g. improve EV uptake)..

Examples of uncertainty mechanisms

Input-based frameworks ↔ Output-based frameworks

Simple ← Uncertainty mechanisms → *Complex*

Mechanistic UMs such as **indexation** and **pass through** help address uncertainties such as RPI indexation, cost of debt or licence costs, etc.

They protect against variations in the market-wide movements and avoid the resource costs of forecasting.

✓Known and used in New Zealand – e.g. CPI indexation

Volume drivers can be used to address uncertainties from volume / timing of connections, uptake of EVs / DER, while **automatic triggers** can help address tax and legislative uncertainty.

These tools tend to benefit customers (e.g. by contributing to lower financing costs by EDBs[3]), but volume drivers may **weaken efficiency incentives**, and both tools may increase the **volatility of charges**.

Outcome-based adjustments and **re-opener**s help address uncertainties of complex or hard-to-measure outcomes (e.g. ↓MW of peak demand or energy efficiency investment).

While they can link directly to customer goals and contribute to lower financing costs by EDBs,[3] the determination of appropriate **baseline and target levels can be complex**.

Key takeaways for Vector

UMs can help manage circumstances that are beyond the full control of an EDB. When designed adequately, they can give EDBs the flexibility to directly and promptly respond to specific customer needs (e.g. connection of DER) and provide location- and customer-specific solutions.

Transparency: Easy to implement and understand but increases complexity of regulatory framework

Efficiency: Can provide direct link to addressing customer needs and enables regulatory decisions to be made around customer priorities

Simplicity:[4] Easy to implement and understand but specific quantitative mechanism parameters may be complex to design and agree on

Proportionality : Enables consistency across industry with specific licensee targets

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1) *Ofgem –RIIO-Uncertainty mechanism, New York Public Service Commission- RAV-Earning Adjustment Mechanisms (EAMs)*
2) *Following implementation of EU Electricity and gas Directive majority of European regulators predominantly focus on ex-ante approval (link).*
3) *Lower financing costs would in turn contribute to lower observations being used setting regulatory WACCs through specified WACC formulas.*
4) *There is a wide range of potential Uncertainty Mechanisms, some of which may be easy to implement and understand, but for other variants, specific quantitative mechanism parameters may be complex to design and agree on. The scoring of UMs against the principle of 'simplicity' reflects this range of potential mechanisms.*

Tool 4

Uncertainty mechanisms: Case study
RIIO Electricity Transmission Volume drivers

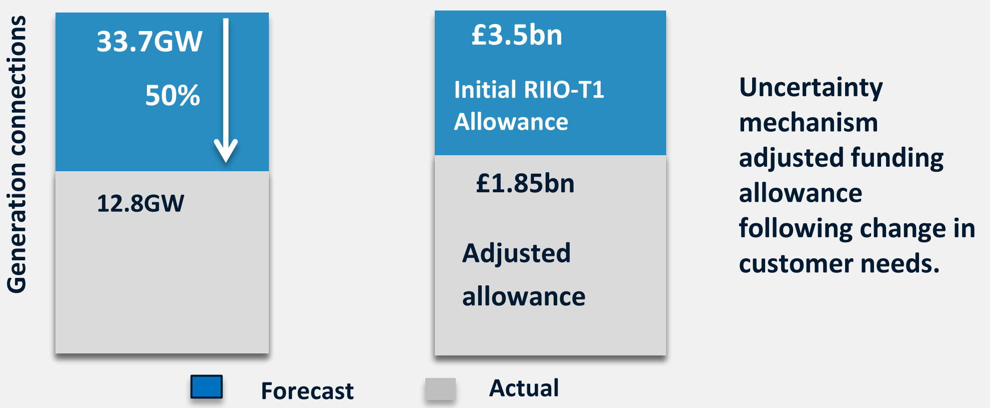
Case Study – Load-related capex in RIIO-ET1[1]

Context: Load-related expenditure represents necessary investment to connect new customers to the network, upgrade the existing network and cater for changes in demand. The main drivers for this investment are the location of new customers as well as changes to existing customers' requirements (both demand and generation).

Objectives: National Grid (the GB transmission system operator) under RIIO - ET1[1] was subject to a range of volume drivers covering the volume of new generation, new demand and wider network reinforcement. The total allowance was automatically adjusted to reflect the level of outputs required. At the time of final determination the total allowance was based on 33GW[2] of expected customer connections.

Outcome: Following delays/cancellations/changes of customer plans National Grid is currently expected to connect only 12.8 GW. The existing RIIO1 uncertainty mechanisms successfully adjusted National Grid's allowance in response to change in customers' plans.

