Guidelines on the calculation and the use of loss factors for reconciliation purposes

Decision

26 June 2018

Market Services

Executive summary

When conveying electricity through networks, some electricity is physically lost, and some electricity may be unaccounted for in measurement errors or data handling processes. Electricity lost or unaccounted for is referred to in the electrical industry as “losses”.

The New Zealand electricity market operates as a “gross pool”, globally reconciled model. Losses are allocated to all electricity generated and all electricity purchased. Losses therefore have a direct impact on both electricity generator revenue and electricity costs paid by consumers.

While grid losses are imputed into final spot price at each grid connection point, distribution network losses are imputed into electricity volumes in the electricity market reconciliation process. The cost of grid and network losses directly affects the cost to purchase electricity. The cost of losses is passed to consumers in distributor and retailer invoices.

The consultation on amendments to the *Guidelines on the calculation and the use of loss factors for reconciliation purposes* was intended to assist with identifying networks that had high losses, so that the source of high losses could be investigated and if necessary dealt with. This could lead to benefits for consumers within that network.

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1 Background

1.1 The Authority consulted on amendments to the *Guidelines on the calculation and the use of loss factors for reconciliation purposes* to identify distribution networks that have high loss factors. The methodology would allow discretionary losses to be identified and reduced.

1.2 When conveying electricity through networks, some electricity is physically lost, and some electricity may be unaccounted for. This lost electricity is referred to as “losses” and is further broken into two sub-categories:

(a) technical losses

(b) non-technical losses.

1.3 Physical electricity losses are called technical losses. Technical losses relate to equipment and the configuration of networks. Reduction of these losses requires capital expenditure by networks, and often the reduction in losses may be small. Technical losses are primarily due to:

(a) fixed losses due to the electricity consumed by transformers which occurs as long as a transformer is electrically connected

(b) variable losses arising from resistance in conductors which increase exponentially as system load increases.

1.4 Non-technical losses can be relatively easily resolved, provided that the extent and location of the issue causing the non-technical loss is known. Non-technical losses are primarily due to data and/or process issues such as :

(a) consumer switching errors

(b) meter inaccuracy and faults

(c) inaccurate meter readings or inaccurate estimates

(d) data handling errors

(e) theft/fraud.

1.5 The New Zealand electricity market operates as a “gross pool”, globally reconciled model. Under this model:

(a) all electricity generated must be sold to the pool

(b) all electricity consumed must be purchased from the pool

(c) all electricity generated, consumed and lost, must be accounted for.

1.6 While grid losses are imputed into the final spot price at each grid connection point, distribution network losses are imputed into electricity volumes in the electricity market reconciliation process.

1.7 Distributors, generators, and buyers of electricity do not pay for losses, but pass these costs through their pricing structures. The total cost of losses is eventually passed to consumers who have an incentive to reduce losses, but no control over the processes that cause losses.

2 Authority monitors unaccounted for electricity

2.1 Losses vary depending on network loading. Any variation in network loading causes loss factors to change. The reconciliation manager allocates losses that occur on distribution networks within the reconciliation process through two separate processes:

(a) Allocate distribution losses: Distributors are required in the Electricity Industry Participation Code 2010 (Code) to publish what they have determined are longer term loss factors.[1] These losses are termed "reconciliation losses" and should be calculated over a two year average.

(b) Allocate unaccounted for electricity (UFE): As the electricity market reconciles by trading period, and reconciliation losses are a two year average, a balancing factor must be used to compensate for variations in loss factors that occur with network loading over differing trading periods.

UFE is the term used to describe that balancing factor. It is calculated and applied by the reconciliation manager in the global reconciliation process. UFE is simply a dynamic loss factor that ensures that for each trading period that the sum of injection = the sum of extraction. UFE is a loss factor that is additional to the reconciliation losses.

2.2 UFE is a useful measure. Positive UFE indicates that either:

(a) reconciliation losses are too low; or

(b) traders have provided insufficient electricity volume to the electricity market for the reasons set out in paragraph 1.4.

