Security and Reliability Council

Reliability risk framework in the electricity industry

Advice to the SRC, to help it decide what role and scope to set when providing advice to the Electricity Authority on reliability matters

19 September 2014

Note: This paper has been prepared for the purpose of the Security and Reliability Council. Content should not be interpreted as representing the views or policy of the Electricity Authority.

Contents

1 Introduction

1.1 Purpose of this paper

1.1.1 The statutory functions of the Security and Reliability Council (SRC) include providing the Electricity Authority (Authority) with advice about reliability. In the process of carrying out this function, the SRC may wish to obtain information from the Authority and participants about their reliability monitoring activities.

1.1.2 The SRC, when considering a reliability paper at its 13 June 2014 meeting, asked for information on:

a) how the electricity industry can better engage with consumers to create appropriate mutual expectations of reliability performance

b) the perceptions and reality of the causes of reliability events

c) how the Authority and the Commerce Commission (Commission) roles interact with respect to reliability.

1.2 Structure and scope of this paper

1.2.1 This paper satisfies the SRC requests set out in paragraphs 1.1.2b)-c) while providing the wider context of the framework under which reliability is managed, regulated and measured. This paper is structured into the following four sections:

a) an overview of the current reliability risk framework

b) a summary of the relevant regulatory components

c) information on how reliability is currently measured and monitored

d) how parties may respond to future changes, including consideration of demand-side involvement.

1.2.2 The SRC request set out in paragraph 1.1.2a) has only been partially met. Some new customer-centric metrics of the reliability performance of distributors are explored in paragraphs 4.5.6-4.5.10.

1.2.3 Reliability is generally considered to be the ability of a system or component of that system to perform its required functions under stated conditions for a specified period of time. From the perspective of an electricity consumer, reliability is the experience of continuous access to electricity supply at the required quality.

1.2.4 In keeping with previous papers to the SRC, this paper focusses of the continuous access aspect of reliability (outages) though it does touch on the power quality aspect at times. This paper does not cover the framework for safety risk management.

1.2.5 Questions for the SRC to consider are set out on the final page of this report (page 28).

1.3 Background

1.3.1 A recurring theme in SRC discussions has been the role that the SRC should play in providing the Authority with advice about power system reliability, and the information it needs to do so. Previous advice to the SRC on this topic has included:

a) Supply reliability risk management (May 2012)[1]

b) The Electricity Authority's role in reliability (August 2012)[2]

c) Supply-side reliability – credible event data (August 2012)[3]

d) Reliability dashboard and reliability-centred monitoring (May 2013)[4]

e) Reliability-centred monitoring (February 2014)[5]

f) Transpower event review (February 2014)[6]

g) Reliability monitoring in the electricity sector (June 2014).[7]

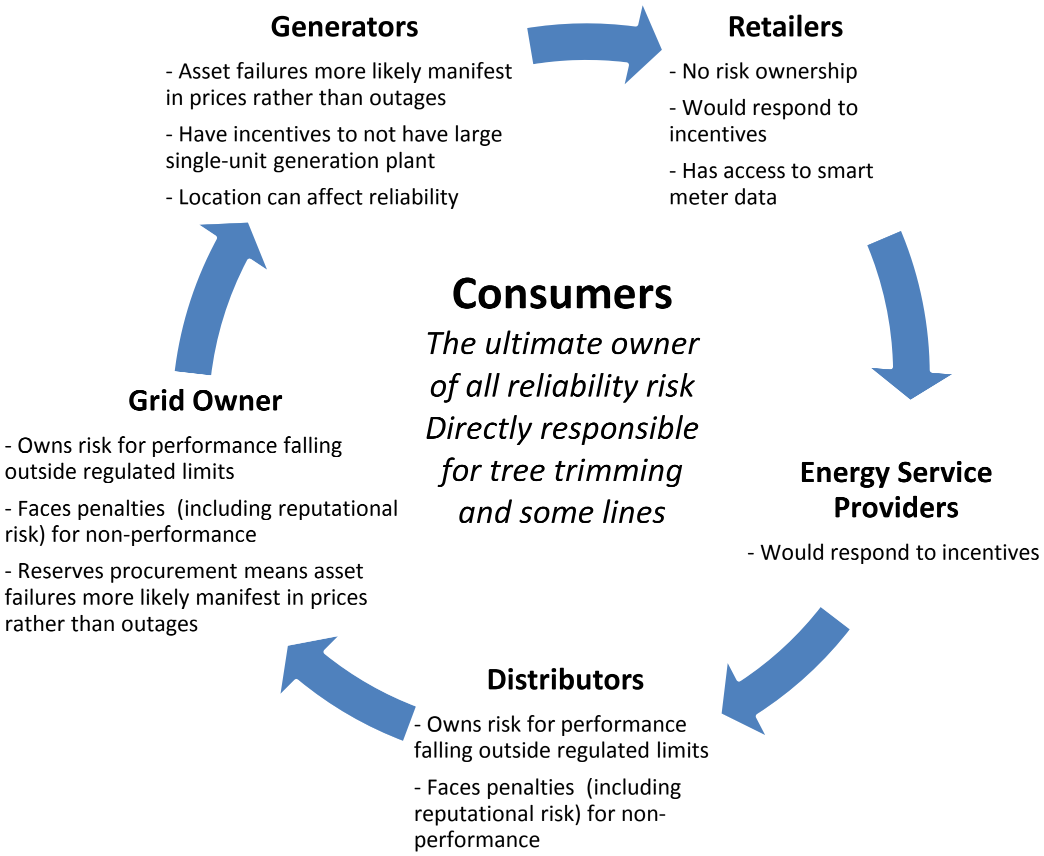
[1] http://www.ea.govt.nz/dmsdocument/13011
[2] http://www.ea.govt.nz/dmsdocument/13602
[3] http://www.ea.govt.nz/dmsdocument/13594
[4] http://www.ea.govt.nz/dmsdocument/14892
[5] http://www.ea.govt.nz/dmsdocument/18106
[6] http://www.ea.govt.nz/dmsdocument/18107
[7] http://www.ea.govt.nz/dmsdocument/18545

2 Current reliability risk framework

2.1 Overview

2.1.1 Consumers' experience of electricity supply reliability is dependent upon the performance of multiple components managed by a number of parties in the supply chain. Achievement of the required reliability standards relies on communication and coordination throughout the supply chain. Incentives are used to promote risk management where there are distinct risk owners.

Figure 1: Overview of key aspects of the risk reliability framework



2.2 Consumers

2.2.1 The consequences of unreliable supply are borne by electricity consumers as either an outage or increased costs of supply, and these consumers can therefore be considered as the ultimate owner of risk. For the delivery of an appropriate level of reliable supply, it is critical that consumers' requirements are taken into account by each party that has the ability to impact on the outcome for consumers.

2.2.2 Ultimately consumers are the last resort reserves through the arming of distribution feeder relays to provide extended reserve (previously known as automatic under-frequency load shedding (AUFLS)) when major system events occur. The Authority has made amendments to the Electricity Industry Participation Code 2010 (Code) that are expected to lead to better prioritisation of which consumers will shed load in an extended reserve event. For example, feeders with emergency services (such as a hospital) or high-value load could be less likely to provide extended reserve.

2.2.3 A significant cause of loss of supply is through the damage that vegetation causes to distribution lines, particularly during extreme weather events. The Electricity (Hazards from Trees) Regulations 2003 regulate safe clearance distances between trees and power lines and assign responsibility for tree trimming. The responsibility for regular tree trimming (usually) falls on the tree owner. These owners tend to be consumers.

2.2.4 When one tree owner fails to trim a tree that then causes a power outage, the cost and inconvenience of the outage may be experienced by other consumers. These externalities are not completely passed on to the tree owner, though fines of up to $10,000 can be imposed. This transfers some risk to tree owners, though there are questions about the suitability of the dollar value involved and how enforceable the penalty actually is. Vegetation management is an area where consumers can improve reliability of supply and reduce costs.