Illustration of uncertainty mechanism



Applicability of the regulatory tool to enable delivery of new and traditional EDB roles

	Type	Rationale
Delivery of new connections	Volume driver	The tool allows revenues to be linked to changes in volume of customer connections (e.g. new demand, storage, uptake of EVs). Revenue can also be adjusted based on pre-defined unit cost per output for different expenditure category (LV/ MV connection etc.)
Network reinforcement, operation and maintenance	None	Reliability and safety are core EDB outputs with reasonably predictable risks. On the other hand, volatility in forecasts for take-up of new technologies (EVs) can trigger the need for reinforcement which can be managed by UM.
Cost-efficient delivery	None	Cost-efficient delivery represents a constant tension between cost and level (quality) of service. Therefore UMs as a tool are unlikely to be appropriate for this role (although some variants could contribute to a lower WACC).
Distribution system operator / active network management	Outcome based adjustment	Re-openers can be used to cover both the cost and volume of developing non-network solutions. Alternatively, volume drivers can be constructed based on the number/cost of activities that use non-network alternatives.
Distribution System Platform	Re-opener	The ex-ante allowed revenue can be supplemented with re-openers triggered if certain conditions are met (e.g. volume of data flow via platform). The re-opener would only be triggered if the additional funding required exceeds the predefined materiality threshold.
Environmental and social obligations / responsibilities	None	Social and environmental obligations are typically part of licence conditions (i.e. legislative obligations). Therefore, uncertainty mechanisms as a tool are unlikely to be appropriate for this role.

1) *RIIO ET1 is the regulatory framework for Electricity Transmission (First period, dating 2031-2021).*
2) *RIIO T1 Annual Report (Ofgem, December 2017)*

Totex mechanism: key principles and assessment

Description of regulatory tool

Context: Traditionally, revenue allowances for regulated businesses are determined using a 'building blocks' framework which assesses Opex and Capex separately. Totex represents a relatively new regulatory concept in asset-heavy industries and aims to approach cost assessment and recovery based on the total cost of business decision – without any significant differentiation between Opex and Capex.

Objectives: The key objectives of the Totex mechanism are:

- Removal of Capex bias – regulated companies under the traditional 'building blocks' approach tend to have a preference for expenditure on engineering physical capital assets over operational expenditure, even in situations in which an Opex solution may be more efficient in the long run.
- Asymmetric regulatory treatment – there may be a perception that regulatory tools for assessment of Opex cost are more stringent (during regulatory assessment) than for Capex, which might have created incentive for network companies to report some Opex expenditure as Capex.
- Increase flexibility in decision making – Under the regulatory principle that risks should be allocated to the party best able to manage them, Totex provides a framework in which businesses have greater freedom to select the most efficient way of delivering their services without always relying on building physical assets.

Adoption: Totex as a regulatory tool is a relatively novel concept but it is currently utilised (or considered to be utilised) by number of regulatory authorities, predominantly in Europe (Ofgem – RIIO, Ofwat- PR19, BNetzA-3rd Period, ACM[1] (previously Dte), or EK, Italy[2]).

Different elements of Totex frameworks in Europe

Outperformance incentive	The approach to Capex and Opex is not uniform across jurisdictions: - One common incentive set ex-ante which applies equally to all types of expenditure (e.g. Ofgem) - No upfront incentive on Totex but range of individual and separate opex and capex incentive mechanisms (Germany)
Cost Assessment	Variants include: - Mix of top-down and bottom-up benchmarking with different weightings applied to establish final allowance (e.g. Ofgem) - Benchmarking total historical cost, with no role for business plans (e.g. BNetzA)[3] - "Yardstick competition"[4] where allowance depends on how company performs relative to the industry average
Capitalisation	Variants include: - Capitalisation policies of the businesses against efficient 'benchmark' capitalisation - Sets a capitalisation rate parameter ex-ante that determines proportion of Totex that goes into Regulatory Asset Base
Reporting	Variants include: - Detailed and disaggregated cost reporting to monitor company performance and inform future benchmarking (Ofgem) – higher regulatory burden - High-level reporting with limited requirement for detailed cost data

Key takeaways for Vector

Adoption of the Totex approach could enable EDBs to select the optimal investment profile to meet changing customer needs. However, its implementation is likely to be a lengthy and complex process, requiring a significant amount of work to being all stakeholders on board.

Transparency: Uses well established capex/opex metrics and is easy to understand by all stakeholders.

Efficiency: Reinforces incentives to make efficient trade-offs between capex and opex solutions for the benefit of customers

Simplicity: Simple as a concept but might require long and comprehensive consultation process (even new legislation?)