2.3 Negative UFE on the other hand indicates that either:

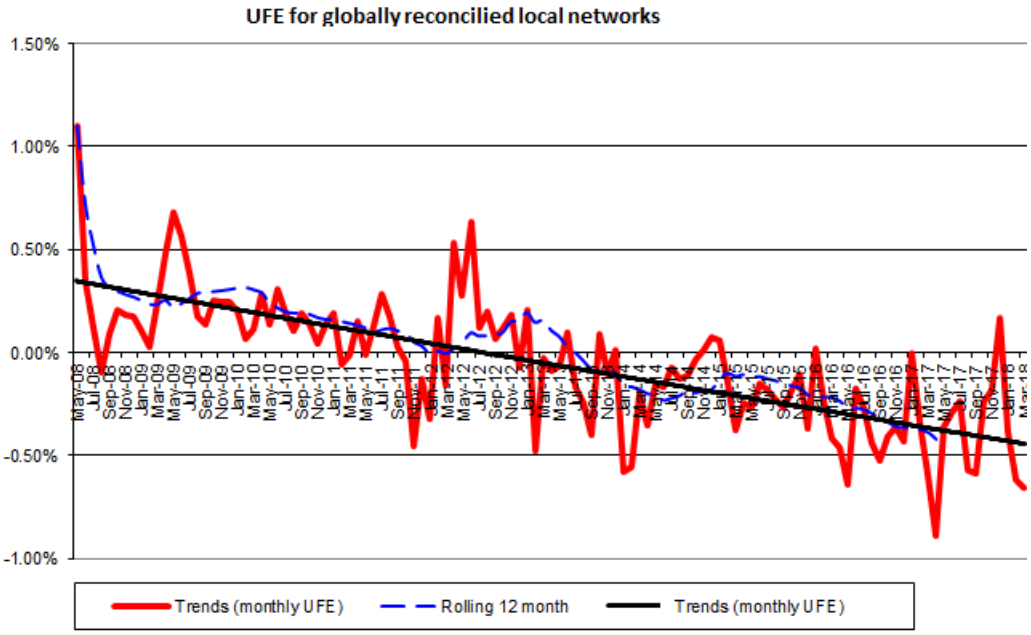
(a) reconciliation losses are too high; or

(b) traders have provided too much electricity volume to the electricity market. This could be due to errors in trader systems.

2.4 The Authority notes that since 1 May 2008, UFE has been reducing. As few networks have reviewed their reconciliation losses factors within that period, this indicates that there has been a reduction in non-technical losses. Those networks that have reviewed their losses, had a small impact on reported UFE.

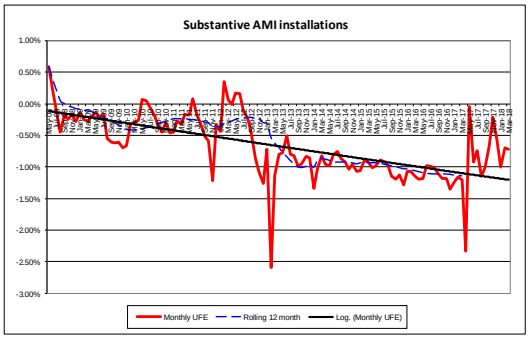
2.5 The Authority also notes there has been a downward trend in national UFE of approximately 0.8 % for all local network areas reconciled using the global reconciliation methodology. This is shown in the graph below which is the weighted average of all grid connected networks that reconciled using the global reconciliation methodology.

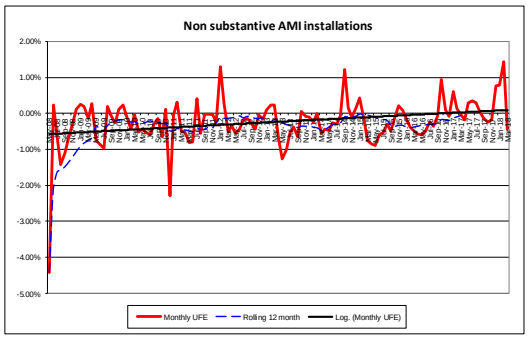
[1] A multiplier that increases a consumer premise metered electricity volume to reference the volume to the nearest connection point to the grid.



