Marginal Loss Factors: Financial Year 2023-24

July 2024

A report for the National Electricity Market

Important notice

Purpose

This document has been prepared by AEMO as the 'Regions Publication' under clause 2A.1.3 of the National Electricity Rules (Rules), and to inform Registered Participants of the 2023-24 inter-regional loss equations under clause 3.6.1 of the Rules and 2023-24 intra-regional loss factors under clause 3.6.2 of the Rules. This document has effect only for the purposes set out in the Rules.

The Rules and the National Electricity Law (Law) prevail over this document to the extent of any inconsistency.

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Version control

Version	Release date	Changes
1	31/3/2023	Final 2023-24 MLFs published
2	31/07/2023	• July 2023 including the following new and revised connection points: • QLD Generation: Bouldercombe BESS , Dulacca Wind Farm • SA Generation: Robertstown 275 kV Wind, Torrens Island BESS • NSW Generation: Avonlie Solar Farm, Darlington Point BESS, Riverina BESS 1, Riverina BESS 2, Wyalong Solar Farm • VIC Generation: Phillip Island BESS • NSW Load: Riverina 415V

AEMO acknowledges the Traditional Owners of country throughout Australia and recognises their continuing connection to land, waters and culture. We pay respect to Elders past and present.

Version	Release date	Changes
		• TAS Load: Emu Bay 22, Greater Hobart Area VTN, Tamar Region VTN
1/11/2023		• November 2023 including the following new and revised connection points: • NSW Generation: Capital BESS, Flyers Creek Wind Farm, Rye Park Wind Farm, Tallawarra B, Wests Illawarra Leagues Club • NSW Load: Dapto (Endeavour Energy)
01/01/2024		• January 2024 including the following new and revised connection points: • QLD Generation: Chinchilla BESS • NSW Generation: Broken Hill BESS • VIC Generation: Glenrowan Solar Farm • SA Generation: Goyder South 1B Wind Farm, Mannum Solar Farm 2 • QLD Load: Larcom Creek, Greenland 132
22/07/2024		• July 2024 including the following new and revised connection points: • QLD Generation: Western Downs BESS • NSW Generation: Crookwell 2 Wind Farm, Crookwell 3 Wind Farm, Wellington North Solar Farm • NSW Load: Crookwell 415V • VIC Generation: Hawkesdale Wind Farm, Hasting 1, Hasting 2, Hasting 3

Introduction

This document sets out the 2023-24 National Electricity Market (NEM) intra-regional loss factors, commonly referred to as marginal loss factors (MLFs), calculated under clause 3.6.2 of the National Electricity Rules (Rules). MLFs represent electrical transmission losses within each of the five regions in the NEM – Queensland, New South Wales, Victoria, South Australia, and Tasmania.

As well as the MLFs, this document provides the following information for the 2023-24 financial year:

- Connection point transmission node identifiers (TNIs).
- Virtual transmission nodes (VTNs).
- NEM inter-regional loss factor equations and loss equations calculated under clause 3.6.1 of the Rules.

This document also serves as the Regions Publication under clause 2A.1.3 of the Rules, providing the following information for the 2023-24 financial year:

- Region definitions.
- Regional reference nodes (RRNs).
- Region boundaries.

Loss factors apply for 2023-24 only, and should not be relied on as an indicator for future years.

Context

In recent years, supply and demand patterns in the NEM have been changing at an increasing rate, driven by new technology and a changing generation mix. This has led to large year-on-year changes in MLFs, particularly in areas of high renewable penetration that are electrically weak and remote from load centres.

The large year-on-year changes in MLFs demonstrate the ongoing need for comprehensive planning to minimise costs to consumers. All-of-system planning documents, such as the *Integrated System Plan* (ISP)[1], are critical in the provision of information to participants regarding the needs of, and changes occurring in, the power system.

Improving transparency

In December 2022, AEMO published a preliminary report on MLFs for 2023-24, intended to provide an early indication to stakeholders of both the potential direction and extent of movement in MLFs across the NEM between 2022-23 and 2023-24. The preliminary report was based on a limited study using some inputs from the 2022-23 study with generation profiles updated to reflect committed generation as of August 2022.

Structure of the report

This document has been structured as follows:

- Section 1 outlines the MLFs for loads and generators in 2023-24.

[1] Available at https://www.aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp.

- Section 2 summarises the key changes that have been observed in MLFs between 2022-23 and 2023-24.
- Section 3 outlines the inter-regional loss factor equations for 2023-24.
- Section 4 outlines the inter-regional loss equations for 2023-24.
- Section 5 outlines the Basslink, Murraylink and Terranora loss equations for 2023-24.
- Section 6 outlines the proportioning of inter-regional losses to regions for 2023-24.
- Section 7 defines the regions and regional reference nodes for 2023-24.
- Section 8 outlines the virtual transmission nodes for 2023-24.
- Appendix A1 provides a background to MLFs.
- Appendix A2 outlines the methodology, inputs, and assumptions that have been used to determine the MLFs for 2023-24.
- Appendix A3 outlines the impact of various technologies on volume weighted MLF outcomes.

Review of calculation

AEMO applied a number of quality assurance steps when calculating the 2023-24 MLFs. These included engaging an independent consultant to review the quality and accuracy of the MLF calculation process. The consultant is satisfied that AEMO is appropriately applying the published Methodology based on the data provided by registered participants, historical market data, and AEMO's electricity consumption forecasts, and a review of the process applied to the calculation of MLF values.

Changes since draft report

AEMO published a draft report on 2023-24 MLFs on 1 March 2023 and sought feedback from stakeholders.

AEMO incorporated new information relating to the return of service of the Callide C Power Station. AEMO also made a number of minor improvements to modelling compared to the study used for the draft report, following completion of calculation review. These changes are detailed in Section 2.4 of this report.

Observations and trends

For the 2023-24 MLF study, the primary observation is the projected impact of thermal generation behaviour driven by variations in availability (Liddell Power Station closure, Callide C Power Station return to service), demand forecasts, and the continual addition of generation capacity in the form of solar and wind.

The closure of Liddell, coupled with the increased generation availability in Queensland and the staged increase of Queensland to New South Wales transfer capacity, has led to material variations in MLF outcomes in both regions.

In addition to generation-driven variations, forecast demand variations are material in nature for 2023-24. Further information on forecast demand is detailed in Section A2.2 of this report.

Further information on observations and trends is detailed in Section 2.5 of this report.

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1 Marginal loss factors by region

This section shows the intra-regional loss factors, commonly known as marginal loss factors (MLFs), for financial year 2023-24, for every existing load or generation transmission connection point (identified by transmission node identifier [TNI] or dispatchable unit identifier [DUID]) in each National Electricity Market (NEM) region. As required by clause 3.6.2 of the National Electricity Rules (Rules), these MLFs have been calculated in accordance with AEMO's published Forward Looking Loss Factor Methodology (Methodology).

The generation profiles for committed but not yet NEM-registered projects are included in the MLF calculation, however AEMO does not publish MLFs for connection points relating to projects whose registration has not been completed as at the date of publication. AEMO will publish MLFs for those connection points following registration. MLF updates and additions that are developed throughout the year will be included in the "2023-24 MLF Applicable from 1 July 2023" spreadsheet, which is also published on AEMO's website[2].

1.1 Queensland marginal loss factors

Table 1 Queensland loads

Location	Voltage (kilovolts [kV])	TNI code	2023-24 MLF	2022-23 MLF
Abermain	33	QABM	0.9985	0.9992
Abermain – Dual MLF (Generation)	110	QABR	0.9985	0.9995
Abermain – Dual MLF (Load)	110	QABR	0.9985	0.9980
Alan Sherriff	132	QASF	0.9845	1.0027
Algester	33	QALG	1.0174	1.0142
Alligator Creek	132	QALH	0.9714	0.9885
Alligator Creek	33	QALC	0.9788	0.9972
Ashgrove West	110	QCBW	1.0126	1.0113
Ashgrove West	33	QAGW	1.0154	1.0137
Belmont	110	QBMH	1.0128	1.0108
Belmont Wecker Road	33	QBBS	1.0146	1.0119
Biloela	66/11	QBIL	0.9261	0.9473
Blackstone	110	QBKS	0.9980	0.9973
Blackwater	132	QBWH	0.9655	0.9844
Blackwater	66/11	QBWL	0.9722	0.9890
Bluff	132	QBLF	0.9663	0.9859
Bolingbroke	132	QBNB	0.9571	0.9775
Bowen North	66	QBNN	0.9616	0.9807
Boyne Island	132	QBOL	0.9485	0.9756
Boyne Island	275	QBOH	0.9496	0.9794

[2] At https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Loss-factor-and-regional-boundaries.

Location	Voltage (kilovolts [kV])	TNI code	2023-24 MLF	2022-23 MLF
Braemar – Kumbarilla Park	275	QBRE	0.9723	0.9753
Bulli Creek (Essential Energy)	132	QBK2	0.9773	0.9748
Bulli Creek (Waggamba)	132	QBLK	0.9773	0.9748
Bundamba	110	QBDA	0.9987	0.9992
Burton Downs	132	QBUR	0.9716	0.9851
Cairns	22	QCRN	0.9760	0.9954
Cairns City	132	QCNS	0.9684	0.9860
Callemondah (Rail)	132	QCMD	0.9395	0.9676
Calliope River	132	QCAR	0.9386	0.9672
Cardwell	22	QCDW	0.9818	1.0017
Chinchilla	132	QCHA	0.9692	0.9781
Clare	66	QCLR	0.9878	1.0003
Collinsville Load	33	QCOL	0.9503	0.9719
Columboola	132	QCBL	0.9774	0.9828
Columboola 132 (Bellevue LNG load)	132	QCBB	0.9784	0.9841
Coppabella (Rail)	132	QCOP	0.9844	0.9917
Dan Gleeson	66	QDGL	0.9881	1.0031
Duaringa	132	QDRG	0.9627	0.9660
Dysart	132	QDYS	0.9779	0.9939
Eagle Downs Mine	132	QEGD	0.9750	0.9898
Edmonton	22	QEMT	0.9878	1.0039
Egans Hill	66	QEGN	0.9318	0.9524
El Arish	22	QELA	0.9822	1.0085
Garbutt	66	QGAR	0.9883	1.0064
Gin Gin	132	QGNG	0.9621	0.9855
Gladstone South	66/11	QGST	0.9411	0.9713
Goodna	33	QGDA	1.0042	1.0031
Goonyella Riverside Mine	132	QGYR	0.9885	1.0015
Grantleigh (Rail)	132	QGRN	0.9264	0.9574
Greenland	132	QGLD	0.9735	
Gregory (Rail)	132	QGRE	0.9469	0.9677
Ingham	66	QING	0.9903	1.0113
Innisfail	22	QINF	0.9841	1.0053
Invicta Load	132	QINV	0.9317	0.9501
Kamerunga	22	QKAM	0.9837	1.0065
Kemmis	66	QEMS	0.9704	0.9826
King Creek	132	QKCK	0.9569	0.9806
Larcom Creek	275	QLCH	0.9261	
Lilyvale	66	QLIL	0.9486	0.9716

Location	Voltage (kilovolts [kV])	TNI code	2023-24 MLF	2022-23 MLF
Lilyvale (Barcaldine)	132	QLCM	0.9564	0.9786
Loganlea	110	QLGH	1.0118	1.0087
Loganlea	33	QLGL	1.0144	1.0120
Mackay	33	QMKA	0.9735	0.9896
Middle Ridge (Energex)	110	QMRX	0.9886	0.9823
Middle Ridge (Ergon)	110	QMRG	0.9886	0.9823
Mindi (Rail)	132	QMND	0.9527	0.9726
Molendinar	110	QMAR	1.0132	1.0086
Molendinar	33	QMAL	1.0127	1.0084
Moranbah (Mine)	66	QMRN	0.9898	1.0014
Moranbah (Town)	11	QMRL	0.9852	1.0026
Moranbah Substation	132	QMRH	0.9853	0.9926
Moura	66/11	QMRA	0.9443	0.9537
Mt McLaren (Rail)	132	QMTM	0.9835	0.9785
Mudgeeraba	110	QMGB	1.0126	1.0078
Mudgeeraba	33	QMGL	1.0137	1.0083
Murarrie (Belmont)	110	QMRE	1.0129	1.0101
Nebo	11	QNEB	0.9515	0.9718
Newlands	66	QNLD	0.9809	1.0056
North Goonyella	132	QNGY	0.9859	1.0030
Norwich Park (Rail)	132	QNOR	0.9631	0.9856
Oakey	110	QOKT	0.9883	0.9804
Oonooie (Rail)	132	QOON	0.9743	0.9891
Orana LNG	275	QORH	0.9715	0.9764
Palmwoods	132	QPWD	1.0130	1.0095
Pandoin	132	QPAN	0.9267	0.9539
Pandoin	66	QPAL	0.9294	0.9639
Peak Downs (Rail)	132	QPKD	0.9878	0.9996
Pioneer Valley	66	QPIV	0.9886	1.0008
Proserpine	66	QPRO	0.9878	1.0112
Queensland Alumina Ltd (Gladstone South)	132	QQAH	0.9445	0.9754
Queensland Nickel (Yabulu)	132	QQNH	0.9716	0.9899
Raglan	275	QRGL	0.9311	0.9571
Redbank Plains	11	QRPN	1.0054	1.0034
Richlands	33	QRLD	1.0158	1.0130
Rockhampton	66	QROC	0.9325	0.9575
Rocklea (Archerfield)	110	QRLE	1.0054	1.0040
Ross	132	QROS	0.9716	0.9906
Runcorn	33	QRBS	1.0180	1.0151

Location	Voltage (kilovolts [kV])	TNI code	2023-24 MLF	2022-23 MLF
South Pine	110	QSPN	1.0045	1.0046
Stony Creek	132	QSYC	0.9727	0.9859
Sumner	110	QSUM	1.0064	1.0050
Tangkem (Dalby) – Dual MLF (Generation)	110	QTKM	0.9892	0.9792
Tangkem (Dalby) – Dual MLF (Load)	110	QTKM	0.9892	0.9827
Tarong	66	QTRL	0.9712	0.9734
Teebar Creek	132	QTBC	0.9816	0.9956
Tennyson	33	QTNS	1.0101	1.0077
Tennyson (Rail)	110	QTNN	1.0078	1.0062
Townsville East	66	QTVE	0.9772	0.9975
Townsville South	66	QTVS	0.9778	1.0025
Townsville South (KZ)	132	QTZS	0.9979	1.0029
Tully	22	QTLL	1.0063	1.0223
Turkinje	66	QTUL	1.0029	1.0201
Turkinje (Craiglie)	132	QTUH	1.0068	1.0235
Wandoan South	132	QWSH	0.9897	0.9953
Wandoan South (NW Surat)	275	QWST	0.9890	0.9946
Wandoo (Rail)	132	QWAN	0.9554	0.9760
Wivenhoe Pump	275	QWIP	0.9994	0.9994
Woolooga (Energex)	132	QWLG	0.9800	0.9942
Woolooga (Ergon)	132	QWLN	0.9800	0.9942
Woree	132	QWRE	0.9777	0.9938
Wotonga (Rail)	132	QWOT	0.9818	0.9938
Wycarbah	132	QWCB	0.9249	0.9525
Yarwun – Boat Creek (Ergon)	132	QYAE	0.9369	0.9659
Yarwun – Rio Tinto	132	QYAR	0.9363	0.9632

Table 2 Queensland generation

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Baking Board Solar Farm (Chinchilla Solar Farm)	132	BAKING1	QCHS1C	QCHS	0.9598	0.9664
Barcaldine Power Station (PS) – Lilyvale	132	BARCALDN	QBCG	QBCG	0.9380	0.9350
Barcaldine Solar at Lilyvale (132)	132	BARCSF1	QLLV1B	QLLV	0.9150	0.9334
Barron Gorge Power Station Unit 1	132	BARRON-1	QBGH1	QBGH	0.9590	0.9623
Barron Gorge Power Station Unit 2	132	BARRON-2	QBGH2	QBGH	0.9590	0.9623
Bluegrass Solar Farm	132	BLUEGSF1	QCBS1B	QCBS	0.9546	0.9600
Bouldercombe BESS (Generation)	132	BBATTERY	QBCB1B	QBCB	0.9198	
Bouldercombe BESS (Load)	132	BBATRYL1	QBCB2B	QBCB	0.9271	
Braemar PS Unit 1	275	BRAEMAR1	QBRA1	QBRA	0.9617	0.9630

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Braemar PS Unit 2	275	BRAEMAR2	QBRA2	QBRA	0.9617	0.9630
Braemar PS Unit 3	275	BRAEMAR3	QBRA3	QBRA	0.9617	0.9630
Braemar Stage 2 PS Unit 5	275	BRAEMAR5	QBRA5B	QBRA	0.9617	0.9630
Braemar Stage 2 PS Unit 6	275	BRAEMAR6	QBRA6B	QBRA	0.9617	0.9630
Braemar Stage 2 PS Unit 7	275	BRAEMAR7	QBRA7B	QBRA	0.9617	0.9630
Browns Plains Landfill Gas PS	110	BPLANDF1	QLGH3B	QLGH	1.0118	1.0087
Callide A PS Unit 4	132	CALL_A_4	QCAA4	QCAA	0.9138	0.9392
Callide A PS Unit 4 Load	132	CALLNL4	QCAA2	QCAA	0.9138	0.9392
Callide B PS Unit 1	275	CALL_B_1	QCAB1	QCAB	0.9149	0.9404
Callide B PS Unit 2	275	CALL_B_2	QCAB2	QCAB	0.9149	0.9404
Callide C PS Unit 3	275	CPP_3	QCAC3	QCAC	0.9096	0.9361
Callide C PS Unit 4	275	CPP_4	QCAC4	QCAC	0.9096	0.9361
Callide PS Load	132	CALLNL1	QCAX	QCAX	0.9181	0.9351
Childers Solar Farm	132	CHILDSF1	QTBS1C	QTBS	0.9704	0.9823
Chinchilla BESS (Generation)	275	CHBESSG1	QWDB1C	QWDB	0.9588	
Chinchilla BESS (Load)	275	CHBESSL1	QWDB2C	QWDB	0.9750	
Clare Solar Farm	132	CLARESF1	QCLA1C	QCLA	0.8981	0.9177
Clermont Solar Farm	132	CLERMSF1	QLLV3C	QLLV	0.9150	0.9334
Collinsville Solar Farm	33	CSPVPS1	QCOS1C	QCOS	0.9132	0.9268
Columboola Solar Farm	132	COLUMSF1	QCBR1C	QCBR	0.9746	0.9812
Columboola – Condamine PS	132	CPSA	QCND1C	QCND	0.9731	0.9744
Coopers Gap Wind Farm	275	COOPGWF1	QCPG1C	QCPG	0.9658	0.9685
Darling Downs PS	275	DDPS1	QBRA8D	QBRA	0.9617	0.9630
Darling Downs Solar Farm	275	DDSF1	QBRS1D	QBRS	0.9762	0.9796
Daydream Solar Farm	33	DAYDSF1	QCCK1D	QCCK	0.9098	0.9296
Dulacca Wind Farm	132	DULAWF1	QCBF1D	QCBF	0.9776	0.9541
Edenvale Solar Park	275	EDENVSF1	QORS1E	QORS	0.9720	0.9753
Emerald Solar Farm	66	EMERASF1	QLIS1E	QLIS	0.9111	0.9333
Gangarri Solar Farm	132	GANGARR1	QWSS1G	QWSS	0.9837	0.9921
German Creek Generator	66	GERMCRK	QLIL2	QLIL	0.9486	0.9716
Gladstone PS (132 kV) Unit 3	132	GSTONE3	QGLD3	QGLL	0.9323	0.9581
Gladstone PS (132 kV) Unit 4	132	GSTONE4	QGLD4	QGLL	0.9323	0.9581
Gladstone PS (132kV) Load	132	GLADNL1	QGLL	QGLL	0.9323	0.9581
Gladstone PS (275 kV) Unit 1	275	GSTONE1	QGLD1	QGLH	0.9329	0.9623
Gladstone PS (275 kV) Unit 2	275	GSTONE2	QGLD2	QGLH	0.9329	0.9623
Gladstone PS (275 kV) Unit 5	275	GSTONE5	QGLD5	QGLH	0.9329	0.9623
Gladstone PS (275 kV) Unit 6	275	GSTONE6	QGLD6	QGLH	0.9329	0.9623
Grosvenor PS At Moranbah 66 No 1	66	GROSV1	QMRN2G	QMRV	0.9821	0.9923

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Grosvenor PS At Moranbah 66 No 2	66	GROSV2	QMRV1G	QMRV	0.9821	0.9923
Hamilton Solar Farm	33	HAMISF1	QSLD1H	QSLD	0.9060	0.9238
Haughton Solar Farm	275	HAUGHT11	QHAR1H	QHAR	0.9151	0.9300
Hayman Solar Farm	33	HAYMSF1	QCCK2H	QCCK	0.9098	0.9296
Hughenden Solar Farm	132	HUGSF1	QROG2H	QROG	0.9222	0.9369
Invicta Sugar Mill	132	INVICTA	QINV1I	QINV	0.9317	0.9501
Isis CSM	132	ICSM	QGNG1I	QTBC	0.9816	0.9956
Kaban Wind Farm	275	KABANWF1	QTMW1K	QTMW	0.9575	0.9513
Kareeya PS Unit 1	132	KAREEYA1	QKAH1	QKYH	0.9559	0.9702
Kareeya PS Unit 2	132	KAREEYA2	QKAH2	QKYH	0.9559	0.9702
Kareeya PS Unit 3	132	KAREEYA3	QKAH3	QKYH	0.9559	0.9702
Kareeya PS Unit 4	132	KAREEYA4	QKAH4	QKYH	0.9559	0.9702
Kennedy Energy Park Battery (Generation)	132	KEPBG1	QROW3K	QROW	0.9667	0.9808
Kennedy Energy Park Battery (Load)	132	KEPBL1	QROW4K	QROW	0.9667	0.9808
Kennedy Energy Park Solar Farm	132	KEPSF1	QROW2K	QROW	0.9667	0.9808
Kennedy Energy Park Wind Farm	132	KEPWF1	QROW1K	QROW	0.9667	0.9808
Kidston Solar Farm	132	KSP1	QROG1K	QROG	0.9222	0.9369
Kogan Creek PS	275	KPP_1	QBRA4K	QWDN	0.9673	0.9698
Koombooloomba	132	KAREEYA5	QKYH5	QKYH	0.9559	0.9702
Lilyvale Solar Farm	33	LILYSF1	QBDR1L	QBDR	0.9064	0.9323
Longreach Solar Farm	132	LRSF1	QLLV2L	QLLV	0.9150	0.9334
Mackay GT	33	MACKAYGT	QMKG	QMKG	0.9715	0.9871
Maryrorough Solar Farm (Brigalow Solar Farm)	110	MARYRSF1	QMRY2M	QMRY	0.9914	0.9861
Middlemount Sun Farm	66	MIDDLSF1	QLIS2M	QLIS	0.9111	0.9333
Millmerran PS Unit 1	330	MPP_1	QBCK1	QMLN	0.9763	0.9762
Millmerran PS Unit 2	330	MPP_2	QBCK2	QMLN	0.9763	0.9762
Moranbah Generation	11	MORANBAH	QMRL1M	QMRL	0.9852	1.0026
Moranbah North PS	66	MBAHNTH	QMRN1P	QMRN	0.9898	1.0014
Mount Emerald Wind farm	275	MEWF1	QWKM1M	QWKM	0.9472	0.9575
Moura Solar Farm	132	MOUSF1	QMRR1M	QMRR	0.9081	0.9224
Mt Stuart PS Unit 1	132	MSTUART1	QMSP1	QMSP	0.9164	0.9160
Mt Stuart PS Unit 2	132	MSTUART2	QMSP2	QMSP	0.9164	0.9160
Mt Stuart PS Unit 3	132	MSTUART3	QMSP3M	QMSP	0.9164	0.9160
Oakey 1 Solar Farm	110	OAKEY1SF	QTKS1O	QTKS	0.9869	0.9800
Oakey 2 Solar Farm	110	OAKEY2SF	QTKS2O	QTKS	0.9869	0.9800
Oakey PS Unit 1	110	OAKEY1	QOKY1	QOKY	0.9628	0.9530
Oakey PS Unit 2	110	OAKEY2	QOKY2	QOKY	0.9628	0.9530
Oaky Creek 2	66	OAKY2	QLIL3O	QLIL	0.9486	0.9716

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Oaky Creek Generator	66	OAKYCREK	QLIL1	QLIL	0.9486	0.9716
Rocky Point Gen (Loganlea 110kV)	110	RPCG	QLGH2	QLGH	1.0118	1.0087
Roma PS Unit 7 – Columboola	132	ROMA_7	QRMA7	QRMA	0.9643	0.9761
Roma PS Unit 8 – Columboola	132	ROMA_8	QRMA8	QRMA	0.9643	0.9761
Ross River Solar Farm	132	RRSF1	QROG3R	QROG	0.9222	0.9369
Rugby Run Solar Farm	132	RUGBYR1	QMPL1R	QMPL	0.9185	0.9224
Stanwell PS Load	132	STANNL1	QSTX	QSTX	0.9265	0.9527
Stanwell PS Unit 1	275	STAN-1	QSTN1	QSTN	0.9181	0.9409
Stanwell PS Unit 2	275	STAN-2	QSTN2	QSTN	0.9181	0.9409
Stanwell PS Unit 3	275	STAN-3	QSTN3	QSTN	0.9181	0.9409
Stanwell PS Unit 4	275	STAN-4	QSTN4	QSTN	0.9181	0.9409
Stapylton	110	STAPYLTON1	QLGH4S	QLGH	1.0118	1.0087
Sun Metals Solar Farm	132	SMCSF1	QTZS1S	QTZS	0.9979	1.0029
Sunshine Coast Solar Farm	132	VALDORA1	QPWD1S	QPWD	1.0130	1.0095
Susan River Solar Farm	132	SRSF1	QTBS2S	QTBS	0.9704	0.9823
Swanbank E GT	275	SWAN_E	QSWE	QSWE	0.9987	0.9976
Tarong North PS	275	TNPS1	QTNT	QTNT	0.9712	0.9737
Tarong PS Unit 1	275	TARONG#1	QTRN1	QTRN	0.9707	0.9729
Tarong PS Unit 2	275	TARONG#2	QTRN2	QTRN	0.9707	0.9729
Tarong PS Unit 3	275	TARONG#3	QTRN3	QTRN	0.9707	0.9729
Tarong PS Unit 4	275	TARONG#4	QTRN4	QTRN	0.9707	0.9729
Ti Tree BioReactor	33	TITREE	QABM1T	QABM	0.9985	0.9992
Wandoan Battery Energy Storage System (BESS) (Generation)	132	WANDBG1	QWSB1W	QWSB	0.9751	0.9767
Wandoan BESS (Load)	132	WANDBL1	QWSB2W	QWSB	1.0020	1.0007
Wandoan South Solar Farm 1	275	WANDSF1	QWSR1W	QWSR	0.9832	0.9884
Warwick Solar Farm 1	110	WARWSF1	QMRY3W	QMRY	0.9914	0.9861
Warwick Solar Farm 2	110	WARWSF2	QMRY4W	QMRY	0.9914	0.9861
Western Downs BESS (Generation)	275	WDBESSG1	QWDE1W	QWDE	0.9586	
Western Downs BESS (Load)	275	WDBESSL1	QWDE2W	QWDE	0.9768	
Western Downs Green Power Hub	275	WDGPH1	QWDR1W	QWDR	0.9712	0.9757
Whitsunday Solar Farm	33	WHITSF1	QSLS1W	QSLS	0.9010	0.9218
Windy Hill Wind Farm	66	WHILL1	QTUL	QTUL	1.0029	1.0201
Wivenhoe Generation Unit 1	275	W/HOE#1	QWIV1	QWIV	0.9900	0.9913
Wivenhoe Generation Unit 2	275	W/HOE#2	QWIV2	QWIV	0.9900	0.9913
Wivenhoe Pump 1	275	PUMP1	QWIP1	QWIP	0.9994	0.9994
Wivenhoe Pump 2	275	PUMP2	QWIP2	QWIP	0.9994	0.9994
Wivenhoe Small Hydro – Dual MLF (Generation)	110	WIVENSH	QABR1	QABR	0.9985	0.9995

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Wivenhoe Small Hydro – Dual MLF (Load)	110	WIVENSH	QABR1	QABR	0.9985	0.9980
Woolooga Solar Farm	132	WOOLGSF1	QWLS1W	QWLS	0.9736	0.9832
Yabulu PS	132	YABULU	QTYP	QTYP	0.9519	0.9572
Yabulu Steam Turbine (Garbutt 66kV)	66	YABULU2	QGAR1	QYST	0.9417	0.9237
Yarranlea Solar Farm	110	YARANSF1	QMRY1Y	QMRY	0.9914	0.9861
Yarwun PS	132	YARWUN_1	QYAG1R	QYAG	0.9349	0.9627

1.2 New South Wales marginal loss factors[3]

Table 3 New South Wales loads

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Albury	132	NALB	0.9464	0.9551
Alexandria	33	NALX	1.0024	1.0039
Armidale	66	NAR1	0.9224	0.9429
Australian Newsprint Mill	132	NANM	0.9446	0.9426
BHP (Waratah)	132	NWR1	0.9931	0.9949
Balranald	22	NBAL	0.9017	0.8998
Beaconsfield North	132	NBFN	1.0021	1.0036
Beaconsfield South	132	NBFS	1.0021	1.0036
Belmore Park	132	NBM1	1.0024	1.0039
Belmore Park 11	11	NBMP	1.0042	1.0063
Beryl	66	NBER	0.9851	0.9813
Boambee South	132	NWST	0.9566	0.9830
Boggabri East	132	NBGE	0.9463	0.9611
Boggabri North	132	NBGN	0.9457	0.9630
Brandy Hill	11	NBHL	0.9971	0.9988
Brandy Hill (Essential Energy)	11	NBHX	0.9971	0.9988
Broken Hill	22	NBKG	0.8844	0.8685
Broken Hill	220	NBKH	0.8710	0.8600
Bunnerong	132	NBG1	1.0025	1.0039
Bunnerong	33	NBG3	1.0047	1.0055
Buronga	220	NBRG	0.8982	0.8866
Burrinjuck	132	NBU2	0.9458	0.9601
Campbell Street	11	NCBS	1.0025	1.0060
Campbell Street	132	NCS1	1.0023	1.0038
Canterbury	33	NCTB	1.0047	1.0175
Carlingford	132	NCAR	1.0010	1.0010

[3] The New South Wales region includes the Australian Capital Territory (ACT). ACT generation and load are detailed separately for ease of reference.

