

# Loss Factors

Effective 1 April 2021



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## 1 Introduction

Aurora Energy is obliged to calculate and publish loss factors under industry agreements such as the Electricity Industry Participation Code and Use of System Agreements. This document describes the methodology used to calculate loss factors and sets out the loss factors applicable from 1 April 2021.

Aurora Energy publishes reconciliation loss factors which include technical losses and non-technical losses.

## 2 Loss Factor

### 2.1 General

Distribution technical losses represent the electricity entering the network that is dissipated, generally as heat, during the delivery to consumers' installations. The quantity of electricity metered at consumer installations is thus after losses and, in order to determine each retailer's purchase responsibilities, the electricity measured at the consumer's meter has to be multiplied by a "loss factor".

There are two main technical components to the distribution technical loss:

- A fixed component due to the iron losses of zone substation and distribution transformers.
- Variable components arising from the heating effects of the resistance in delivery circuits. The resistive losses are proportional to the square of the load current and occur in our 66kV, 33kV, 11kV and 6.6kV and LV network conductors and in zone substations and distribution transformers.

Non-technical losses arise from time-to-time, and include metering errors, theft, and sales reporting errors. These errors are also included in the overall calculated reconciliation loss determined from the sales reports received from retailers.

Non-technical losses can only be calculated by subtracting an estimate of the technical loss from the reconciliation loss. The technical loss cannot practically be calculated with any great accuracy however a reasonable estimate can be made. The technical loss on the Aurora Energy network is estimated as follows;

Dunedin area:	Technical loss estimate = 5.7% ± 1%
Central Otago and Wanaka area:	Technical loss estimate = 7.8% ± 1%
Queenstown area:	Technical loss estimate = 4.8% ± 1%
Te Anau area:	Technical loss estimate = 3.6% ± 1%

### 2.2 HV and LV Metered Installations

Most consumer installations are metered at LV. However, a few consumers' installations are metered at HV, and these installations should not incur any LV network losses or the fixed and variable losses in the distribution transformer.

### 2.3 Methodology

Aurora Energy has adopted the following methodology in determining the reconciliation loss factors.

The loss ratio for the distribution network, as declared for Information Disclosure purposes, is used as the basis for the calculation, and the average of several years' data is used to calculate the reconciliation loss factors for the following year. A single year's data is considered to be insufficient as it can be unduly influenced by a poor calculation of the accrual value (kWh) in the "normalised" sales reports forwarded by retailers each month, or due to data quality problems associated with the competitive market.

Once the average reconciliation loss ratio is obtained, the kWh lost is determined for the year. The total "fixed" annual losses are determined from the data for the zone substation and distribution substation transformers. The total variable losses are determined by deducting the fixed losses from the total reconciliation losses.

The variable losses are allocated to each half hour of the year using the total network demand for each half hour as these variable losses are a ratio of the square of the kW demand for each half hour. Once the variable component is determined for each half hour, the fixed component is added back and the "loss kWh" is thus available for each half hour. From this is calculated the reconciliation loss factor for each half hour and implicit in this calculation is the non-technical losses.

Average reconciliation loss factors have also been calculated for each of the following time zones by calculating the loss kWh for the zone and then determining the average loss factor:

Summer day	October to April	0700 - 2300 hours
Summer night	October to April	2300 - 0700 hours
Winter day	May to September	0700 - 2300 hours
Winter night	May to September	2300 - 0700 hours

## 2.4 Dunedin (Halfway Bush and South Dunedin GXP Areas)

Loss factors for the Dunedin pricing area are based upon an average of the loss ratio for the past 3 years (2018-2020), which is 5.97% compared to 5.78% for a 5-years average.

The individual reconciliation loss ratios for the March information disclosure year are:

2020	6.01%
2019	5.97%
2018	5.93%
2017	5.83%
2016	5.15%

The declared loss factors for the Dunedin pricing area, based upon an overall loss ratio of 5.97%, are listed in Schedule A.

## 2.5 Central Otago and Wanaka (Clyde and Cromwell GXP Areas)

Losses are higher within the Central Otago and Wanaka pricing area, due to the greater quantity of small distribution transformers (which are less efficient than large distribution transformers), and the greater length of delivery conductor needed per consumer compared to the Dunedin or Queenstown pricing areas.

Loss factors for the Central Otago and Wanaka pricing area are based upon an average of the loss ratio for the 3 years (2018-2020), which is 8.50% compared to 8.46% for a 5-years average.

The individual reconciliation loss ratios for the March year are:

2020	7.65%
2019	8.53%
2018	9.31%
2017	6.72%
2016	10.07%

The declared loss factors for the Central Otago and Wanaka pricing area, based upon an overall loss ratio of 8.50%, are listed in Schedule B. A 33kV loss factor has also been declared since there are several 33kV connections to the network.

## 2.6 Queenstown (Frankton GXP Area)

Loss factors for the Queenstown pricing area are based upon the average loss ratio for the past 3 years (2018-2020), which is 5.18% compared to 4.92% for a 5-years average.

The individual reconciliation loss ratios for the March year are:

2020	5.23%
2019	4.69%
2018	5.63%
2017	4.27%
2016	4.78%

The declared loss factors for the Queenstown pricing area, based upon an overall loss ratio of 5.18%, are listed in Schedule C. A 33kV loss factor has also been declared since there are several 33kV connections to the network.