2.2.5 The Authority understands that in the wake of the June 2013 storm that hit Wellington, many consumers thought Wellington Electricity would repair everything. These consumers did not understand their own responsibilities for repairing their own customer service lines.[8] Consumers having responsibility for their own lines provides good alignment in the reliability risk framework. However, if consumers are unaware of their responsibilities until an outage happens, then they cannot take appropriate preventative action or maintenance of their lines.

2.3 Retailers

2.3.1 As retailers are largely unable to influence reliability, it seems suitable that they have no risk ownership in the framework.

2.3.2 Reliability tends to be a multi-customer issue. A retailer who expended effort to influence reliability improvements may not see any strong competitive advantage as other retailers' customers would benefit.

2.3.3 Despite having no risk ownership, retailers tariffs can influence how clearly price signals from distributors and the grid owner are passed through to consumers.

2.3.4 The retailer-led roll-out of smart meters may provide retailers with access to datasets that could be valuable for improving reliability. This data will be shared with parties able to directly influence reliability (such as a distributor) provided commercial arrangements are put in place.

2.4 Energy service providers

2.4.1 In the context of this paper, energy service providers (such as load aggregators) are non-traditional intermediaries between consumers and the supply-side. They would be responsive to incentives through price signals and would be prepared to take on some of a customer's risk for the right price.

2.5 Distributors

2.5.1 Distributors have direct ability to influence reliability outcomes. Accordingly, distributors own a lot of risk for reliability performance falling outside the regulated reliability and quality standards set for them by the Commission.

2.5.2 All distributors manage a cost/reliability trade off within quality limits. Privately-owned distributors are cost controlled through price-quality regulation, whereas community-owned

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[8] Typically this means the section of line owned by the consumer that runs from the consumer's house to the street, though the exact boundary of ownership change varies depending on a variety of factors including when the line was built.

distributors are subject to an information disclosure regime and ultimately the voting choices of their community.

2.5.3 Distributors can also face some penalties for non-restoration of supply within a reasonable time. However, reputational risk may be the more significant incentive for many distributors.

2.5.4 In recent years the use of international standards such as ISO 31000:2009[9] Risk Management and ISO55000:2014[10] Asset Management (previously PAS 55) has become standard practice for infrastructure management. Most of New Zealand's electricity distributors (and Transpower) make reference to these standards in their asset management related publications. Together these standards provide guidelines for the identification, measurement, treatment and communication of risks for infrastructure businesses. Their use as a potential risk measurement tool is discussed further in paragraphs 4.7.2 and 4.7.3.

2.5.5 Many distributors engage with their consumers on reliability matters. In principle, this should better enable distributors to determine whether they're providing a level of reliability that optimises the value for consumers. The practicalities of this approach are discussed further in section 4 of this paper ('Measuring reliability performance').

2.6 Grid owner

2.6.1 The grid owner has a direct ability to influence reliability outcomes. Through price-quality regulation, the grid owner owns a lot of risk for reliability performance falling outside the regulated reliability and quality standards set for it by the Commission.

2.6.2 Reputation risk for major failures is also a key incentive. When transmission failures do cause power disruptions they will generally affect a large number of consumers. Also, because of the scale of transmission assets (e.g. the size of transformers and the length and remoteness of transmission lines) restoration times can be longer than for distribution faults. This means that the probability of transmission failures causing power cuts are less probable but have greater consequences than distribution failures.

2.6.3 Asset failures on the transmission system do not always result in a direct impact on the reliability experienced by consumers, as these failures are often managed through the procurement of sufficient reserves to cover the event. The procurement of these reserves does however mean that transmission reliability can impact wholesale and ancillary service prices. However, the grid owner faces reliability incentives through payment of instantaneous reserve costs and penalties if found to be the causer of an under-frequency event.

2.7 Generators

2.7.1 In general, generator reliability does not impact directly on reliability experienced by consumers. The effects of generation asset failure are more likely to be seen on wholesale and ancillary service prices than manifested in loss of supply to consumers, as sufficient reserves are generally procured to accommodate the failure of the largest generating asset.

2.7.2 Generators face incentives to limit the capacity of their largest plant, lest they regularly become the instantaneous reserve risk-setter. They can also attract a $/MW charge if they're found to be the causer of an under-frequency event.

[9] Refer to http://www.iso.org/iso/home/standards/iso31000.htm

[10] Refer to http://www.iso.org/iso

2.7.3 While there are price signals to generators that will influence their choices of where to locate future generation plant, these signals do not explicitly reflect reliability outcomes. Decisions to locate generation further from load centers would generally be expected to expose more supply to transmission circuits of greater length and therefore lower reliability. Because transmission losses are built into wholesale prices, the price signals that grid-connected generators are exposed to are generally congruent with incentivising siting of generation closer to load centers.

3 Relevant regulatory, standards-based and contractual instruments

3.1 Overview

3.1.1 Regulation, standards and commercial contractual instruments provide financial incentives and penalties on parties to provide services that meet reliability performance standards. For example:

a) Part 4 of the Commerce Act 1986

b) the Electricity Industry Act 2010

c) the Code

d) standards, whether mandatory or voluntarily adopted

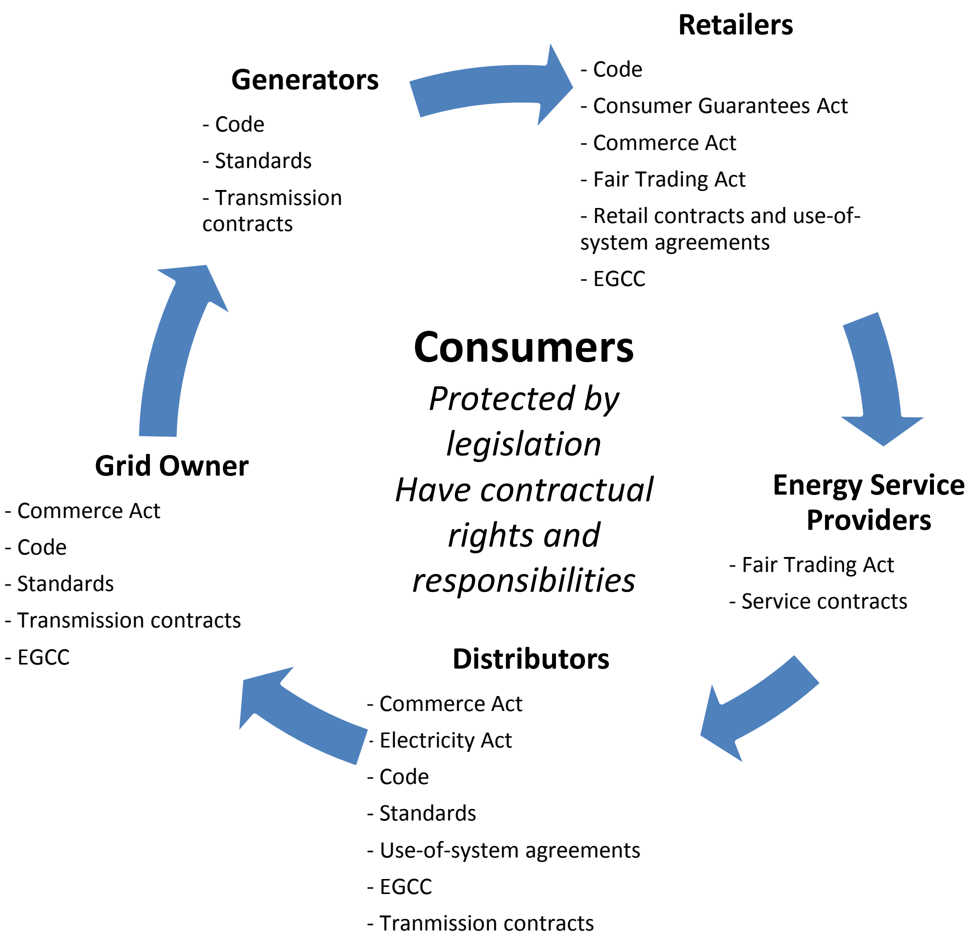
e) connection contracts

f) use-of-system agreements

g) membership in the Electricity and Gas Complaints Commissioner (EGCC) scheme.