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Casino	132	NCSN	0.9532	0.9864
Charmhaven	11	NCHM	0.9942	0.9967
Coffs Harbour	66	NCH1	0.9488	0.9747
Coleambally	132	NCLY	0.9266	0.9268
Cooma	66	NCMA	0.9679	0.9625
Cooma (AusNet Services)	66	NCM2	0.9679	0.9625
Cowra – Dual MLF (Generation)	66	NCW8	0.9378	0.9746
Cowra – Dual MLF (Load)	66	NCW8	0.9713	0.9746
Crookwell 415V	0.5	NCK4	0.9679	
Dapto (Endeavour Energy) – (effective prior to 17/10/2023)	132	NDT1	0.9895	0.9934
Dapto (Endeavour Energy) – (effective from 17/10/2023)	132	NDT1	0.9888	0.9934
Dapto (Essential Energy)	132	NDT2	0.9895	0.9934
Darlington Point	132	NDNT	0.9371	0.9397
Deniliquin	66	NDN7	0.9720	0.9733
Dorrigo	132	NDOR	0.9336	0.9692
Dunoon	132	NDUN	0.9632	0.9991
Far North VTN		NEV1	0.9774	0.9781
Finley	66	NFNY	0.9687	0.9708
Finley – Dual MLF (Generation)	132	NFN2	0.9797	0.9815
Finley – Dual MLF (Load)	132	NFN2	0.9320	0.9070
Forbes	66	NFB2	1.0125	1.0018
Gadara	132	NGAD	0.9580	0.9693
Glen Innes	66	NGLN	0.9061	0.9346
Gosford	33	NGSF	1.0029	1.0053
Gosford	66	NGF3	1.0023	1.0048
Grafton East 132	132	NGFT	0.9329	0.9709
Green Square	11	NGSQ	1.0048	1.0063
Griffith	33	NGRF	0.9467	0.9473
Gunnedah	66	NGN2	0.9572	0.9833
Haymarket	132	NHYM	1.0022	1.0038
Heron's Creek	132	NHNC	1.0176	1.0350
Holroyd	132	NHLD	1.0018	1.0020
Holroyd (Ausgrid)	132	NHLX	1.0018	1.0020
Homebush Bay	11	NHBB	1.0150	1.0161
Hurstville North	11	NHVN	1.0020	1.0048
Ilford	132	NLFD	0.9622	0.9639
Ingleburn	66	NING	0.9958	0.9976

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Inverell	66	NNVL	0.9157	0.9461
Kemps Creek	330	NKCK	0.9937	0.9959
Kempsey	33	NKS3	0.9871	1.0107
Kempsey	66	NKS2	0.9708	1.0008
Kogarah	11	NKOG	1.0040	1.0066
Koolkhan	66	NKL6	0.9733	1.0008
Kurnell	132	NKN1	1.0006	1.0023
Lake Munmorah	132	NMUN	0.9838	0.9890
Lane Cove	132	NLCV	1.0112	1.0130
Liddell	33	NLD3	0.9661	0.9678
Lismore	132	NLS2	0.9814	1.0079
Liverpool	132	NLP1	0.9999	1.0011
Macarthur	132	NMC1	0.9929	0.9954
Macarthur	66	NMC2	0.9947	0.9972
Macksville	132	NMCV	0.9722	0.9966
Macquarie Park	11	NMQP	1.0221	1.0188
Macquarie Park	33	NMQS	1.0110	1.0128
Manildra	132	NMLD	1.0250	1.0025
Marrickville	11	NMKV	1.0071	1.0089
Marulan (Endeavour Energy)	132	NMR1	1.0095	1.0118
Marulan (Essential Energy)	132	NMR2	1.0095	1.0118
Mason Park	132	NMPK	1.0123	1.0135
Meadowbank	11	NMBK	1.0154	1.0167
Molong	132	NMOL	1.0428	1.0258
Moree	66	NMRE	0.9563	0.9761
Morven	132	NMVN	0.9476	0.9431
Mt Piper	66	NMP6	0.9752	0.9744
Mudgee	132	NMDG	0.9853	0.9797
Mullumbimby	11	NML1	0.9533	0.9987
Mullumbimby	132	NMLB	0.9471	0.9899
Munmorah STS 33	33	NMU3	0.9907	0.9937
Munyang	11	NMY1	0.9838	0.9633
Munyang	33	NMYG	0.9838	0.9633
Murrumbateman	132	NMBM	0.9545	0.9645
Murrumburrah	66	NMRU	0.9648	0.9719
Muswellbrook	132	NMRK	0.9774	0.9788
Nambucca Heads	132	NNAM	0.9685	0.9905
Narrabri	66	NNB2	0.9799	0.9926
Newcastle	132	NNEW	0.9926	0.9942

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Newcastle (Essential Energy)	132	NNEX	0.9926	0.9942
North of Broken Bay VTN		NEV2	0.9950	0.9970
Orange	66	NRGE	1.0645	1.0427
Orange North	132	NONO	1.0589	1.0348
Ourimbah	132	NOR1	0.9998	1.0007
Ourimbah	33	NORB	0.9991	1.0017
Ourimbah	66	NOR6	0.9987	1.0013
Panorama	66	NPMA	1.0398	1.0252
Parkes	132	NPKS	1.0022	0.9865
Parkes	66	NPK6	1.0442	1.0026
Peakhurst	33	NPHT	1.0013	1.0037
Potts Hill 11	11	NPHL	1.0056	1.0072
Potts Hill 132	132	NPO1	1.0030	1.0044
Pt Macquarie	33	NPMQ	1.0105	1.0312
Queanbeyan 132	132	NQBY	0.9861	0.9941
Raleigh	132	NRAL	0.9611	0.9847
Ravine	330	NRVN	0.9507	0.9495
Regentville	132	NRGV	0.9986	0.9984
Riverina 415V	0.42	NRVA	0.9376	0.9331
Rockdale (Ausgrid)	11	NRKD	1.0040	1.0060
Rookwood Road	132	NRWR	1.0028	1.0043
Rose Bay	11	NRSB	1.0053	1.0069
Snowy Adit	132	NSAD	0.9771	0.9550
Somersby	11	NSMB	1.0033	1.0057
South of Broken Bay VTN		NEV3	1.0044	1.0057
St Peters	11	NSPT	1.0056	1.0069
Strathfield South	11	NSFS	1.0034	1.0091
Stroud	132	NSRD	1.0084	1.0119
Sydney East	132	NSE2	1.0063	1.0061
Sydney North (Ausgrid)	132	NSN1	1.0028	1.0042
Sydney North (Endeavour Energy)	132	NSN2	1.0028	1.0042
Sydney South	132	NSYS	0.9988	1.0009
Sydney West (Ausgrid)	132	NSW1	1.0010	1.0010
Sydney West (Endeavour Energy)	132	NSW2	1.0010	1.0010
Tamworth	66	NTA2	0.9516	0.9660
Taree (Essential Energy)	132	NTR2	1.0305	1.0411
Tenterfield	132	NTTF	0.9341	0.9600
Terranora	110	NTNR	0.9623	0.9771
Tomago	330	NTMG	0.9932	0.9953

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Tomago (Ausgrid)	132	NTME	0.9965	0.9980
Tomago (Essential Energy)	132	NTMC	0.9965	0.9980
Top Ryde	11	NTPR	1.0142	1.0157
Tuggerah	132	NTG3	0.9956	0.9974
Tumut	66	NTU2	0.9559	0.9735
Tumut 66 (AusNet DNSP)	66	NTUX	0.9559	0.9735
Upper Tumut 11kV (Essential Energy)	11	NUT4	0.9480	0.9493
Vales Pt.	132	NVP1	0.9871	0.9924
Vineyard	132	NVYD	0.9998	1.0001
Wagga	66	NWG2	0.9459	0.9529
Wagga North	132	NWGN	0.9446	0.9487
Wagga North	66	NWG6	0.9453	0.9500
Wallerawang (Endeavour Energy)	132	NWW6	0.9754	0.9747
Wallerawang (Essential Energy)	132	NWW5	0.9754	0.9747
Wallerawang 330 PS Load	330	NWWP	0.9748	0.9737
Wallerawang 66	66	NWW7	0.9759	0.9752
Wallerawang 66 (Essential Energy)	66	NWW4	0.9759	0.9752
Waverley	11	NWAV	1.0050	1.0066
Wellington	132	NWL8	0.9897	0.9862
West Gosford	11	NGWF	1.0039	1.0063
Williamsdale (Essential Energy) (Bogong)	132	NWD1	0.9407	0.9682
Wyong	11	NWYG	0.9972	0.9992
Yanco	33	NYA3	0.9504	0.9502
Yass	66	NYS6	0.9568	0.9643
Yass	132	NYS1	0.9437	0.9485

Table 4 New South Wales generation

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Appin Power Station	66	APPIN	NAPP1A	NAPP	0.9950	0.9973
Avonlie Solar Farm	132	AVLSF1	NNRN1A	NNRN	0.8881	0.9011
Bango 973 Wind Farm	132	BANGOWF1	NBA21B	NBA2	0.9159	0.9107
Bango 999 Wind Farm	132	BANGOWF2	NBB21B	NBB2	0.9288	0.9283
Bayswater PS Unit 1	330	BW01	NBAY1	NBAY	0.9646	0.9653
Bayswater PS Unit 2	330	BW02	NBAY2	NBAY	0.9646	0.9653
Bayswater PS Unit 3	500	BW03	NBAY3	NBYW	0.9651	0.9653
Bayswater PS Unit 4	500	BW04	NBAY4	NBYW	0.9651	0.9653
Beryl Solar Farm	66	BERYLSF1	NBES1B	NBES	0.9339	0.9289
Blowering	132	BLOWERNG	NBLW8	NBLW	0.9241	0.9064

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Boco Rock Wind Farm	132	BOCORWF1	NCMA3B	NBCO	0.9444	0.9355
Bodangora Wind Farm	132	BODWF1	NBOD1B	NBOD	0.9622	0.9595
Bomen Solar Farm	132	BOMENSF1	NWGS1B	NWGS	0.9110	0.9089
Broadwater PS	132	BWTR1	NLS21B	NLS2	0.9814	1.0079
Broken Hill BESS (Generation)	22	BHBG1	NBKB1B	NBKB	0.8671	
Broken Hill BESS (Load)	22	BHBL1	NBKB2B	NBKB	0.8919	
Broken Hill GT 1	22	GB01	NBKG1	NBKG	0.8844	0.8685
Broken Hill Solar Farm	22	BROKENH1	NBK11B	NBK1	0.8324	0.8381
Brown Mountain	66	BROWNMT	NCMA1	NCMA	0.9679	0.9625
Burrendong Hydro PS	132	BDONGHYD	NWL81B	NWL8	0.9897	0.9862
Burrinjuck PS	132	BURRIN	NBUK	NBUK	0.9454	0.9459
Campbelltown WSLC	66	WESTCBT1	NING1C	NING	0.9958	0.9976
Capital Wind Farm	330	CAPTL_WF	NCWF1R	NCWF	0.9575	0.9558
Capital BESS (Generation)	132	CAPBES1G	NQBC1C	NQBC	0.9704	
Capital BESS (Load)	132	CAPBES1L	NQBC2C	NQBC	1.0260	
Coleambally Solar Farm	132	COLEASF1	NCLS1C	NCLS	0.8894	0.8770
Collector Wind Farm	330	COLWF01	NCLW1C	NCLW	0.9576	0.9581
Colongra PS Unit 1	330	CG1	NCLG1D	NCLG	0.9831	0.9864
Colongra PS Unit 2	330	CG2	NCLG2D	NCLG	0.9831	0.9864
Colongra PS Unit 3	330	CG3	NCLG3D	NCLG	0.9831	0.9864
Colongra PS Unit 4	330	CG4	NCLG4D	NCLG	0.9831	0.9864
Condong PS	110	CONDONG1	NTNR1C	NTNR	0.9623	0.9771
Copeton Hydro PS	66	COPTNHYD	NNVL1C	NNVL	0.9157	0.9461
Corowa Solar Farm	132	CRWASF1	NAL11C	NAL1	0.9365	0.9242
Crookwell 2 Wind Farm (effective prior to 14/05/2024)	330	CROOKWF2	NCKW1C	NCKW	0.9608	0.9611
Crookwell 2 Wind Farm (effective from 14/05/2024)	33	CROOKWF2	NCKW1C	NCKW	0.9601	
Crookwell 3 Wind Farm	33	CROOKWF3	NCW31C	NCW3	0.9571	
Crudine Ridge Wind Farm	132	CRURWF1	NCDS1C	NCDS	0.9260	0.9381
Cullerin Range Wind Farm	132	CULLRGWF	NYS11C	NYS1	0.9437	0.9485
Darlington Point BESS (Generation)	33	DPNTBG1	NRDP1D	NRDP	0.9089	0.9402
Darlington Point BESS (Load)	33	DPNTBL1	NRDP2D	NRDP	0.9024	0.9476
Darlington Point Solar Farm	132	DARLSF1	NDNS1D	NDNS	0.8958	0.8880
Eastern Creek	132	EASTCRK	NSW21	NSW2	1.0010	1.0010
Eastern Creek 2	132	EASTCRK2	NSW23L	NSW2	1.0010	1.0010
Eraring 330 BS UN (GT)	330	ERGT01	NEP35B	NEP3	0.9848	0.9865
Eraring 330 PS Unit 1	330	ER01	NEPS1	NEP3	0.9848	0.9865
Eraring 330 PS Unit 2	330	ER02	NEPS2	NEP3	0.9848	0.9865

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Eraring 500 PS Unit 3	500	ER03	NEPS3	NEPS	0.9856	0.9877
Eraring 500 PS Unit 4	500	ER04	NEPS4	NEPS	0.9856	0.9877
Eraring PS Load	132	ERNL1	NEPSL	NNEW	0.9926	0.9942
Finley Solar Farm	132	FINLYSF1	NFNS1F	NFNS	0.9255	0.9036
Flyers Creek Wind Farm	132	FLYCRKWF	NONF1F	NONF	1.0266	
Glenbawn Hydro PS	132	GLBWNHYD	NMRK2G	NMRK	0.9774	0.9788
Glenn Innes (Pindari PS)	66	PINDARI	NGLN1	NGLN	0.9061	0.9346
Glennies Creek PS	132	GLENNCRK	NMRK3T	NMRK	0.9774	0.9788
Goonumbla Solar Farm	66	GOONSF1	NPG12G	NPG1	0.9000	0.8818
Grange Avenue	132	GRANGEAV	NVYD1	NVYD	0.9998	1.0001
Griffith Solar Farm	33	GRIFSF1	NGG11G	NGG1	0.8894	0.8862
Gullen Range 1 Wind Farm	330	GULLRWF1	NGUR1G	NGUR	0.9580	0.9592
Gullen Range 2 Wind Farm	330	GULLRWF2	NGUR3G	NGUR	0.9580	0.9592
Gullen Range Solar Farm	330	GULLRSF1	NGUR2G	NGUR	0.9580	0.9592
Gunnedah Solar Farm	132	GNNDHSF1	NGNE1G	NGNE	0.8273	0.8353
Gunning Wind Farm	132	GUNNING1	NYS12A	NYS1	0.9437	0.9485
Guthega	132	GUTHEGA	NGUT8	NGUT	0.8930	0.8870
Guthega Auxiliary Supply	11	GUTHNL1	NMY11	NMY1	0.9838	0.9633
Hillston Solar Farm	132	HILLSTN1	NDNH1H	NDNH	0.8979	0.8906
Hume (New South Wales Share)	132	HUMENSW	NHUM	NHUM	0.9205	0.9118
Hunter Economic Zone	132	HEZ1	NNEE1H	NNEE	0.9899	0.9920
Jemalong Solar Farm	66	JEMALNG1	NFBS1J	NFBS	0.8964	0.8833
Jindabyne Generator	66	JNDABNE1	NCMA2	NCMA	0.9679	0.9625
Jounama PS	66	JOUNAMA1	NTU21J	NTU2	0.9559	0.9735
Junee Solar Farm	132	JUNEESF1	NWGJ1J	NWGJ	0.9108	0.9059
Kangaroo Valley (Shoalhaven) Pumps – Dual MLF (Load)	330	SHPUMP	NSHP1	NSHN	0.9905	0.9896
Kangaroo Valley – Bendeela (Shoalhaven) – Dual MLF (Generation)	330	SHGEN	NSHL	NSHN	0.9732	0.9733
Keepit	66	KEEPIT	NKPT	NKPT	0.9572	0.9833
Liddell 330 PS Load	330	LIDDNL1	NLDPL	NLDP	0.9660	0.9659
Liddell 330 PS Unit 1 (Inactive from 01/05/2023)	330	LD01	NLDP1	NLDP	0.9660	0.9659
Liddell 330 PS Unit 2 (Inactive from 01/05/2023)	330	LD02	NLDP2	NLDP	0.9660	0.9659
Liddell 330 PS Unit 4 (Inactive from 01/05/2023)	330	LD04	NLDP4	NLDP	0.9660	0.9659
Limondale Solar Farm 1	220	LIMOSF11	NBSF1L	NBSF	0.8255	0.8314
Limondale Solar Farm 2	22	LIMOSF21	NBL21L	NBL2	0.8310	0.8309
Liverpool 132 (Jacks Gully)	132	JACKSGUL	NLP11	NMC1	0.9929	0.9954
Lower Tumut Pipeline Auxiliary	66	TUMT3NL3	NTU2L3	NTU2	0.9559	0.9735
Lower Tumut Pumps – Dual MLF (Load)	330	SNOWYP	NLTS3	NLTS	0.9696	0.9895

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Lower Tumut T2 Auxiliary	66	TUMT3NL1	NTU2L1	NTU2	0.9559	0.9735
Lower Tumut T4 Auxiliary	66	TUMT3NL2	NTU2L2	NTU2	0.9559	0.9735
Lower Tumut – Dual MLF (Generation)	330	TUMUT3	NLTS8	NLTS	0.9080	0.9092
Lucas Heights II Power Plant	132	LUCASHGT	NSYS2G	NSYS	0.9988	1.0009
Lucas Heights Stage 2 Power Station	132	LUCAS2S2	NSYS1	NSYS	0.9988	1.0009
Manildra Solar Farm	132	MANSLR1	NMLS1M	NMLS	0.9557	0.9287
Metz Solar Farm	132	METZSF1	NMTZ1M	NMTZ	0.8486	0.8831
Molong Solar Farm	66	MOLNGSF1	NMOS1M	NMOS	0.9733	0.9433
Moree Solar Farm	66	MOREESF1	NMR41M	NMR4	0.7977	0.8275
Mt Piper PS Load	330	MPNL1	NMPPL	NMTP	0.9717	0.9720
Mt Piper PS Unit 1	330	MP1	NMTP1	NMTP	0.9717	0.9720
Mt Piper PS Unit 2	330	MP2	NMTP2	NMTP	0.9717	0.9720
Narromine Solar Farm	132	NASF1	NWLS1N	NWLS	0.9439	0.9352
Nevertire Solar Farm	132	NEVERSF1	NWLS3N	NWLS	0.9439	0.9352
New England Solar Farm 1	330	NEWENSF1	NURR1N	NURR	0.8718	0.9007
New England Solar Farm 2	330	NEWENSF2	NURR2N	NURR	0.8718	0.9007
Nyngan Solar Farm	132	NYNGAN1	NWL82N	NWL8	0.9897	0.9862
Parkes Solar Farm	66	PARSF1	NPG11P	NPG1	0.9000	0.8818
Queanbeyan BESS (Generation)	66	QBYNBG1	NQBB1Q	NQBB	0.9790	0.9752
Queanbeyan BESS (Load)	66	QBYNBL1	NQBB2Q	NQBB	0.9910	0.9917
Riverina BESS 1 (Generation)	33	RESS1G	NRBB1R	NRBB	0.9089	0.9286
Riverina BESS 1 (Load)	33	RESS1L	NRBB2R	NRBB	0.9024	0.9311
Riverina BESS 2 (Generation)	33	RIVNBG2	NRB21R	NRB2	0.9106	0.9058
Riverina BESS 2 (Load)	33	RIVNBL2	NRB22R	NRB2	0.9073	0.9185
Rye Park Solar Farm	330	RYEPARK1	NRPK1R	NRPK	0.9544	
Sapphire Wind Farm	330	SAPHWF1	NSAP1S	NSAP	0.9086	0.9470
Sebastopol Solar Farm	132	SEBSF1	NWGJ2S	NWGJ	0.9108	0.9059
Silverton Wind Farm	220	STWF1	NBKW1S	NBKW	0.8101	0.7973
Sithe (Holroyd Generation)	132	SITHE01	NSYW1	NHD2	1.0015	1.0018
South Keswick Solar Farm	132	SKSF1	NWLS2S	NWLS	0.9439	0.9352
St George Leagues Club	33	STGEORG1	NPHT1E	NPHT	1.0013	1.0037
Sunraysia Solar farm	220	SUNRSF1	NBSF2S	NBSF	0.8255	0.8314
Suntop Solar Farm	132	SUNTPSF1	NWLW1S	NWLW	0.9224	0.9128
Tahmoor PS	132	TAHMOOR1	NLP12T	NLP1	0.9999	1.0011
Tallawarra B PS	132	TALWB1	NDTB1T	NDTB	0.9845	
Tallawarra PS	132	TALWA1	NDT13T	NTWA	0.9856	0.9901
Taralga Wind Farm	132	TARALGA1	NMR22T	NMR2	1.0095	1.0118
The Drop Power Station	66	THEDROP1	NFNY1D	NFNY	0.9687	0.9708

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Tower Power Plant	132	TOWER	NLP11T	NLP1	0.9999	1.0011
Upper Tumut	330	UPPTUMUT	NUTS8	NUTS	0.9318	0.9347
Uranquinty PS Unit 11	132	URANQ11	NURQ1U	NURQ	0.8383	0.8673
Uranquinty PS Unit 12	132	URANQ12	NURQ2U	NURQ	0.8383	0.8673
Uranquinty PS Unit 13	132	URANQ13	NURQ3U	NURQ	0.8383	0.8673
Uranquinty PS Unit 14	132	URANQ14	NURQ4U	NURQ	0.8383	0.8673
Vales Point 330 PS Load	330	VPNL1	NVPPL	NVPP	0.9869	0.9892
Vales Point 330 PS Unit 5	330	VP5	NVPP5	NVPP	0.9869	0.9892
Vales Point 330 PS Unit 6	330	VP6	NVPP6	NVPP	0.9869	0.9892
Wagga North Solar Farm	66	WAGGNSF1	NWGG1W	NWGG	0.9070	0.9064
Wallgrove BESS (Generation)	132	WALGRVG1	NSWB1W	NSWG	1.0010	1.0010
Wallgrove BESS (Load)	132	WALGRVL1	NSWB2W	NSWB	1.0009	1.0009
Wellington North Solar Farm	330	WELNSF1	NWLN1W	NWLN	0.9457	
Wellington Solar Farm	132	WELLSF1	NWLS4W	NWLS	0.9439	0.9352
West Wyalong Solar Farm	132	WSTWYSF1	NWGJ3W	NWGJ	0.9108	0.9059
Wests Illawarra Leagues Club (effective prior to 17/10/2023)	132	WESTILL1	NDT14E	NDT1	0.9895	0.9934
Wests Illawarra Leagues Club (effective from 17/10/2023)	132	WESTILL1	NDT14E	NDT1	0.9888	0.9934
White Rock Solar Farm	132	WRSF1	NWRK2W	NWRK	0.8289	0.8697
White Rock Wind Farm	132	WRWF1	NWRK1W	NWRK	0.8289	0.8697
Wilga Park A	66	WILGAPK	NNB21W	NNB2	0.9799	0.9926
Wilga Park B	66	WILGB01	NNB22W	NNB2	0.9799	0.9926
Woodlawn Bioreactor	132	WDLNGN01	NMR21W	NMR2	1.0095	1.0118
Woodlawn Wind Farm	330	WOODLWN1	NCWF2W	NCWF	0.9575	0.9558
Wyalong Solar Farm	132	WYASF1	NWGJ4W	NWGJ	0.9108	0.9059
Wyangala A PS - Dual MLF (Generation)	66	WYANGALA	NCW81A	NCW8	0.9378	0.9746
Wyangala A PS - Dual MLF (Load)	66	WYANGALA	NCW81A	NCW8	0.9713	0.9746
Wyangala B PS - Dual MLF (Generation)	66	WYANGALB	NCW82B	NCW8	0.9378	0.9746
Wyangala B PS - Dual MLF (Load)	66	WYANGALB	NCW82B	NCW8	0.9713	0.9746

Table 5 ACT loads

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
ACT VTN	132	AAVT	0.9663	0.9687
Angle Crossing	132	AAXG	0.9645	0.9549
Belconnen	132	ABCN	0.9655	0.9675
City East	132	ACTE	0.9684	0.9695
Civic	132	ACVC	0.9667	0.9672
East lake	132	AELK	0.9687	0.9681

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Gilmore	132	AGLM	0.9665	0.9678
Gold Creek	132	AGCK	0.9643	0.9693
Latham	132	ALTM	0.9640	0.9688
Queanbeyan (ACTEW)	66	AQB1	0.9867	0.9866
Queanbeyan (Essential Energy)	66	AQB2	0.9867	0.9866
Telopea Park	132	ATLP	0.9683	0.9687
Theodore	132	ATDR	0.9639	0.9691
Wanniassa	132	AWSA	0.9660	0.9693
Woden	132	AWDN	0.9658	0.9685

The Regional Reference Node (RRN) for ACT load and generation is the Sydney West 330 kV node.