2.6 The reduction of national UFE of about 0.8 % is a significant reduction that will directly impact trader purchasing costs from the electricity market, and should have a pass through consequence to consumers. Given some of this reduction is due to adjustments made to network losses, the Authority estimates the ongoing annual value associated with this reduction on local networks to be between $12 million and $17 million.

2.7 The reduction in UFE is most marked on networks where the majority of metering installations have been upgraded to advanced metering infrastructure (AMI). Those networks that have not had substantive AMI upgrades have not had as much reduction in UFE and, in a few cases, UFE has increased. These are shown in the two graphs below.





2.8 The Authority considers there may be a variety of reasons for the reduction in UFE, such as:

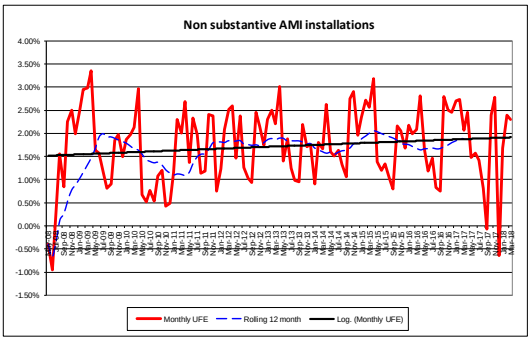
(a) the greater accuracy of AMI meters

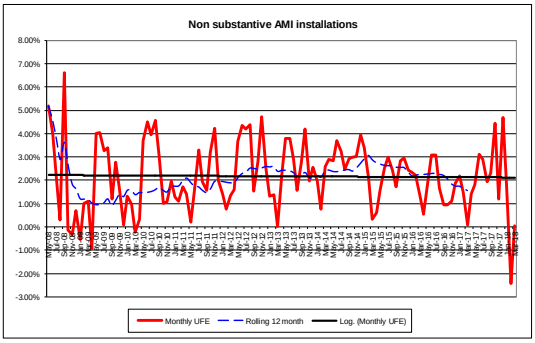
(b) the displacement of slow and stopped meters

(c) the correction of metering records which are now transparent in the registry

(d) the correction of multipliers on larger metering installations.

2.9 The Authority also notes that some local networks are not correctly calculating or reviewing reconciliation losses regularly. This is despite the requirements in the Code for information provided to the registry to be accurate. Two examples of this are shown below.





2.10 All traders and local and embedded network owners have access to UFE for their own customers/networks via current reconciliation reports.

3 Key themes in submissions

3.1 In submissions, most distributors disagreed with the proposed changes, and most retailers agreed with the proposed changes. There was misunderstanding from some submitters that the *Guidelines on the calculation and the use of loss factors for reconciliation purposes* (guidelines) were requiring distributors to reduce technical loss factors. There was also, in some cases, a lack of understanding of the nature of losses.

3.2 This section provides a summary of feedback of the areas that influenced the Authority's decisions on the proposed changes to the guidelines. The feedback included:

(a) changes in UFE that have occurred since the guidelines were first approved in 2008

(b) the guidelines should not be mandatory

(c) reconciliation loss factors should comprise technical and non-technical losses

(d) complexity of the technical loss methodology in the guidelines and lower cost approach

(e) cost benefit of the proposed changes

(f) threshold for embedded networks.

Changes since the guidelines were approved in 2008

3.3 A number of participants commented on further analysis being required.

3.4 Orion New Zealand Limited (Orion) was the only participant to note there had been considerable change in the industry since the introduction of global reconciliation. Orion also mentioned the metering record transparency that would occur in the Part 10 changes: *"We find it particularly surprising is that there is no comment about changes to the industry that have occurred since the current guidelines were approved in September 2008. What have we learned about non-technical 'losses' after nearly 5 years of global reconciliation? Has the deployment of hundreds of thousands of smart meters increased or decreased non-technical 'losses'? Have*

retailer systems and processes improved? What impact will the forthcoming Part 10 changes have? Has increased competition and new market entry had any impact?"

