

Loss Factors

Effective: 1 April 2017

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1 Introduction

Aurora 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 the loss factors and sets out the loss factors applicable from 1 April 2017.

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

Non-technical loss arises from time-to-time, and includes 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 estimation 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 network is estimated as follows;

Dunedin area:	Technical loss estimate = 5.9% ± 1%
Wakatipu area:	Technical loss estimate = 5.1% ± 1%
Central Otago area:	Technical loss estimate = 8.3% ± 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 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 by the retailers for the accrual value of kWh in the "normalised" sales reports forwarded by retailers each month or due to poor 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 Halfway Bush and South Dunedin GXP Areas

Aurora calculates loss factors based upon the average loss ratio for the 3 years 2014-2016 which is 6.09% compared to 5.89% for 5 years.

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

2016	6.32%
2015	6.38%
2014	5.58%
2013	5.11%
2012	6.05%

The declared loss factors for the Halfway Bush & South Dunedin GXP areas based upon an overall loss ratio of 6.09% are listed in Schedule 1.

2.5 Central Otago - Clyde and Cromwell GXP Areas

Historically loss factors were calculated for the combined Central Otago and Wakatipu areas as losses for the combined area had been published for Information Disclosure purposes.

Over the last 9 years the reconciliation loss for the CYD and CML GXP areas has been tracked separately from the FKN GXP area since these have different pricing and the different characteristics, such as number of connections per km of line, which drive distribution pricing, will also affect technical losses.

The losses are higher for the Clyde/Cromwell network due to the greater percentage of small distribution transformers which are less efficient than large distribution transformers, and the greater length of delivery conductor needed on a per consumer basis compared to Dunedin or Frankton pricing areas.

The individual reconciliation loss ratios for the March year are:

2016	8.78%
2015	8.80%
2014	8.44%
2013	8.89%
2012	8.96%

Aurora has calculated loss factors based upon the average loss ratio for the 3 years 2014-2016 which is 8.67% compared to 8.77% for 5 years.

The declared loss factors for the Clyde and Cromwell GXP areas are listed in Schedule 2. A 33kV loss factor has also been declared since there are several 33kV connections to the network.

2.6 Wakatipu - Frankton GXP Areas

Similarly for the Frankton area, the individual reconciliation loss ratios for the March year are:

2016	5.20%
2015	5.22%
2014	5.22%
2013	4.26%
2012	5.52%

Aurora has calculated loss factors based upon the average loss ratio for the 3 years 2014-2016 which is 5.21% compared to 5.08% for 5 years. The declared loss factors for the Frankton GXP area are listed in Schedule 3. A 33kV loss factor has also been declared since there are several 33kV connections to the network.

2.7 Heritage Estate – Te Anau Area

The history of the reconciliation loss ratio for the embedded network at Heritage Estate to the NSP of HER0111 is;

2016	3.88%
2015	3.92%
2014	3.79%
2013	2.94%
2012	3.22%

Aurora has calculated loss factors based upon the average loss ratio for the 3 years 2014-2016 which is 3.88% compared to 3.56% for 5 years. The declared loss factors for the Heritage Estate area are listed in Schedule 4.

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.

SCHEDULE 1

AURORA ENERGY LTD Halfway Bush and South Dunedin GXP areas

LOSS FACTORS - APPLICABLE 1 APRIL 2017

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 CODE			HV metered	LV metered
			DEHV	DELV
Summer	Day	0700 - 2300 hrs	1.0464	1.0619
Summer	Night	2300 - 0700 hrs	1.0425	1.0566
Winter	Day	0700 - 2300 hrs	1.0566	1.0755
Winter	Night	2300 - 0700 hrs	1.0445	1.0593

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.

Dunedin area - the Aurora 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

SCHEDULE 2

AURORA ENERGY LTD Clyde and Cromwell GXP areas

LOSS FACTORS - APPLICABLE 1 APRIL 2017

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	1.0611	1.0748	1.0998
Summer Night	1.0429	1.0656	1.0875
Winter Day	1.0630	1.0747	1.0996
Winter Night	1.0525	1.0646	1.0861

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 Aurora distribution network connected to the Transpower grid exit points at Cromwell and Clyde.

SCHEDULE 3

AURORA ENERGY LTD Frankton GXP areas

LOSS FACTORS - APPLICABLE 1 APRIL 2017

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	1.0265	1.0369	1.0492
Summer Night	1.0226	1.0345	1.0459
Winter Day	1.0441	1.0484	1.0646
Winter Night	1.0316	1.0403	1.0538

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 Aurora distribution network connected to the Transpower grid exit point at Frankton.

SCHEDULE 4

AURORA ENERGY LTD ***Heritage Estate – Te Anau area- North Makarewa GXP***

LOSS FACTORS **- APPLICABLE 1 APRIL 2017**

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	1.0392
Summer Night	1.0447
Winter Day	1.0406
Winter Night	1.0395

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.

`Te Anau area - the Aurora embedded distribution network connected to The Power Company network supply point HER0111.

As at 1 November 2013 the Loss Factors declared by The Power Company applicable to translate kWh at the NSP HER0111 to the NMA0331 grid exit point are as follows:

LOSS FACTORS AND CODES	HER0111
	PNL25
Summer Day	1.0500
Summer Night	1.0380
Winter Day	1.0800
Winter Night	1.0570