Table 6 ACT generation

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Capital East Solar Farm	66	CESF1	AQB21C	AQB2	0.9867	0.9866
Mugga Lane Landfill	132	MLLFGEF1	AGLM1M	AAVT	0.9663	0.9687
Mugga Lane Solar Farm	132	MLSP1	ACA12M	AMS1	0.9674	0.9606
Royalla Solar Farm	132	ROYALLA1	ACA11R	ARS1	0.9668	0.9596

The RRN for ACT load and generation is the Sydney West 330 kV node.

1.3 Victoria marginal loss factors

Table 7 Victoria loads

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Altona	220	VAT2	0.9979	0.9949
Altona	66	VATS	1.0046	1.0108
BHP Western Port	220	VJLA	0.9945	0.9926
Ballarat	66	VBAT	0.9759	0.9699
Bendigo	22	VBE2	1.0169	1.0072
Bendigo	66	VBE6	1.0165	1.0084
Brooklyn (Jemena)	22	VBL2	1.0020	1.0014
Brooklyn (Jemena)	66	VBL6	1.0032	1.0066
Brooklyn (Powercor)	22	VBL3	1.0020	1.0014
Brooklyn (Powercor)	66	VBL7	1.0032	1.0066
Brunswick (CitiPower)	22	VBT2	1.0007	0.9980
Brunswick (Jemena)	22	VBTS	1.0007	0.9980
Brunswick 66 (CitiPower)	66	VBT6	0.9997	0.9971
Cranbourne	220	VCB2	0.9931	0.9916
Cranbourne (AusNet Services)	66	VCBT	0.9956	0.9935
Cranbourne (United Energy)	66	VCB5	0.9956	0.9935

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Deer Park	66	VDPT	1.0024	0.9994
East Rowville (AusNet Services)	66	VER2	0.9957	0.9962
East Rowville (United Energy)	66	VERT	0.9957	0.9962
Fishermens Bend (CitiPower)	66	VFBT	1.0016	0.9997
Fishermens Bend (Powercor)	66	VFB2	1.0016	0.9997
Fosterville	220	VFVT	1.0108	1.0034
Geelong	66	VGT6	0.9939	0.9933
Glenrowan	66	VGNT	1.0233	1.0182
Heatherton	66	VHTS	1.0010	0.9981
Heywood	22	VHY2	0.9947	0.9923
Horsham	66	VHOT	0.9139	0.9092
Keilor (Jemena)	66	VKT2	1.0005	0.9991
Keilor (Powercor)	66	VKTS	1.0005	0.9991
Kerang	22	VKG2	1.0203	1.0092
Kerang	66	VKG6	1.0282	1.0136
Khancoban	330	NKHN	1.0386	1.0239
Loy Yang Substation	66	VLY6	0.9828	0.9791
Malvern	22	VMT2	0.9986	0.9960
Malvern	66	VMT6	0.9975	0.9950
Malvern (CitiPower)	66	VMT7	0.9975	0.9950
Morwell PS (G4&5)	11	VMWP	0.9805	0.9801
Morwell Power Station Units 1 to 3	66	VMWG	0.9829	0.9756
Morwell TS	66	VMWT	0.9825	0.9977
Mt Beauty	66	VMBT	1.0335	1.0190
Portland	500	VAPD	0.9983	0.9945
Red Cliffs	22	VRC2	0.9845	0.9732
Red Cliffs	66	VRC6	0.9907	0.9744
Red Cliffs (Essential Energy)	66	VRCA	0.9907	0.9744
Richmond	22	VRT2	0.9992	0.9970
Richmond (CitiPower)	66	VRT7	1.0000	0.9973
Richmond (United Energy)	66	VRT6	1.0000	0.9973
Ringwood (AusNet Services)	22	VRW3	1.0005	0.9978
Ringwood (AusNet Services)	66	VRW7	1.0001	1.0002
Ringwood (United Energy)	22	VRW2	1.0005	0.9978
Ringwood (United Energy)	66	VRW6	1.0001	1.0002
Shepparton	66	VSHT	1.0410	1.0313
South Morang (AusNet Services)	66	VSMT	0.9975	0.9951
South Morang (Jemena)	66	VSM6	0.9975	0.9951
Springvale (CITIPOWER)	66	VSVT	1.0001	0.9972

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Springvale (United Energy)	66	VSV2	1.0001	0.9972
Templestowe (AusNet Services)	66	VTS3	1.0007	0.9996
Templestowe (CitiPower)	66	VTS2	1.0007	0.9996
Templestowe (Jemena)	66	VTST	1.0007	0.9996
Templestowe (United Energy)	66	VTS4	1.0007	0.9996
Terang	66	VTGT	0.9933	0.9972
Thomastown (AusNet Services)	66	VTT2	1.0000	1.0000
Thomastown (Jemena)	66	VTTS	1.0000	1.0000
Tyabb	66	VTBT	0.9960	0.9938
Wemen 66 (Essential Energy)	66	VWEA	0.9782	0.9622
Wemen TS	66	VWET	0.9782	0.9622
West Melbourne	22	VWM2	1.0000	0.9995
West Melbourne (CitiPower)	66	VWM7	1.0004	0.9985
West Melbourne (Jemena)	66	VWM6	1.0004	0.9985
Wodonga	22	VWO2	1.0333	1.0260
Wodonga	66	VWO6	1.0246	1.0198
Yallourn	11	VYP1	0.9660	0.9638

Table 8 Victoria generation

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Ararat Wind Farm	220	ARWF1	VART1A	VART	0.8899	0.8894
Bairnsdale Power Station	66	BDL01	VMWT2	VBDL	0.9804	0.9913
Bairnsdale Power Station Generator Unit 2	66	BDL02	VMWT3	VBDL	0.9804	0.9913
Bald Hills Wind Farm	66	BALDHWF1	VMWT9B	VMWT	0.9825	0.9977
Ballarat BESS (Generation)	22	BALBG1	VBA21B	VBA2	0.9756	0.9663
Ballarat BESS (Load)	22	BALBL1	VBA22B	VBA2	0.9691	0.9629
Ballarat Health Services	66	BBASEHOS	VBAT1H	VBAT	0.9759	0.9699
Banimboola	220	BAPS	VDPS2	VDPS	0.9622	0.9542
Bannerton Solar Farm	66	BANN1	VWES1B	VWES	0.8947	0.8928
Basslink (Loy Yang Power Station Switchyard) Tasmania to Victoria	500	BLNKVIC	VLYP13	VTBL	0.9755	0.9749
Basslink (Loy Yang Power Station Switchyard) Victoria to Tasmania	500	BLNKVIC	VLYP13	VTBL	0.9826	0.9821
Berrybank Wind Farm	220	BRYB1WF1	VBBT1B	VBBT	0.9397	0.9496
Berrybank Wind Farm 2	220	BRYB2WF2	VBBT2B	VBBT	0.9397	0.9496
Broadmeadows Power Plant	66	BROADMDW	VTTS2B	VTTS	1.0000	1.0000
Brooklyn Landfill & Recycling Facility	66	BROOKLYN	VBL61	VBL6	1.0032	1.0066
Bulgana BESS (Generation)	220	BULBESG1	VBGT2B	VBGT	0.8821	0.8839
Bulgana BESS (Load)	220	BULBESL1	VBGT3B	VBGT	0.8821	0.8839

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Bulgana Green Power Hub	220	BULGANA1	VBGT1B	VBGT	0.8821	0.8839
Challicum Hills Wind Farm	66	CHALLHWF	VHOT1	VBAT	0.9759	0.9699
Chepstowe Wind Farm	66	CHPSTWF1	VBAT3C	VBAT	0.9759	0.9699
Cherry Tree Wind Farm	66	CHYTWF1	VSM71C	VSM7	0.9974	0.9955
Clayton Landfill Gas Power Station	66	CLAYTON	VSV21B	VSV2	1.0001	0.9972
Clover PS	66	CLOVER	VMBT1	VMBT	1.0335	1.0190
Codrington Wind Farm	66	CODRNGTON	VTGT2C	VTGT	0.9933	0.9972
Cohuna Solar Farm	66	COHUNSF1	VKGS2C	VKGS	0.9413	0.9336
Coonooer Bridge Wind Farm	66	CBWF1	VBE61C	VBE6	1.0165	1.0084
Corio LFG PS (Inactive from 09/05/2023)	66	CORIO1	VGT61C	VGT6	0.9939	0.9933
Crowlands Wind Farm	220	CROWLWF1	VCWL1C	VCWL	0.8904	0.8877
Dartmouth PS	220	DARTM1	VDPS	VDPS	0.9622	0.9542
Diapur Wind Farm	66	DIAPURWF1	VHOG2D	VHOG	0.8827	0.8788
Dundonnell Wind Farm 1	500	DUNDWF1	VM051D	VM05	0.9870	0.9824
Dundonnell Wind Farm 2	500	DUNDWF2	VM052D	VM05	0.9870	0.9824
Dundonnell Wind Farm 3	500	DUNDWF3	VM053D	VM05	0.9870	0.9824
Eildon Hydro PS	66	EILDON3	VTT22E	VSMT	0.9975	0.9951
Eildon PS Unit 1	220	EILDON1	VEPS1	VEPS	0.9920	0.9887
Eildon PS Unit 2	220	EILDON2	VEPS2	VEPS	0.9920	0.9887
Elaine Wind Farm	220	ELAINWF1	VELT3E	VELT	0.9576	0.9480
Ferguson North Wind Farm	66	FNWF1	VTGT6F	VTGT	0.9933	0.9972
Ferguson South Wind Farm	66	FSWF1	VTGT7F	VTGT	0.9933	0.9972
Gannawarra BESS (Generation)	66	GANNBG1	VKGB1G	VKGB	1.0290	1.0026
Gannawarra BESS (Load)	66	GANNBL1	VKGB2G	VKGL	0.9849	0.9846
Gannawarra Solar Farm	66	GANNSF1	VKGS1G	VKGS	0.9413	0.9336
Glenmaggie Hydro PS	66	GLENMAG1	VMWT8G	VMWT	0.9825	0.9977
Glenrowan West Sun Farm	66	GLRWNSF1	VGNS1G	VGNS	0.9675	0.9671
Glenrowan Solar Farm	220	GLENSF1	VGN21G	VGN2	0.9627	
Hallam Mini Hydro	66	HLMSEW01	VER21H	VCBT	0.9956	0.9935
Hallam Road Renewable Energy Facility	66	HALAMRD1	VER22L	VER2	0.9957	0.9962
Hasting 1	66	HASTING1	VTBT1H	VTBT	0.9960	
Hasting 2	66	HASTING2	VTBT2H	VTBT	0.9960	
Hasting 3	66	HASTING3	VTBT3H	VTBT	0.9960	
Hawkesdale Wind Farm	132	HD1WF1	VTR11H	VTR1	0.9849	
Hazelwood BESS (Generation)	220	HBESSG1	VHW21H	VHW2	0.9789	0.9785
Hazelwood BESS (Load)	220	HBESSL1	VHW22H	VHW2	0.9828	0.9825
Hepburn Community Wind Farm	66	HEPWIND1	VBAT2L	VBAT	0.9759	0.9699
Hume (Victorian Share)	66	HUMEV	VHUM	VHUM	0.9389	0.9535
Jeeralang A PS Unit 1	220	JLA01	VJLGA1	VJLG	0.9764	0.9727

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Jeeralang A PS Unit 2	220	JLA02	VJLGA2	VJLG	0.9764	0.9727
Jeeralang A PS Unit 3	220	JLA03	VJLGA3	VJLG	0.9764	0.9727
Jeeralang A PS Unit 4	220	JLA04	VJLGA4	VJLG	0.9764	0.9727
Jeeralang B PS Unit 1	220	JLB01	VJLGB1	VJLG	0.9764	0.9727
Jeeralang B PS Unit 2	220	JLB02	VJLGB2	VJLG	0.9764	0.9727
Jeeralang B PS Unit 3	220	JLB03	VJLGB3	VJLG	0.9764	0.9727
Jindabyne pump at Guthega	132	SNOWYGJP	NGJP	NGJP	1.0783	1.0914
Karadoc Solar Farm	66	KARSF1	VRCS1K	VRCS	0.8877	0.8886
Kiamal Solar Farm	220	KIAMSF1	VKMT1K	VKMT	0.8775	0.8775
Kiata Wind Farm	66	KIATAWF1	VHOG1K	VHOG	0.8827	0.8788
Laverton PS (LNGS1)	220	LNGS1	VAT21L	VAT2	0.9979	0.9949
Laverton PS (LNGS2)	220	LNGS2	VAT22L	VAT2	0.9979	0.9949
Longford	66	LONGFORD	VMWT6	VMWT	0.9825	0.9977
Loy Yang A PS Load	500	LYNL1	VLYPL	VLYP	0.9782	0.9783
Loy Yang A PS Unit 1	500	LYA1	VLYP1	VLYP	0.9782	0.9783
Loy Yang A PS Unit 2	500	LYA2	VLYP2	VLYP	0.9782	0.9783
Loy Yang A PS Unit 3	500	LYA3	VLYP3	VLYP	0.9782	0.9783
Loy Yang A PS Unit 4	500	LYA4	VLYP4	VLYP	0.9782	0.9783
Loy Yang B PS Unit 1	500	LOYYB1	VLYP5	VLYP	0.9782	0.9783
Loy Yang B PS Unit 2	500	LOYYB2	VLYP6	VLYP	0.9782	0.9783
MacArthur Wind Farm	500	MACARTH1	VTRT1M	VTRT	0.9849	0.9807
Maroona Wind Farm	66	MAROOWF1	VBAT5M	VBAT	0.9759	0.9699
McKay Creek / Bogong PS	220	MCKAY1	VMKP1	VT14	0.9819	0.9665
Moorabool Wind Farm	220	MOORAWF1	VELT2M	VELT	0.9576	0.9480
Mortlake South Wind Farm	220	MRTLSWF1	VTG21M	VTG2	0.9528	0.9573
Mortlake Unit 1	500	MORTLK11	VM0P1O	VM0P	0.9927	0.9901
Mortlake Unit 2	500	MORTLK12	VM0P2O	VM0P	0.9927	0.9901
Mortons Lane Wind Farm	66	MLWF1	VTGT4M	VTGT	0.9933	0.9972
Mt Gellibrand Windfarm	66	MTGELWF1	VGTW1M	VGTW	0.9896	0.9879
Mt Mercer Windfarm	220	MERCER01	VELT1M	VELT	0.9576	0.9480
Murra Warra Wind Farm	220	MUWAWF1	VMRT1M	VMRT	0.8768	0.8661
Murra Warra Wind Farm Stage 2	220	MUWAWF2	VMRT2M	VMRT	0.8768	0.8661
Murray	330	MURRAY	NMUR8	NMUR	0.9850	0.9719
Murray (Geehi Tee off Auxiliary)	330	MURAYNL3	NMURL3	NMUR	0.9850	0.9719
Murray Power Station M1 Auxiliary	330	MURAYNL1	NMURL1	NMUR	0.9850	0.9719
Murray Power Station M2 Auxiliary	330	MURAYNL2	NMURL2	NMUR	0.9850	0.9719
Newport PS	220	NPS	VNPS	VNPS	0.9937	0.9919
Numurkah Solar Farm	66	NUMURSF1	VSHS1N	VSHS	0.9738	0.9715
Oaklands Hill Wind Farm	66	OAKLAND1	VTGT3A	VTGT	0.9933	0.9972

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Phillip Island BESS (Generation)	66	PIBESSG1	VMWT10	VMWT	0.9825	0.9977
Phillip Island BESS (Load)	66	PIBESSL1	VMWT11	VMWT	0.9825	0.9977
Rubicon Mountain Streams Station	66	RUBICON	VTT21R	VSMT	0.9975	0.9951
Salt Creek Wind Farm	66	SALTCRK1	VTG61S	VTG6	0.9476	0.9584
Shepparton Waste Gas	66	SHEP1	VSHT2S	VSHT	1.0410	1.0313
Somerton Power Station	66	AGLSOM	VTTS1	VSOM	0.9960	0.9924
Springvale Power Plant	66	SVALE1	VSV22S	VSV2	1.0001	0.9972
Stockyard Hill Wind Farm	500	STOCKYD1	VHGT1S	VHGT	0.9869	0.9799
Tatura	66	TATURA01	VSHT1	VSHT	1.0410	1.0313
Timboon West Wind Farm	66	TIMWEST	VTGT5T	VTGT	0.9933	0.9972
Toora Wind Farm	66	TOORAWF	VMWT5	VMWT	0.9825	0.9977
Traralgon NSS	66	TGNSS1	VMWT1T	VMWT	0.9825	0.9977
Valley Power Unit 1	500	VPGS1	VLYP07	VLYP	0.9782	0.9783
Valley Power Unit 2	500	VPGS2	VLYP08	VLYP	0.9782	0.9783
Valley Power Unit 3	500	VPGS3	VLYP09	VLYP	0.9782	0.9783
Valley Power Unit 4	500	VPGS4	VLYP010	VLYP	0.9782	0.9783
Valley Power Unit 5	500	VPGS5	VLYP011	VLYP	0.9782	0.9783
Valley Power Unit 6	500	VPGS6	VLYP012	VLYP	0.9782	0.9783
Victorian Big Battery (Generation)	220	VBBG1	VMLB1V	VMLB	0.9885	0.9848
Victorian Big Battery (Load)	220	VBBL1	VMLB2V	VMLB	0.9895	0.9870
Waubra Wind Farm	220	WAUBRAWF	VWBT1A	VWBT	0.9240	0.9233
Wemen Solar Farm	66	WEMENSF1	VWES2W	VWES	0.8947	0.8928
West Kiewa PS Unit 1	220	WKIEWA1	VWKP1	VWKP	1.0110	1.0049
West Kiewa PS Unit 2	220	WKIEWA2	VWKP2	VWKP	1.0110	1.0049
William Hovell Hydro PS	66	WILLHOV1	VW061W	VGNT	1.0233	1.0182
Winton Solar Farm	66	WINTSF1	VGNS2W	VGNS	0.9675	0.9671
Wollert Renewable Energy Facility	66	WOLLERT1	VSMT1W	VSMT	0.9975	0.9951
Wonthaggi Wind Farm	66	WONWP	VMWT7	VMWT	0.9825	0.9977
Yallourn W PS 220 Load	220	YWNL1	VYP2L	VYP2	0.9624	0.9602
Yallourn W PS 220 Unit 1	220	YWPS1	VYP21	VYP3	0.9696	0.9690
Yallourn W PS 220 Unit 2	220	YWPS2	VYP22	VYP2	0.9624	0.9602
Yallourn W PS 220 Unit 3	220	YWPS3	VYP23	VYP2	0.9624	0.9602
Yallourn W PS 220 Unit 4	220	YWPS4	VYP24	VYP2	0.9624	0.9602
Yaloak South Wind Farm	66	YSWF1	VBAT4Y	VBAT	0.9759	0.9699
Yambuk Wind Farm	66	YAMBUKWF	VTGT1	VTGT	0.9933	0.9972
Yarrawonga Hydro PS	66	YWNGAHYD	VSHT3Y	VSHT	1.0410	1.0313
Yatpool Solar Farm	66	YATSF1	VRCS2Y	VRCS	0.8877	0.8886
Yawong Wind Farm	66	YAWWF1	VBE62Y	VBE6	1.0165	1.0084
Yendon Wind Farm	66	YENDWF1	VBAW1Y	VBAW	0.9522	0.9497

1.4 South Australia marginal loss factors

Table 9 South Australia loads

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Angas Creek	33	SANC	1.0095	1.0096
Ardrossan West	33	SARW	0.9332	0.9472
Back Callington	11	SBAC	1.0069	1.0063
Baroota - Dual MLF (Generation)	33	SBAR	0.9733	0.9680
Baroota - Dual MLF (Load)	33	SBAR	0.9868	0.9893
Berri	66	SBER	0.9709	0.9875
Berri (Powercor)	66	SBE1	0.9709	0.9875
Blanche	33	SBLA	1.0201	1.0038
Blanche (Powercor)	33	SBL1	1.0201	1.0038
Brinkworth	33	SBRK	0.9868	0.9876
Bungama Industrial	33	SBUN	0.9797	0.9817
Bungama Rural	33	SBUR	0.9888	0.9905
City West	66	SACR	1.0069	1.0068
Clare North	33	SCLN	0.9813	0.9846
Dalrymple	33	SDAL	0.9012	0.9127
Davenport	275	SDAV	0.9779	0.9788
Davenport	33	SDAW	0.9799	0.9812
Dorrien	33	SDRN	1.0049	1.0036
East Terrace	66	SETC	1.0013	1.0009
Happy Valley	66	SHVA	1.0041	1.0030
Hummocks	33	SHUM	0.9537	0.9587
Kadina East	33	SKAD	0.9672	0.9864
Kanmantoo	11	SKAN	1.0113	1.0108
Keith	33	SKET	1.0175	1.0119
Kilburn	66	SKLB	1.0022	1.0010
Kincraig	33	SKNC	1.0180	1.0053
Lefevre	66	SLFE	1.0002	1.0003
Leigh Creek South (effective prior to 12/07/2023)	33	SLCS	1.0026	1.0033
Leigh Creek South (effective from 12/07/2023)	11	SLCS	1.0026	1.0033
Magill	66	SMAG	1.0023	1.0026
Mannum	33	SMAN	1.0169	1.0185
Mannum – Adelaide Pipeline 1	3.3	SMA1	1.0153	1.0141
Mannum – Adelaide Pipeline 2 - Dual MLF (Generation)	3.3	SMA2	0.9943	0.9944
Mannum – Adelaide Pipeline 2 - Dual MLF (Load)	3.3	SMA2	1.0151	1.0143
Mannum – Adelaide Pipeline 3 - Dual MLF (Generation)	3.3	SMA3	0.9946	0.9934

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Mannum – Adelaide Pipeline 3 - Dual MLF (Load)	3.3	SMA3	1.0149	1.0141
Middleback	132	SMBK	0.9924	0.9955
Middleback	33	SMDL	0.9893	0.9923
Millbrook	132	SMLB	1.0017	1.0019
Mobilong	33	SMBL	1.0108	1.0091
Morgan Whyalla Pump Station 1 PV	3.3	SMW1	0.9847	1.0018
Morgan Whyalla Pump Station 2 PV	3.3	SMW2	0.9880	0.9999
Morgan Whyalla Pump Station 3 PV - Dual MLF (Generation)	3.3	SMW3	0.9847	0.9717
Morgan Whyalla Pump Station 3 PV - Dual MLF (Load)	3.3	SMW3	0.9847	0.9864
Morgan Whyalla Pump Station 4 PV	3.3	SMW4	0.9796	0.9889
Morphett Vale East	66	SMVE	1.0039	1.0036
Mount Barker South	66	SMBS	1.0052	1.0038
Mt Barker	66	SMBA	1.0039	1.0024
Mt Gambier	33	SMGA	1.0240	1.0060
Mt Gunson	33	SMGU	0.9882	0.9883
Mt Gunson South	132	SMGS	0.9781	0.9895
Munno Para	66	SMUP	0.9991	0.9980
Murray Bridge – Hahndorf Pipeline 1	11	SMH1	1.0132	1.0115
Murray Bridge – Hahndorf Pipeline 2 - Dual MLF (Generation)	11	SMH2	1.0006	1.0190
Murray Bridge – Hahndorf Pipeline 2 - Dual MLF (Load)	11	SMH2	1.0151	1.0190
Murray Bridge – Hahndorf Pipeline 3	11	SMH3	1.0116	1.0104
Neuroodla	33	SNEU	0.9939	0.9952
New Osborne	66	SNBN	0.9999	1.0008
North West Bend	66	SNWB	0.9805	0.9892
Northfield	66	SNFD	1.0024	1.0023
Para	66	SPAR	0.9998	1.0000
Parafield Gardens West	66	SPGW	0.9995	1.0002
Penola West 33	33	SPEN	1.0162	1.0009
Pimba	132	SPMB	1.0700	0.9952
Playford	132	SPAA	0.9766	0.9773
Port Lincoln	33	SPLN	0.9779	0.9786
Port Pirie	33	SPPR	0.9835	0.9867
Roseworthy	11	SRSW	1.0062	1.0067
Snuggery Industrial	33	SSNN	1.0526	1.0029
Snuggery Rural	33	SSNR	0.9901	0.9797
South Australian VTN		SJP1	0.9964	0.9962
Stony Point	11	SSPN	0.9823	0.9843

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Tailem Bend	33	STAL	1.0087	1.0110
Templers	33	STEM	1.0164	1.0011
Torrens Island	66	STSY	1.0000	1.0000
Waterloo	33	SWAT	0.9775	0.9786
Whyalla Central Substation	33	SWYC	0.9836	0.9845
Whyalla Terminal BHP	33	SBHP	0.9836	0.9847
Woomera	132	SWMA	0.9902	0.9902
Wudina	66	SWUD	0.9934	0.9945
Yadnarie	66	SYAD	0.9786	0.9792