Proportionality: Provides simple and flexible framework while reducing regulatory burden

1) *ACM-Dutch regulator applies yardstick competition model but cost allowances are determined on a basis of total cost - https://www.acm.nl/en/publications/publication/17231/Incentive-regulation-of-the-gas-and-electricity-networks/*
2) *In Italy Totex approach is applied only for determination of allowances for TSO and five largest DNOs*
3) *https://www.bundesnetzagentur.de/EN/Areas/Energy/Companies/GeneralInformationOnEnergyRegulation/IncentiveRegulation/Tools/IncentReg_Tools-node.html*
4) *https://www.acm.nl/sites/default/files/old_publication/publicaties/17231_incentive-regulation-of-the-gas-and-elektricity-networks-in-the-netherlands-2017-05-17.pdf*

Tool 5

Totex mechanism: Case study
Italy's transition towards Totex

Case Study – Transition towards output-based Totex regulation in Italy

Context: Network regulation in Italy is of the hybrid revenue-cap type with an incentive for new investments. The Italian Regulator conducted a strategic review in 2015, which found that the original assumptions (upon which the incentives for new investment introduced in 2005 were based on) significantly deviated from actual outturn (notably demand growth and gas consumption). Subsequently the Regulator decided to introduce the Totex approach for the electricity sector.[1]

Objectives: Recognising the need for significant and time consuming consultations with industry and customers, an output-based Totex approach is planned to be implemented from 2020. To protect network users from potential increases in cost, a new Cost-Benefit Assessment requirement for any investment in new network capacity was introduced.

Outcome: The quantification of benefits is based on three objectives (security of supply, impact on prices and on the environment), which correspond to indicators translated into monetary terms (i.e. "outputs"). This represents an initial step on the transition from an "input-based" framework towards an "output-based" framework.

The principles of the Totex mechanism under an output-based regulatory framework were set out in the public consultation[2] for the electricity sector. The detailed methodology of the regulatory framework is still in development, but the main features are as follows:

- Individual companies are expected to submit business plans with detailed justifications. Plans are due to be assessed/benchmarked by the regulator and would lead to an ex-ante approval of a regulatory allowance;
- Expected outputs/ objectives need to be determined in consultation with customers in advance of the final determination; and
- Definition and design of reward/penalties is based on RIIO principles e.g. fast tracking.

Adoption: Experience from Italy and other jurisdictions[3] demonstrates that such a fundamental change in the regulatory framework is likely to be time consuming and would require significant engagement to obtain support from a wide range of stakeholders.

Applicability of the regulatory tool to enable delivery of new and traditional EDB roles

	Rationale
Delivery of new connections	Removal of the Capex bias creates a significant incentive for selecting optimal solutions to respond effectively to requests for new connections (e.g. EDBs may be incentivised to develop new ANM solutions).[4]
Network reinforcement, operation and maintenance	Network safety and reliability are already incentivised through other elements of the regulatory framework, but Totex can provide further support (see 'Cost-efficient delivery' box immediately below).
Cost-efficient delivery	Totex, coupled with a shared incentive rate, can improve the incentives for companies to deliver their services below allowed revenue.
Distribution system operator / active network management	Totex can encourage the adoption of new technologies but only if it leads to a reduction of costs.[5] Technologies or roles that increase costs need to be supported by either correspondingly higher allowances or via additional innovation allowances.
Distribution System Platform	The DSP is a new role for EDBs and is likely to (at least initially) lead to new costs. Efficiency of Totex mechanism is likely to materialise if it is accompanied by correspondingly higher allowances set at the price control review.
Environmental and social obligations / responsibilities	Social and environmental obligations are typically part of legislative obligations but customers require from EDBs to have regard for the sustainable use of natural capital. Totex enables EDB to consider not only traditional elements (e.g. assets) but the wider costs and benefits to the economy, society and the environment as well.

1) Decision COD 654/2015 / R / EEL

2) 335/2015 / R / EEL

3) In GB, Ofgem conducted a detailed review of energy network regulation under RPI-X@20 programme which lasted over 3 years

4) LV Connect and Manage- is one example how new approaches and new business processes can be developed to address customer requirements for fast, reliable connection.

5) During early implementation of RIIO significant proportion of new ANM/DSO activities were funded via innovation allowance – see full list of projects at http://www.smarternetworks.org/