3.1.2 Figure 2 below provides an overview of the various supply-side responsibilities under a selection of regulatory, standards-based and contractual instruments relevant to reliability.

Figure 2: Overview of responsibilities for reliability risk under regulation, standards and contracts



3.2 Consumers

3.2.1 In general, consumers are collectively the target for protection in legislative instruments. For example, in the case of Part 4 of the Commerce Act, the regulation of reliability is at a high-voltage feeder level and not at the level of the individual consumer.

3.2.2 Consumers have rights and responsibilities under their contracts with retailers (and sometimes through contracts direct with distributors). The responsibilities include steps to protect the distribution network for reliability purposes, though it seems likely many (if not most) consumers are unaware of these responsibilities.

3.2.3 Consumers also have access to the EGCC for complaints on reliability performance.

3.3 Retailers

3.3.1 A key piece of legislation that relates to electricity retailers is the Consumer Guarantees Act 1993. It provides a guarantee that the supply of electricity by a retailer must be of an acceptable quality. It also gives consumers the right to claim a remedy from retailers that fail to comply with the guarantee. Under the Consumer Guarantees Act, in some circumstances, liability for such remedies can transfer to the distributor (including Transpower when it is acting as a lines service provider, but not when acting as the system operator).

3.4 Energy service providers

3.4.1 There is presently no reliability-related regulation of these parties, except to the extent that they are already industry participants under the Code (say as a provider of interruptible load into the instantaneous reserves market). Energy service providers are also subject to the Fair Trading Act and the commercial terms under which they contract their services. If they provide reliability related services to consumers there may be some risks associated with poor performance of their services and/or products.

3.5 Distributors

3.5.1 The setting and application of reliability standards and planning criteria (such as N-1)[11] by regulators directly influences the management of reliability. There is an inherent trade-off between reliability and cost to consumers.

3.5.2 An example of this trade-off occurred in 2004 in Queensland when security/reliability standards were changed in response to perceived under-investment. The changes directed the two state-owned distributors to achieve N-1 security on bulk-supply substations, large zone substations (5 MVA and above) and sub-transmission feeders. This change was subsequently reviewed in 2008 in response to consumer concern over escalating prices. The 2008 review amended the security/reliability standards as it was found that the N-1 standard could be achieved more cost-effectively.[12]

3.5.3 Section 105 of the Electricity Industry Act 2010 specifies that distributors can be fined if they fail to restore supplies within a reasonable time following an outage.

3.5.4 As discussed in paragraph 2.5.4, distributors and the grid owner generally use international standards for risk and asset management. Whilst the use of these standards is not mandatory,

[11] N-1 is where a system of N components continues to operate after the loss of one component of the system.

[12] Queensland Electricity Network Capital Program Review 2011, Detailed Report of the Independent Panel, Page 2

when reviewing electricity lines businesses regulators will take them into account and use them as a good practice benchmark.

The roles of the Commission and the Authority with respect to reliability in the distribution sector

3.5.5 The Commission is responsible for Part 4 of the Commerce Act that includes incentive schemes and other measures for lines businesses. For distribution businesses the quality limits in the price/quality regulation highlight any material unexplained underperformance in SAIDI[13] and SAIFI.[14] Distributors face investigation and other consequences for any underperformance under these provisions.

3.5.6 In addition to financial incentives, the Commission's information disclosure regime provides a window through which the relative performance of lines businesses is exposed to scrutiny. Poor-performing networks can be exposed to reputation damage if they become an outlier against better-performing peers.

3.5.7 The Authority publishes distribution pricing principles that guide how distributors set their prices to recover the total revenue that the Commission allows them to gather. The Authority has recently commenced a review of distribution pricing.

3.5.8 The Authority interprets its statutory objective to mean –with respect to reliability– the provision of an *efficient level* of reliability.

> "In regard to reliable supply the Authority notes that both **continuity of supply and quality of supply are of interest to the Authority**, subject to the jurisdiction of the Commerce Act" [emphasis added][15]

> "The Authority interprets promoting reliable supply to mean exercising its functions to encourage efficient reliable supply. Promoting reliable supply does not mean achieving a prescribed level of reliable supply."[16]

3.5.9 The Authority has relevant restrictions placed on its Code-making ability in Section 32(2) of the Electricity Industry Act 2010.

> "The Code may not...purport to do or regulate anything that the Commerce Commission is authorised or required to do or regulate under Part 3 or 4 of the Commerce Act 1986 (other than to set quality standards for Transpower and set pricing methodologies (as defined in section 52C of that Act) for Transpower and distributors)"

3.5.10 The Commission and the Authority have a Memorandum of Understanding (MoU) between the organisations.[17] The MoU notes that the Commission's responsibilities include "monitoring compliance with price-quality paths" and the Authority's include "to undertake industry and market monitoring…to promote competition, reliability and efficiency for the long-term benefit of consumers."

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13 System Average Interruption Duration Index. This is a measure of the length of outages.

14 System Average Interruption Frequency Index. This is a measure of how often outages occur.

15 Paragraph 2.3.1 of the Authority's interpretation of its statutory objective available from http://www.ea.govt.nz/about-us/strategic-planning-and-reporting/foundation-documents/

16 Paragraph A.47, Ibid.

17 Available from http://www.ea.govt.nz/about-us/strategic-planning-and-reporting/mous/

3.5.11 As monitoring of distribution sector reliability is an area of overlapped responsibilities, the MoU requires the organisations to "work together to avoid…duplication of effort between the parties, and to maximise efficiency and effectiveness."

3.5.12 While the Authority has a direct role in the monitoring of distribution sector reliability, it is unlikely to be permitted to take direct action in this regard. As part of its monitoring role, the Authority can conduct enquiries and publish reports on distribution sector reliability.

3.5.13 Accordingly, the SRC can give advice to the Authority on distribution sector reliability and be confident that the Authority will either have a direct monitoring/reporting role or can relay advice to the Commission for their consideration.

3.5.14 The future of monitoring reliability (and power quality) is discussed further in section 4 of this paper ('Measuring reliability performance').

3.6 Grid owner

3.6.1 For Transpower –in its role as the grid owner– the regulatory environment is similar to privately-owned distributors. The Commission regulates its total revenue and required reliability through a price-quality path. The Authority is responsible for determining the transmission pricing methodology.

3.6.2 Unlike the distribution sector, the Authority also sets grid reliability standards through the Code. Essentially, these standards are a combination of N-1 for the core grid and a calculated value of lost load (VOLL) of $20,000/MWh.[18] The Commission analyses Transpower's proposed grid investments and has the power to approve or decline them.

3.6.3 For Transpower's coming regulatory control period, a risk-based approach has been taken to categorising assets into prioritised classes that will each have reliability targets to meet.

3.6.4 As a state-owned enterprise, Transpower has also been the subject of two reports by the Office of the Auditor-General. The second (follow-up) report in 2014 found that Transpower had been proactive in improving asset and risk management.

> "Transpower has set up a large number of initiatives covering all elements of asset and risk management. Many of the initiatives are still in the early stage of development. However, they are progressing on a measured path that, if continued, will meet best-practice asset management and deliver the long-term outcomes described in *Transmission Tomorrow*."[19]

3.6.5 With respect to standards, the grid owner has adopted ISO 31000 Risk Management and ISO 55000 (previously PAS 55) Asset Management practices in the management of its business. Whilst the use of these standards is not mandatory, Transpower has stated its use of the standards in published documents and is therefore likely to be held accountable if its performance falls short of their requirements. Transpower stated in its Independent Price Proposal to the Commission that the following asset management objectives are directly related to reliability:

> "1. Asset Health and Condition: targets have been set out in our fleet strategies that manage the risk of asset failure and the associated reliability impacts.
>
> 2. Certification: we will seek asset management (PAS 55) certification by June 2014.