Table 10 South Australia generation

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Adelaide Desalination Plant Battery (Generation)	66	ADPBA1G	SMVE4D	SMVE	1.0039	1.0036
Adelaide Desalination Plant Battery (Load)	66	ADPBA1L	SMVE5D	SMVE	1.0039	1.0036
Adelaide Desalination Plant Hydro	66	ADPMH1	SMVE9D	SMVE	1.0039	1.0036
Adelaide Desalination Plant PV1	66	ADPPV1	SMVE6D	SMVE	1.0039	1.0036
Adelaide Desalination Plant PV2	66	ADPPV2	SMVE7D	SMVE	1.0039	1.0036
Adelaide Desalination Plant PV3	66	ADPPV3	SMVE8D	SMVE	1.0039	1.0036
Angaston Power Station	33	ANGAST1	SDRN1	SANG	1.0048	1.0027
Barker Inlet PS	275	BARKIPS1	SBPS1B	SBPS	1.0000	0.9996
Bolivar Power Station	66	BOLIVPS1	SPGG1B	SPGG	0.9949	0.9946
Bolivar WWT Plant	66	BOLIVAR1	SPGW1B	SPGW	0.9995	1.0002
Bolivar Wastewater Treatment Plant PV	66	BOWWPV1	SPGW2B	SPGW	0.9995	1.0002
Bolivar Wastewater Treatment Plant Reserve BESS (Generation)	66	BOWWBA1G	SPGW3B	SPGW	0.9995	1.0002
Bolivar Wastewater Treatment Plant Reserve BESS (Load)	66	BOWWBA1L	SPGW4B	SPGW	0.9995	1.0002
Bolivar Wastewater Treatment Plant Reserve Diesel	66	BOWWDG1	SPGW5B	SPGW	0.9995	1.0002
Bungala One Solar Farm	132	BNGSF1	SBEM1B	SBEM	0.9601	0.9567
Bungala Two Solar Farm	132	BNGSF2	SBEM2B	SBEM	0.9601	0.9567
Canunda Wind Farm	33	CNUNDAWF	SSNN1	SCND	0.9671	0.9742
Cathedral Rocks Wind Farm	132	CATHROCK	SCRK	SCRK	0.9319	0.9281
Christies Beach BESS (Generation)	66	CBWWBA1G	SMVE7C	SMVE	1.0039	1.0036
Christies Beach BESS (Load)	66	CBWWBA1L	SMVE8C	SMVE	1.0039	1.0036
Christies Beach Biogas	66	CBWWBG1	SMVE11	SMVE	1.0039	1.0036
Christies Beach Diesel 1	66	CBWWDG1	SMVE12	SMVE	1.0039	1.0036
Christies Beach Diesel 2	66	CBWWDG2	SMVE13	SMVE	1.0039	1.0036
Christies Beach Solar Farm 1	66	CBWWPV1	SMVE9C	SMVE	1.0039	1.0036
Christies Beach Solar Farm 2	66	CBWWPV2	SMVE10	SMVE	1.0039	1.0036

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Clements Gap Wind Farm	132	CLEMGPWF	SCGW1P	SCGW	0.9522	0.9530
Cummins Lonsdale PS	66	LONSDALE	SMVE1	SMVE	1.0039	1.0036
Dalrymple North BESS (Generation)	33	DALNTH01	SDAN1D	SDAM	0.8954	0.9432
Dalrymple North BESS (Load)	33	DALNTHL1	SDAN2D	SDAN	0.8790	0.9113
Dry Creek PS Unit 1	66	DRYCGT1	SDCA1	SDPS	0.9992	0.9991
Dry Creek PS Unit 2	66	DRYCGT2	SDCA2	SDPS	0.9992	0.9991
Dry Creek PS Unit 3	66	DRYCGT3	SDCA3	SDPS	0.9992	0.9991
Goyder South Wind Farm 1B	275	GSWF1B1	SRAB1G	SRAB	0.9728	
Hallett 1 Wind Farm	275	HALLWF1	SHPS2W	SHPS	0.9599	0.9599
Hallett 2 Wind Farm	275	HALLWF2	SMOK1H	SMOK	0.9570	0.9572
Hallett PS	275	AGLHAL	SHPS1	SHPS	0.9599	0.9599
Happy Valley BESS (Generation)	66	HVWWBA1G	SHVA1H	SHVA	1.0041	1.0030
Happy Valley BESS (Load)	66	HVWWBA1L	SHVA2H	SHVA	1.0041	1.0030
Happy Valley Solar Farm	66	HVWWPC1	SHVA3H	SHVA	1.0041	1.0030
Hornsdale Battery (Generation)	275	HPRG1	SMTL1H	SMTL	0.9653	0.9652
Hornsdale Battery (Load)	275	HPRL1	SMTL2H	SMTL	0.9682	0.9681
Hornsdale Wind Farm Stage 1	275	HDWF1	SHDW1H	SHDW	0.9467	0.9479
Hornsdale Wind Farm Stage 2	275	HDWF2	SHDW2H	SHDW	0.9467	0.9479
Hornsdale Wind Farm Stage 3	275	HDWF3	SHDW3H	SHDW	0.9467	0.9479
Ladbroke Grove PS Unit 1	132	LADBROK1	SPEW1	SPEW	0.9736	0.9553
Ladbroke Grove PS Unit 2	132	LADBROK2	SPEW2	SPEW	0.9736	0.9553
Lake Bonney BESS (Generation)	33	LBBG1	SLBB1L	SLBB	0.9790	0.9851
Lake Bonney BESS (Load)	33	LBBL1	SLBB2L	SLBB	1.0290	1.0230
Lake Bonney Wind Farm	33	LKBONNY1	SMAY1	SMAY	0.9656	0.9585
Lake Bonney Wind Farm Stage 2	33	LKBONNY2	SMAY2	SMAY	0.9656	0.9585
Lake Bonney Wind Farm Stage 3	33	LKBONNY3	SMAY3W	SMAY	0.9656	0.9585
Lincoln Gap Wind Farm	275	LGAPWF1	SLGW1L	SLGW	0.9601	0.9628
Lincoln Gap Wind Farm Stage 2	275	LGAPWF2	SLGW4L	SLGW	0.9601	0.9628
Mannum-Adelaide Pipeline Pumping Station No 2 Solar Farm – Dual MLF (Generation)	3.3	MAPS2PV1	SMA21M	SMA2	0.9943	0.9944
Mannum-Adelaide Pipeline Pumping Station No 2 Solar Farm – Dual MLF (Load)	3.3	MAPS2PV1	SMA21M	SMA2	1.0151	1.0143
Mannum-Adelaide Pipeline Pumping Station No 3 Solar Farm – Dual MLF (Generation)	3.3	MAPS3PV1	SMA31M	SMA3	0.9946	0.9934
Mannum-Adelaide Pipeline Pumping Station No 3 Solar Farm – Dual MLF (Load)	3.3	MAPS3PV1	SMA31M	SMA3	1.0149	1.0141
Mannum Solar Farm 2	33	MANNSF2	SMAE1M	SMAE	0.9893	
Mintaro PS	132	MINTARO	SMPS	SMPS	0.9746	0.9793
Morgan Whyalla Pump Station 1 PV	3.3	MWPS1PV1	SMW11M	SMW1	0.9847	1.0018
Morgan Whyalla Pump Station 2 PV	3.3	MWPS2PV1	SMW21M	SMW2	0.9880	0.9999

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Morgan Whyalla Pump Station 3 PV – Dual MLF (Generation)	3.3	MWPS3PV1	SMW31M	SMW3	0.9847	0.9717
Morgan Whyalla Pump Station 3 PV – Dual MLF (Load)	3.3	MWPS3PV1	SMW31M	SMW3	0.9847	0.9864
Morgan Whyalla Pump Station 4 PV	3.3	MWPS4PV1	SMW41M	SMW4	0.9796	0.9889
Morphett Vale East 66	66	SATGS1	SMVG1L	SMVG	1.0020	1.0015
Mt Millar Wind Farm	33	MTMILLAR	SMTM1	SMTM	0.9259	0.9245
Murray Bridge - Hahndorf Pipeline SF 2 - Dual MLF (Generation)	11	MBPS2PV1	SMH21M	SMH2	1.0006	1.0190
Murray Bridge - Hahndorf Pipeline SF 2 - Dual MLF (Load)	11	MBPS2PV1	SMH21M	SMH2	1.0151	1.0190
North Brown Hill Wind Farm	275	NBHWF1	SBEL1A	SBEL	0.9508	0.9539
O.C.P.L. Unit 1	66	OSB-AG	SNBN1	SOCP	0.9992	0.9999
Para 66 Generation	66	SATGN1	SPAG1E	SPAG	0.9991	0.9996
Pelican Point PS	275	PPCCGT	SPPT	SPPT	0.9984	0.9983
Port Augusta Renewable Energy Park - Solar	275	PAREPS1	SDAP2P	SDAP	0.9654	0.9641
Port Augusta Renewable Energy Park - Wind	275	PAREPW1	SDAP1P	SDAP	0.9654	0.9641
Port Lincoln 3	33	POR03	SPL31P	SPL3	0.9799	0.9945
Port Lincoln PS	132	POR01	SPLN1	SPTL	0.9822	0.9899
Pt Stanvac PS	66	PTSTAN1	SMVE3P	SMVE	1.0039	1.0036
Quarantine PS Unit 1	66	QPS1	SQPS1	SQPS	0.9946	0.9871
Quarantine PS Unit 2	66	QPS2	SQPS2	SQPS	0.9946	0.9871
Quarantine PS Unit 3	66	QPS3	SQPS3	SQPS	0.9946	0.9871
Quarantine PS Unit 4	66	QPS4	SQPS4	SQPS	0.9946	0.9871
Quarantine PS Unit 5	66	QPS5	SQPS5Q	SQPS	0.9946	0.9871
Roberstown 275 kV Wind	275	GSWF1A	SROB1G	SROB	0.9702	0.9734
Snapper Point PS	275	SNAPPER1	SNPT1S	SNPT	0.9993	0.9990
Snowtown Wind Farm	33	SNOWTWN1	SNWF1T	SNWF	0.8968	0.9162
Snowtown Wind Farm Stage 2 – North	275	SNOWNTH1	SBLWS1	SBLW	0.9638	0.9666
Snowtown Wind Farm Stage 2 – South	275	SNOWSTH1	SBLWS2	SBLW	0.9638	0.9666
Snuggery PS Units 1 to 3	132	SNUG1	SSGA1	SSPS	0.9877	0.9388
Starfish Hill Wind Farm	66	STARHLWF	SMVE2	SMVE	1.0039	1.0036
Tailem Bend BESS 2 (Generation)	132	TB2BG1	STBB2T	STBB	1.0079	0.9966
Tailem Bend BESS 2 (Load)	132	TB2BL1	STBB3T	STBB	1.0079	0.9966
Tailem Bend Solar Farm	132	TBSF1	STBS1T	STBS	1.0030	1.0029
Tailem Bend Solar Farm 2	132	TB2SF1	STBB1T	STBB	1.0079	0.9966
Tatiara Meat Co	33	TATIARA1	SKET1E	SKET	1.0175	1.0119
The Bluff Wind Farm	275	BLUFF1	SBEL2P	SBEL	0.9508	0.9539
Torrens Island BESS (Generation)	275	TIBG1	STPB1T	STPB	0.9996	1.0001
Torrens Island BESS (Load)	275	TIBL1	STPB2T	STPB	0.9997	0.999
Torrens Island PS B Unit 1	275	TORRB1	STSB1	STPS	0.9997	0.9994

Generator	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Torrens Island PS B Unit 2	275	TORRB2	STSB2	STPS	0.9997	0.9994
Torrens Island PS B Unit 3	275	TORRB3	STSB3	STPS	0.9997	0.9994
Torrens Island PS B Unit 4	275	TORRB4	STSB4	STPS	0.9997	0.9994
Torrens Island PS Load	66	TORNL1	STSYL	STSY	1.0000	1.0000
Waterloo Wind Farm	132	WATERLWF	SWLE1R	SWLE	0.9599	0.9582
Wattle Point Wind Farm	132	WPWF	SSYP1	SSYP	0.8073	0.8174
Willogoleche Wind Farm	275	WGWF1	SWGL1W	SWGL	0.9534	0.9549
Wingfield 1 LFG PS	66	WINGF1_1	SKLB1W	SKLB	1.0022	1.0010
Wingfield 2 LFG PS	66	WINGF2_1	SNBN2W	SNBN	0.9999	1.0008

1.5 Tasmania marginal loss factors

Table 11 Tasmania loads

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Arthurs Lake	6.6	TAL2	0.9726	0.9774
Avoca	22	TAV2	1.0032	1.0104
Boyer SWA	6.6	TBYA	1.0026	1.0144
Boyer SWB	6.6	TBYB	1.0116	1.0248
Bridgewater	11	TBW2	1.0266	1.0206
Burnie	22	TBU3	0.9846	0.9872
Chapel St.	11	TCS3	1.0128	1.0051
Comalco	220	TCO1	1.0007	1.0006
Creek Road	33	TCR2	1.0124	1.0069
Derby	22	TDE2	0.9581	0.9614
Derwent Bridge	22	TDB2	0.8965	0.9177
Devonport	22	TDP2	0.9817	0.9880
Electrona	11	TEL2	1.0289	1.0218
Emu Bay	11	TEB2	0.9836	0.9850
Emu Bay 22	22	TEB3	0.9836	0.9850
Fisher (Rowallan)	220	TFI1	0.9557	0.9655
Fisher 220 DNSP	220	TFI2	0.9557	0.9655
George Town	22	TGT3	1.0025	1.0013
George Town (Basslink)	220	TGT1	1.0000	1.0000
Gordon	22	TGO2	0.9930	0.9879
Greater Hobart Area VTN		TVN1	1.0142	1.0092
Hadspen	22	THA3	0.9878	0.9931
Hampshire	110	THM2	0.9818	0.9834
Huon River	11	THR2	1.0286	1.0299
Kermandie	11	TKE2	1.0326	1.0288
Kingston	11	TKI2	1.0249	1.0165

Location	Voltage (kV)	TNI code	2023-24 MLF	2022-23 MLF
Kingston	33	TK13	1.0195	1.0119
Knights Road	11	TKR2	1.0301	1.0267
Lindisfarne	33	TLF2	1.0145	1.0101
Meadowbank	22	TMB2	0.9771	0.9972
Mornington	33	TMT2	1.0160	1.0104
Mowbray	22	TMY2	0.9867	0.9924
New Norfolk	22	TNN2	0.9988	1.0054
Newton	11	TNT3	0.9373	0.9582
Newton	22	TNT2	0.9635	0.9709
North Hobart	11	TNH2	1.0123	1.0066
Norwood	22	TNW2	0.9863	0.9921
Palmerston	22	TPM3	0.9633	0.9759
Port Latta	22	TPL2	0.9745	0.9644
Que	22	TQU2	0.9685	0.9805
Queenstown	11	TQT3	0.9424	0.9623
Queenstown	22	TQT2	0.9508	0.9617
Railton	22	TRA2	0.9814	0.9876
Risdon	11	TRI3	1.0150	1.0184
Risdon	33	TRI4	1.0151	1.0133
Rokeby	11	TRK2	1.0204	1.0138
Rosebery	44	TRB2	0.9599	0.9694
Savage River	22	TSR2	0.9965	1.0054
Scottsdale	22	TSD2	0.9670	0.9734
Sheffield	22	TSH3	0.9796	0.9813
Smithton	22	TST2	0.9645	0.9507
Sorell	22	TSO2	1.0361	1.0300
St Leonard	22	TSL2	0.9867	0.9935
St Leonards 22kV - Scheduled Load	22	TSL3	0.9857	0.9945
St. Marys	22	TSM2	1.0251	1.0271
Starwood	110	TSW1	1.0011	1.0001
Tamar Region VTN		TVN2	0.9887	0.9937
Temco	110	TTE1	1.0041	1.0030
Trevallyn	22	TTR2	0.9878	0.9932
Triabunna	22	TTB2	1.0439	1.0395
Tungatinah	22	TTU2	0.8976	0.9176
Ulverstone	22	TUL2	0.9810	0.9864
Waddamana	22	TWA2	0.9295	0.9298
Wayatinah	11	TWY2	0.9819	0.9910
Wesley Vale	22	TWV2	0.9781	0.9847

Table 12 Tasmania generation

Generator description	Voltage (kV)	DUID	Connection Point ID	TNI code	2023-24 MLF	2022-23 MLF
Basslink (George Town)	220	BLNKTAS	TGT11	TGT1	1.0000	1.0000
Bastyan	220	BASTYAN	TFA11	TFA1	0.9202	0.9334
Bell Bay No.3	110	BBTHREE1	TBB11	TBB1	0.9968	0.9975
Bell Bay No.3	110	BBTHREE2	TBB12	TBB1	0.9968	0.9975
Bell Bay No.3	110	BBTHREE3	TBB13	TBB1	0.9968	0.9975
Bluff Point and Studland Bay Wind Farms	110	WOOLNTH1	TST11	TST1	0.9112	0.8951
Butlers Gorge	110	BUTLERSG	TBG11	TBG1	0.8911	0.9140
Catagunya	220	LI_WY_CA	TLI11	TLI1	0.9809	0.9845
Cethana	220	CETHANA	TCE11	TCE1	0.9504	0.9544
Cluny	220	CLUNY	TCL11	TCL1	0.9857	0.9850
Devils Gate	110	DEVILS_G	TDG11	TDG1	0.9537	0.9594
Fisher	220	FISHER	TFI11	TFI1	0.9557	0.9655
Gordon	220	GORDON	TGO11	TGO1	0.9731	0.9400
Granville Harbour Wind Farm	220	GRANWF1	TGH11G	TGH1	0.9388	0.9543
John Butters	220	JBUTTERS	TJB11	TJB1	0.9208	0.9395
Lake Echo	110	LK_ECHO	TLE11	TLE1	0.8888	0.9142
Lemonthyme	220	LEM_WIL	TSH11	TSH1	0.9567	0.9672
Liapootah	220	LI_WY_CA	TLI11	TLI1	0.9809	0.9845
Mackintosh	110	MACKNTSH	TMA11	TMA1	0.9059	0.9186
Meadowbank	110	MEADOWBK	TMB11	TMB1	0.9688	0.9824
Musselroe	110	MUSSELR1	TDE11M	TDE1	0.9119	0.9168
Paloona	110	PALOONA	TPA11	TPA1	0.9572	0.9642
Poatina	110	POAT110	TPM21	TPM2	0.9555	0.9625
Poatina	220	POAT220	TPM11	TPM1	0.9733	0.9771
Reece No.1	220	REECE1	TRCA1	TRCA	0.9052	0.9229
Reece No.2	220	REECE2	TRCB1	TRCB	0.9068	0.9195
Repulse	220	REPULSE	TCL12	TCL1	0.9857	0.9850
Rowallan	220	ROWALLAN	TFI12	TFI1	0.9557	0.9655
Tamar Valley CCGT	220	TVCC201	TTV11A	TTV1	1.0000	1.0000
Tamar Valley OCGT	110	TVPP104	TBB14A	TBB1	0.9968	0.9975
Tarraleah	110	TARRALEA	TTA11	TTA1	0.8977	0.9216
Trevallyn	110	TREVALLN	TTR11	TTR1	0.9825	0.9891
Tribute	220	TRIBUTE	TTI11	TTI1	0.9089	0.9263
Tungatinah	110	TUNGATIN	TTU11	TTU1	0.8782	0.8795
Wayatinah	220	LI_WY_CA	TLI11	TLI1	0.9809	0.9845
Wild Cattle Hill Wind Farm	220	CTHLWF1	TWC11C	TWC1	0.9836	0.9888
Wilmot	220	LEM_WIL	TSH11	TSH1	0.9567	0.9672

2 Changes in marginal loss factors

2.1 Marginal loss factors in the NEM

The MLF for a connection point represents the marginal electrical transmission losses in electrical power flow between that connection point and the Regional Reference Node (RRN) for the region in which the connection point is located.

An MLF below 1 indicates that an incremental increase in power flow from the connection point to the RRN would increase total losses in the network. An MLF above 1 indicates the opposite.

According to the current NEM design, the difference between the cost of electricity at a connection point remote from the RRN and the cost of electricity at the RRN is directly proportional to the MLF for the connection point. If the MLF for a connection point is 0.9, then the effective values of electricity purchased or sold at that connection point will be 90% of the regional reference price. Consequently, a fall in MLF at a connection point is likely to have a positive impact on customers and a negative impact on generators.

More information on the treatment of electricity losses in the NEM is available on AEMO's website[4].

2.2 Reasons marginal loss factors change

There are three main reasons why the MLF for a connection point changes from year to year:

1. Changes to projected power flows over the transmission network caused by projected changes to power system generation and demand, including building new generation, retirement of power stations, and revised electricity consumption forecasts.
   - If the projected power flow from a connection point towards the RRN increases, then the MLF for that connection point would be expected to decrease. Conversely, if the projected power flow from a connection point towards the regional reference node decreases, then the MLF for that connection point would be expected to increase.
2. Forecast variations in seasonal patterns, diurnal patterns, intra-year commencement of operation, intra-year cessation of operation.
   - As MLF outcomes are volume weighted, year-on-year variations in patterns of either consumption or export (load and generation respectively) can result in material variations in MLF outcomes. For further detail on the impact of volume weighting on MLF outcomes, please refer to Appendix A3.
3. Changes to the impedance of the transmission network caused by augmentation of the transmission network, such as building new transmission lines.
   - If augmentations decrease the impedance of the transmission network between a connection point and the RRN, then the MLF for the connection point would be expected to move closer to 1.

[4] AEMO, Treatment of Loss Factors in the National Electricity Market,1 July 2012, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Loss_Factors_and_Regional_Boundaries/2016/Treatment_of_Loss_Factors_in_the_NEM.pdf.

The location of new generation projects and load developments on the transmission and distribution network has a significant impact on the MLFs in an area. As more generation is connected to electrically weak areas of the network that are remote from the RRN, MLFs in these areas will continue to decline.

2.3 Changes between the preliminary 2023-24 MLFs and the final 2023-24 MLFs

In December 2022, AEMO published a preliminary report containing indicative MLFs for 2023-24. While the preliminary report is intended to provide stakeholders with early insight into possible future MLF outcomes, there are several variances between the input data utilised in the preliminary and draft/final MLF studies. Table 13 provides a high level summary of these differences.

Table 13 Preliminary vs draft/final study variations

Item	Preliminary	Draft/final
New generation projects	Inclusion based on generator project status in October 2022 Generation Information page [A]. Projects are included where the status is COM or COM* [B].	Inclusion based on generator project status in February 2023 Generation Information page. Projects are included where the status is COM or COM*.
Load profiles	Scaled historical load profiles from 2021-22.	Forecast load profiles for 2023-24.
Network model	2022-23 MLF study network model.	Revised network model incorporating future augmentations that are committed.
Intra-regional limit management	Intra-regional limits as identified and incorporated into the 2022-23 MLF study.	Intra-regional limits reviewed for 2023-24, revised and incorporated into the 2023-24 MLF study.

A. The Generation Information page provides stakeholders with information on the capacity of existing, withdrawn, committed, and proposed generation projects in the NEM. See https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information.

B. Committed (COM) projects meet all five of AEMO's commitment criteria (relating to site, components, planning, finance, and date). Committed* (COM*) projects are classified as Advanced, have commenced construction or installation, and meet AEMO's site, finance, and date criteria, but are required to meet only one of the components or planning criteria.

2.4 Changes between the draft 2023-24 MLFs and the final 2023-24 MLFs

In March 2023, AEMO published a draft report containing draft MLFs for 2023-24. The draft report was intended to provide stakeholders updated insight (beyond preliminary report) into MLF outcomes for 2023-24 and to provide an opportunity to provide feedback.

Notably, AEMO has become aware of information that supports variations to the draft input assumptions for the 2023-24 MLF outcomes. These revised assumptions have been incorporated with the intent of ensuring that the outcomes presented within this report are reflective of anticipated market conditions within 2023-24.

These revisions include:

1. Revised return to service timing for Callide C3 and C4[5].

[5] See https://www.csenergy.com.au/news/updated-return-to-service-dates-for-callide-c-generating-units and DUID level Medium Term Projected Assessment of System Adequacy (MT PASA) submissions at http://nemweb.com.au/Reports/Current/MTPASA_DUIDAvailability/.

- On 8 March 2023, CS Energy publicly advised of revised return to service dates for Callide C3 and C4 as per Table 14.

Table 14 Callide C3/C4 return to service schedule

	Previous	New
Unit C3	Staged return to service from June 2023	30 Sept 2023 – 300 MW 31 Dec 2023 – 466 MW
Unit C4	Staged return to service from May 2023	31 Oct 2023 – 300 MW 30 Nov 2023 – 350 MW 31 Jan 2024 – 466MW

2. Revised Queensland – New South Wales Interconnector (QNI) southerly transfer limit increase timeline.
   - The timeline relating to the staged increases to QNI limits in the southerly direction has been revised, and this revision has been incorporated into the 2023-24 MLFs. Further information on the treatment of QNI is presented in Section A2.6 of this report.
3. Additional intra-regional limit considerations.
   - As per Section A1.4 of the Draft Marginal Loss Factors: Financial Year 2023-24 report, AEMO has continued to investigate the relevancy of system normal intra-regional limits in relation to the 2023-24 MLF outcomes.
   - Since publication, AEMO has identified additional system normal intra-regional limits which were observed to be high impact. The additional limits incorporated are N>>NIL_84_88_S and N>>NIL_88_84_S, additional information is provided in Section A2.4 of this report.

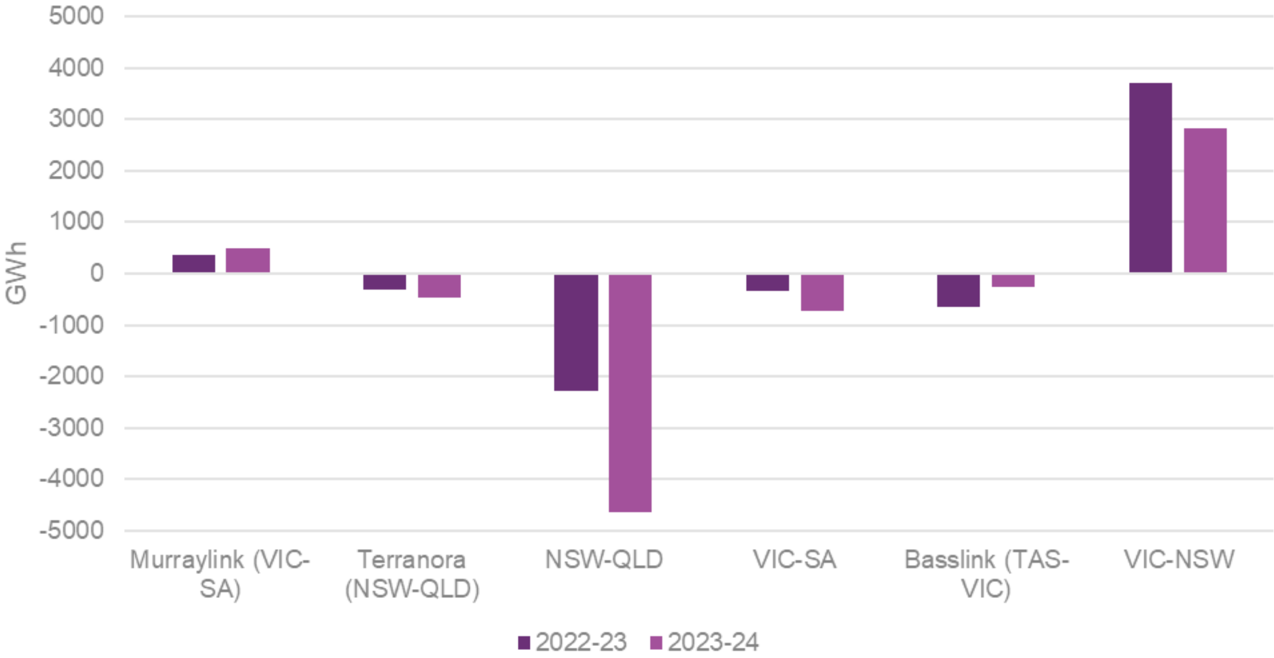
2.5 Changes between 2022-23 MLFs and 2023-24 MLFs

This section summarises the changes in MLFs for 2022-23 compared to the 2023-24 MLFs at a sub-regional level, and the general trends driving the changes. Appendix A2 provides more detailed information on the inputs, methodology, and assumptions for the 2023-24 calculations, and key changes from 2022-23.

For further details on how MLFs are calculated, refer to Section A1.2.

Figure 1 shows the annual projected gigawatt-hours (GWh) flows for all interconnectors within the NEM for both the 2022-23 and 2023-24 MLF studies.