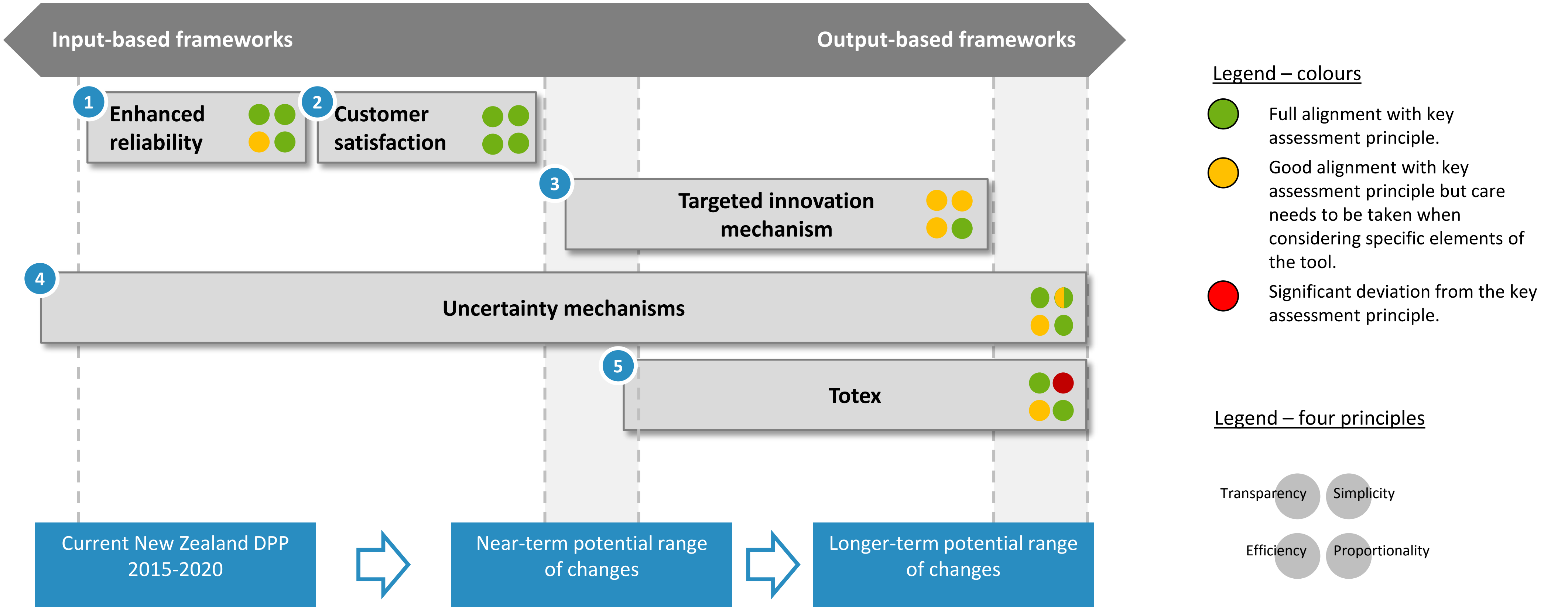
Case studies on five regulatory tools - summary

There are pros and cons associated with each of the five regulatory tools considered in this section. Not all of them are likely to be suitable for implementation in the short run, but New Zealand is relatively well placed to deploy some of them, e.g. if smart meter data could be leveraged for the benefit of customers.

No single regulatory tool appears to be able to support all of the traditional and new/emerging EDB roles. Rather, the regulator may choose to implement a combination of these tools to deliver better customer outcomes.

Figure 14 below summarises the assessment of each of the five tools based on the good regulatory practice principles..

Figure 14: Spectrum of regulatory tools and recommendations



Chapter 6: Conclusions: the Blueprint for New Zealand

Conclusions on regulatory tools (1/2)

1) Enhanced reliability incentives

These metrics are a discrete regulatory tool that can be implemented in the existing framework in New Zealand.

Focus of the tool

This tool is relatively narrow-focused in terms of customer outcomes: it is well suited for the delivery of some of EDBs' traditional roles (notably network reinforcement, operation and maintenance) and some of EDBs' new roles (notably DSO / ANM), but it is less well suited for other new roles that EDBs may be taking on. It may therefore be appropriate to combine this tool with other additional changes to the regulatory framework.

Design

The detailed design of the regulatory tool (e.g. what exact refined metrics are to be measured and incentivised) is important and would need to be consulted on appropriately to ensure that the design is proportionate and appropriate for all EDBs (and considers potential new price-quality trade-offs).

Potential for implementation

Design changes (e.g. the inclusion of new metrics such as CEMI) are relatively straightforward to design and implement, and we consider that this could be done in the near future. Smart meter data from customers could be a key enabler in introducing this tool. More complex variants that allow for price-quality differentiation would need to take into account customers' interests and are likely to be suitable for implementation in the medium term. More specific Enhanced reliability incentives would require a consideration of the level of resources needed for these controls to be delivered.

2) Customer satisfaction incentives

Incentives related to customer satisfaction are likely to directly encourage EDBs to serve their customers better, if designed to capture present and future expectations (which change e.g. due to technology developments around communication).

Focus of the tool

This tool is focuses directly on customer outcomes and may work well to improve certain aspects of EDBs' performance (e.g. communication or the new 'platform' role that EDBs may play in the future). However, it is not as narrow-focused as enhanced reliability incentives, because the introduction of customer satisfaction incentives can be linked to a wide range of outcomes (and therefore indirectly impact any of the activities where customer touchpoints already exist).

Design

The detailed design of the regulatory tool needs to consider exactly what metrics are 'desirable' (noting that customer preferences evolve over time and there is a risk of 'regulatory lag') and what the relevant incentive mechanism (e.g. financial or reputational) may be.

Potential for implementation

There are a number of well established precedents in other jurisdictions that can could be used as a starting point for the design of this tool. The conceptual objectives (although not necessarily the exact metrics) are straightforward to articulate and explain to stakeholders. Smart meter data could be a key enabler in introducing this tool. Subject to appropriate consultations being undertaken, we consider that this is a tool that could be implemented in the near future.