Authority response

3.5 The Authority agreed with this submission, and has carried out further analysis using 2018 information. This analysis is summarised in section 2 of this decisions paper.

3.6 As discussed in section 2, the Authority notes the overall reduction of losses is in the order of 0.8 %. The consultation paper used a reduction of 0.4 % within the cost benefit analysis, and quoted an expected range of non-technical losses in Appendix F of the consultation paper of 0.5–1.5 %.

3.7 As a result of the changes observed in section 2 with national UFE reducing, the expected issues of non-technical losses may have been largely resolved on many networks. However, there may be individual networks that still have a non-technical loss issue that would benefit from investigation.

3.8 The Authority will publish mass market loss factors for each network, using the reporting included in the existing guidelines, and adding UFE to the reconciliation losses. Adding UFE to reconciliation losses gives the total loss factor for each network.

3.9 Individual networks with higher than normal total losses may be identified by comparison against similar network total losses.

The guidelines should not be mandatory

3.10 Although most submitters agreed that the guidelines should not be mandatory, four submitters specifically noted that compliance should be voluntary.

3.11 Meridian Energy Limited (Meridian) supported mandating the guidelines but noted that while the guidelines were a good step forward, further analysis is required. Meridian commented, "*However, while Meridian considers the publication of the updated Guidelines represents a good step forward, we also consider the full benefit of the Guidelines will only be achieved if their adoption is mandated. While publication of voluntary guidelines may see marginal improvements, it is possible that many networks will choose not to implement the Guideline methodology, leaving the full benefits unrealised……..".*

3.12 Vector Limited (Vector) noted, "*Most importantly, Vector recommends that the Guidelines remain voluntary and distributors retain the ability to vary their approach to meet the circumstances of their own networks and ensure the loss factors are calculated in a cost-effective manner."*

3.13 WEL Networks Limited (WEL Networks) commented, *"…..the EA will no doubt be aware the Loss Factor Guidelines are referenced in model Use-of-System Agreements and more specifically are attached to obligations on distributors to calculate loss factors in accordance with the guidelines".*

3.14 Wellington Electricity Lines Limited (Wellington Electricity) commented "Based on the above, WELL considers that the proposed Guidelines should remain truly voluntary and the Authority should not monitor compliance with the Guidelines with a view to potentially mandating these in the future."

Authority response

3.15 The Authority had not proposed a Code amendment to make the guidelines mandatory. However, reference to these guidelines in distributors' use of system agreements could possibly make the guidelines, including the method of calculating technical loss factors, mandatory. Note that this is a contractual arrangement between the distributor and the trader and not a Code requirement. This was unintended.

3.16 As a consequence, the Authority will:

(a) remove the prescriptive methodology to determine technical losses from the guidelines. However distributors should note that the existing guidelines published on the Authority's website recommends that distributors review technical loss factors *"…every five years (unless, within a five year period, there is a significant change in network configuration and/or load, in which case the review should be re-run). Technical loss factors must be reported each year to the Authority."*

(b) name the amended guidelines the same as the guidelines approved in 2008.

3.17 To ensure the technical loss methodology is not lost, the Authority will create a separate guideline for the determination of technical losses.

Complexity of the technical loss methodology in the guidelines and lower cost approach

3.18 To determine non-technical losses, technical loss factors must first be determined. The proposed guidelines expected that distributors would calculate technical losses *"….for the entire network study area within ±20% given the accuracy of the assumptions that will be required and the capability of load flow software. This means that if a TLR[2] for the entire network study area is calculated to be 5%, then the actual TLR will lie between 4% and 6%."*

3.19 A number of submitters disagreed with the complexity of the methodology for the calculation of technical losses.

3.20 Orion noted, *"None of the above discussion should be interpreted as suggesting that Orion does not take technical losses seriously. We do, and to quite low levels in our network for planning purposes, and we also estimate the components of technical losses for parts of our network. It is just that we do not see that there is any benefit in this being reflected in complex technical loss factors. …. Generally, we find that simple modelling, or more targeted complex modelling provides us ample information."*