Figure 1 2022-23 vs 2023-24 MLF interconnector flow projections



2.5.1 Changes to marginal loss factors in Queensland

Figure 3 shows a geographical representation of MLF variations at Queensland connection points between 2022-23 and 2023-24. Table 15 shows the average sub-regional year-on-year MLF variations between 2022-23 and 2023-24.

Primary drivers of changes

The primary drivers of change in Queensland are variations in projected generation within Queensland and variations in projected export volumes to New South Wales between the 2022-23 and 2023-24 MLF studies.

The cause of these variations is largely a projected increase in the availability of thermal generation capacity within central Queensland, compounded by the complete closure of the Liddell Power Station in New South Wales. This resulted in a material increase in southerly flows from central Queensland, and in turn downward pressure on MLF outcomes in both northern and central Queensland is observable.

Notable changes

The northern sub-region average MLFs have decreased for both generation and load, by 0.5% and 1.67% respectively.

The central sub-region average MLFs have decreased for both generation and load, by 2% and 2.36% respectively.

Notably, while the year-on-year variations in central Queensland are material in nature the outcomes themselves are not unprecedented, as can be seen in Figure 2 which details historical averages for a selection of generator MLFs between 2008-09 and 2023-24.

Figure 2 Central Queensland historical average MLF trend

Notable changes between draft 2023-24 and final 2023-24

Post-publication of the draft 2023-24 MLFs, CS Energy advised of a delayed return to service for Callide C3 and C4 as per Table 14. Additionally, the timing relating to release of transfer capacity on QNI due to the QNI upgrade has been delayed. These revisions have reduced the magnitude of MLF variations in both northern and central Queensland.

Figure 3 Queensland changes compared to 2023-24 MLFs

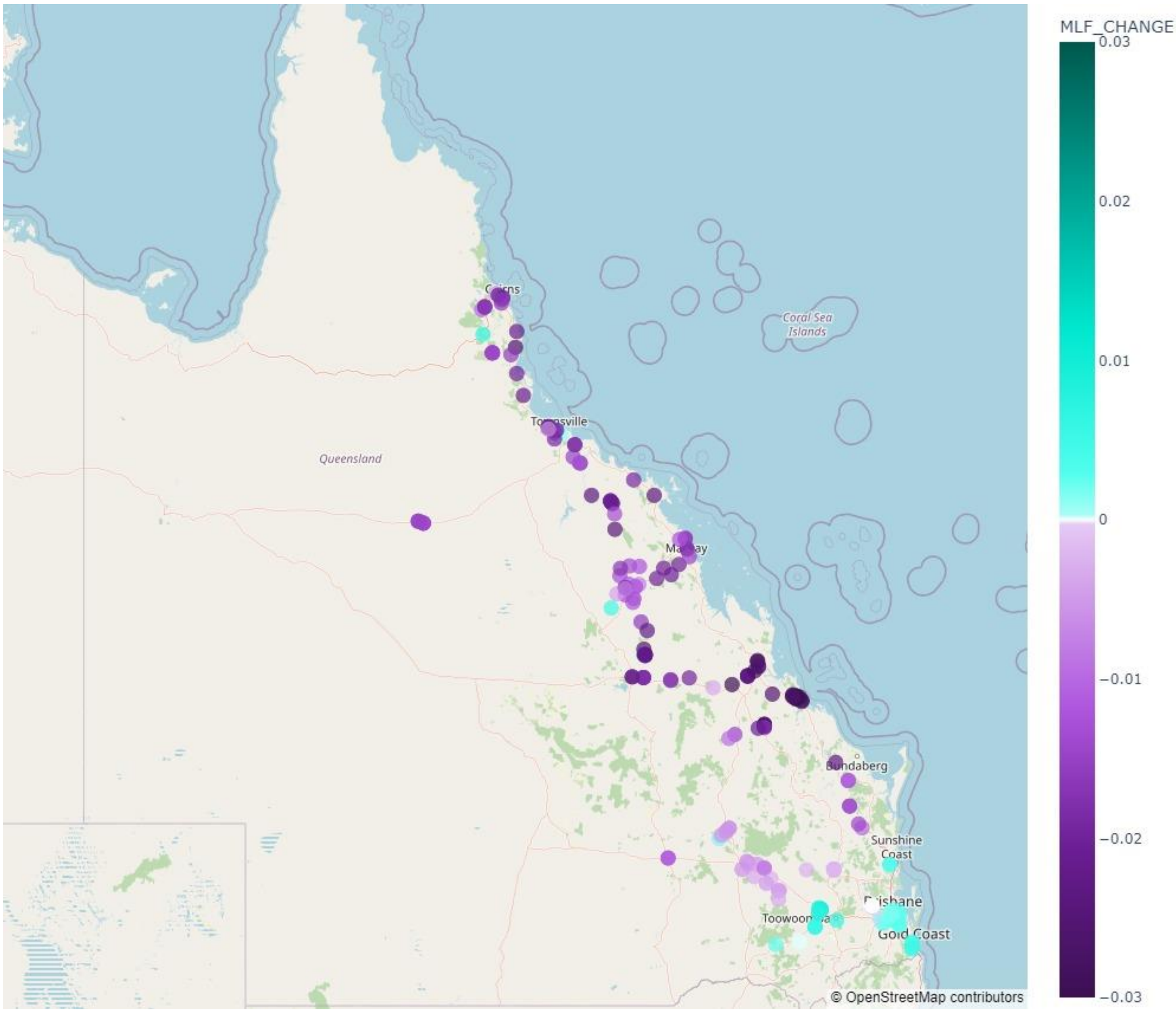


Table 15 Queensland sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2022-23 to 2023-24	
	Gen	Load
Central	-2.00%	-2.36%
North	-0.50%	-1.67%
South-east	-0.01%	0.19%
South-west	-0.03%	-0.24%

2.5.2 Changes to marginal loss factors in New South Wales

Figure 4 shows a geographical representation of MLF variations at New South Wales connection points between 2022-23 and 2023-24. Table 16 shows the average sub-regional year on year MLF variations between 2022-23 and 2023-24.

Primary drivers of changes

The primary drivers of change in New South Wales are variations in projected imports from both Queensland (coinciding with increases in interconnector capacity expected from “QNI Minor”) and Victoria, a projected increase in remote generation, and the closure of Liddell Power Station.

The projected increase in southerly flows from Queensland has led to material downward pressure on MLF outcomes in northern New South Wales; this is compounded by additional generation capacity within northern New South Wales, but this capacity is not the primary driver of change.

Notable changes

The northern New South Wales sub-region average MLFs decreased for both generation and load, by 3.44% and 2.77% respectively. This has primarily been driven by a material increase in southerly flows from Queensland. The projected flows between New South Wales and Queensland have a strong diurnal pattern (daily trend in strength of flow), which results in the materiality of the impact increasing for connection points where the projected flows correlate strongly with this diurnal pattern.

The western New South Wales sub-region average MLFs have increased for both generation and load, by 0.95% and 1.3% respectively. This has been driven by a decrease in local thermal generation (due to an increase in short duration historical outages within reference years) and increase in forecast local industrial demand.

The south-western New South Wales sub-region average MLFs have increased for both generation and load, by 0.4% and 0.08% respectively. Notably, individual MLF outcomes in this sub-region continue to be heavily dependent on the diurnal pattern of flows, as such while the general trend has been increases there are several MLF outcomes in south-western New South Wales that have reduced year on year. Intra-regional limits continue to impact generation in this sub-region, limiting year on year increases in generation.

Notable changes between draft 2023-24 and final 2023-24

Post-publication of the draft 2023-24 MLFs, CS Energy advised of a delayed return to service for Callide C3 and C4 as per Table 14. Additionally, the timing relating to release of transfer capacity on QNI due to the QNI upgrade has been delayed. These revisions have reduced the magnitude of MLF variations in northern New South Wales.

Figure 4 New South Wales changes compared to 2023-24 MLFs

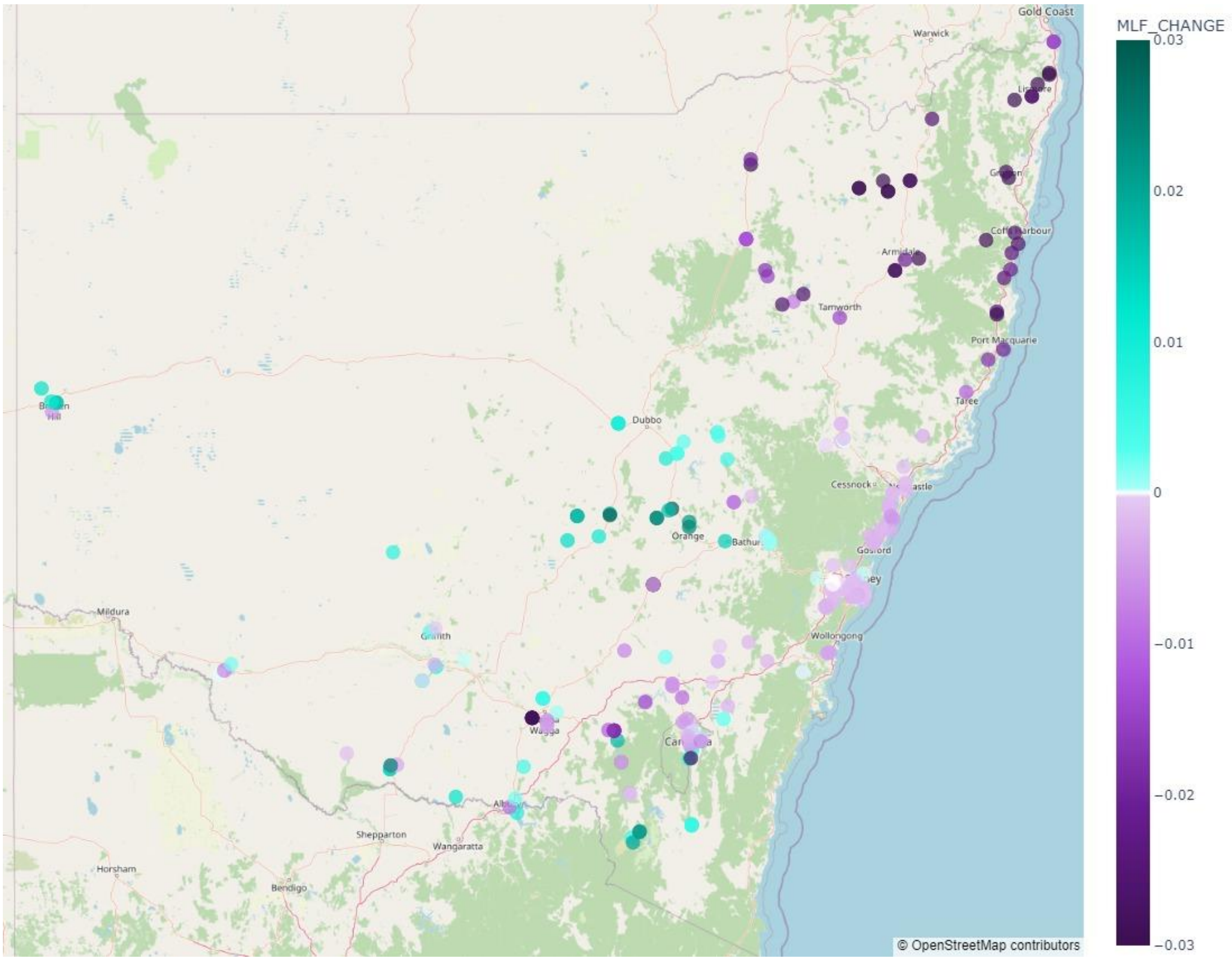


Table 16 New South Wales sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2022-23 to 2023-24	
	Gen	Load
ACT	-0.03%	0.07%
Hunter	0.04%	-0.04%
North	-3.44%	-2.47%
South-west	0.40%	0.08%
Snowy	-0.07%	-0.19%
Sydney	-0.01%	-0.19%
West	0.95%	1.30%

2.5.3 Changes to marginal loss factors in Victoria

Figure 5 shows a geographical representation of MLF variations at Victorian connection points between 2022-23 and 2023-24. Table 17 shows the average sub-regional year on year MLF variations between 2022-23 and 2023-24.

Primary drivers of changes

The primary drivers of change in Victoria are variations in projected local generation and demand between 2022-23 and 2023-24.

A large portion of the projected increase in forecast demand has been met by thermal generation in the Latrobe Valley and western Victoria. This projected increase in generation in both sub-regions has led to downward pressure on MLFs.

In north-western, northern, and central Victoria the projected generation has decreased, and forecast demand has increased, this has led to increased localised consumption of generation within these sub-regions and in turn upward pressure on MLFs. These variations in projections have more than offset the impact on MLF outcomes of the projected decrease in exports to New South Wales.

Notable changes

The north-western Victoria sub-region average MLFs increased for both generation and load, by 0.42% and 1.07% respectively. Intra-regional limits continue to impact generation in this sub-region, limiting year on year increases in generation.

Both northern and central Victoria sub-region average MLFs have increased, for generation and load the increases are 0.23% and 0.92% respectively for northern Victoria and 0.37% and 0.64% respectively for central Victoria.

Both western Victoria and the Latrobe Valley sub-region average MLFs have decreased, for generation and load the decreases are -0.49% and -0.31% respectively for western Victoria and -0.21% and -0.62% respectively for the Latrobe Valley.

Figure 5 Victoria changes compared to 2023-24 MLFs

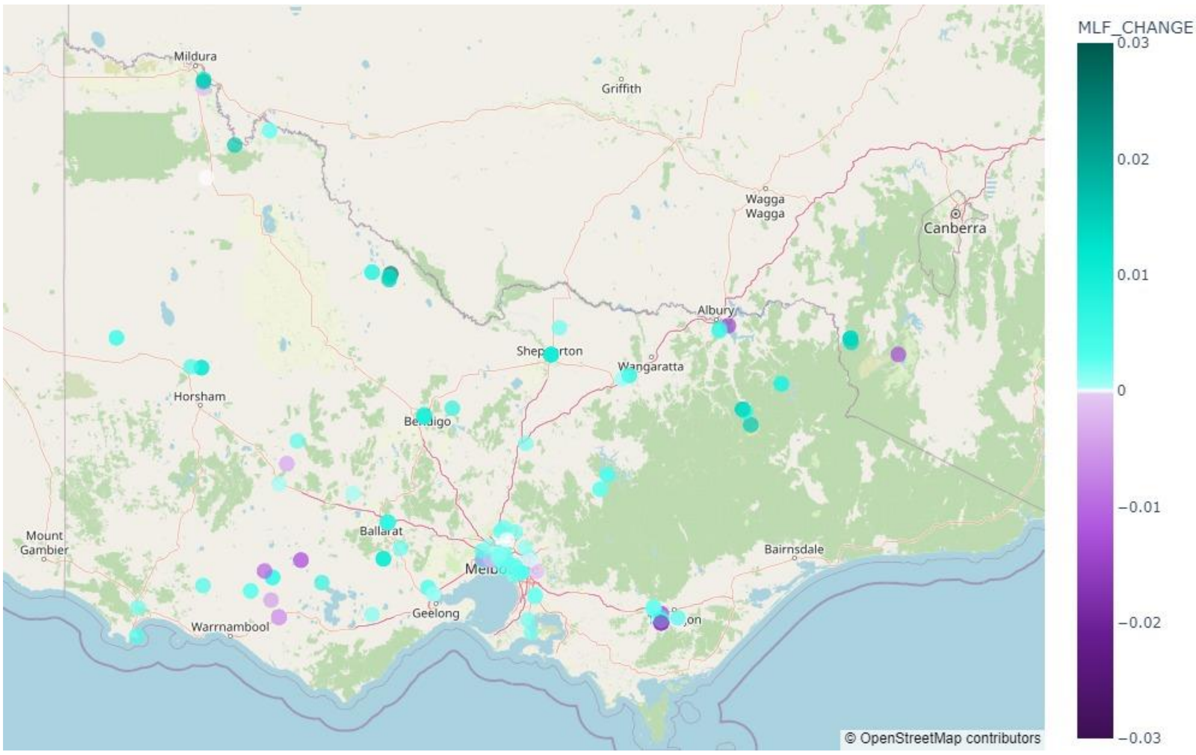


Table 17 Victoria sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2022-23 to 2023-24	
	Gen	Load
Central	0.37%	0.65%
Latrobe Valley	-0.21%	-0.62%
Melbourne	0.26%	0.13%
North	0.23%	0.90%
North-west	0.47%	1.12%
West	-0.49%	-0.31%

2.5.4 Changes to marginal loss factors in South Australia

Figure 6 shows a geographical representation of MLF variations at South Australian connection points between 2022-23 and 2023-24. Table 18 shows the average sub-regional year on year MLF variations between 2022-23 and 2023-24.

Primary drivers of changes

The primary drivers of change in South Australia are additional generation capacity and increased demand within South Australia and increased export limits to Victoria via Heywood following the return to service of the Para static VAR compensator (SVC).

Notable changes

The Riverland sub-region MLFs decreased on average by 1.29%, primarily driven by increased imports to South Australia via Murraylink and additional generation capacity within this sub-region.

The south-eastern sub-region MLFs increased on average by 0.96% for generation and 1.81% for load, primarily driven by a projected increase in exports to Victoria via Heywood because of additional generation capacity within South Australia and the projected increase in export limits on Heywood.

The northern sub-region MLFs decreased on average by 1.02% and 0.24% for generation and load respectively. This has primarily been driven by a projected increase in local generation within this sub-region.

Figure 6 South Australia changes to 2023-24 MLFs

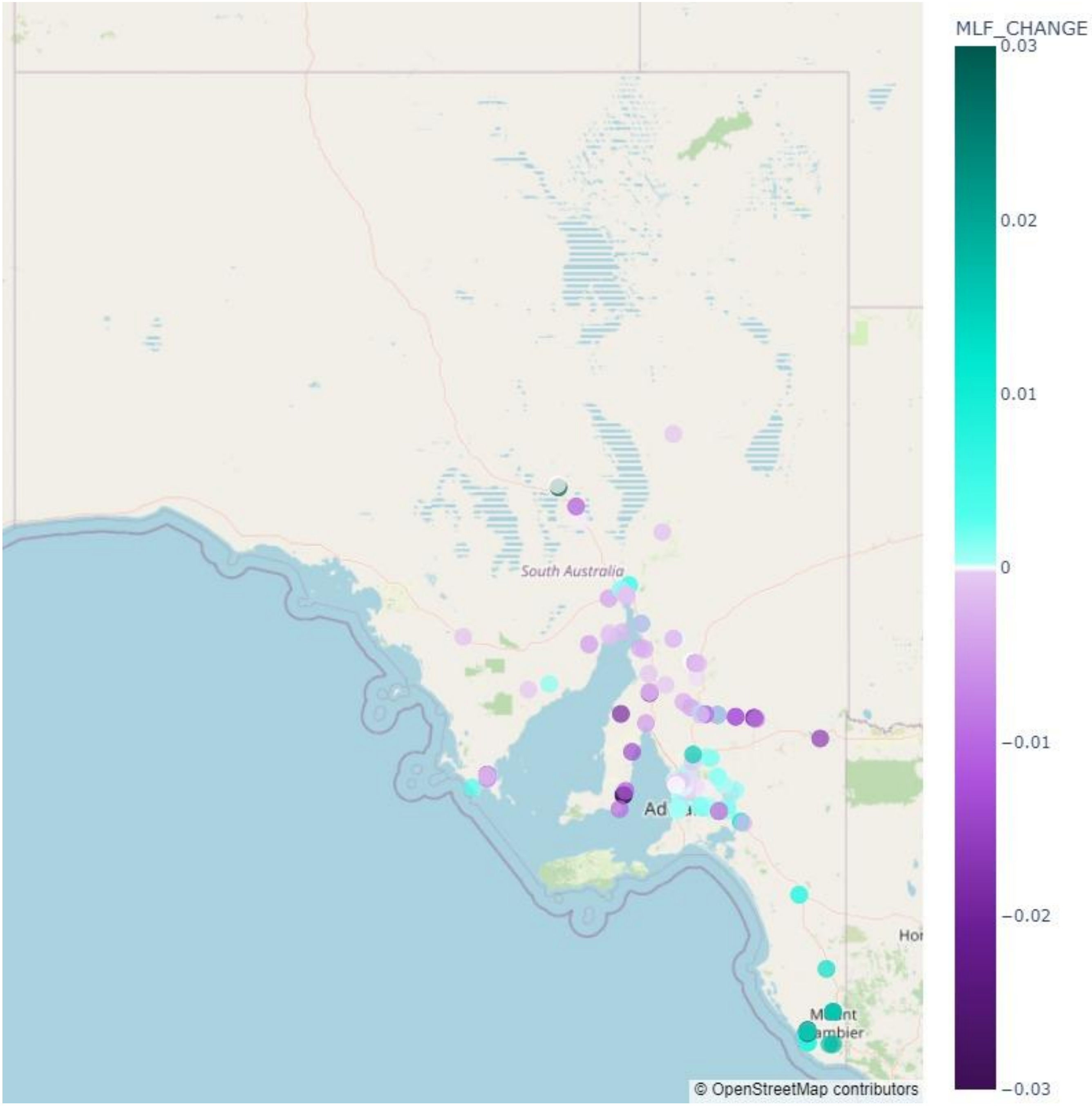


Table 18 South Australia sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2022-23 to 2023-24	
	Gen	Load
Adelaide	0.12%	-0.05%
North	-1.02%	-0.24%
Riverland	NA	-1.29%
South-east	0.96%	1.81%

2.5.5 Changes to marginal loss factors in Tasmania

Figure 7 shows a geographical representation of MLF variations at Tasmanian connection points between 2022-23 and 2023-24. Table 19 shows the average sub-regional year on year MLF variations between 2022-23 and 2023-24.

Primary drivers of changes

The primary drivers of change in Tasmania are a projected variation in generation within Tasmania which is driven by variations in water storage levels, projected generation availability, and a projected decrease in imports from the mainland via Basslink between 2022-23 and 2023-24.

Notable changes

All sub-regions except George Town have seen decreases in average MLF outcomes. This is due to the increased flows from these sub-regions to the RRN which is supported by the change in Basslink flows.

Figure 7 Tasmania changes to 2023-24 MLFs

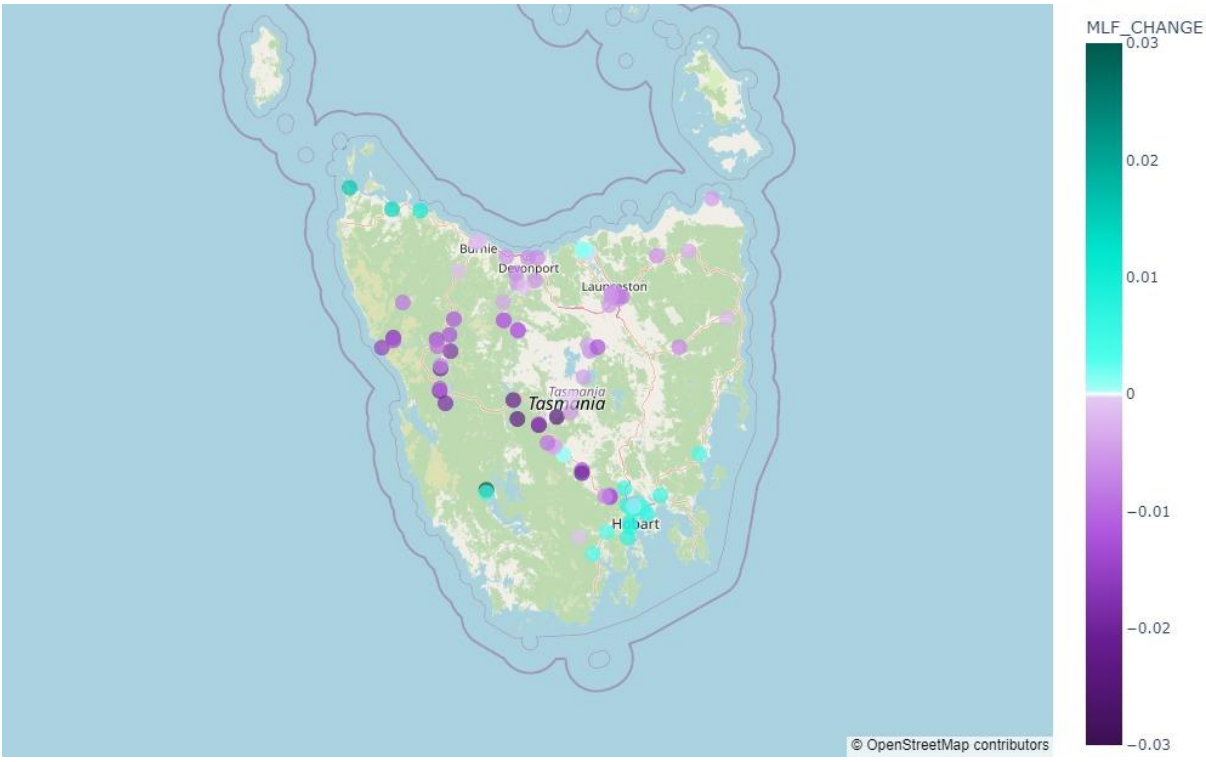


Table 19 Tasmania sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2022-23 to 2023-24	
	Gen	Load
George Town	-0.20%	-0.02%
North-west	-0.71%	-0.07%
North	-1.06%	-0.54%

Sub-region	Average MLF change 2022-23 to 2023-24	
South	-0.62%	-0.21%
West coast	-1.66%	-1.35%

3 Inter-regional loss factor equations

This section describes the inter-regional loss factor equations.

Inter-regional loss factor equations describe the variation in loss factor at one RRN with respect to an adjacent RRN. These equations are necessary to cater for the large variations in loss factors that may occur between RRNs as a result of different power flow patterns. This is important in minimising the distortion of economic dispatch of generating units.

