

HORIZON LOSS FACTOR METHODOLOGY 2021-2022

Category	Operations
Type	Procedure
Approved By	General Manager
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Responsible Officer	Operations Manager
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1. PURPOSE

The Electricity Authority (EA) requires that Electricity Distributors calculate and publish Reconciliation Loss Factor for each loss factor code in the registry each year. Losses are the energy lost in distribution from the point of connection to the end consumer, and are comprised of losses through transmission line resistance, transformer losses, network parasitic losses, metering errors, and unmetered energy.

This document presents the **Loss Factor** that can be applied to customer's metered energy to recover upstream losses on Horizon Networks. It outlines the methodology, assumptions and data used for the calculation of the loss factors effective 1 April 2021.

2. ORGANISATIONAL SCOPE

This Procedure applies to the operations and regulatory teams, and should be updated every 5 years along with the loss factors.

3. RESPONSIBILITIES

ROLE	RESPONSIBILITY
Operations Team	Calculating Technical loss factors & updating the methodology
Regulatory	Publishing loss factors to the registry

4. OPERATING PROCEDURE

4.1. Network Energy Losses

The three main categories of energy losses are summarized below:

4.1.1. Reconciliation Losses

Reconciliation loss is the difference between the energy metered at the Grid Connection Point (GXP) and the energy metered at the customers connection point.

Input energy sources are from Transpower at each GXP, large network embedded generators, and distributed generation embedded throughout the network, mainly solar generators.

Energy consumed is provided by retailers against each ICP. These are accumulated over a rolling 12-month period and are compared to the energy delivered at each GXP or injection point.

4.1.2. Technical Loss Factors

Technical losses are an engineering assessment of the losses in the distribution network. These are calculated using the methods below

- (i) **No-Load Losses:** A fixed amount of energy that arises from the magnetisation requirements of power transformers. These losses are a constant for any given transformer, but each transformer has its own magnetisation energy requirement. No-load losses are obtained from manufacture nameplate data and test sheets. For calculation of no-load energy losses as follows:

$$\text{No-Load Energy (kWh)} = \text{No-Load Power (kW)} \times \text{TH (hrs)} \dots (i)$$

To calculate the annual no-load losses the energy is calculated from the nameplate no-load power in kilowatts multiplied by the number of hours in a year to get kilowatt/hours.

An example for a 100kVA transformer with iron losses of 195 watts, the annual energy loss in kWh is $0.195 \times 365 \times 24 = 1708 \text{ kWh}$

- (ii) **Load Losses:** A variable components arising from the heating effects of the resistance in the delivery conductors and transformers and depends on the load current they carry. These losses are also known as copper losses or I^2R losses.

Load losses in kilowatt-hours (kWh) are derived using the following methods.

- a) **33kV line losses** and zone substation transformer losses are modelled using load flow analysis tools. Horizon uses PSS@SINCAL. The average loads are used to model the load flow for each feeder and network region. Average loads in kW are derived by taking the annual customer metered total kWh divided by the number of hours in the year.
- b) **Distribution transformer losses** (known as load, or copper losses) are calculated using an Excel model that uses the average metered consumer energy supplied by retailers summated at each transformer for all loads connected at the transformer. Published transformer losses and impedance values are used apportioned to the average load.
- c) **Distribution Network Losses** are the losses in the 11kV distribution network from the zone substation to the end user. These technical losses are calculated using network modelling software and apply to the lines and cables used to distribute energy. Distribution transformers are excluded from the modelling and are described in paragraph b) above
- The average load for each feeder is used to provide a loss factor for the load. Losses are calculated for each region as described in section 2.1.4. then annualised.
- Major loads described in section 3.2 are removed from the load flow modelling so the losses represent the losses that apply to the end mass market user.
- d) **Low Tension Losses** are the losses in the 400V distribution circuits These losses are not modelled nor easily able to be determined so a factor of 1% of the energy delivered is used as an approximation for low tension line and cable losses.

4.1.3. Non-Technical Losses

Reconciliation loss is the difference between the energy supplied by Transpower plus any embedded generation, and the energy metered at the customers premises.

Non-technical losses are losses that represent the difference between reconciliation losses and technical losses. These losses represent inaccuracies caused by measurement, data handling, modelling assumptions, metering and reading errors, and misappropriation.

Once the technical losses are calculated, the non-technical losses are calculated as follows:

$$\text{Non-Technical Losses} = \text{Reconciliation Losses} - \text{Technical Losses}$$

4.1.4. Loss Areas

Loss areas are determined for each GXP; Edgecumbe, Waiotahi, and Kawerau.

A separate loss area is Galatea which is embedded within the Edgecumbe GXP but is supplied normally by the Aniwhenua power station.

Galatea region loss factor is determined with the supply connected to Aniwhenua. The benefit to the network of the embedded generation is determined by taking the difference between the losses to the network when supplied out of Aniwhenua and the losses as if Galatea is supplied out of Edgecumbe.

4.2. Embedded Generation and Major Loss Factors

4.2.1. Technical Loss Factor for Generation sites

The Technical loss factor for each generation site connected to the network is calculated at the average net injection from the site. The loss factor is calculated by assessing the impact on network losses with and without the generation operational using load flow modelling

4.2.2. Major Customers (industrial) Loss Factor

The Technical loss factor for each major customer with a peak demand of greater than 2MVA connected to the network is calculated based on the average load of the site.

If the customer is connected to the network by dedicated assets directly from the GXP or zone substation the assessment is restricted to those assets.

Where the major customer is connected to shared network assets, (zone substation transformers, distribution or sub-transmission circuits) the apportionment of losses, including no-load losses, is calculated by modelling all loads connected, then re-calculated with various loads removed to be able to apportion losses to each load zone.

$$\text{DLF for Majors} = 1 + \frac{\text{Total losses applicable to Major Customer (kWh)}}{\sum \text{Energy Major Consumption (kWh)}}$$

4.3. Loss Factors effective 1 April 2021

Loss Factor Code	Category	Load (Consumption)	Export (Generation)
LF1	Mass Market (Galatea)	1.1290	1.0000
LF104	Timberlands Forests	1.0814	1.0000
LF105	Whakatane Mills Ltd	1.0328	1.0000
LF106	Fonterra	1.0288	1.0000
LF2	Mass Market (Edgecumbe)	1.0574	1.0000
LFG1	Aniwhenua	1.0638	1.0400
LF101	Norske Skog Oxidation Ponds	1.0174	1.0000
LF102	Tasman Lumber	1.0112	1.0000
LF103	Asaleo care	1.0098	1.0000
LF107	Sequal Lumber	1.0158	1.0000
LF3	Mass Market (Kawerau)	1.0390	1.0000
LF109	TAOM Geothermal	1.0000	1.0000
LF110	Waiu Dairy Ltd	1.0250	1.0000
LF5	Mass Market (Waiotahi)	1.0911	1.0000
LF6	Mass Market (Te Kaha)	1.0773	1.0000

5. CONTACT FOR FURTHER INFORMATION

If you have any queries regarding the content of this Procedure or need further clarification, contact the Shane Piaray, 021 569 619 or email: shane.piaray@horizonnetworks.nz.

6. REVISION HISTORY

REVISION	PUBLISH DATE	DESCRIPTION OF CHANGE
1.0	3/2/2021	Initial Issue