[18] For more detail, see http://www.ea.govt.nz/operations/transmission/grid-reliability-standards/

[19] Available from http://www.oag.govt.nz/2014/soe-audits/part4

> 3. Risk Management: we will implement an integrated asset risk framework that includes both qualitative and quantitative assessment techniques by 2015." [20]

3.6.6 Transpower's inclusion of its intended use of the standards in its expenditure proposal to the Commission effectively places a compliance obligation on its performance relative to these standards.

3.6.7 Transpower is also party to transmission contracts that are largely regulated by the Code.

3.7 Generators

3.7.1 Generators' source of main reliability-related regulation is found in the Code. There are requirements for completion of asset capability statements and meeting of asset owner performance obligations. The Code is also the source of the risk-setter and event causer incentives discussed in paragraph 2.7.2.

3.7.2 Connection contracts can be formed with the grid owner or a distributor, depending on where the generation plant is being connected.

3.7.3 As with distribution and transmission lines businesses it is normal practice for generators to adopt practices that are aligned with international standards. ISO 55000 Asset Management and ISO 31000 Risk Management standards would be expected to be referred to in large generator businesses. Smaller generators may not adopt practices to international standard levels. Whilst not mandatory for reliability performance such standards are important in respect of safety and hazard risk management.

3.7.4 In addition AS 4777 is emerging as a standard commonly required by distributors for installations of small-scale distributed generation (such as solar).

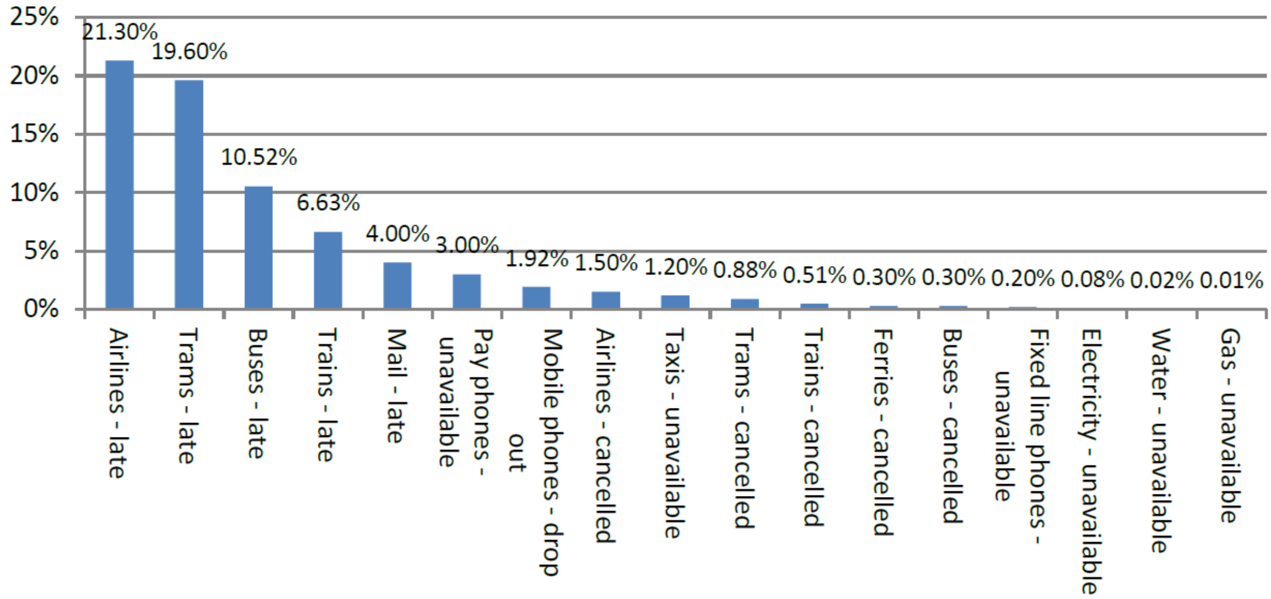
[20] Transpower December 2013 Expenditure Proposal for Regulatory Control Period 2 to the Commerce Commission

4 Measuring reliability performance

4.1 Overview

4.1.1 While it cannot begin to identify whether the level of reliability experienced is efficient, Figure 3 below provides an interesting set of cross-industry reliability comparisons.

Figure 3: Various measures of unreliability across essential service industries



Source: Energy Supply Association of Australia[21]

4.1.2 The sources of measures of reliability are primarily from those parties most directly able to manage reliability risks: the grid owner and distributors. Figure 4 illustrates this imbalance in the source of reliability metrics.

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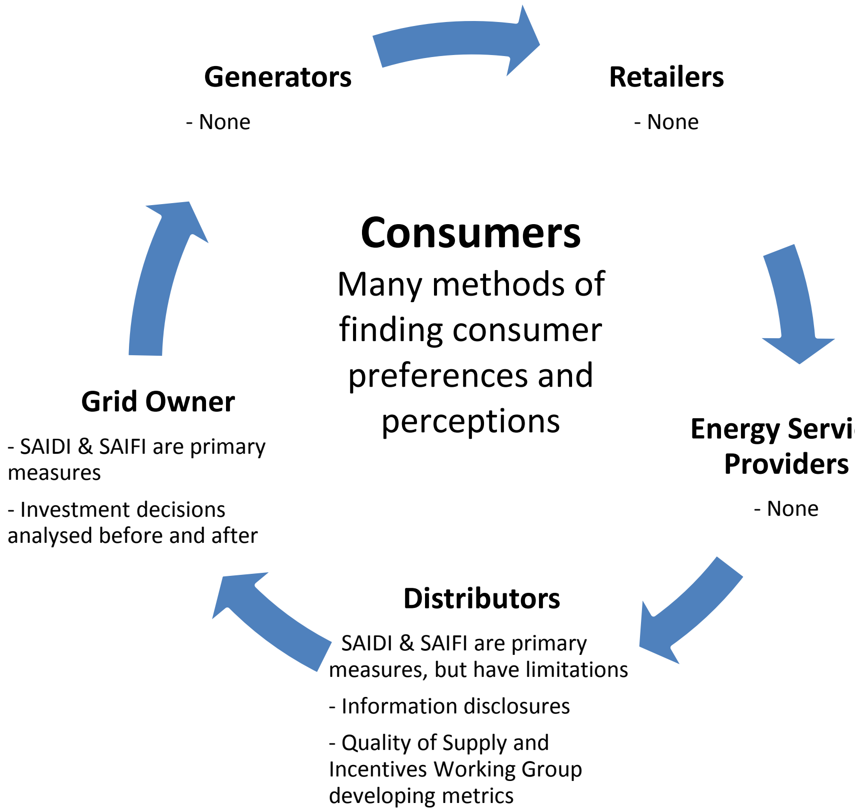
21 *How reliable do we want our power supplies to be?* Available from http://www.esaa.com.au/policy/power_supply_reliability_1

Figure 4: Measuring reliability performance



4.2 Consumers

4.2.1 For the purposes of determining the grid reliability standards,[22] the Authority uses survey-based econometric techniques to estimate VOLL. The VOLL technique produces an estimation of how much consumers value reliability and provides more insight than the responses to traditional consumer survey methods (discussed further in paragraph 4.5.5). The Authority published updated VOLL values in July 2013 and is considering how this could be applied throughout the electricity industry.[23]

4.2.2 Figure 5 shows a variety of results from a survey of consumers that the Authority commissioned UMR Research to conduct. There are two key reliability-related observations from these results:

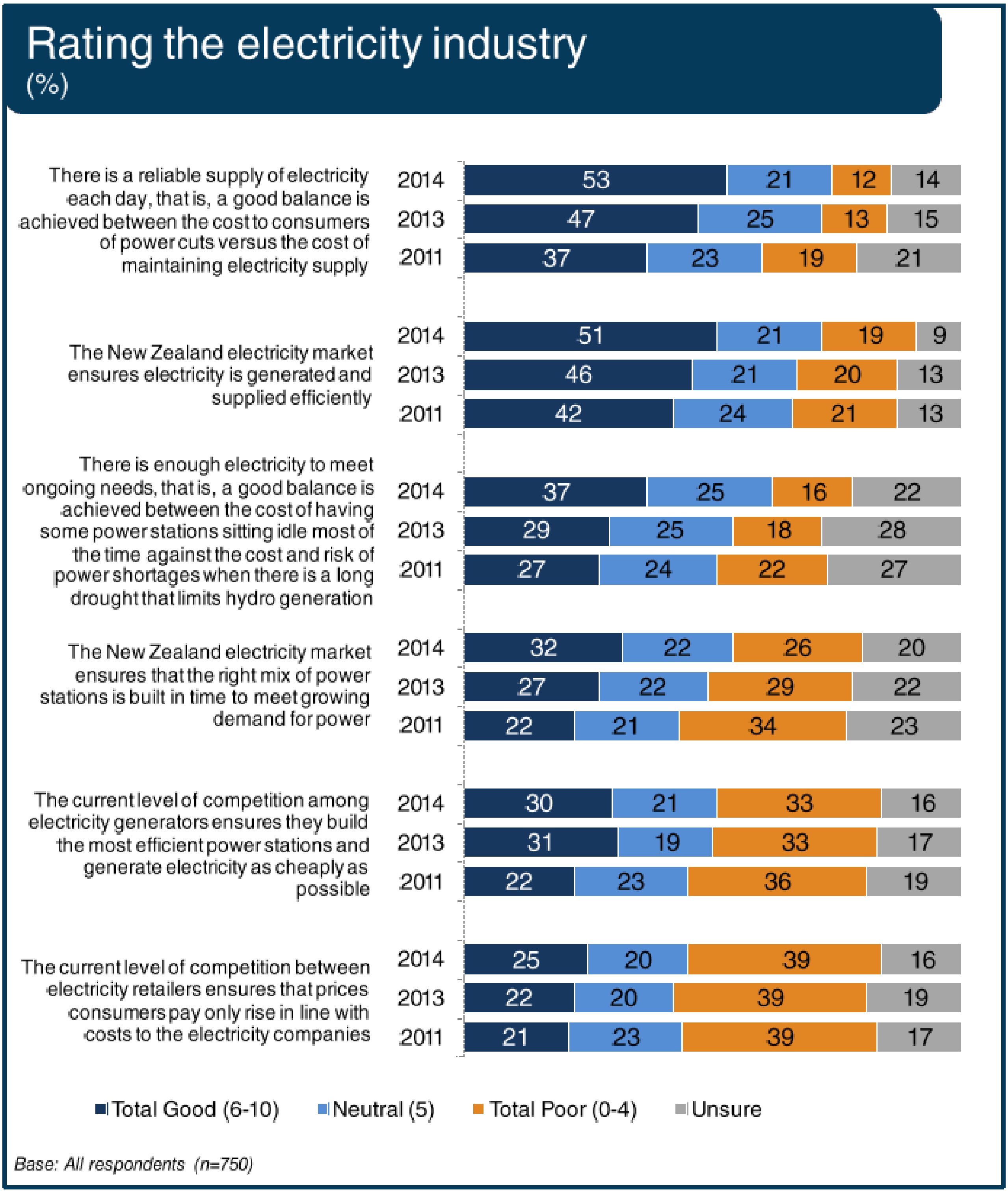
a) consumers' perceptions of reliability performance are improving, with assessments of 'good' reliability rising 16 percentage points since 2011

b) there is quite a contrast between consumers' perceptions of reliability (the top ranked result with 53% rated 'good') and perceptions of the effectiveness of competition at constraining price increases (lowest ranked result with 25% rated 'good').

[22] As discussed in paragraph 3.6.2

[23] Refer to http://www.ea.govt.nz/development/work-programme/transmission-distribution/investigation-of-the-value-of-lost-load/

Figure 5: Ratings of performance of aspects of the electricity industry 2011-14



Source: Electricity Authority[24]

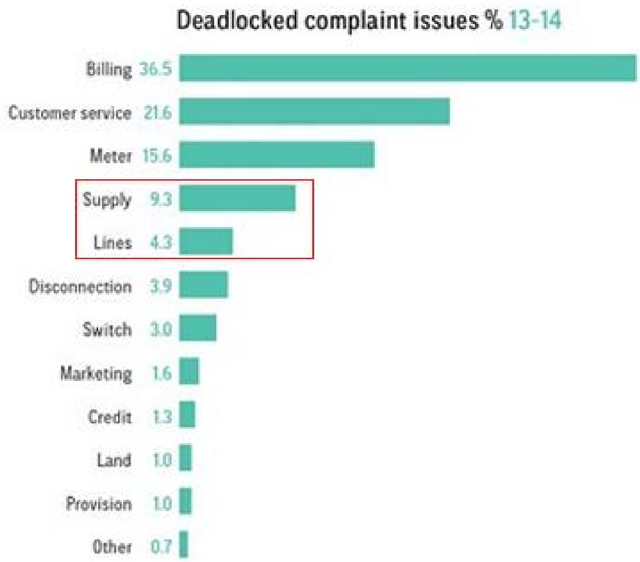
[24] Consumers survey available from http://www.ea.govt.nz/about-us/corporate-projects/2014-2017-planning-and-reporting/implementation/consumer-and-stakeholder-surveys-2014/

4.2.3 Another way to understand consumer perceptions of reliability is by looking at complaints made to the EGCC. Figure 6 shows the issues that consumers complain about: issues of 'Supply' and 'Lines' are relevant to reliability and will include power quality concerns.

Figure 6: Reliability-related complaints to the EGCC for 2013-14

Complaint issues %

	11 - 12	12 - 13	13 - 14
Billing	42.3	46.4	43.0
Customer service	17.7	16.3	16.9
Disconnection	8.1	9.2	9.7
Meter	9.5	7.0	9.5
Supply	5.1	4.5	5.1
Switch	4.4	3.0	3.4
Credit	n/a	n/a	3.0
Lines	1.6	1.9	2.6
Marketing	n/a	n/a	2.0
Other	3.7	5.0	2.0
Provision	1.0	1.6	1.4
Land	0.4	0.5	0.6
Prepay	n/a	n/a	0.6
Debt	5.6	4.5	0.1
Outside Jurisdiction	0.0%	0.0%	0.0%



Source: EGCC website[25] [red boxes added for emphasis]