Loss factor equation (South Pine 275 referred to Sydney West 330)

$= 0.8536 + 1.8850E\text{-}04 * NQ_t + 1.4428E\text{-}05 * Qd + 9.7051E\text{-}06 * Nd$

Loss factor equation (Sydney West 330 referred to Thomastown 66)

$= 1.0793 + 1.6759E\text{-}04 * VN_t + -8.7111E\text{-}06 * Vd + 8.6242E\text{-}06 * Nd + -4.9347E\text{-}05 * Sd$

Loss factor equation (Torrens Island 66 referred to Thomastown 66)

$= 1.0166 + 3.4263E\text{-}04 * VSA_t + -1.2753E\text{-}06 * Vd + -1.5712E\text{-}06 * Sd$

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = New South Wales demand

Sd = South Australian demand

NQ_t = transfer from New South Wales to Queensland

VN_t = transfer from Victoria to New South Wales

VSA_t = transfer from Victoria to South Australia

Figure 8 MLF (South Pine 275 referred to Sydney West 330)

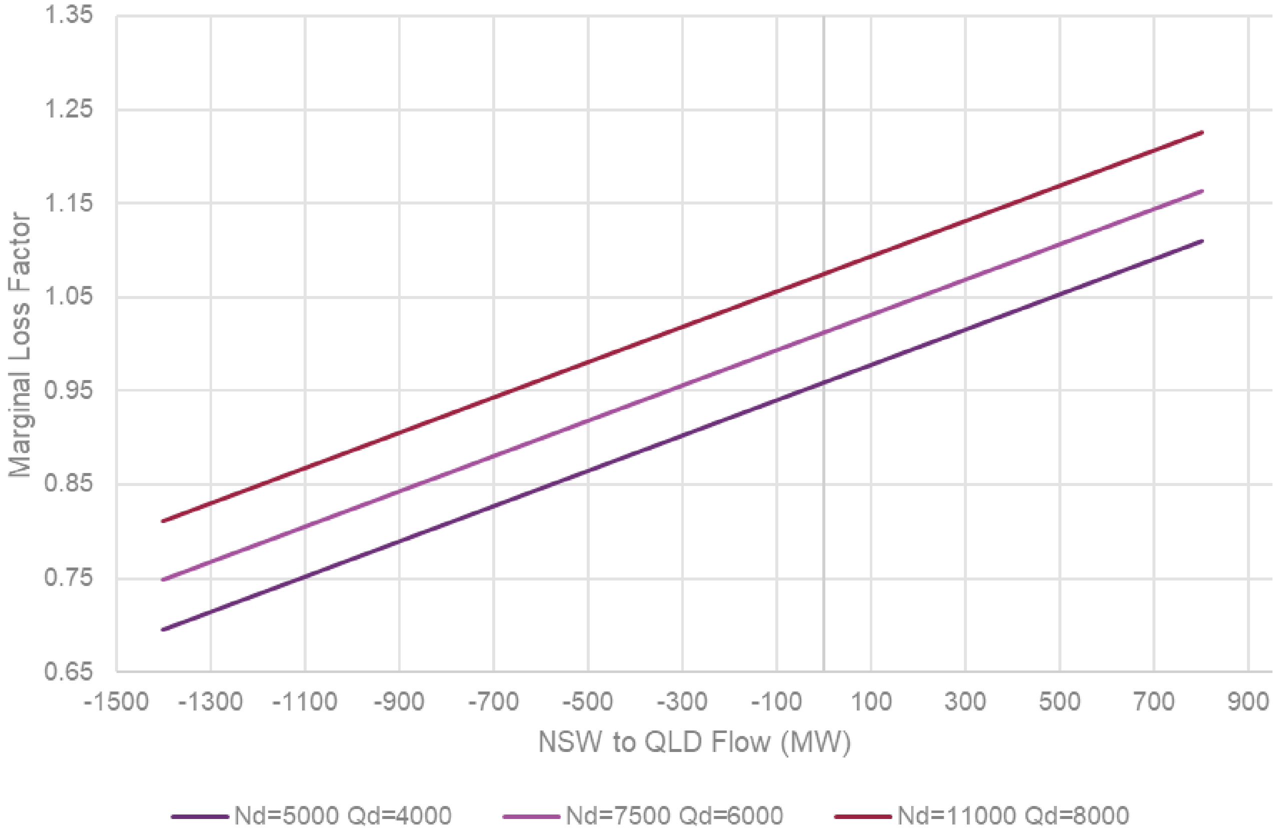


Table 20 South Pine 275 referred to Sydney West 330 MLF versus New South Wales to Queensland flow coefficient statistics

Coefficient	Qd	Nd	NQt	Constant
Coefficient value	1.4428E-05	9.7051E-06	1.8850E-04	0.8536

Figure 9 MLF (Sydney West 330 referred to Thomastown 66)

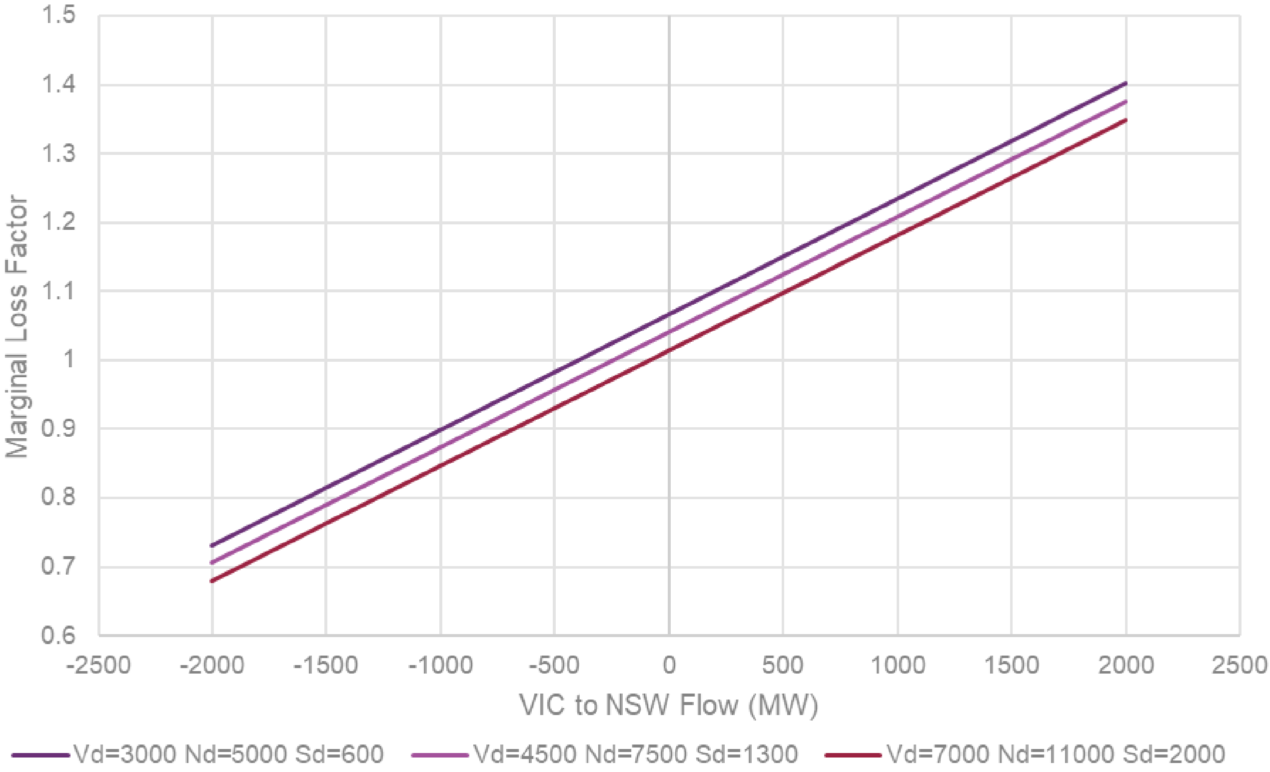


Table 21 Sydney West 330 referred to Thomastown 66 MLF versus Victoria to New South Wales flow coefficient statistics

Coefficient	Sd	Nd	Vd	VNt	Constant
Coefficient value	-4.9347E-05	8.6242E-06	-8.7111E-06	1.6759E-04	1.0793

Figure 10 MLF (Torrens Island 66 referred to Thomastown 66)

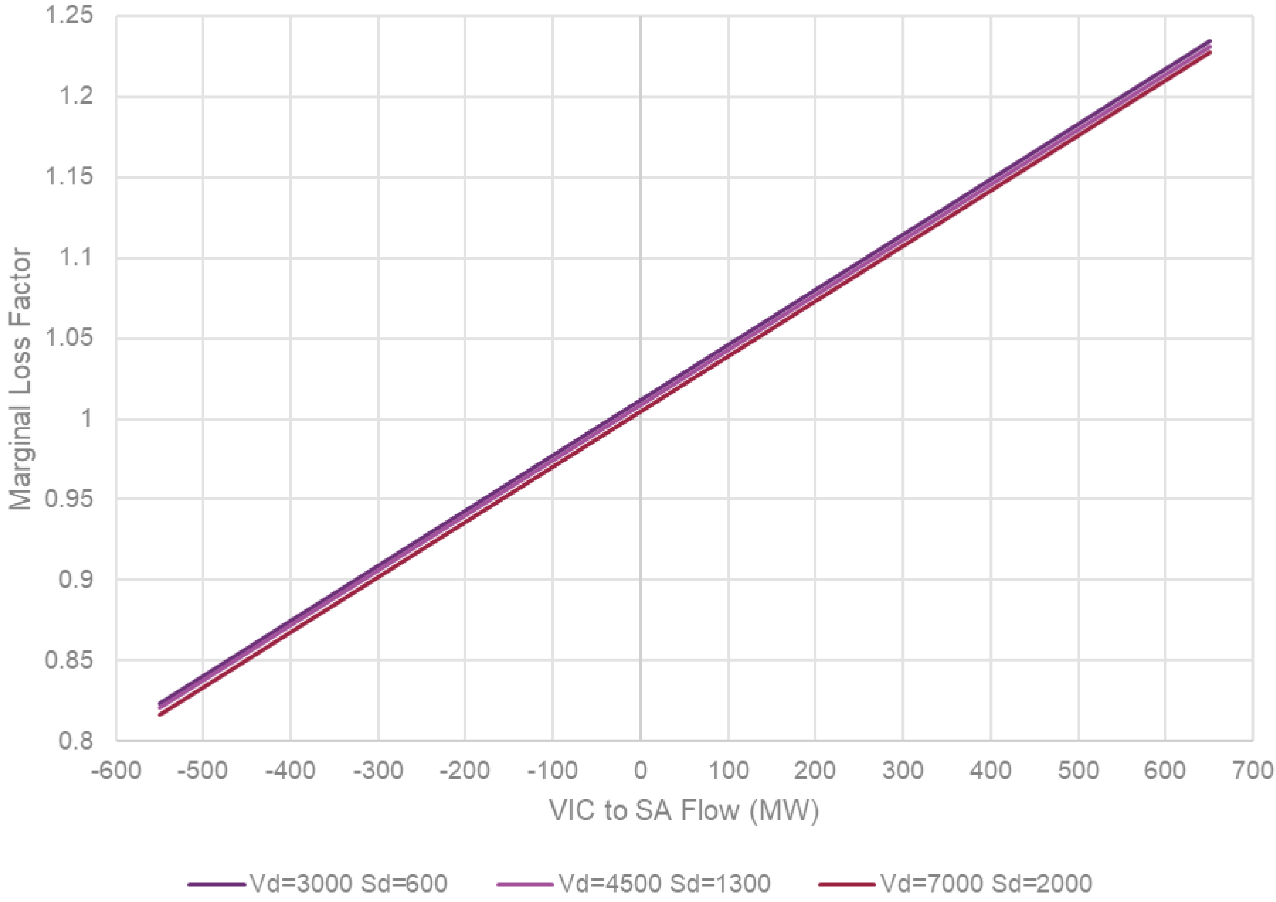


Table 22 Torrens Island 66 referred to Thomastown 66 MLF versus Victoria to South Australia flow coefficient statistics

Coefficient	Sd	Vd	VSAt	Constant
Coefficient value	-1.5712E-06	-1.2753E-06	3.4263E-04	1.0166

4 Inter-regional loss equations

This section describes how inter-regional loss equations are derived.

Inter-regional loss equations are derived by integrating the equation (Loss factor – 1) with respect to the interconnector flow, i.e.:

$$\text{Losses} = \int(\text{Loss factor} - 1)\, d\text{Flow}$$

South Pine 275 referred to Sydney West 330 notional link average losses

$= (-0.1464 + 1.4428E\text{-}05*Qd + 9.7051E\text{-}06*Nd)*NQ_t + 9.4250E\text{-}05*(NQ_t)^2$

Sydney West 330 referred to Thomastown 66 notional link average losses

$= (0.0793 + -8.7111E\text{-}06*Vd + 8.6242E\text{-}06*Nd + -4.9347E\text{-}05*Sd)*VN_t + 8.3797E\text{-}05*(VN_t)^2$

Torrens Island 66 referred to Thomastown 66 notional link average losses

$= (0.0166 + -1.2753E\text{-}06*Vd + -1.5712E\text{-}06*Sd)*VSA_t + 1.7132E\text{-}04*(VSA_t)^2$

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = New South Wales demand

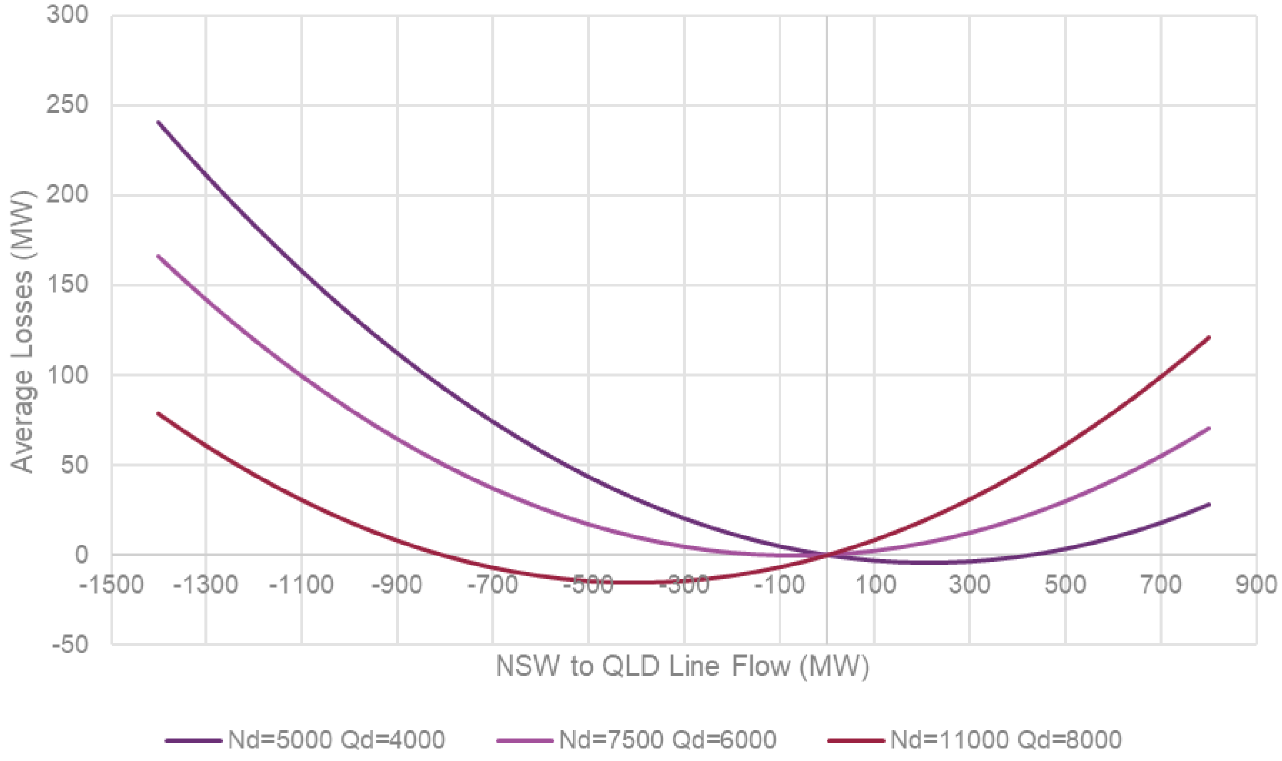
Sd = South Australia demand

NQ_t = transfer from New South Wales to Queensland

VN_t = transfer from Victoria to New South Wales

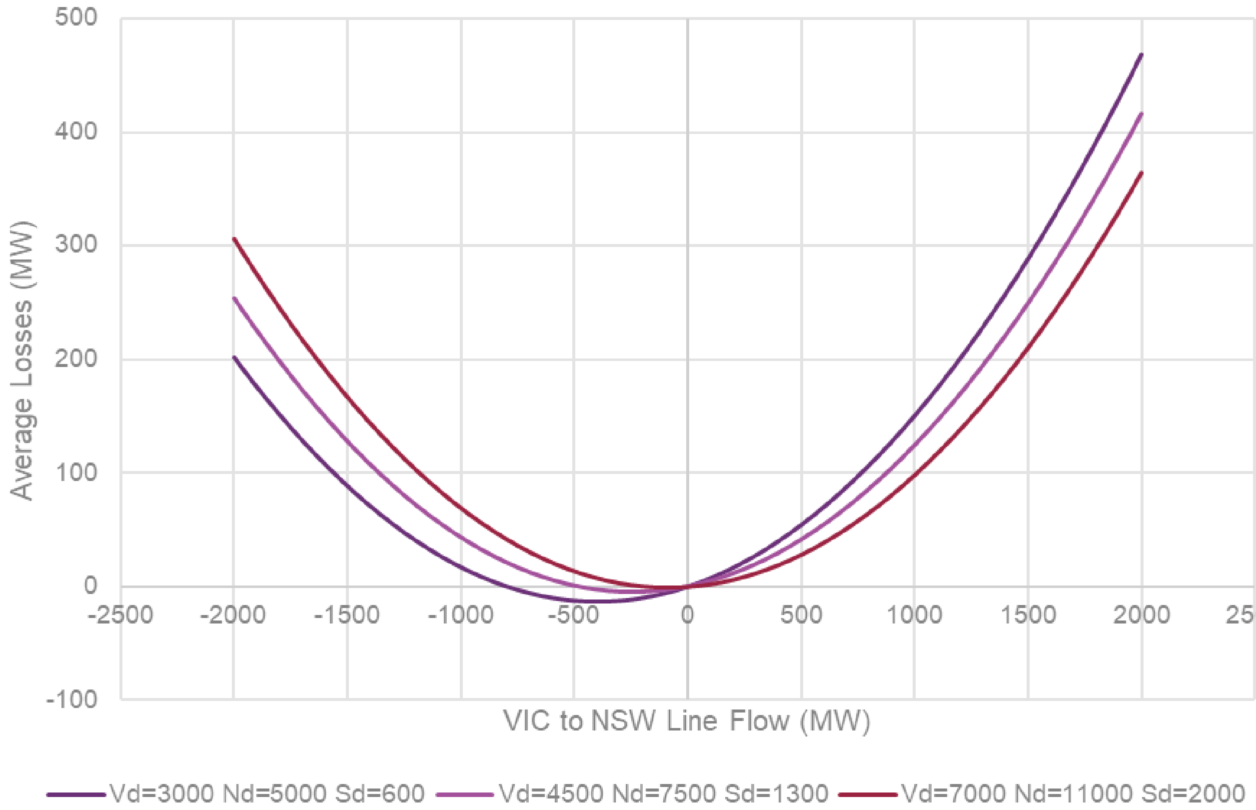
VSA_t = transfer from Victoria to South Australia

Figure 11 Average losses for New South Wales – Queensland notional link



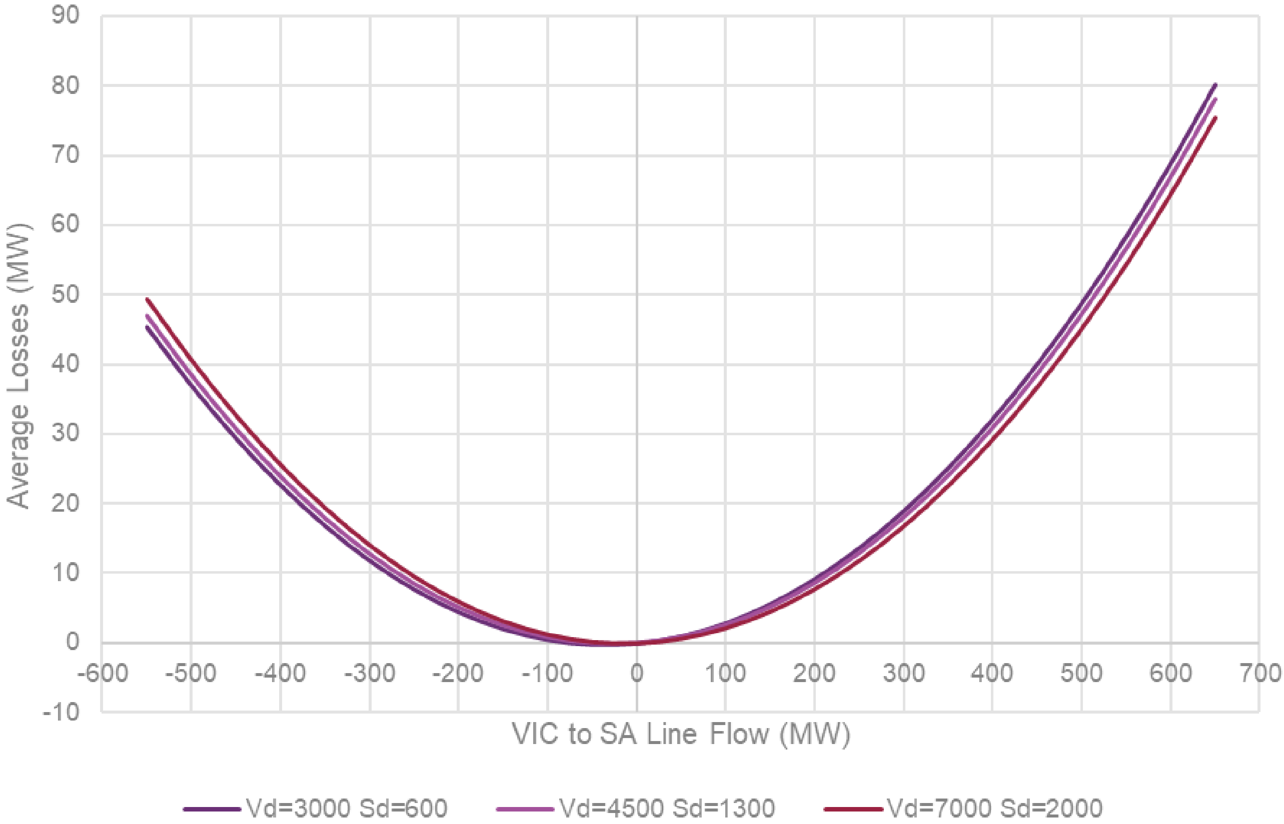
New South Wales to Queensland notional link losses versus New South Wales to Queensland notional link flow

Figure 12 Average losses for Victoria – New South Wales notional link



Victoria to New South Wales notional link losses versus Victoria to New South Wales notional link flow

Figure 13 Average losses for Victoria – South Australia notional link



Victoria to South Australia notional link losses versus Victoria to South Australia notional link flow

5 Basslink, Murraylink, Terranora loss equations

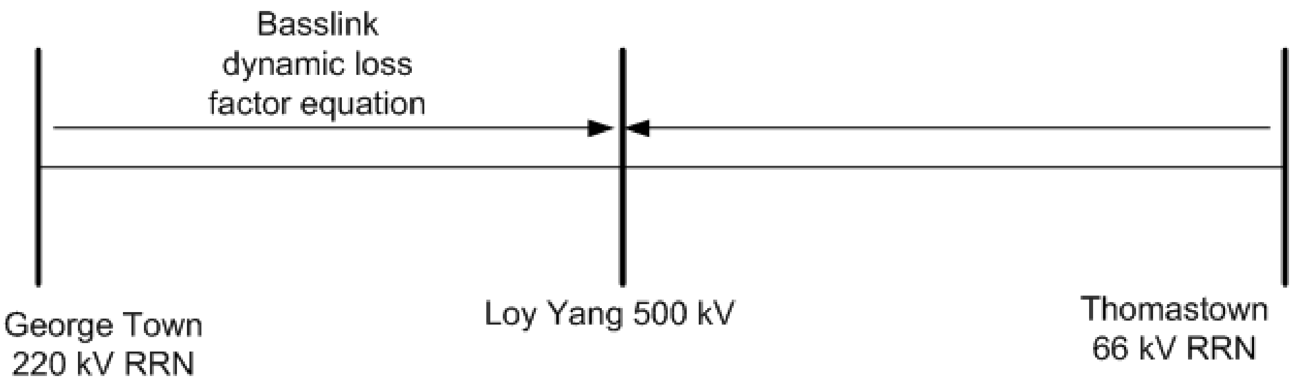
This section describes the loss equations for the direct current (DC) interconnectors.

5.1 Basslink

The loss factor model for Basslink is made up of the following parts:

- George Town 220 kilovolts (kV) MLF referred to Tasmania RRN = 1.0000.
- Basslink (Loy Yang Power Station [PS] Switchyard) 500 kV MLF referred to Victorian RRN is 0.9826 when exporting power to Tasmania and 0.9755 when importing power from Tasmania.
- Receiving end dynamic loss factor referred to the sending end = 0.99608 + 2.0786 * 10^{-4} * P(receive), where P(receive) is the Basslink flow measured at the receiving end.

Figure 14 Basslink loss factor model



The equation describing the losses between the George Town 220 kV and Loy Yang 500 kV connection points can be determined by integrating the (loss factor equation – 1), giving:

$$P(send) = P(receive) + [\ (-3.92\times10^{-3}) * P(receive) + (1.0393\times10^{-4}) * P(receive)^2 + 4]$$

where:

P(send): Power in megawatts (MW) measured at the sending end,

P(receive): Power in MW measured at the receiving end.

The model is limited from 40 MW to 630 MW. When the model falls below 40 MW, this is within the ±50 MW 'no-go zone' requirement for Basslink operation.

5.2 Murraylink

Murraylink is a regulated interconnector. In accordance with clause 3.6.1(a) of the Rules, the Murraylink loss model consists of a single dynamic MLF from the Victorian RRN to the South Australian RRN.

The measurement point is the 132 kV connection to the Monash converter, which effectively forms part of the boundary between the Victorian and South Australian regions.

The losses between the Red Cliffs 220 kV and Monash 132 kV connection points are given by the following equation:

$$\text{Losses} = (0.0039 * \text{Flow}_t + 2.8177 * 10^{-4} * \text{Flow}_t^2)$$

AEMO determined the following Murraylink MLF model using regression analysis:

$$\text{Murraylink MLF (Torrens Island 66 referred to Thomastown 66)} = 0.9449 + 2.0094\text{E-03}*\text{Flow}_t$$

This model, consisting of a constant and a Murraylink flow coefficient, is suitable because most of the loss is due to variations in the Murraylink flow, and other potential variables do not improve the model.

