

# AURORA ENERGY LTD

## Loss Factors

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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 2011. Aurora publishes reconciliation loss factors which include technical losses and non-technical losses.

## 2 LOSSES

### 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 including metering errors, theft and sales reporting errors and 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 can not 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 = 5.0% ± 1%
Wakatipu area:	Technical loss estimate = 5.2% ± 1%
Central Otago area:	Technical loss estimate = 7.5% ± 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 nor 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 then 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 2008-2010 which is 5.06% as compared to 4.89% for 5 years. Note that for the 2010 year, the reconciliation loss has reduced significantly however it is noted that there was a corresponding high loss in 2009.

The individual values are:

2010	4.41%
2009	5.71%
2008	5.07%
2007	4.01%
2006	5.26%

The declared loss factors for the Halfway Bush & South Dunedin GXP areas are listed in Schedule 1.

## 2.5 Central Otago - Clyde and Cromwell GXP Areas

Historically losses have been calculated for the combined Central Otago and Wakatipu areas as losses for the combined area had been published for Information

Disclosure purposes. Based upon this data Aurora notes that the average loss ratio for the 3 years 2008-2010 is 6.23% as compared to 6.49% for 5 years.

The losses are slightly higher for the Central 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. The individual values are:

2010	6.09%
2009	5.71%
2008	6.89%
2007	6.27%
2006	7.51%

Over the last 2 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.

Aurora is also aware that the Electricity Commission (now Electricity Authority) has recently commenced the production of reports of rolling 12 month Unaccounted for Energy by GXP which reveal that energy on the Frankton GXP is over reported and under reported on the Clyde and Cromwell GXPs.

Analysis of the rolling 24 month reconciliation loss data for the CYD & CML GXP reveals that the loss ratio trend is about 7.51%. Published loss factors are based upon this overall loss.

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 analysis of the rolling 24 month reconciliation loss data for the FKN GXP reveals that the loss ratio trend is about 5.17%. Published loss factors are based on this overall loss.

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

2010	5.37%
2009	5.80%
2008	11.54%
2007	21.22%
2006 (6 months)	61.31%

The reason for the apparent high initial loss ratio is that until the 180 lot subdivision is fully populated when a loss ratio of less about 3% is expected then losses in this embedded network will be dominated by the standing iron losses of the distribution transformers modified by variations of estimates of reported sales by retailers. The same applies in large distribution networks however in these situations; the iron losses associated with distribution transformers in new subdivisions is not material when compared to the total losses in the network.

For the 2011 year it is predicted that the loss ratio will reduce to 4.80% and loss factors from 1 April 2011 have been based upon this value.

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 2011**

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.

<b>LOSS FACTORS AND CODE</b>			<b>HV metered</b>	<b>LV metered</b>
			<b>DEHV</b>	<b>DELV</b>
Summer	Day	0700 - 2300 hrs	1.0388	1.0517
Summer	Night	2300 - 0700 hrs	1.0371	1.0495
Winter	Day	0700 - 2300 hrs	1.0450	1.0601
Winter	Night	2300 - 0700 hrs	1.0370	1.0494

*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.

<b>ICP</b>	<b>Description</b>	<b>Loss Factor Code</b>	<b>Load Loss Factor</b>	<b>Injection Loss Factor</b>
0000201299DEE20	Waipori 33kV	DEWPG	1.0200	1.0000

**SCHEDULE 2****AURORA ENERGY LTD**  
***Clyde and Cromwell GXP areas*****LOSS FACTORS**  
**- APPLICABLE 1 APRIL 2011**

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.

<b>LOSS FACTORS AND CODES</b>	<b>SUPPLY @ 33kV</b>	<b>SUPPLY @ 11kV/6.6kV</b>	<b>GENERAL 400V</b>
	<b>CC33</b>	<b>CCHV</b>	<b>CCLV</b>
Summer Day	1.0469	1.0597	1.0796
Summer Night	1.0341	1.0553	1.0737
Winter Day	1.0559	1.0665	1.0886
Winter Night	1.0461	1.0570	1.0760

*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 2011**

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.

<b>LOSS FACTORS AND CODES</b>	<b>SUPPLY @ 33kV</b>	<b>SUPPLY @ 11kV/6.6kV</b>	<b>GENERAL 400V</b>
	<b>FR33</b>	<b>FRHV</b>	<b>FRLV</b>
Summer Day	1.0278	1.0372	1.0494
Summer Night	1.0276	1.0371	1.0495
Winter Day	1.0445	1.0464	1.0619
Winter Night	1.0331	1.0397	1.0529

*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 2011**

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	1.0486
Summer Night	1.0516
Winter Day	1.0527
Winter Night	1.0480

*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 2010 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