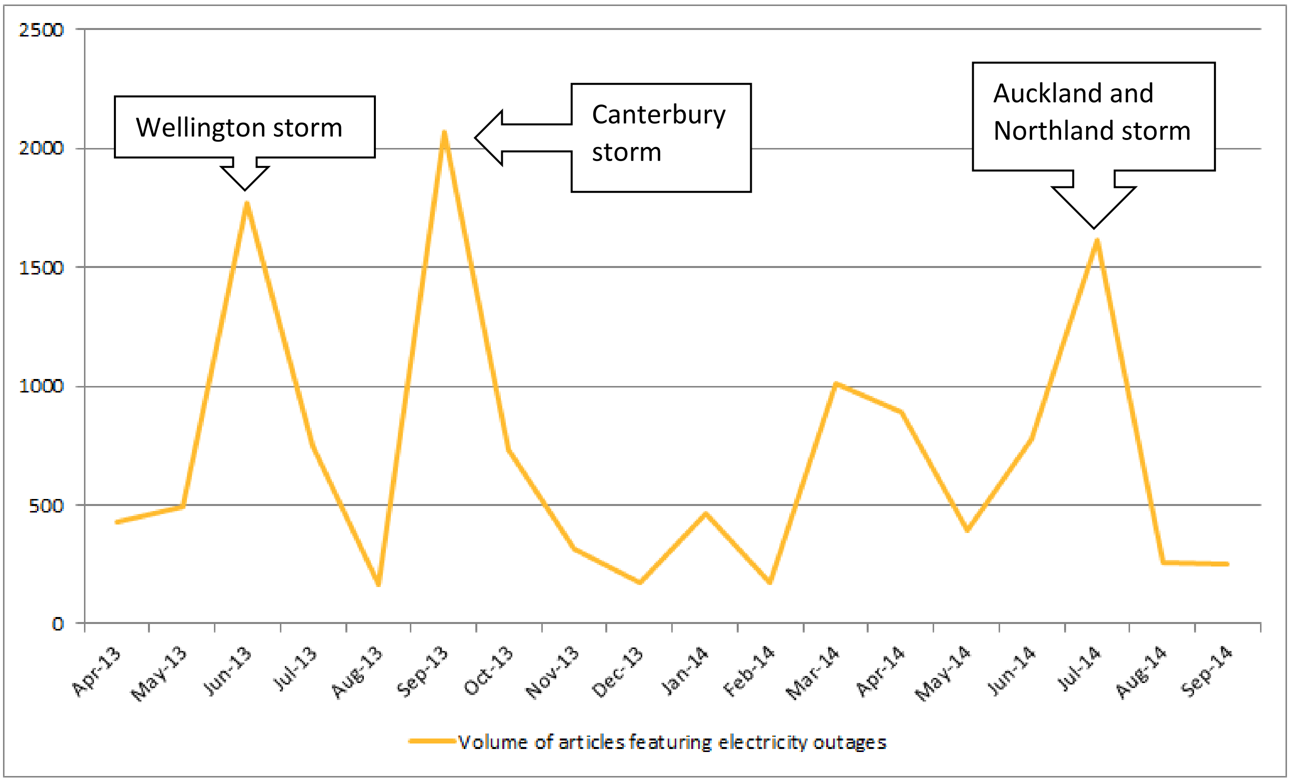
4.2.4 Figure 7 illustrates how media articles may be influencing public perceptions of reliability. It tracks the number of New Zealand media articles relating to power outages. From this data it can be observed that:

a) not a month goes by where there aren't at least 175 articles published related to power outages

b) peaks in media coverage occur when major population centres suffer from high-wind storms causing significant power outages.

[25] See http://www.egcomplaints.co.nz/publications/2013-14-issues-in-complaints.aspx

Figure 7: Monthly trends in media articles relating to power outages



Source: Electricity Authority

4.3 Retailers

4.3.1 There are no measures of reliability that relate to retailers.

4.4 Energy service providers

4.4.1 There is no measurement of reliability that relates to energy service providers, though the amount of interruptible load offered by load aggregators such as EnerNOC can shed some light on this emerging area.

4.5 Distributors

4.5.1 SAIDI and SAIFI are the key reliability metrics for distributors. They report these results to the Commission under the information disclosure provisions of the Commerce Act.

4.5.2 However, SAIDI and SAIFI are measured at the feeder level, so do not reflect any interruptions that do not involve feeder outages. A report prepared for the U.S Department of Energy noted that "Survey results have shown that [SAIDI] can double with the inclusion of data down to the fuse level."[26]

4.5.3 SAIDI and SAIFI are also typically expressed with the exclusion of major event days such as major storms or civil emergencies. Distributors usually track the SAIDI and SAIFI of major event days separated, enabling monitoring of this aspect of reliability.

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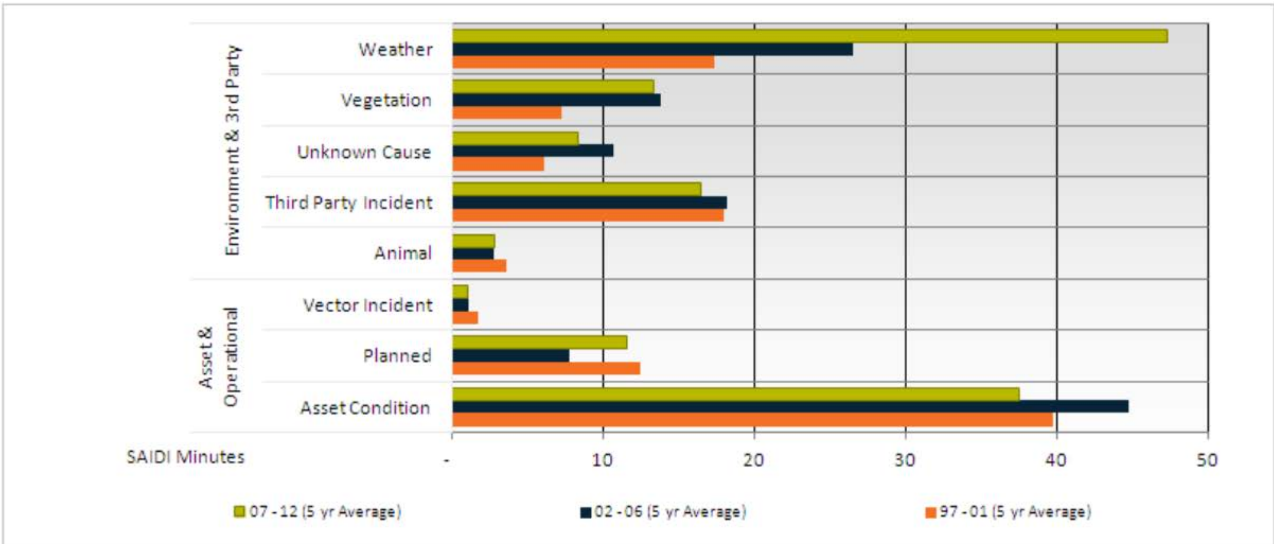
[26] Page 9 of Measurement Practice for Reliability and Power Quality, Oak Ridge National Laboratory, available from http://www.science.smith.edu/~jcardell/Courses/EGR325/Readings/ornl_tm_2004_91.pdf

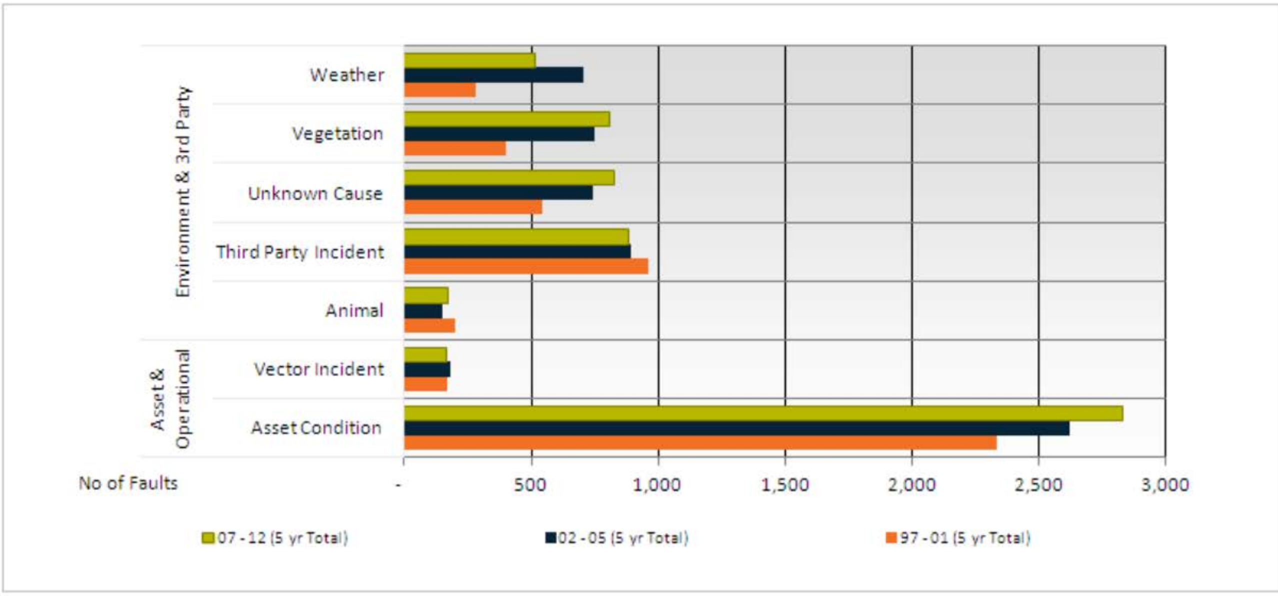
4.5.4 Figure 8 and Figure 9 show Vector's SAIDI and SAIFI results by cause. This gives some insight into the reality of what causes customer interruptions, though it seems reasonable that outages caused by vegetation or third party incidents (especially motor vehicle accidents) would be under-represented as these are more likely to happen below the feeder level.