3.21 Powerco Limited (Powerco) noted, *"The calculation of technical loss factors within a distribution network is inherently complex. However, it is a large volume of analysis to calculate loss factors for every subtransmission circuit and distribution feeder, requiring a large volume of half hour data to be extracted from the SCADA system, error checked and then analysed.*

When compared with a simple process of assessing reconciliation losses, deducting an expected percentage of non-technical losses and arriving at a technical loss factor

[2] Total Loss Ration

which is borne out by historical performance, a fairly similar technical loss factor result would be arrived at with much less analytical effort."

3.22 Vector noted, *"Vector recommends that the Authority note our comments above and reduce the costs and complexity of the methodology in the Guidelines. A simplified approach would be likely to deliver similar levels of accuracy for less cost."*

3.23 In response to the question "Do you agree that the proposed Guidelines strike the right balance between pragmatism and complexity":

(a) Contact Energy Limited (Contact) noted, *"We do not agree, but mainly because the Guidelines appear to give inadequate attention to an appropriate balance between simplicity and complexity.."*

(b) Horizon Energy Limited noted, *"We are happy to see that there is a balance been complexity and what can be realistically modelled for a distribution system. The emphasis must be on 'make reasonable effort' rather than try and get it absolute."*

3.24 Two networks recommended an alternative approach to that set out in the guidelines:

(a) Powerco noted, *"A pragmatic alternative would be to assess the technical loss factors already in use, compare to historical performance and determine for each balancing area if a detailed calculation of loss factors is warranted. If that was determined to be necessary, the detailed calculation could be performed only on those balancing areas where the loss factors appear to be significantly in error. If this approach was adopted then the effort required may be reduced and better targeted on to areas that require attention."*

(b) WEL Networks noted, *"WEL recommends that the EA consider the merits of using a technical losses methodology disclosure regime similar to pricing methodologies to increase transparency and the accuracy of technical losses. A focus on technical losses will also increase transparency of non-technical losses and achieve the EA objectives in a more transparent and least cost way. A disclosure regime has the advantage of allowing distributors flexibility in their approach."*

Authority response

3.25 Given the decrease in UFE that has occurred since 1 May 2008, the Authority has decided not to proceed with a prescriptive technical loss factor methodology at this time. The Authority agrees that a lower cost and more targeted method should be used to calculate reconciliation loss factors. A complex methodology to calculate technical loss factors need only be used where networks have abnormally high reconciliation losses or non-technical losses.

3.26 WEL Networks' suggestion will be modified to provide a lower cost solution. This is discussed later in this decision paper.

Cost benefit of the proposed changes

3.27 The consultation paper estimated the industry cost over three scenarios (low, base, and high). The costs ranged between $2 million and $4.1 million. A number of submitters disagreed with the estimates. For instance:

(a) Powerco noted, *"We would like to point out how significant the cost of implementing the Guidelines would be for Powerco. We would need to employ one full time junior engineer to complete the calculation of loss factors over our thirteen*

balancing areas within a five year period (assuming that the 13 week duration per balancing area stated in the Consultation Paper is correct)."

(b) Vector noted, *"The cost benefit analysis indicates that the Authority's approach requires 15 weeks of work by an engineer, for a balancing area. Vector has two balancing areas, which would require 30 weeks of an engineer - roughly equating to two-thirds of one full time employee. The Authority's approach also requires periodic on-going work and resources to enable the five year review."*

(c) Wellington Electricity noted, *"WELL estimates the additional labour cost required for WELL to implement the Guideline would be at least $100,000. Under the 2010-15 Default Price-quality Path, set by the Commerce Commission, WELL would not be compensated for these implementation costs."*

Authority response

3.28 Although the cost of determining technical and non-technical losses falls to the distributor, the benefit falls to the customer. The cost noted in the responses above falls within the base to high range scenarios noted within the consultation paper. That is, a reduction in losses of 0.4 % would be economic.