The regression statistics for this Murraylink loss factor model are presented in the following table:

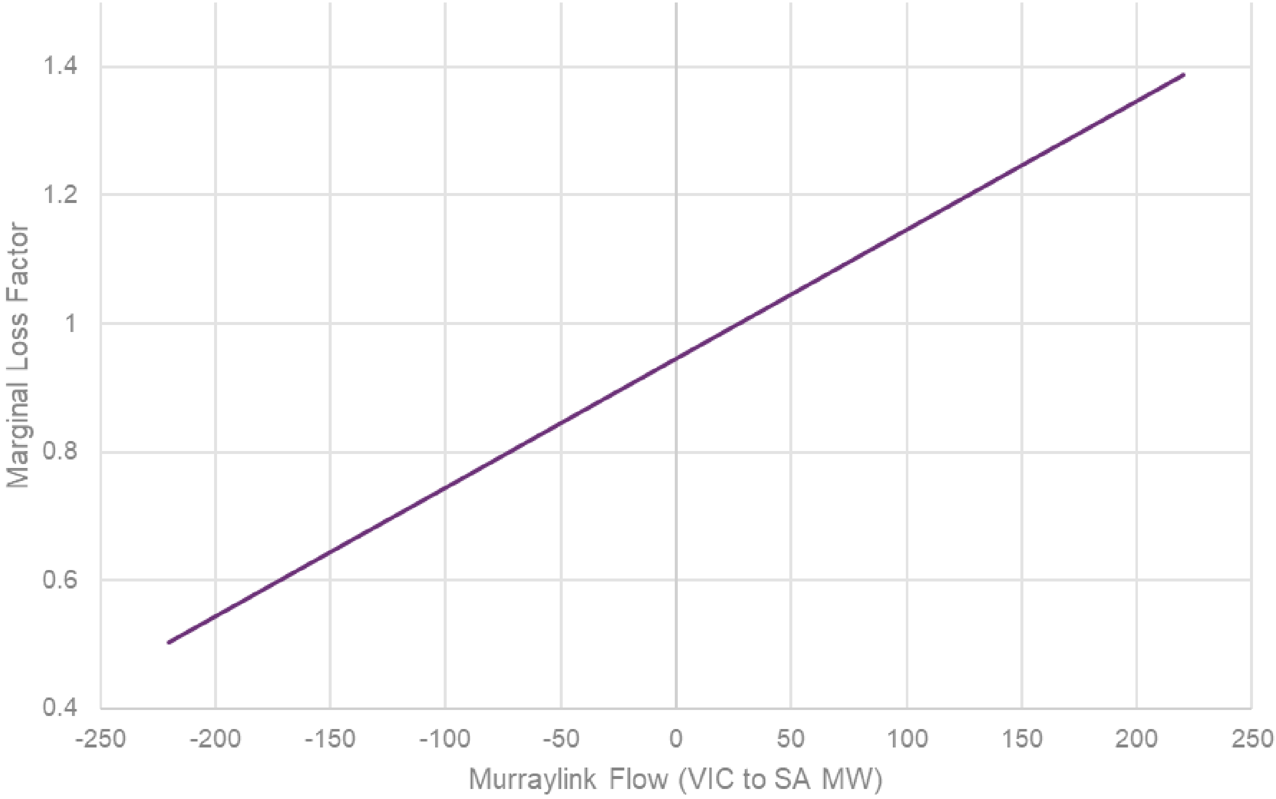
Table 23 Regression statistics for Murraylink

Coefficient	Murraylink flow	Constant
Coefficient value	2.0094E-03	0.9449

The loss model for a regulated Murraylink interconnector can be determined by integrating (MLF-1), giving:

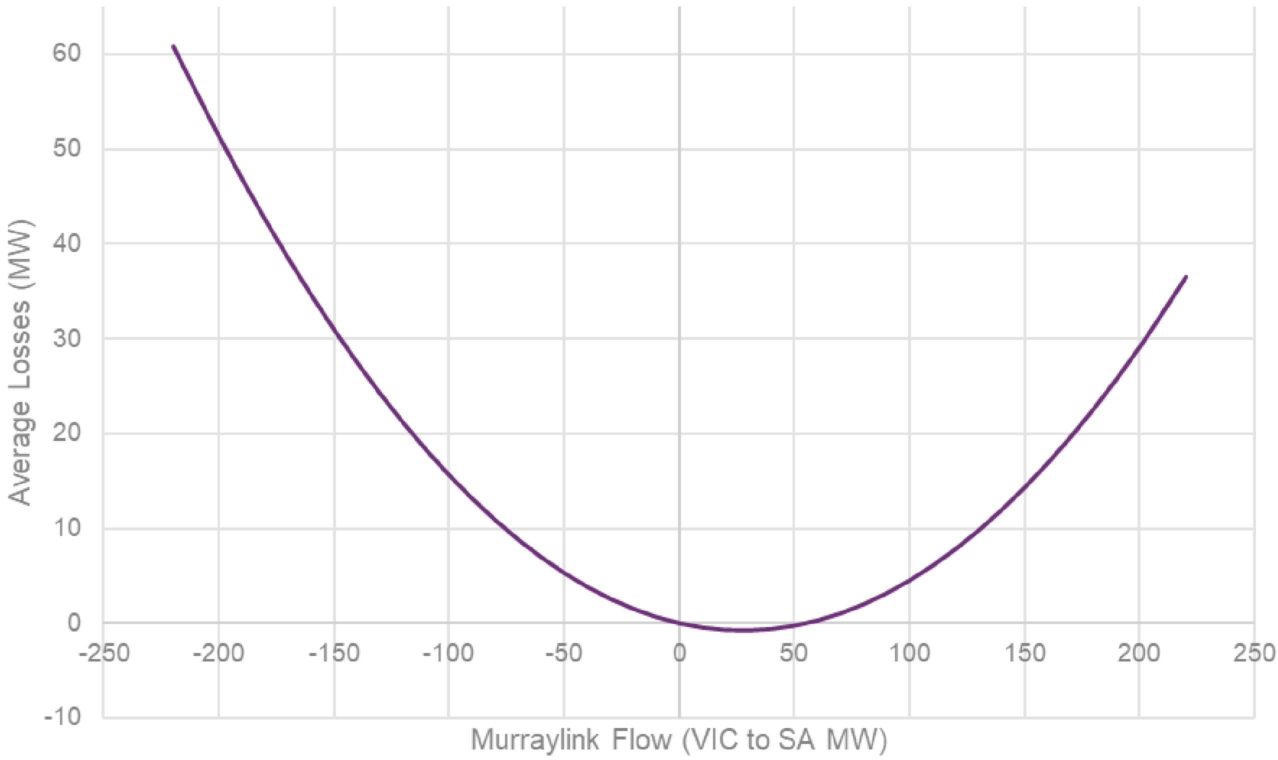
$$\text{Murraylink loss} = -0.0551*\text{Flow}_t + 1.0047\text{E-03}*(\text{Flow}_t)^2$$

Figure 15 Murraylink MLF (Torrens Island 66 referred to Thomastown 66)



Torrens Island 66 referred to Thomastown 66 versus Murraylink interconnector flow (Victoria to South Australia).

Figure 16 Average losses for Murraylink interconnector (Torrens Island 66 referred to Thomastown 66)



Murraylink notional link losses versus Murraylink flow (Victoria to South Australia).

5.3 Terranora

Terranora is a regulated interconnector. In accordance with clause 3.6.1(a) of the Rules, the Terranora loss model consists of a single dynamic MLF from the New South Wales RRN to the Queensland RRN.

The measurement point is 10.8 km north from Terranora on the two 110 kV lines between Terranora and Mudgeeraba, which effectively forms part of the boundary between the New South Wales and Queensland regions.

The losses between the Mullumbimby 132 kV and Terranora 110 kV connection points are given by the following equation:

$$\text{Losses} = (-0.0013 * \text{Flow}_t + 2.7372 * 10^{-4} * \text{Flow}_t^2)$$

AEMO determined the following Terranora MLF model using regression analysis:

Terranora interconnector MLF (South Pine 275 referred to Sydney West 330)

$$= 1.0538 + 3.0511\text{E-}03 * \text{Flow}_t$$

This model consisting of a constant and a Terranora flow coefficient is suitable because most of the loss is due to variations in the Terranora flow and other potential variables do not improve the model.

The regression statistics for this Terranora loss factor model are presented in the following table:

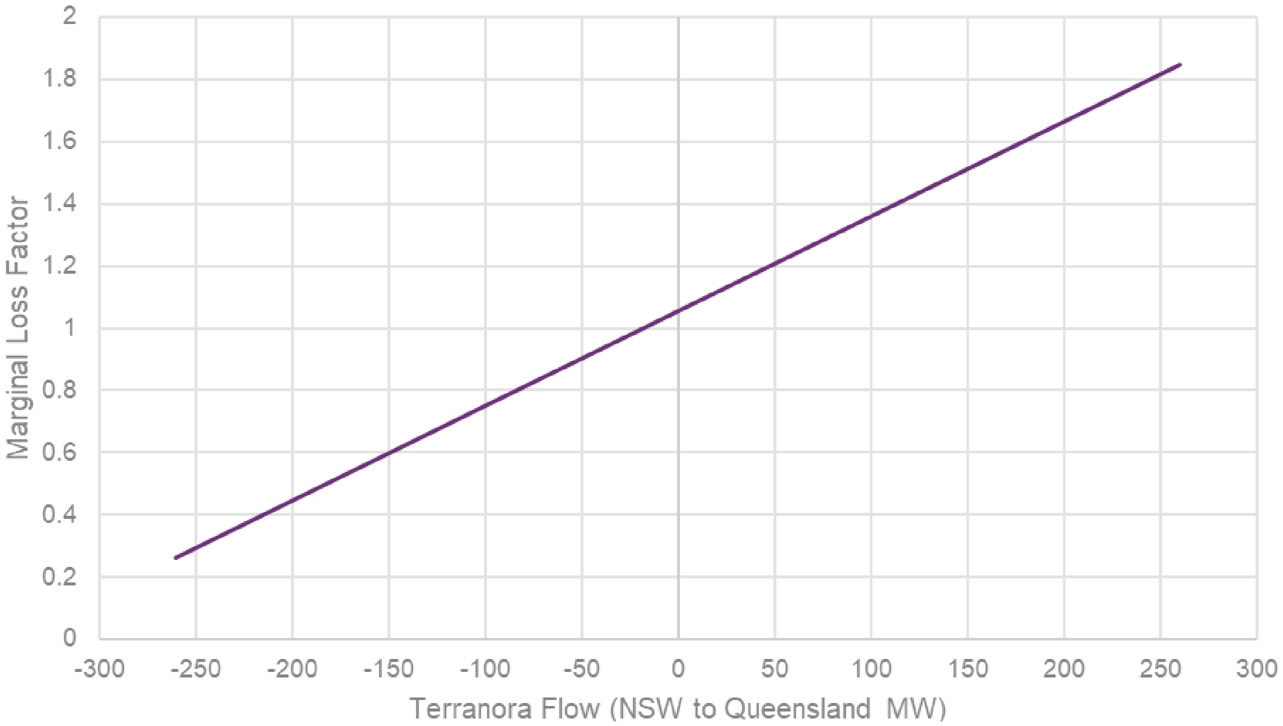
Table 24 Regression statistics for Terranora

Coefficient	Terranora flow	Constant
Coefficient value	3.0511E-03	1.0538

The loss model for a regulated Terranora interconnector can be determined by integrating (MLF-1), giving:

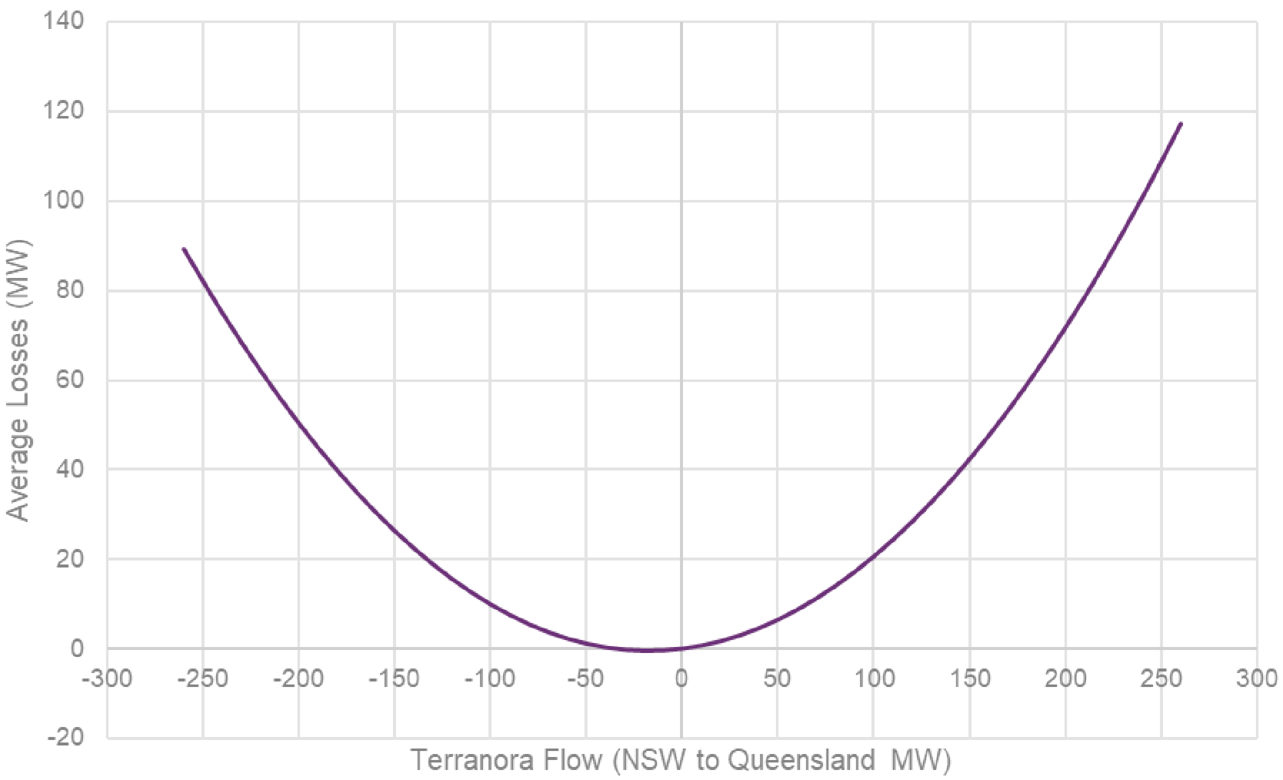
$$\text{Terranora loss} = 0.0538 * \text{Flow}_t + 1.5256\text{E-}03 * (\text{Flow}_t)^2$$

Figure 17 Terranora interconnector MLF (South Pine 275 referred to Sydney West 330)



South Pine 275 referred to Sydney West 330 MLF versus Terranora interconnector flow (New South Wales to Queensland)

Figure 18 Average losses for Terranora interconnector (South Pine 275 referred to Sydney West 330)



Terranora interconnector notional link losses versus flow (New South Wales to Queensland)

6 Proportioning of inter-regional losses to regions

This section details how the inter-regional losses are proportioned by the National Electricity Market Dispatch Engine (NEMDE).

NEMDE implements inter-regional loss factors by allocating the inter-regional losses to the two regions associated with a notional interconnector.

The proportioning factors are used to allocate the inter-regional losses to two regions by an increment of load at one RRN from the second RRN. The incremental changes to the inter-regional losses in each region are found from changes to interconnector flow and additional generation at the second RRN.

The average proportion of inter-regional losses in each region constitutes a single static loss factor.

The following table provides the factors used to allocate inter-regional losses to the associated regions for the 2023-24 financial year:

Table 25 Factors for inter-regional losses

Notional interconnector	Proportioning factor	Applied to
Queensland – New South Wales (QNI)	0.6245	New South Wales
Queensland – New South Wales (Terranora Interconnector)	0.5959	New South Wales
Victoria – New South Wales (VNI)	0.5423	Victoria
Victoria – South Australia (Heywood)	0.6778	Victoria
Victoria – South Australia (Murraylink)	0.6593	Victoria

7 Regions and regional reference nodes

This section describes the NEM regions, the RRN for each region and regional boundaries.

7.1 Regions and Regional Reference Nodes

Table 26 Regions and Regional Reference Nodes

Region	Regional Reference Node
Queensland	South Pine 275 kV node
New South Wales	Sydney West 330 kV node
Victoria	Thomastown 66 kV node
South Australia	Torrens Island PS 66 kV node
Tasmania	George Town 220 kV node

7.2 Region boundaries

Physical metering points defining the region boundaries are at the following locations.

7.2.1 Between the Queensland and New South Wales regions

- At Dumaresq Substation on the 8L and 8M Dumaresq to Bulli Creek 330 kV lines[6].
- 10.8 km north of Terranora on the two 110 kV lines between Terranora and Mudgeeraba (lines 757 & 758). Metering at Mudgeeraba adjusted for that point.

7.2.2 Between the New South Wales and Victoria regions

- At Wodonga Terminal Station (WOTS) on the 060 Wodonga to Jindera 330 kV line.
- At Red Cliffs Terminal Station (RCTS) on the Red Cliffs to Buronga 220 kV line.
- At Murray Switching Station (MSS) on the MSS to Upper Tumut Switching Station (UTSS) 330 kV lines.
- At MSS on the MSS to Lower Tumut Switching Station (LTSS) 330 kV line.
- At Guthega Switching Station on the Guthega to Jindabyne PS 132 kV line.
- At Guthega Switching Station on the Guthega to Geehi Dam Tee 132 kV line.

7.2.3 Between the Victoria and South Australia regions

- At South East Switching Station (SESS) on the SESS to Heywood 275 kV lines.
- At Monash Switching Station on the Berri (Murraylink) converter 132 kV line.

[6] The metering at Dumaresq is internally scaled to produce an equivalent flow at the New South Wales/Queensland State borders.

7.2.4 Between the Victoria and Tasmania regions

Basslink is not a regulated interconnector. It has the following metering points:

- At Loy Yang 500 kV PS.
- At George Town 220 kV Switching Station.

8 Virtual transmission nodes

This section describes the configuration of the different virtual transmission nodes (VTNs) that have been advised to AEMO at time of publication.

VTNs are aggregations of transmission nodes for which a single MLF is applied. AEMO has considered the following VTNs which have been approved by the Australian Energy Regulator (AER).

8.1 New South Wales virtual transmission nodes

Table 27 New South Wales virtual transmission nodes

VTN TNI code	Description	Associated transmission connection points (TCPs)
NEV1	Far North	Muswellbrook 132, Liddell 33
NEV2	North of Broken Bay	Brandy Hill 11, Charmhaven 11, Gosford 66, Gosford 33, West Gosford 11, Munmorah STS 33, Lake Munmorah 132, Newcastle 132, Ourimbah 132, Ourimbah 66, Ourimbah 33, Somersby 11, Tomago 132, Tuggerah 132, Vales Pt 132, Waratah 132, Wyong 11
NEV3	South of Broken Bay	Alexandria 33, Beaconsfield North 132, Beaconsfield South 132, Belmore Park 11, Bunnerong 132, Bunnerong 33, Belmore Park 132, Campbell Street 11, Campbell Street 132, Canterbury 33, Green Square 11, Homebush Bay 11, Hurstville North 11, Haymarket 132, Kurnell 132, Kogarah 11, Lane Cove 132, Meadowbank 11, Marrickville 11, Mason Park 132, Peakhurst 33, Macquarie Park 11, Macquarie Park 33, Potts Hill 132, Potts Hill 11, Rockdale 11, Rookwood Road 132, Rose Bay 11, Strathfield South 11, Sydney East 132, Sydney North 132, St Peters 11, Sydney West 132, Sydney South 132, Top Ryde 11, Waverley 11
AAVT	ACT	Angle Crossing 132, Belconnen 132, City East 132, Civic 132, East Lake 132, Gilmore 132, Gold Creek 132, Latham 132, Telopea Park 132, Theodore 132, Wanniassa 132, Woden 132

8.2 South Australia virtual transmission nodes

The SJP1 VTN for South Australia includes all South Australian load transmission connection points, excluding:

- Snuggery Industrial, as nearly its entire capacity services an industrial facility at Millicent.
- Whyalla MLF, as its entire capacity services an industrial plant in Whyalla.

8.3 Tasmania virtual transmission nodes

Table 28 Tasmania virtual transmission nodes

VTN TNI code	Description	Associated TCPs
TVN1	Greater Hobart Area	Chapel Street 11, Creek Road 33, Lindisfarne 33, Mornington 33, North Hobart 11, Risdon 33 and Rokeby 11.
TVN2	Tamar Region	Hadspen 22, Mowbray 22, Norwood 22, St Leonards 22, Trevallyn 22, George Town 22

A1. Background to marginal loss factors

This section summarises the method AEMO uses to account for electricity losses in the NEM. It also specifies AEMO's Rules responsibilities related to regions, calculation of MLFs, and calculation of inter-regional loss factor equations.

The NEM uses marginal costs to set electricity prices that need to include pricing of transmission electrical losses.

For electricity transmission, electrical losses are a transport cost that needs to be recovered. A feature of electrical losses is that they also increase with an increase in the electrical power transmitted. That is, the more a transmission line is loaded, the higher the percentage losses. Thus, the price differences between the sending and receiving ends is not determined by the average losses, but by the marginal losses of the last increment of electrical power delivered.

Electrical power in the NEM is traded through the spot market managed by AEMO. The central dispatch process schedules generation to meet demand to maximise the value of trade.

Static MLFs represent intra-regional electrical losses of transporting electricity between a connection point and the RRN. In the dispatch process, generation prices within each region are adjusted by MLFs to determine dispatch of generation.

Dynamic inter-regional loss factor equations calculate losses between regions. Depending on flows between regions, inter-regional losses also adjust the prices in determining generation dispatch to meet demand.

AEMO calculates the Regional Reference Price (RRP) for each region, which is then adjusted by reference to the MLFs between customer connection points and the RRN.

A1.1 Rules requirements

Clause 2A.1.3 of the Rules requires AEMO to establish, maintain, review and publish by 1 April each year a list of regions, RRNs, and the market connection points (represented by TNIs) in each region.

Rule 3.6 of the Rules requires AEMO to calculate the inter-regional loss factor equations (clause 3.6.1) and intra-regional loss factors (MLFs) (clause 3.6.2) by 1 April each year that will apply for the next financial year.

Clauses 3.6.1, 3.6.2 and 3.6.2A specify the requirements for calculating the inter-regional loss factor equations and MLFs, and the data used in the calculation.

The Rules require AEMO to calculate and publish a single, volume-weighted average, intra-regional MLF for each connection point. The Rules also require AEMO to calculate and publish dual MLFs for connection points where one MLF does not satisfactorily represent transmission network losses for active energy generation and consumption.

A1.2 Application of marginal loss factors

Under marginal pricing, the spot price for electricity is the incremental cost of additional generation (or demand reduction) for each spot market trading interval.

Consistent with this, the marginal losses are the incremental increase in total losses for each incremental additional unit of electricity. The MLF of a connection point represents the marginal losses to deliver electricity to that connection point from the RRN.

The tables in Section 1 show the MLFs for each region. The price of electricity at a TNI is the price at the RRN multiplied by the MLF. Depending on network and loading configurations MLFs vary, ranging from below 1.0 to above 1.0.

A1.2.1 Marginal loss factors greater than 1.0

At any instant at a TNI, the marginal value of electricity will equal the cost of generating additional electrical power at the RRN and transmitting it to that point. Any increase or decrease in total losses is then the marginal loss associated with transmitting electricity from the RRN to this TNI. If the marginal loss is positive, less power can be taken from this point than at the RRN, the difference having been lost in the network. In this case, the MLF is above 1.0. This typically applies to loads but would also apply to generation in areas where the local load is greater than the local level of generation.

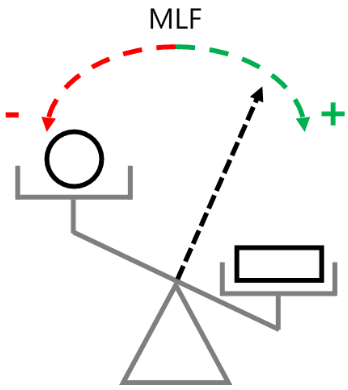
For example, a generating unit supplying an additional 1 MW at the RRN may find that a customer at a connection point can only receive an additional 0.95 MW. Marginal losses are 0.05 MW, or 5% of generation, resulting in an MLF of 1.05.

Marginal loss factors greater than 1.0 – simplified

Figure 19 shows this effect in a simple manner using a scale as an analogy. While this is an oversimplification of the underlying drivers of MLF outcomes, thinking of changes as being driven by localised shifts in load/generation balance can be a helpful way to understand MLF outcomes.

In particular, expanding this thinking to interconnector behaviour – where an interconnector exporting can be thought of as 'load' and importing as 'generation' – can help with understanding year-on-year variations in MLF outcomes at connection points in close proximity to interconnectors.

Figure 19 MLFs greater than 1.0 simplified



A1.2.2 Marginal loss factors less than 1.0

Losses increase with distance, so the greater the distance between the RRN and a connection point, the higher the MLF. However additional line flow only raises total losses if it moves in the same direction as existing net flow. At any instant, when additional flow is against net flow, total network losses are reduced. In this case, the MLF is below 1.0. This typically applies to generation but would also apply to loads in areas where the local generation level is greater than local load.

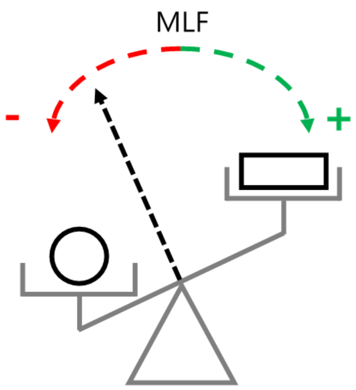
Using the example above, if net flow is in the direction from the connection point to the RRN, a generating unit at the RRN is only required to supply an additional 0.95 MW to meet an additional load of 1 MW at the connection point. Marginal losses are then -0.05 MW, or 5% reduction in generation, resulting in an MLF of 0.95.

Marginal loss factors less than 1.0 – simplified

Figure 20 shows this effect in a simple manner using a scale as an analogy. While this is an oversimplification of the underlying drivers of MLF outcomes, thinking of changes as being driven by localised shifts in load/generation balance can be a helpful way to understand MLF outcomes.

In particular, expanding this thinking to interconnector behaviour – where an interconnector exporting can be thought of as ‘load’ and importing as ‘generation’ – can help with understanding year-on-year variations in MLF outcomes at connection points in close proximity to interconnectors.

Figure 20 MLFs less than 1.0 simplified



A1.2.3 Marginal loss factors impact on National Electricity Market settlements

For settlement purposes, the value of electricity purchased or sold at a connection point is multiplied by the connection point MLF. For example:

A **Market Customer** at a connection point with an MLF of 1.05 purchases $1,000 of electricity. The MLF of 1.05 multiplies the purchase value to 1.05 x 1,000 = $1,050. The higher purchase value covers the cost of the electrical losses in transporting electricity to the Market Customer’s connection point from the RRN.

A **Market Generator** at a connection point with an MLF of 0.95 sells $1,000 of electricity. The MLF of 0.95 multiplies the sales value to 0.95 x 1,000 = $950. The lower sales value covers the cost of the electrical losses in transporting electricity from the Market Generator’s connection point to the RRN.

Therefore, it follows that in the settlements process:

- Higher MLFs tend to advantage, and lower MLFs tend to disadvantage, generation connection points.
- Higher MLFs tend to disadvantage, and lower MLFs tend to advantage, load connection points.

A2. Methodology, inputs, and assumptions

This section outlines the principles underlying the MLF calculation, the load and generation data inputs AEMO obtains and uses for the calculation, and how AEMO checks the quality of this data. It also explains how networks and interconnectors are modelled in the MLF calculation.

A2.1 Marginal loss factors calculation methodology

AEMO uses a forward-looking loss factor (FLLF) methodology (Methodology)[7] for calculating MLFs. The Methodology uses the principle of "minimal extrapolation", the high level steps in this can be summarised as:

- Develop a load flow model of the transmission network that includes committed augmentations for the year that the MLFs will apply.
- Obtain connection point demand forecasts for the year that the MLFs will apply.
- Estimate the dispatch of committed new generating units.
- Adjust the dispatch of new and existing generating units to restore the supply-demand balance in accordance with section 5.5 of the Methodology.
- Calculate the MLFs using the resulting power flows in the transmission network.

A2.2 Load data requirements for the MLF calculation

The annual energy targets used in load forecasting for the 2023-24 MLF calculation are in Table 29 below.

Annual consumption forecasts varied materially between the 2021 and 2022 *Electricity Statement of Opportunities* (ESOO). The 2021 consumption forecasts considered *Progressive Change* as the Central scenario. The April 2022 *Update to the 2021 ESOO* forecasts shifted the Central scenario to the *Step Change* scenario, which introduced greater forecast electrification of the economy. Re-baselining the underlying business mass market and residential forecasts with revised historical data further increased the consumption outlook compared to the 2021 ESOO. The 2022 ESOO forecasts incorporated these changes and normal updates to other model inputs.

Table 29 Operational demand

Region	2022-23 forecast operational energy (GWh)[A]	2023-24 forecast operational energy (GWh)[A]
Queensland[B]	47,380	52,633
New South Wales[B]	60,671	63,886
Victoria[B]	36,902	42,900
South Australia	10,964	11,916
Tasmania	10,964	11,392

A. Forecasting operational energy – as sent out energy was sourced from the most recent published Electricity Statement of Opportunities (2021 ESOO for 2023-23 and 2022 ESOO for 2023-24), at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/NEM-Electricity-Statement-of-Opportunities.