Figure 8: Impact of interruptions on Vector's network, categorised by cause



Source: Vector Limited[27]

Figure 9: Number of interruptions on Vector's network, categorised by cause



Source: Vector Limited[28]

27 Page 22 of section 4 of Vector's Asset Management Plan 2013-2023 available from http://vector.co.nz/sites/vector.co.nz/files/Electricity%20Information%20Disclosure_0.pdf

28 Page 30 of section 4 of Vector's Asset Management Plan 2013-2023

4.5.5 Many distributors engage in consumer surveys for their networks, often delving into perceptions of reliability. After discussions with Wellington Electricity and reviewing information from Powerco and Vector, the Authority considers that a fair summary of these surveys would be that large percentages of consumers say they:

a) think keeping the lights on is at least ‘important’ (and that distributors do a decent job of that)

b) want stable prices

c) want distributors to get the lights back on quickly when they do go out.

The Quality of Supply and Incentives Working Group (QoSI)

4.5.6 The Electricity Networks Association (ENA) established the QoSI in July 2013. In February 2014, the QoSI published its first report: *Pathway to Quality*. QoSI comprises a broad selection of distributor representatives and meetings have been attended by observers from the Commission and the Authority.

4.5.7 *Pathway to Quality* covers:

> “What is quality and what does it mean for consumers?
>
> What should be considered when measuring quality performance?
>
> The technical options available for measuring quality and the quality path.
>
> Implementation considerations within the longer term context.
>
> Recommendations for the 2014 Commerce Commission default price path reset process.”[29]

4.5.8 The work of QoSI is particularly relevant to the sorts of questions the SRC has been asking about reliability. The work of QoSI seems likely to lead to a broader and deeper set of reliability metrics for the distribution sector. For example, QoSI are interested in:

a) disaggregating SAIDI and SAIFI to more deeply understand the range of consumer reliability experiences that are obscured by averages

b) broadening the range of metrics to include measures of consumer satisfaction with call centre services.

4.5.9 Figure 10 lists the options that QoSI have recommended for use in the forthcoming default price path reset by the Commission. Figure 11 sets out the options that QoSI consider would be useful in future.

4.5.10 The chairperson of QoSI –Richard Fletcher of Powerco– has offered to present to the SRC on any of the following:

a) QoSI’s work to date

b) progress since the *Pathway to Quality* was released

c) future plans for development.

[29] Page 13 of the Quality of Supply and Incentives Working Group February 2014 paper

Figure 10: Summary of options recommended by QoSI

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation
1.3	SAIDI	✓✓✓	✓✓✓	✓✓✓	✓✓✓
1.4	SAIFI	✓✓✓	✓✓✓	✓✓✓	✓✓✓
2.1	Unplanned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓
2.2	Planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓✓
2.3	Based on company averages	✓✓	✓✓✓	✓✓	✓✓✓
2.4	Identified by voltage level	✓	✓✓✓	✓	✓✓✓
4.1	Limits based on fixed historical data	✓✓	✓✓✓	✓✓✓	✓✓✓
4.4	Allowance for natural variation	✓✓✓	✓✓✓	✓✓✓	✓✓✓
6.1	Major event days	✓✓✓ (with proposed adjustments	✓✓✓	✓✓✓ (with proposed adjustments)	✓✓✓
7.2	Revenue linked incentives	✓✓✓	✓✓✓	✓✓✓	✓✓ incentive rates to be developed

Source: Figure 15 of the Quality of Supply and Incentives Working Group February 2014 paper

Figure 11: Summary of possible longer-term options recommended by QoSI

Ref	Measure / Option	Value to customer (Current)	Data Availability	Incentive for timely investment	Ease of implementation
1.8	CAIDI	✓✓✓	✓✓✓	✓	✓✓✓
1.9	Energy not supplied	✓✓✓	×	✓✓	×
1.10	Capacity availability	✓	×	Unknown	×
1.11	Expected number and duration of outages	✓	×	Unknown	×
2.5	Identified by customer location	✓✓✓	✓	✓✓✓	✓
2.7	Worst served customers	✓✓✓	✓	✓✓✓	✓
3.1	Customer satisfaction	✓✓✓	✓	✓✓✓	✓
3.3	Quality of information provided during an outage	✓✓✓	×	✓✓✓	✓
3.4	Processing of new connection applications	✓✓✓	✓	✓✓✓	✓
3.5	Timely notification of planned outages	✓✓✓	✓✓✓	✓✓✓	✓✓
4.3	Forward looking benchmarks	✓✓✓	✓	✓✓✓	✓
5.1	Established by the EDB customer surveys	✓✓✓	×	TBD	TBD

Source: Figure 16 of the Quality of Supply and Incentives Working Group February 2014 paper

Notes: CAIDI means customer average interruption disruption index, which represents the duration of outages for the consumers that lost power. EDB means electricity distribution business (a distributor).

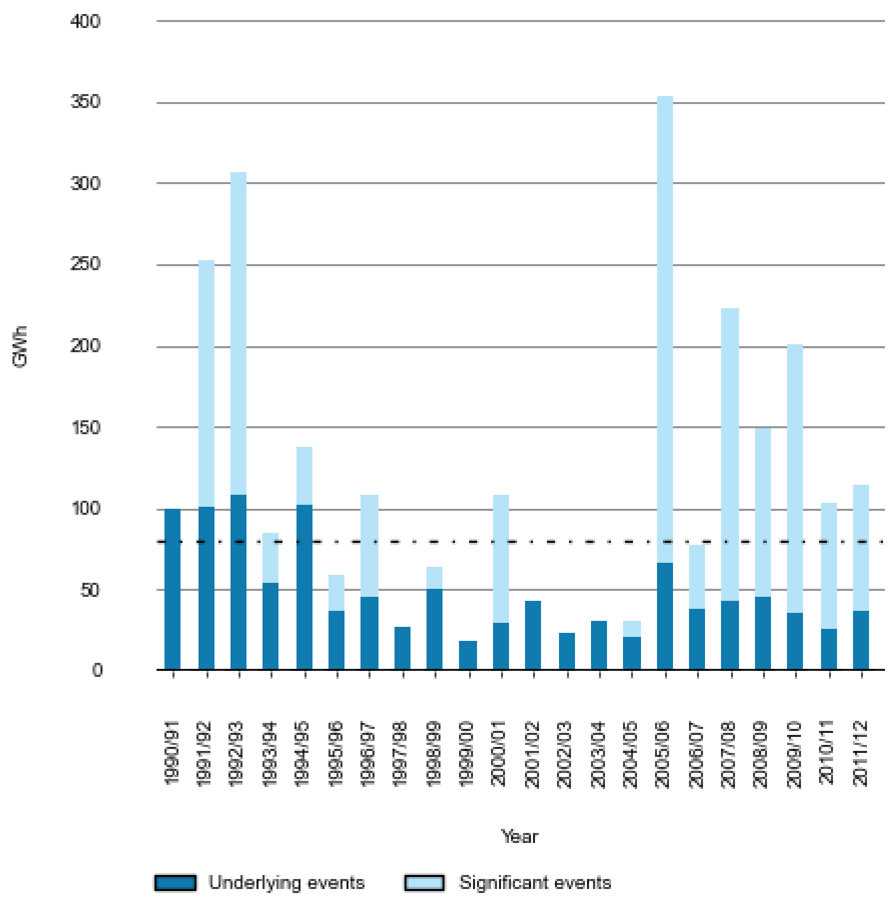
4.6 Grid owner

4.6.1 In terms of reliability metrics, there are broad similarities between transmission and distribution. However, the limitations of SAIDI and SAIFI as measures of network performance (as discussed in paragraph 4.5.2) are not an issue in transmission.