3.29 However, the Authority has decided not to proceed with a prescriptive technical loss factor methodology at this time. The Authority agrees that a lower cost and more targeted method should be used. A complex methodology need only be used for networks that have abnormally high non-technical losses.

Threshold for embedded networks

3.30 On 1 July 2017, the Electricity Industry Act 2010 was amended to make secondary network owners/operators "participants". While the proposed guidelines are not mandatory, secondary network owners are expected to adhere with the guidelines.

3.31 The consultation paper for the guidelines contained a guide to loss factors on embedded networks in Appendix B. The guidelines noted that embedded networks were typically too small to warrant calculation of technical losses, and that only reconciliation losses should be calculated.

3.32 Wellington Electricity noted, *"The loss factor methodologies for embedded networks (set out in Appendix B of the Guidelines) is simplistic and may not be reflective of larger embedded networks. WELL considers that there should be a capacity or volume threshold set such that larger embedded networks would be required to apply the same methodology as distributors, particularly where there is an HV distribution component and/or multiple transformers."*

3.33 Contact noted, *"As a minimum we would recommend that embedded network owners be required to include the following information on their pricing schedules – local network gateway ICP(s) and associated loss category code(s) and loss factor(s), embedded network loss category code(s) and associated loss factor(s), and the overall loss factors being the product of the local and embedded network loss factors."*

Authority response

3.34 The Authority agrees that, given the size and conductor length of embedded networks, particular loss factor arrangements should be recommended. We have decided to leave this part of the proposed guidelines in place.

3.35 The Authority considers there is merit in establishing an upper threshold for embedded networks. A threshold of 1,000 ICP identifiers has been placed into Appendix B of the guidelines.

4 Authority decisions

4.1 The Authority notes that distributors must already calculate technical losses to provide different loss factors at points of connection that have different voltages, seasonality, or capacity requirements. The Authority wants to ensure:

(a) consumers are not overcharged for losses on networks that they are electrically connected to

(b) that where loss factors are too high, that the network is identified so that further investigation and potential loss reduction can be carried out.

4.2 Given the summary of analysis in section 2 and the submissions from participants, the Authority has decided to:

(a) remove the proposed methodology for calculation of technical losses and associated workbook from the guidelines. Note that the current guidelines require the calculation of technical losses, but do not prescribe the methodology. Distributors may continue to make the assumptions that they consider are suitable, eg voltage connections, study areas, etc. The methodology and workbooks will be moved to a separate guideline to be published at a later date

(b) include an upper threshold of 1,000 ICPs for embedded networks

(c) publish and monitor a mass market total loss factor table, and may communicate further with distributors where loss factors are abnormal

(d) recommend that where a distributors technical losses exceeds that of similar networks that the distributor should investigate why there is the difference

(e) include an overview of losses, as an educational section in the guidelines

(f) recommend that distributors also conduct a loss factor review if average UFE is outside the tolerance of +/- 1% (which is addition to the current two year recommendation)

(g) not amend the Code as set out in the consultation paper

(h) continue to recommend networks provide an annual loss factor report to the Authority (recommended also in the 2008 guidelines). A new simplified template will be developed for this reporting (instead of the consulted on template)

(i) monitor loss factors going forward, and reconsider the loss factor methodology if the need arises.

Establish monitoring regime

4.3 To ensure the Authority can identify and investigate networks with high non-technical loss factors, the Authority will implement a monitoring regime for loss factors and publish an annual table of mass market total loss factors on its web site.

4.4 The Authority will carry out this monitoring using the reporting required under both the current and proposed guidelines.

4.5 The loss factor table will identify:

(a) each distributor's network

(b) reconciliation loss factors

(c) technical loss factors

(d) non-technical loss factors

(e) last review date of loss factors.

4.6 Distributors, traders, and consumers will be able to benchmark networks against similar networks to identify networks with abnormally high technical and non-technical loss factors.