[7] Forward Looking Transmission Loss Factors (Version 8), at https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/forward-looking-loss-factor-methodology.pdf?la=en.

B. Queensland, New South Wales and Victoria annual consumption forecasts have varied materially between the 2021 and 2022 ESOOs. See https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/accuracy-report/forecast-accuracy-report-2022.pdf?la=en.

A2.2.1 Historical data accuracy and due diligence of the forecast data

AEMO regularly verifies the accuracy of historical connection point data. AEMO calculates the losses using this historical data by adding the summated generation values to the interconnector flow and subtracting the summated load values. These transmission losses are used to verify that no large errors occur in the data.

AEMO also performs due diligence checks of connection point load traces to ensure that:

- The demand forecast is consistent with the latest ESOO.
- Load profiles are reasonable, and the drivers for load profiles that have changed from the historical data are identifiable.
- The forecast for connection points is inclusive of any relevant embedded generators, where the embedded generators are not considered as part of operational demand[8].
- Industrial and auxiliary type loads are not scaled with residential drivers.

A2.3 Generation data requirements for the MLF calculation

AEMO obtained historical real power (MW) and reactive power (megavolt-amperes-reactive [MVAr]) data from its settlements database for each trading interval (half-hour) covering every generation connection point in the NEM from 1 July 2021 to 30 June 2022.

AEMO also obtained the following data:

- Generation capacity data from AEMO's Generation Information Page published on its website on 16 February 2023.
- Historical generation availability, as well as on-line and off-line status data from AEMO's Market Management System (MMS).
- Future generation availability based on THE most recent medium term projected assessment of system adequacy (MT PASA) data, as of 1 January 2023[9], as a trigger for AEMO to request information from participants with the potential to use an adjusted generation profile for the loss factor calculation.

A2.3.1 New generation

The new generation included is taken from the Generation Information Page as published on 16 February 2023. Projects listed as committed[10] (Committed/Committed*) and with a target commercial operation date that implies generation in the target year are included. These generating systems are incorporated into the network model and forecast generation profiles are created.

[8] Demand Terms in EMMS Data Model, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/dispatch-information/policy-and-process-documentation#demandterms.

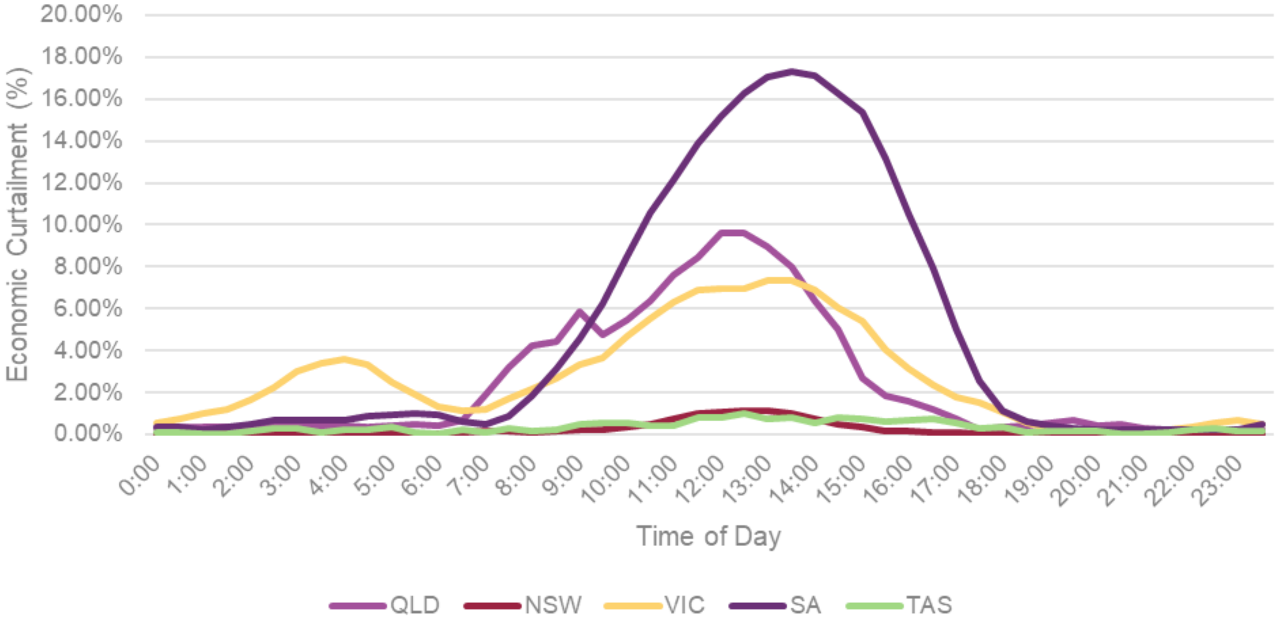
[9] As noted in Section 2.4 of this report, consideration for MT PASA revisions was extended to include the most recent information pertaining to the return to service of Callide C3 and C4.

[10] Criteria for Committed and Committed* are under the Background information tab in each spreadsheet on the Generation Information page, at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information.

For new solar and wind projects, AEMO created half-hourly profiles based on nameplate capacity and the Full Commercial Use Date (FCUD) indicated on the Generation Information Page, using the reference year 2021-22 weather data. Default hold point schedules were applied to these profiles prior to their FCUD. Historical data from the previous financial year was incorporated into the profile if available. Relevant proponents for each project were consulted during the process.

Economic curtailment was factored into the solar and wind forecast generation profiles to align them with historical generation data. AEMO calculated the time-of-day average curtailment by region for the reference year 2021-22. Forecast generation profiles were reduced by the time-of-day percentage of curtailment for the appropriate region. Of note is that the intent of consideration and implementation of economic curtailment is to ensure an equitable baseline between solar and wind forecast generation profiles and solar and wind profiles derived from historical outcomes (from reference year 2021-22 for the 2023-24 MLF outcomes).

Figure 21 Time of day average economic curtailment for 2023-24



For new thermal generation, the relevant proponents were requested to provide forecasts. For new storage projects, the relevant proponents were requested to provide forecasts; where forecasts were not provided, the data utilised has been based on historical data.

The following committed generation was included in the modelling, however AEMO does not publish MLFs for connections that are not yet registered:

Queensland new generation

- Clarke Creek Wind Farm 1
- Clarke Creek Wind Farm 2
- Dulacca Wind Farm

New South Wales and Australian Capital Territory new generation

- Avonlie Solar Farm
- Broken Hill Battery Energy Storage System (BESS)
- Darlington Point Energy Storage System
- Riverina Energy Storage System 1
- Riverina Energy Storage System 2
- Riverina Solar Farm
- Rye Park Wind Farm
- Tallawarra B Power Station
- Wollar Solar Farm
- Wyalong Solar Farm

Victoria new generation

- None

South Australia new generation

- Goyder South Wind Farm 1A
- Goyder South Wind Farm 1B

Tasmania new generation

- None

A2.3.2 Registered unit forecasts

AEMO created half-hourly profiles for registered solar and wind projects that did not operate at full capacity for the entire reference year or where historical generation data does not represent generation in the target year (due to unit specific constraints). Forecast generation profiles for registered units were modelled using the reference year 2021-22 weather data and the registered maximum capacity for the project. Historical data from the reference year was incorporated into the profile where available.

Relevant proponents for each project were consulted during the process to provide feedback or propose their own generation profile. Where applicable, adjustments based on the feedback received were made or the proponent modelled profiles were implemented where deemed appropriate.

For registered thermal and storage projects where operation was not at full capacity for the entire reference year, relevant proponents were requested to provide forecasts. Where forecasts were not provided, the data utilised has been based on historical data.

A2.3.3 Abnormal generation patterns

AEMO replaced a number of historical generation profiles with adjusted profiles as an input to the 2023-24 MLF calculation process.

In accordance with section 5.5.7 of the Methodology, AEMO used adjusted generation profiles based on verifiable information, where it was satisfied that the reference year profile was clearly unrepresentative of the expected generation for 2022-23. Historical generation patterns were adjusted to backfill historical outages and incorporate future outages identified through MT PASA data submitted as of 1 January 2023 (noting additional consideration for Callide C3/C4 variations). This was performed where outages longer than 30 days have been identified, and only if deemed practicable. For example, highly variable sources of generation such as 'peakers' would not be backfilled due to the inconsistent nature of the generation.

A2.3.4 Stakeholder engagement for new generation

AEMO consulted with relevant participants/proponents to provide feedback on the forecast generation profiles. Where applicable, adjustments based on the received feedback were made or participant/proponent modelled profiles were implemented where deemed appropriate.

Through the feedback process, three forecast generation profiles were accepted with a material deviation in FCUD from the February Generation Information publication. AEMO determined the amended FCUD to be more reflective of the expected plant activity in the 2023-24. The relevant proponents were contacted, and have agreed to publish these changes in this report:

- Edenvale Solar Park – February 2024 to June 2023 (pushed forward eight months).
- Goyder South Wind Farm 1A – July 2023 to July 2024 (pushed back 12 months).
- Goyder South Wind Farm 1B – July 2024 to February 2025 (pushed back seven months).

A2.4 Intra-regional limit management

When performing MLF calculations, AEMO has identified several high impact system normal intra-regional limits that are likely to have a material impact on MLFs for the target year. To minimise deviations between the MLF calculations and actual market outcomes, AEMO incorporated these limits by reducing generation levels to ensure the limits are not exceeded.

Constraints were incorporated into the 2023-24 MLF study using the approaches discussed below.

Thermal/transfer limit

Where a thermal or transfer limit on a line or cut set is identified as relevant, this limit was first assessed using an unconstrained study with the relevant line flows being observed. The input profiles of relevant generators are then locationally grouped and reduced on a pro-rata basis (in line with MLF minimal extrapolation theory). The following limits were applied in this way:

- Balranald to Darlington Point voltage collapse limit (N^^N_NIL_3).
- Darlington Point to Wagga Wagga voltage collapse limit (N::N_NIL_63).

- Waubra to Ballarat transfer limit (V>>V_NIL_9).
- Murray to Dederang transfer limit (V>>V_NIL_1A and V>>V_NIL_1B).

The following thermal limits that were not incorporated into the draft 2023-24 MLF study have been implemented for the final 2023-24 MLF study following analysis that indicated high relevancy for 2023-24:

- Tamworth to Muswellbrook transfer limit (N>>NIL_88_84_S).
- Tamworth to Liddell transfer limit (N>>NIL_84_88_S).

AEMO continuously monitors and assesses the impact of other system normal limits. The following lists the limits which have been considered; the transfers associated with these limits have been monitored and analysed and observations indicate appropriate management via the supply and demand balancing process (minimal extrapolation):

- Queensland Central to South transfer limit (Q^NIL_CS).
- Monash to North West Bend transfer limit (S>NIL_MHNW1_MHNW2).
- Molong to Orange North transfer limit (N>NIL_94T).
- Gunnedah to Tamworth transfer limit (N>NIL_969).
- Ararat to Waubra transfer limit (V>>V_NIL_18).

A2.5 Network representation in the marginal loss factors calculation

An actual network configuration recorded by AEMO's Energy Management System (EMS) was used to prepare the NEM interconnected power system load flow model for the MLF calculation. This recording is referred to as a 'snapshot'. AEMO reviewed the snapshot and modified it where necessary to represent all normally connected equipment. AEMO also checked switching arrangements for the Victorian Latrobe Valley's 220 kV and 500 kV networks to ensure they reflect normal operating conditions.

AEMO added relevant network augmentations that are scheduled to occur in 2023-24. The snapshot is thus representative of the anticipated normally operating power system in 2023-24.

A2.5.1 Network augmentation for 2023-24

Relevant transmission network service providers (TNSPs) advised of the following network augmentations to be completed in or prior to 2023-24.

Queensland network augmentations

Powerlink provided the following list of planned network augmentations in 2023-24 in Queensland:

- Replacement of CP.02463 Dysart Transformer:
  - Replace Transformers 1 and 2 at T035 Dysart.
- Rebuilding CP.01128 Mackay Substation:
  - Establish bus configuration.

- Replacement of CP.01561 Strathmore second Transformer:
  - Updated transformer based on Powerlink advice.
- Establishment of CP.02883 Ross Woree third 275 kV circuit:
  - First stage – Tully South 275 kV substation – 275 kV connection between Tully and Ross.
- Restore FNQ original configuration:
  - Lines 877, 8902, 857, 7301, 7389, 7327 and 7132 back to original configuration.

New South Wales network augmentations

Transgrid provided the following list of planned network augmentations in 2023-24 in New South Wales:

- Dapto No.3 Transformer – removed Dapto 330/132 kV No.3 transformer and updated No.2 transformer to 'closed' status by adding ZIL between Dapto 132 and 330 kV buses.
- Retirement of Chullora Series Reactors.
- Station Road Data Centre:
  - Removed existing lines 930 (circuit 1 and 2). Modelled new Station Road 132 kV 930 and 931 Tee buses and added new lines 930/1, 930/2, 930/3, 931/1, 931/2, 931/3.
- Molonglo 132/11kV:
  - Updated line parameters.
- Maragle Substation (HumeLink):
  - Updated lines 64 and 6M to Maragle Substation from Upper Tumut and Lower Tumut.
- Tallawarra B Gas Turbine:
  - Removed lines 982, 983, 984, 98Y as per Dapto 132 kV Series Reactors retirement.

The 2023-24 MLF study has not incorporated the modelling of EnergyConnect. The 2022 ESOO estimated that the transfer capacity for EnergyConnect will commence from July 2024 therefore it is outside the scope for the 2023-24 MLF study.

Victoria network augmentations

AEMO Victorian Planning provided the following list of planned network augmentations in 2023-24 in Victoria:

- Replacement of West Melbourne terminal station existing B1, B2 and B3 transformers.
- Redevelopment of WMTS:
  - Removed B4, L transformers and 22 kV network.
- Redevelopment of Springvale terminal station:
  - Replaced B1, 2, and 3.
- Minor Victoria to New South Wales upgrade:
  - Added South Morang terminal station second transformer.

  - Updated South Morang terminal station to-Dederang terminal station 330 kV lines parameters.

South Australia network augmentations

ElectraNet provided the following list of planned network augmentations in 2023-24 in South Australia:

- Para – Brinkworth – Davenport line hazard mitigation:
  - Upgrade of 275 kV line.
- Updated 275 kV branches of Tailem Bend – Tunkillo – Mount Barker – Cherry Garden along with relevant network configuration.
- Main Grid System Strength Support:
  - Updated Davenport and Robertstown synchronous condensers' machine impedance.
  - Updated Robertstown Syncon 275/15 kV unit transformers' impedance.
- NCIPAP Smart Wire Power Guardian Technology Trial (NCIPAP):
  - Updated 132 kV line reactance.
- Eyre Peninsula Transmission Supply:
  - Updated line configuration and impedances.

Tasmania network augmentations

TasNetworks provided the following list of planned network augmentations in 2023-24 in Tasmania:

- None.

A2.5.2 Treatment of Basslink interconnector

Basslink consists of a controllable network element that transfers power between Tasmania and Victoria.

In accordance with sections 5.3.1 and 5.3.2 of the Methodology, AEMO calculated the Basslink connection point MLFs using historical data, adjusted to reflect any change in forecast generation in Tasmania.

A2.5.3 Treatment of Terranora interconnector

The Terranora interconnector is a regulated interconnector.

The boundary between Queensland and New South Wales between Terranora and Mudgeeraba is north of Directlink. The Terranora interconnector is in series with Directlink and, in the MLF calculation, AEMO manages the Terranora interconnector limit by varying the Directlink limit when necessary.

For the 2023-24 MLFs, the relationship between Terranora and QNI has been derived from historical system normal (excludes data where limits applied that were related to network outages) observations from 2021-22.

As Directlink resides entirely within New South Wales, considerations were made for load between Directlink and Terranora to ensure that the intended relationship between QNI and Terranora was achieved.

A2.5.4 Treatment of the Murraylink interconnector

The Murraylink interconnector is a regulated interconnector.

In accordance with section 5.3 of the Methodology, AEMO treats the Murraylink interconnector as a controllable network element in parallel with the regulated Heywood interconnector.

For the 2023-24 MLFs, the relationship between Murraylink and Heywood has been derived from historical system normal (excludes data where limits applied that were related to network outages) observations from 2021-22.

A2.5.5 Treatment of Yallourn unit 1

Yallourn Power Station Unit 1 can be connected to either the 220 kV or 500 kV network in Victoria.

AEMO modelled Yallourn Unit 1 at the two connection points (one at 220 kV and the other one at 500 kV) and calculated loss factors for each connection point. AEMO then calculated a single volume-weighted loss factor for Yallourn Unit 1 based on the individual loss factors at 220 kV and at 500 kV, and the output of the unit.

A2.6 Interconnector capacity

In accordance with section 5.5.4 of the Methodology, AEMO estimated nominal interconnector limits for summer peak, summer off-peak, winter peak, and winter off-peak periods. These values are in the table below. AEMO also sought feedback from the relevant TNSPs as to whether there were any additional factors that might influence these limits.

Table 30 Inter-regional limits

From region	To region	Summer day (MW)[A]	Summer night (MW)[A]	Winter day (MW)[A]	Winter night (MW)[A]
Queensland	NSW[B]	1,300/1,350/1,400	1,300/1,350/1,400	1,300/1,350/1,400	1,300/1,350/1,400
NSW	Queensland[B]	700	750	700	750
NSW	Victoria	1,700	1,700	1,700	1,700
Victoria	NSW	1,670	1,670	1,670	1,670
Victoria	South Australia	650	650	650	650
South Australia	Victoria[C]	550	550	550	550
Victoria (Murraylink)	South Australia (Murraylink)	220	220	220	220
South Australia (Murraylink)	Victoria (Murraylink)	188 minus Northwest Bend & Berri loads	198 minus Northwest Bend & Berri loads	215 minus Northwest Bend & Berri loads	215 minus Northwest Bend & Berri loads
Queensland (Terranora)	NSW (Terranora)	224	224	224	224
NSW (Terranora)	Queensland (Terranora)	107	107	107	107
Tasmania (Basslink)	Victoria (Basslink)[E]	594	594	594	594
Victoria (Basslink)	Tasmania (Basslink)[E]	478	478	478	478

A. The peak interconnector capability does not necessarily correspond to the network capability at the time of the maximum regional demand; it refers to average capability during daytime, which corresponds to 6.00 am to 6.00 pm (AEST) in MLF studies.

B. The "QNI minor" upgrade was modelled. Southwards flow limit was incremented in stages to align with testing in dispatch timeframe, where the limits for 2023-24 are effective from 1 July 2023, 30 August 2023 and 29 November 2023 respectively.
C. Para 275 kV substation SVC outage limiting flows on Heywood from South Australia to Victoria will be back in service, therefore the interconnector was modelled at its normal capacity.
D. Limit referring to the receiving end.

A2.7 Calculation of MLFs

AEMO uses the TPRICE[11] software to calculate MLFs using the following method:

- Convert the half-hourly forecast load and historical generation data, generating unit capacity and availability data together with interconnector data into a format suitable for input to TPRICE.
- Adjust the load flow case to ensure a reasonable voltage profile in each region at times of high demand.
- Convert the load flow case into a format suitable for use in TPRICE.
- Feed into TPRICE, one trading interval at a time, the half-hourly generation and load data for each connection point, generating unit capacity and availability data, with interconnector data. TPRICE allocates the load and generation values to the appropriate connection points in the load flow case.
- TPRICE iteratively dispatches generation to meet forecast demand and solves each half-hourly load flow case subject to the rules in section 5.5.2 of the Methodology, and calculates the loss factors appropriate to the load flow conditions.
- Refer the loss factors at each connection point in each region are referred to the RRN.
- Average the loss factors for each trading interval and for each connection point using volume weighting.

In accordance with section 5.6.1 of the Methodology, AEMO calculates dual MLF values at connection points where one MLF does not satisfactorily represent active power generation and consumption.

A2.7.1 MLF calculation quality control

As with previous years, AEMO has engaged consultants to review the quality and accuracy of the MLF calculation. The consultants will perform the following work:

- An independent verification of AEMO's data inputs to the MLF calculation.
- A verification study using AEMO's input data to independently validate AEMO's calculation results. AEMO will use the verification study to ensure that AEMO's MLF calculation methods and results are accurate.

[11] TPRICE is a transmission pricing software package. It is capable of running a large number of consecutive load flow cases quickly. The program outputs loss factors for each trading interval as well as averaged over a financial year using volume weighting.

A3. Impact of technology on MLF outcomes

As discussed in Appendix A2, MLFs are calculated by simulating power flows on the network for every half-hour, in the next financial year, using forecast supply and demand values. The calculated raw loss factors for each half-hour are then weighted by the volume of energy at the TNI to calculate the MLF for that TNI.

Calculated raw MLFs reflect the supply and demand at each half-hour and, as with supply and demand outcomes, can vary drastically. In remote locations with material levels of grid-connected solar capacity, an increasingly stronger diurnal pattern in half-hourly MLFs is observed due to increased supply and low demand (driven by distributed photovoltaics [PV]) during daylight hours. The combination of increased generation and reduced local demand results in the energy produced needing to travel longer distances to supply load resulting in increased losses over the transmission network and lower MLF outcomes for these generators.

While this diurnal volatility in underlying half-hourly MLFs does result in poor outcomes for grid-connected solar, it can present potential opportunities for storage technologies which may be able to achieve a delta between load and generation MLFs that will complement arbitrage behaviour.

As a hypothetical example, Figure 22 shows the time-of-day average raw MLFs and generation (% of capacity) for several technologies, all connected to the same location within the shared transmission network.

Table 31 shows the MLF outcomes for the different technologies shown in Figure 22, highlighting that, despite all having the same underlying raw half-hourly MLFs, the outcomes vary drastically.

- Solar farm – the solar farm is generating into the middle of the day, when the underlying half-hourly MLFs are low, which reflects generation at this location needing to travel long distances to serve load during these times. The result is the second lowest MLF outcome; given the lowest MLF outcome is the battery load, the solar farm MLF outcome is the least favourable.
- Wind farm – the wind farm weighting tends toward the evening peak, when the underlying half-hourly MLFs are high, which reflects generation at this location not needing to travel long distances to serve load during these times. The result is the highest MLF outcome of all technologies, which is favourable.
- Battery (generation) – the battery is generating into both morning and evening peaks, when the underlying half-hourly MLFs are above average, which reflects generation at this location not needing to travel long distances to serve load during these times. The result is the second highest MLF outcome of all technologies, which is favourable.
- Battery (load) – the battery is loading into the middle of the day, when the underlying half-hourly MLFs are low, which reflects generation at this location needing to travel long distances to serve load during these times. As the battery is increasing local load, this decreases the volume of energy that is required to travel long distances to serve load. The result is the lowest outcome of all technologies, which is favourable.

Figure 22 Time-of-day impact of technology on MLF outcomes

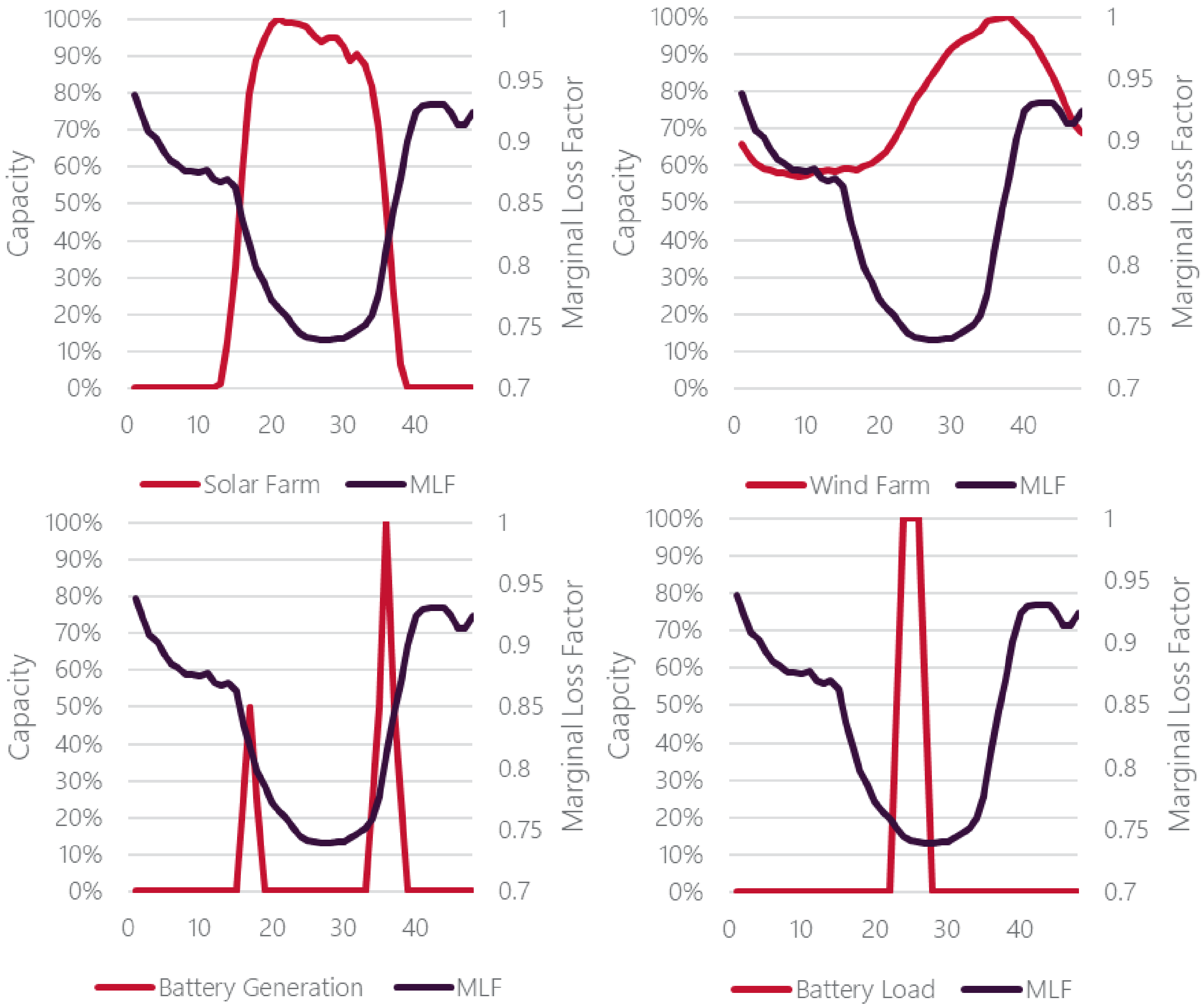


Table 31 Impact of technology on MLF outcomes

Technology	Indicative MLF
Solar farm	0.7657
Wind farm	0.8364
Battery (generation)	0.8130
Battery (load)	0.7431

Glossary

Term	Definition
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
DC	Direct current
ESOO	*Electricity Statement Of Opportunities*
FLLF	Forward Looking Loss Factor
GWh	Gigawatt-hour
km	Kilometre
kV	Kilovolt
LNG	Liquefied natural gas
MLF	Marginal Loss Factor (intra-regional loss factor)
Methodology	Forward Looking Loss Factor Methodology
MVAr	Megavolt-ampere-reactive
MW	Megawatt
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NSP	Network service provider
PS	Power station
RRN	Regional Reference Node
Rules	National Electricity Rules
TNI	Transmission Node Identity
TNSP	Transmission network service provider
VTN	Virtual Transmission Node