3) Targeted innovation mechanisms

Unlike more general tools (such as a higher WACC) that can partly motivate companies to become more innovative, targeted mechanisms are purpose-built tools to deliver the sole objective of innovation.

Focus of the tool

This tool is relatively broadly focused. By its nature, innovation can deliver improved customer outcomes both in the current EDB roles (e.g. innovation in the delivery of new connections) as well as the new and emerging EDB roles (e.g. innovation in the DSO role and/or DSP roles).

Design

A key feature of this mechanism is the known and measured risk that the regulator deliberately takes when it allows an EDB to spend a certain quantum of revenues on innovation with outcomes that are by definition uncertain. The quantum of money used in this way, and how the outcomes of the innovative process are shared among different stakeholders, needs to be carefully considered so that customers receive value for money.

Potential for implementation

Some incremental variants of targeted innovation mechanisms (e.g. opex allowance based on cost-benefit analysis, or part-sharing of R&D costs) are relatively straightforward to implement in the short run. More complex variants (e.g. competition among EDBs for a fixed pot of innovation funding) may be more suitable for the long term, as they require a considerable level of buy-in from a wide range of stakeholders.[1]

1) *Innovation funding can realise significant savings for customers: for example, independent review of Ofgem innovation funding estimate benefits are at least 3 times greater than innovation investment cost. See Ofgem-(2016) – The network innovation review (link)*

Conclusions on regulatory tools (2/2)

4) Uncertainty mechanisms

Uncertainty mechanisms have a wide range of variants, ranging from mechanical adjustments to highly complex outcome-based mechanisms that require an appropriate baseline and targets to be set by the regulator.

Focus of the tool

The focus of this tool depends on the specific variant deployed (e.g. indexation could impact all of the roles while automatic triggers tend to be more narrow). Volume driver adjustments are, for example, relatively narrow-focused and are most suitable for outcomes related to the delivery of specific levels of output where high uncertainty is observed (e.g. EVs deployment).

Design

The wide range of variants of this tool means that there can be relatively simple designs (such as indexation) as well as technical designs (such as outcome-based tools that are linked to energy efficiency investments). The simpler variants (for example, volume drivers) would represent a smaller disruption to the existing framework and could be delivered as an "add-on".

Potential for implementation

Some UMs are already used by Commerce Commission (e.g. CPI indexation), but the range of tools could be expanded to include some of the simpler volume drivers – for example links to customer EV uptake. This could also assist in the transition from a weighted-average price cap to a revenue cap (where incremental volume is not encouraged by the price control).

More complex uncertainty mechanisms would require extensive consultations to be undertaken, but could be considered for the medium to long term.

5) Totex

Totex is a relatively novel regulatory tool that (excluding GB) has not been tested extensively by regulators and is not, as yet, part of the 'standard' regulatory toolbox.

Focus of the tool

Totex puts the onus on EDBs to select the optimal set of solutions, and to potentially depend less on long-life physical assets to meet network needs. However, on its own, it may not be sufficient to deliver on EDBs' new roles; it may need to be accompanied by targeted incentives, a higher allowance, or other tools.

Design

To design and implement Totex successfully, the regulator needs to consider a number of different issues, such as outperformance incentives, cost assessments, capitalisation and reporting. As there are multiple sub-variants of Totex that can be applied, it is important to ensure that relevant stakeholders are consulted sufficiently to ensure the final Totex design is fully understood by all parties, and is seen as suitable for implementation in the New Zealand context.

Potential for implementation

Due to the limited international precedent, we consider that a Totex approach could be considered in the long term, but not in the short term. Italy's example shows that there is long lead-in period to implementing Totex, with a number of preliminary activities that need to be initiated well ahead of the actual implementation date.

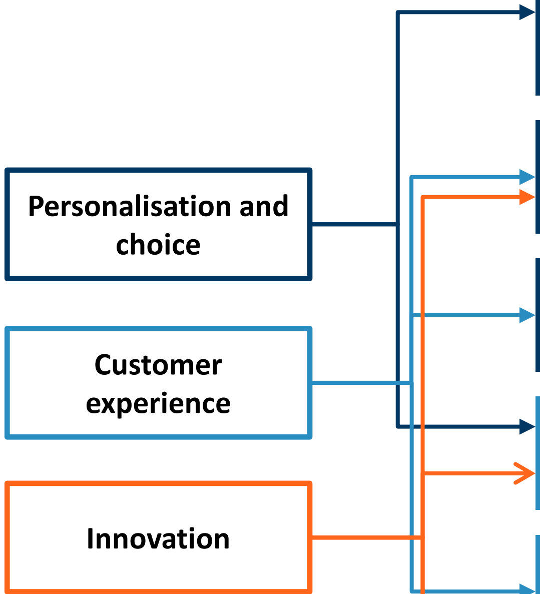
Based on the assessment of the five regulatory tools, in the context of evolving customer expectations (in terms of personalisation, innovation and better customer experience), we consider a "blueprint" for New Zealand EDP regulation in the following slides.