## 2.7 Te Anau (Heritage Estate Embedded Network)

Due to the anomalous out-turn for 2019, loss factors for the Te Anau pricing area are based upon the average loss ratio for the past 5 years (2016-2020), which is 2.76% compared to 2.88% for a 3-year average.

The history of the reconciliation loss ratio for the Te Anau embedded network to the NSP of HER0111 is:

2020	3.85%
2019	-0.59%
2018	5.39%
2017	2.12%
2016	3.03%

The significant difference in reconciliation loss ratios observed between 2016 and 2020 likely indicates under-submission and/or over-submission of volume by retailers in successive years. In this context, Aurora Energy considers that calculating the declared loss factors based on the 5-year average is preferable to the 3-year average.

The declared loss factors for the Te Anau pricing area, based upon an overall loss ratio of 2.76%, are listed in Schedule D.

The Power Company Ltd has also declared loss factors to be added to the consumption at the NSP in order to determine purchase quantities at the North Makarewa GXP.

### 3 Schedule A – Dunedin Pricing Area

#### 3.1 LOSS FACTORS - APPLICABLE FROM 1 APRIL 2021

The following Loss Factors are used in the Reconciliation Process associated with the Wholesale Energy Market to multiply the kWh recorded on the meter at each Connected Customer's Installation, in order to determine the Electricity Retailer's responsibility for the purchase of kWh within the distribution network.

LOSS FACTORS AND CODES	HV metered	LV metered
	DEHV	DELV
Summer Day	1.0462	1.0616
Summer Night	1.0412	1.0549
Winter Day	1.0549	1.0731
Winter Night	1.0434	1.0579

Note: Winter months are May - September inclusive.

Summer months are October - April inclusive.

Day is 7:00 am to 11:00 pm

Night is 11:00 pm to 7:00 am

Time is NZ Standard Time or Daylight Saving Time as applicable.

The stated loss factors apply to the Aurora Energy distribution network connected to the Transpower grid exit points at Halfway Bush and South Dunedin.

Unique loss factor codes apply at the following ICPs.

ICP	Description	Loss Factor Code	Load Loss Factor	Injection Loss Factor
0000201299DEE20	Waipori 33kV	DEWPG	1.0200	1.0000

## 4 Schedule B – Central Otago and Wanaka Pricing Area

### 4.1 LOSS FACTORS - APPLICABLE 1 FROM APRIL 2021

The following Loss Factors are used in the Reconciliation Process associated with the Wholesale Energy Market to multiply the kWh recorded on the meter at each Connected Customer's Installation in order to determine the Electricity Retailer's responsibility for the purchase of kWh within the distribution network.

LOSS FACTORS AND CODES	SUPPLY @ 33kV	SUPPLY@11kV /6.6kV	GENERAL 400V
	CC33	CCHV	CCLV
Summer Day	1.0581	1.0718	1.0958
Summer Night	1.0418	1.0645	1.0860
Winter Day	1.0633	1.0750	1.1001
Winter Night	1.0527	1.0647	1.0863

Note: Winter months are May - September inclusive  
 Summer months are October - April inclusive  
 Day is 7:00 am to 11:00 pm  
 Night is 11:00 pm to 7:00 am  
 Time is NZ Standard Time or Daylight Saving Time as applicable.

The stated loss factors apply to the Aurora Energy distribution network connected to the Transpower grid exit points at Cromwell and Clyde.

## 5 Schedule C – Queenstown Pricing Area

### 5.1 LOSS FACTORS - APPLICABLE FROM 1 APRIL 2021

The following Loss Factors are used in the Reconciliation Process associated with the Wholesale Energy Market to multiply the kWh recorded on the meter at each Connected Customer's Installation in order to determine the Electricity Retailer's responsibility for the purchase of kWh within the distribution network.

LOSS FACTORS AND CODES	SUPPLY @ 33kV	SUPPLY@11kV /6.6kV	GENERAL 400V
	FR33	FRHV	FRLV
Summer Day	1.0270	1.0373	1.0497
Summer Night	1.0214	1.0333	1.0443
Winter Day	1.0440	1.0483	1.0644
Winter Night	1.0311	1.0398	1.0531

*Note:* Winter months are May - September inclusive  
 Summer months are October - April inclusive  
 Day is 7:00 am to 11:00 pm  
 Night is 11:00 pm to 7:00 am  
 Time is NZ Standard Time or Daylight Saving Time as applicable.

The stated loss factors apply to the Aurora Energy distribution network connected to the Transpower grid exit point at Frankton.



## 6 Schedule D – Te Anau Area (Heritage Estate Embedded Network) Pricing Area

### 6.1 LOSS FACTORS - APPLICABLE FROM 1 APRIL 2021

The following Loss Factors are to be used in the Reconciliation Process associated with the Wholesale Energy Market to multiply the kWh recorded on the meter at each Connected Customer's Installation in order to determine the Electricity Retailer's responsibility at the NSP of HER0111 for the purchase of kWh within the embedded distribution network.

LOSS FACTORS AND CODES	GENERAL 400V
	HELV
Summer Day	1.0282
Summer Night	1.0287
Winter Day	1.0288
Winter Night	1.0274

Note: Winter months are May - September inclusive.

Summer months are October - April inclusive.

Day is 7:00 am to 11:00 pm.

Night is 11:00 pm to 7:00 am.

Time is NZ Standard Time or Daylight Saving Time as applicable.

The stated loss factors apply to the embedded Aurora Energy distribution network connected to The Power Company network supply point HER0111. Published loss factors from The Power Company will need to be considered when calculating overall distribution loss factors within the embedded network.