4.6.2 The Authority has been developing options to better understand whether consumers are receiving an efficient level of transmission investment. [30] Quantifying reliability benefits will be a vital part of that analysis.

4.6.3 The Authority's *2013 Year in Review* included information on transmission reliability. Figure 12 shows unserved energy: system minutes lost divided by peak energy. Significant variation exists, but the last two years of available data have shown improved reliability compared with the prior five years.

Figure 12: Transmission unserved energy since 1990/91



Source: Electricity Authority[31]

4.7 Generators

4.7.1 There are no published reliability measures for generators, though generators have incentives to ensure their plant is highly reliable.

[30] Detail available from http://ar2013.publications.ea.govt.nz/Investment+performance+transmission

[31] From the Authority's *2013 Year in Review, available from* http://ar2013.publications.ea.govt.nz/Transmission+reliability

Residual risks identified under ISO 31000 could form a reliability metric

4.7.2 ISO 31000 requires that risks are identified, eliminated or mitigated, and that any residual risk is communicated. Businesses that have adopted ISO 31000 practices are likely to have established standard tools for the identification, measurement and communication of the risks that they face. It is standard practice for high-level corporate risks to be presented in a matrix format with traffic lights indicating the level of probability and consequence for each identified risks.

4.7.3 Electricity lines businesses and generators will likely have undertaken at least high-level risk assessments covering the risks arising from the level of reliability performance of their assets. Such information could be aggregated to provide a view of reliability risk at a regional or national level.

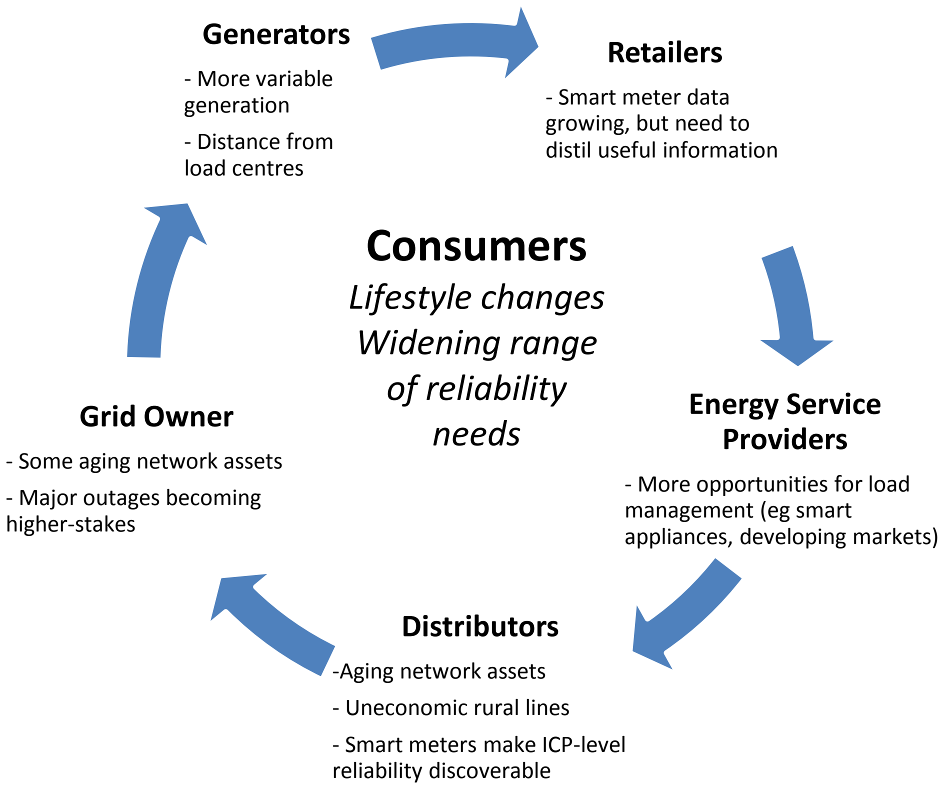
5 Responding to change

5.1 Overview

5.1.1 Earlier sections of this paper have focussed on how reliability is currently managed and measured. The purpose of this section is to highlight future issues and pressures that may influence reliability in future.

5.1.2 Figure 13 shows the emerging pressures on demand- and supply-side parties with respect to reliability.

Figure 13: Responding to change



5.2 Consumers

5.2.1 Residential consumers are continuing to change: more informed, more mobile access to real-time information, more electronic equipment that is often more sensitive, more competing priorities for time/attention.

5.2.2 There seems to be a growing disparity in consumer reliability requirements.

a) At one end of the spectrum, the combination of distributed generation and battery storage (for example, rooftop photovoltaics and electric vehicles) may make some customers almost impervious to outages.

b) At the other end, the growth in dairy farming is increasing the number of consumers needing high levels of reliability.

5.3 Retailers

5.3.1 Smart meters are becoming ubiquitous and will likely develop into a vital part of a consumer experience. That experience will quite commonly involve turning data into information consumers can take action on.

5.4 Energy service providers

5.4.1 Opportunities for energy service providers will continue to grow due to:

a) more smart meters

b) more smart appliances with controllable load

c) more distributed generation and storage

d) markets for demand response continuing to develop.

5.4.2 While demand response is an interesting and dynamic sector, the opportunities for improving reliability are limited. Demand management can assist with:

a) preventing overloading of network assets

b) mitigating capacity constraints in a meshed distribution network already experiencing an outage, but not on radial spurs

c) speeding up restoration times after an outage

d) improving the efficiency of existing reliability arrangements by provided a cheaper form of reserves.

5.5 Distributors

5.5.1 Distribution assets experience increased failure rates towards end of their expected life. Many of New Zealand's distributors are facing management of some network assets that are approaching end of expected life.

5.5.2 Compounding the problem is that many of these aging assets are rural lines with marginal or negative net benefits for reinvestment.

5.5.3 Increasing penetration of distributed generation will raise fault and voltage levels. It can also change energy flows into patterns outside the intention of the network designers.

5.5.4 The introduction of smart meters can give an ICP-level view of reliability for first time. Load management may become increasingly affordable for distributors.

5.6 Grid owner

5.6.1 Substantial elements of the core grid have recently been rejuvenated, though there are still many aging assets within the network. Transpower has obtained ISO 55000 (previously PAS 55) certification and has adopted an approach of condition-based risk management (CBRM). Internationally, CBRM techniques are used extensively by transmission owners and by many distributors.

5.6.2 Regardless of whether there is load growth or not, it seems likely that the value of energy used is growing. This continues to raise the stakes for when a major outage does occur.

5.7 Generators

5.7.1 Continued development of renewable generation will increase the variability in the overall generation portfolio and influence the need for peaking generation and demand response.

5.7.2 If large scale generation is sited further away from load centres, this will slightly negatively impact on reliability due to the increased transmission distances involved.

The SRC may wish to consider the following questions.

Q1. Does the SRC consider that reliability risks (as set out in section 2) are ‘owned’ by the right parties?

Q2. Does the SRC consider that the current regulatory framework (set out in section 3) creates the right incentives for achieving an efficient level of reliability?

Q3. Does the SRC consider that existing arrangements enable effective engagement with consumers on what they consider to be an efficient level of reliability?

Q4. Does the SRC agree that the ENA’s Quality of Supply and Incentives Working Group appears to be the appropriate avenue for the development of customer-centric reliability metrics for the distribution sector?

Q5. Does the SRC want to take the Quality of Supply and Incentives Working Group chairperson up on their offer of a presentation to the SRC? If so, when?

Q6. In light of this paper, can the SRC refine the partially-met action item to “investigate ways in which the supply side can interact with the demand side to establish appropriate reliability expectations, and develop a commensurate level of reporting”?