Implications for traditional and new/emerging EDB roles

New customer expectations are emerging, driven by technology developments and experience from other industries…

…which drives the need for **traditional and new/emerging EDB roles** to evolve and adapt to deliver on those expectations.

The regulatory framework therefore needs to adapt to support EDBs in delivering these roles. Not all of the **regulatory tools** reviewed in this report are equally suited to provide this support, and no single tool is sufficient to address all the needs. To deliver on all of the EDB roles, a combination of different tools is likely to be appropriate.



EDB role	1 Enhanced reliability	2 Customer satisfaction	3 Innovation mechanisms	4 Uncertainty mechanisms	5 Totex
Delivery of new connections		✓		✓	✓
Network reinforcement, operation and maintenance	✓	✓	✓		✓
Cost-efficient delivery					✓
Distribution system operator / active network management	✓		✓	✓	✓
Distribution System Platform (DSP)		✓	✓		✓
Environmental and social obligations / responsibilities		✓	✓		

Blueprint levers

Implications for DPP in New Zealand

The current DPP is largely an input-based framework with basic network reliability incentives, as well as some simple uncertainty mechanisms (such as indexation and re-openers in relation to catastrophic natural events).

Based on the analysis in this report, we consider that there are **opportunities for new and additional regulatory tools to be introduced** that would reflect evolving customer expectations and wider changes in the New Zealand energy market.

It is unlikely to be appropriate for all of the proposed regulatory tools to be introduced at the same time – some of them are more suitable for the near term (as they require relatively limited preliminary activities and consultations), while others require extensive public consultation and careful design to be implemented.

In any event, each of the recommendations proposed below needs to be considered in the context of the wider regulatory framework, to ensure that the detailed design complements the existing features of the regulatory framework in New Zealand and the regulatory settlement works well "**in the round**".

However, New Zealand appears to be **well placed to introduce some of these tools**, including **customer satisfaction incentives** (with designs that can be 'borrowed' from other jurisdictions), **UMs** and **enhanced reliability incentives** (both facilitated by smart meter data), and some of the simpler variants of targeted innovation incentives. In addition, **groundwork could be initiated in the short term** to set the industry on a path towards more complex output-based regulation (e.g. more complex UMs, innovation incentives and Totex).

Key recommendations

The five regulatory tools assessed in this report may be introduced at different timeframes, supporting different customer expectations of personalisation, customer experience and innovation.

Based on the analysis in this report we recommend the following:

1) Introduce **enhanced reliability** incentives to encourage EDBs to deliver reliability outcomes that are more tailored to customer preferences, thus supporting customer expectations of **personalisation** and **customer experience**.
2) Introduce **customer satisfaction** incentives, based on a combination of qualitative and quantitative metrics, to encourage EDBs to collect, analyse and respond to information on customer preferences. This could support the evolving expectations of better **customer experience**.
3) Consider introducing **incremental targeted innovation-focused incentives** (e.g. an allowance subject to cost-benefit analysis) in the short term, to support customer expectation of **innovation** but also to improve **customer experience**. Reserve more complex innovation tools (e.g. competition for funding) for the longer term, so that EDBs have time to prepare and to avoid undue regulatory disruption in the industry.
4) Build on existing experience with uncertainty mechanisms to introduce **volume-based mechanisms**, e.g. those that link directly to customer-driven uncertainty (such as deployment of EVs or DER), to support customer expectations of better **customer experience** and deliver more **innovation**.
5) Consider preparing the industry for a **transition towards a Totex output-based regulatory model**, by introducing new data collection requirements in the short term, but reserve the full introduction for the longer term. The implementation of Totex in the long run could support customer expectations of **personalisation**, **customer experience** and **innovation**.

To deliver better customer outcomes within their current roles, EDBs may need to focus on new quantitative and qualitative metrics

In Figure 15 below (and in Figure 16 in the following slide) we have set out **examples of metrics** that can be measured to assess EDBs' performance in their different roles.

Figure 15: Examples of potential customer metrics (traditional EDB roles)

	Outcomes targeted in current regulatory framework	Examples of potential new / additional customer outcomes: Quantitative	Examples of potential new / additional customer outcomes: Qualitative
1 **Delivery of new connections**	▪ No incentives on new connections	▪ **Speed of connections** such as: ▪ % connections within set number of days ▪ Days to connect and (not) requiring construction ▪ **Customer satisfaction** with the connection process performed (e.g. # complaints per 1,000 customers)	▪ **Support in providing new assets** (storage, solar PV, EV chargers) ▪ **Proactive communication** on the connections process (including convenience issues) ▪ **'Connected' communication** with customers (e.g. limited handovers between call centres)
2 **Network reinforcement, operation and maintenance**	▪ S-factor scheme: rewards based on target SAIFI and SAIDI levels set with respect to 10 year historic averages[1] ▪ Penalty incurred if the target level of SAIDI or SAIFI is exceeded in two out of three consecutive years	▪ Number of **repeat interruptions for a single client** (or location) ▪ **Number and duration of outages** that exceed planned timings ▪ **Speed of reconnection** (may be broken down into (i) time to identify location of fault; (ii) time to arrive on site; and (iii) time to resolve the issue)	▪ **Proactive communication** before, during and after planned / unplanned outage (e.g. reason for outage & extent of outage) ▪ Use of customers' **preferred medium** ▪ **Automated notification** system for planned interruptions ▪ **Back-up plan** for prolonged interruptions
3 **Cost-efficient delivery**	▪ Allowed increase in capital expenditure limited to: (i) 20% of the historic average for network expenditure; and (ii) 100% of historic average for non-network expenditure ▪ Incremental Rolling Incentive Scheme ("IRIS") – 15% retention factor (distributors retain 15% of capital expenditure saved)[2]	▪ Refined **incentives for cost-efficiency** (e.g. addressing potential capex bias through a Totex sharing factor) ▪ **Price differentiation** of service quality tailored to customers' preferences (subject to minimum quality of service threshold standard)	▪ **Customer bill itemisation** ▪ Customer involvement in identifying the right **price-quality balance** (i.e. influence over future increases of bills) ▪ **Communication** of 'exceptional' cost items and/or changes to the bill ahead of time

1) *Commerce Commission (2018) Electricity Distribution Services Input Methodologies Determination 2012*

2) *Commerce Commission (2014) Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020, Main policy paper, Section 7.*

Legend – customer expectations
Personalisation
Customer experience
Innovation

In their new and emerging roles, EDBs may need to develop new ways of measuring their performance and deliver on customer expectations

Figure 16: Examples of potential customer metrics (new/emerging EDB roles)

	Examples of potential new / additional customer outcomes – Quantitative	Examples of potential new / additional customer outcomes – Qualitative
4 **Distribution system operator / active network management**	▪ Number of **new services/products/market** offered (e.g. frequency support) ▪ Average **monetary value to customers** (i.e. to indicate monetisation of assets – storage or distributed generation) ▪ **Improved scheduling of planned outages** based on smart meter data and automated systems (adapting to evolving consumption patterns)	▪ **Proactive identification of issues** that avoids customer needing to make an inquiry /complaint (e.g. 'smart' network that notifies EDB of an outage without customer's involvement) ▪ **Integration of products and services** (e.g. smart meters/EV charging with network maintenance)
5 **Distribution System Platform (DSP)**	▪ Database of EDBs' customer details enabling **timely communication** (measured by % of customers 'up to date') ▪ Increased **network visibility** to EDBs (to enable customers' data to be processed) measured by % behind-meter generation and storage 'visible' to EDBs, and/or % smart meter data shared with EDB	▪ The enhanced capabilities and platform for **customers to have visibility** of network congestion and to offer flexible solutions ▪ Moving away from building new assets and instead giving the **flexible resources market** the opportunity to offer their services ▪ **Customer control** over data they disclose/share with EDB

6 **Environmental and social obligations / responsibilities**	▪ **Commercial/residential energy conservation program** (% of energy use)
	▪ **Diversity and inclusion** (% of minorities)
	▪ **Health/safety** (# incidents or 'narrow misses', by severity)
		▪ **Independent assessment of EDB**
		  ▪ Transparency
		  ▪ Action on climate change
		  ▪ Human rights and ethics
		  ▪ Innovation

Overall, we consider that the specific design of each of these metrics, the thresholds and benchmarks underpinning the performance assessment, as well as the rewards / penalties that need to be developed, would need to be subject to a detailed consideration by the regulator and consulted on appropriately to ensure that their implementation aligns with the needs of New Zealand customers.

Note: By definition, these EDB roles are new and therefore not represented in the current regulatory framework.

Legend – customer expectations
Personalisation
Customer experience
Innovation

Appendix: Detailed analysis of incentive mechanisms and uncertainty mechanisms

Incentive mechanisms are the most widespread regulatory tool, but they need to be designed carefully to deliver the desired outcomes

Incentives are the most widespread regulatory tool and have been used widely by a number of regulators in different jurisdictions.[1] Different types of incentive mechanisms can be used to deliver particular customer outcomes (as illustrated in Figure 17 opposite).

Legal obligations tend to be used for critical and binary outcomes that are of critical value (for example, in relation to the value of human life) and often attract strong penalties (including, inter alia, jail sentences).

Reputational incentives, at the other end of the spectrum, tend to be weaker and are typically used for non-critical outcomes. By definition, they do not attract any direct penalties or rewards from the regulator.

Financial and procedural incentives fall somewhere in-between in terms of their severity, although the sharpness of financial incentives can vary significantly. Some financial incentives can be business-critical (in terms of the revenue-at-risk), whereas other are considerably weaker.

When deciding on the specific parameters of incentive design, regulators need to carefully consider:

- The value that customers place on specific service EDBs provide. A link between EDB service and value that customers place on it is the most powerful principle for setting incentive parameters.
- Setting appropriate reward/penalty target. To be effective, incentives need to provide a sufficient signal to the EDBs to alter its behaviour. However, if there is uncertainty around appropriate target levels (or to avoid windfall gains/losses for EDBs), regulators may use a Cap/Collar approach rather than reduce the overall strength of the incentive.[2]
- The degree of incentive symmetry. Incentives that are designed symmetrically (i.e. as a bonus/malus) are likely to have smaller impact on overall WACC. However, asymmetrical incentives are required when a certain minimum level of service is required and further improvements have limited value to customers.

Figure 17: Types of incentives

Types of incentives	1 Financial	2 Reputational	3 Legal obligations	4 Procedural
Types of outcomes targeted by incentive	■ Meeting customer expectations ■ Appropriate response to technological changes ■ Planned maintenance and repairs	■ Meeting environmental targets ■ Diversity targets	■ Specific policy objectives ■ Health and safety ■ Achieving minimum quality standards	■ Good quality provision by EDBs to the regulator ■ Well-justified business plan that clearly delivers customer-focused outcomes
Examples	■ Lump sum reward / penalty for specific outcome ■ Adjustment to regulatory WACC (or a specific element of regulatory WACC, e.g. beta, notional gearing) upon meeting specific outcome ■ Competition for 'reward pot'	■ Ranking of relative performance of other EDBs on individual metrics ■ 'Naming and shaming' of particular EDBs that do not meet pre-determined standards	■ Health and safety requirements ■ Criminal prosecution of non-compliant individuals ■ Universal minimum service obligation	■ Adjustment to regulatory WACC (or a specific element thereof) upon delivering a specific procedural outcome (e.g. well-justified high-quality business plan)

1) *Majority of European regulatory models are using incentives mechanisms as a regulatory tool (link)*

2) *Cap and floor regime for interconnectors (link)*

Uncertainty mechanisms are a highly flexible tool that can help manage a broad spectrum of risks facing EDBs

Different types of uncertainty mechanisms can be used to allocate the risks facing EDBs appropriately between EDBs and customers. In deciding on the suitability of a particular variant of an uncertainty mechanism two important factors need to be considered: the controllability of risk and the predictability of outcomes, as illustrated in Figure 18 on the right-hand side.

1) Controllability of risk

Automatic mechanisms (e.g. indexation) allocate risks towards customers (rather than EDBs) and are therefore appropriate when the risks fall outside EDBs' control.

Pre-agreed automatic mechanisms (e.g. volume-related revenue allowance triggered by particular events in the market, which could include the % penetration of EVs or volume of distributed resources) share the risks between EDBs and customers: EDBs' revenues increase (paid for by customers) if and only if specific events occur that justify additional investments to be made by EDBs.

Manual mechanisms, such as re-openers, are often triggered at an explicit request of the regulated entity. They allocate more of the risk to the EDB, as customers are not required, ex-ante, to underwrite highly uncertain spend by EDBs.

2) Predictability of outcomes

Ex-ante mechanisms may be used if both the regulator and the EDB know and accept that there is particular uncertainty on certain metrics (e.g. volume of future connections or inflation levels). In such cases, it is possible to design an ex-ante uncertainty mechanism that triggers pre-agreed changes to the regulatory settlement (e.g. higher/lower revenues) in response to specific thresholds being met. Both the 'automatic' and 'pre-agreed' mechanisms in the table opposite fall into this category.

Ex-post mechanisms may be used if neither the regulator nor the EDB anticipated a particular change in the circumstances (e.g. disruptive technological development or natural disaster). In such cases an ex-post mechanism can be applied (often subject to regulator's discretion) to enable the regulator to evaluate ex-post whether any changes need to be made to the regulatory settlement (e.g. exceptional allowance for costs to deal with a flooding).

Figure 18: Types of uncertainty mechanisms

	1 Automatic	2 Pre-agreed	3 Re-openers
Types of UMs	Ex-ante mechanisms		Ex-post mechanisms
Types of outcomes targeted by incentive	▪ EDB financeability facilitated by automatic indexation to published data	▪ "**Known unknowns**": allowance that recognises there is uncertainty over future outcomes such as volume and location of new connections	▪ "**Unknown unknowns**": allowance that, by nature, cannot be covered through the ex-ante settlement
Examples	▪ Inflation indexation ▪ Volume and timing of new connections	▪ Reinforcement allowance triggered by penetration of embedded generation (or heat pumps,…) ▪ Reduction in allowed average cost if volume threshold (hence economies of scale) are achieved	▪ Investments triggered by unexpected changes to the operational rules and thresholds determined by the policy makers

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